MAUL FOSTER ALONGI

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March 9, 2011
Project No. 8006.08.04

Russ Olsen
Washington State Department of Ecology
NW Regional Office
3190 160th Avenue SE
Bellevue, Washington 98008-54

Re: Supplemental Information requested by Ecology for the Former Precision Engineering Site, 1531 SE Director Street, Seattle, Washington

Dear Mr. Olsen:

At the request of the Washington State Department of Ecology (Ecology), Maul Foster & Alongi, Inc. (MFA) has prepared this letter concerning the former Precision Engineering (Precision) site located at 1532 SE Director Street, Seattle, Washington (Property). This letter addresses the issues Ecology identified during a November 3, 2010, meeting between the Ecology, MFA, and Stoel Rives, LLC. MFA also revised the feasibility study (FS) (discussed below) at Ecology's request.

An earlier interim action removed contamination in an off-site drainage ditch next to the Property. Groundwater leaving the Property is now below site-specific cleanup levels (CULs) (MFA, 2011). Therefore, the Property is considered to be the site as defined by Washington Administrative Code (WAC) 173-340-200.

The following sections summarize cleanup level (CUL) development based on industrial and nonpotability determinations for the site and on points of compliance for each media.

GROUNDWATER

Groundwater at the site qualifies as nonpotable, based on Washington Administrative Code (WAC) 173-340-720(2) and the following demonstrations:

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

2. 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 21, 2010, FS (MFA, 2010).[1] Based on Ecology's comment a July 22, 2010, electronic mail (e-mail) (Ecology, 2010), the yield has been recalculated using the formula requested by Ecology:

   - Estimated gallons per foot of drawdown times a percentage of the full saturated zone depth (estimated at 4 feet).

   The updated version of the FS reflecting this recalculation is being submitted to Ecology under separate cover.

3. It is unlikely that hazardous substances from the site will reach groundwater that is a current or likely potential future source of drinking water:

   a. **Downgradient Geology.** MFA has evaluated hydrogeologic conditions at the site, the downgradient Chiyoda property, and the nearby Port of Seattle Terminal 117 property (see boring logs and geologic cross sections in Attachment A; and the entire Terminal 117 report prepared by AECOM, et al. (2010).

      The site is underlain by 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 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 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

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

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 closer to the Duwamish 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 (Duwamish Coalition, 1998a and 1998b; Attachment B) confirms that low yield conditions are 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 considered nonpotable because it contains natural background concentrations of inorganic constituents rendering it unsuitable as a source for drinking water. The criteria for this determination are the maximum contaminant levels in WAC 246-290-31(3)(a).

The salinity of groundwater is also 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 (see Attachment A and AECOM et. al, 2010, for entire report). Much of the groundwater in the vicinity of Terminal 117 exceeds the Washington State drinking water secondary maximum contaminant level (SMCL) for specific conductance (0.7 microsiemens/centimeter [mS/cm]; WAC 246-290-31(3)(a)).

The low yield at the site and similar geologic conditions downgradient, coupled with the increasing salinity toward the river, make the entire area downgradient of the site nonpotable.

b. **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 B and the entire set of Duwamish Coalition reports; Duwamish Coalition, 1998a,b,c).

   The Shallow Groundwater Use Designation report (Duwamish Coalition, 1998b) 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.[2] The rationale for the designation was based on: (1) the distinct nature of the hydrogeologic conditions in the valley; (2) boundaries that 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 as drinking water; and (5) institutional prohibitions against drinking water use. The hydrogeologic conditions described in the use designation reports for the Duwamish (Duwamish Coalition, 1998a, b, c) generally are confirmed with respect to the site and the area downgradient of Precision by the investigations that have been conducted at the Precision, Chiyoda, and T-117 properties.

c. **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 site. It is currently illegal to install a water well in

[2] In a letter dated May 1, 2000, Ecology 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 the Model Toxics Control Act (MTCA) (see Attachment B).

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 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 underground storage tanks. Review of aerial photography of the area shows that 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 of 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 reports (Duwamish Coalition, 1998a,b,c).

In addition to the natural hydrogeologic conditions and water chemistry in the area precluding use of groundwater downgradient of 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 usable 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).

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

5. Appropriate reasonable maximum exposure scenarios were defined for the site:

   a. Industrial Workers—volatilization from groundwater

   b. Excavation Workers—direct contact

   c. Potential discharge to surface water

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

7. Volatilization from groundwater: The CUL was derived from a U.S. Environmental Protection Agency (USEPA) model because MTCA currently does not have methods to calculate volatilization/vapor intrusion.

a. Transfer factors were used to estimate chemical migration from groundwater to air.

8. Excavation Worker: CULS or methods to calculate 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.

9. Potential Discharge to Surface Water: As required by WAC 173-340-720(6)(c)(i)(E), Ambient Water Quality Criteria (AWQC) must be met at the point of compliance (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 indicator hazardous substances (IHSs) in the groundwater. Modeling results showed that, because of degradation and volatilization, IHSs would not reach surface water.

    a. The site also complies with 173-340-720(6)(c)(i)(F): There are no additional mechanisms that would allow contamination in site groundwater to reach surface water, such as a preferential pathway (e.g., irrigation or foundation drains). Further, the site is paved and there are no new discharges to groundwater.

    b. Ecology also required that the BIoChlor 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 concentrations at the site do not result in any releases to surface water).

10. The point of compliance for groundwater was determined for screening purposes. There is a conditional point of compliance at the eastern (downgradient) property boundary. The FS provides a demonstration that the site meets WAC 173-340-720(8)(c), including the requirement that

meeting CULs throughout the site within a reasonable restoration time frame is not practicable.

SOIL

1. 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.

2. Because the site is an industrial property, site-specific modified Method C CULs were determined that are protective of industrial workers, in accordance with WAC 173-340-745(5)(c). It was mentioned by Ecology during our November 3, 2010, meeting that if Method B CULs were being used to screen groundwater data, it would be necessary for Method B CULs to also be used to screen soil data. However, MTCA requires an independent assessment of each medium to determine which cleanup method can be applied. Specifically, WAC 173-340-706(a) states that "Each medium must be evaluated separately using the criteria applicable to that medium." The site qualifies as an industrial property under the Method C criteria, making use of the modified Method C soil CUL determination process of WAC 173-340-745(5)(c) appropriate. The site independently qualifies for the use of Method B groundwater CULs.

3. Appropriate reasonable maximum exposure scenarios for industrial workers were defined for the site:

    a. Ingestion, inhalation, and dermal contact

    b. Volatilization from soil

4. As agreed to by Ecology in e-mail correspondence dated February 28, 2007, soil CULs based on leaching to groundwater were not needed to

protect human health and the environment. Instead, groundwater data were used to evaluate potential risks and determine protectiveness through an empirical demonstration.

5. 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.

6. Volatilization from soil: The CUL was derived from a USEPA model because MTCA currently does not have methods to calculate volatilization/vapor intrusion.

    a. Transfer factors were used to estimate chemical migration from soil to air.

7. 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).

MORE ON CUL DEVELOPMENT

For more detail, please consult Appendix J of the remedial investigation and risk assessment report (MFA, 2008), which goes into further detail on the CUL calculations for soil, groundwater, and air. site-specific CULs for these media are shown on the risk-screening Tables 25 through 35 for all IHSs (shown on the tables directly beneath the standard MTCA Method A, B, and C values and the AWQC values). Note that since the report was submitted, some MTCA criteria values have changed, specifically values for trichloroethene, which will change the site-specific CULs as well. One significant result of that change is that there are now no exceedances of IHSs in air. As was pointed out in Ecology's November 17, 2008, e-mail and in the draft No Further Action determination, because of the new trichloroethene criteria values there is now no need to install the proposed subslab depressurization system (see the final FS [MFA, 2011], which includes the updated screening tables).

MORE ON POINTS OF COMPLIANCE

The POC for soil and air is at the direct point of exposure for potential industrial workers. For air, that is the breathing zone inside the building, and for soil that assumes that the building is no longer in place and that workers may come into contact with the soil under the building's former location. For groundwater, the POC for the excavation worker scenario is at the direct point of potential exposure. The groundwater POC for the protection of downgradient surface water is the eastern property boundary, based on the easterly groundwater flow direction.

FEASIBILITY STUDY

Ecology's December 29, 2009, e-mail requested that Precision complete an FS and a cleanup action plan for the site. Precision completed an FS for the site (MFA, 2010), in compliance with Ecology's request. . Ecology provided its comments in an e-mail dated July 22, 2010(Ecology, 2010). Ecology requested to modifications to the FS as follows:

- Site-specific yields should be calculated differently (as described below).
- The weighting should be adjusted in the disproportionate cost analysis.

MFA has prepared a revised FS and is submitting it under separate cover. Both of the changes Ecology requested were made. In addition to the weighting adjustment, MFA re-calculated aquifer yield by estimating gallons per foot of drawdown multiplied by a percentage of the full aquifer depth. The average shallow aquifer thickness used was 4 feet, as suggested by Ecology. Adding Ecology's requested changes did not change the overall outcome of the FS.

Note that the revised FS also includes an additional round of groundwater data that were collected in July 2010, as requested by Ecology.

CONCLUSION

CULs have been developed for the site that are protective of human health and the environment and comply with MTCA regulations. These CULs are met at the property

boundary, which is the POC for the site. Precision has also produced an FS and a disproportionate cost analysis for the site.

Sincerely,

Maul Foster & Alongi, Inc.

Merideth D'Andrea, LG
Project Geologist

Attachments: Limitations
References
A—Chiyoda Property and Port of Seattle Terminal 117—Boring Logs and Geologic Cross Sections
B—Duwamish Industrial Area Hydrogeologic Pathways Project User Guide and Ecology acceptance letter
C—Stoel Rives Memorandum on Ecology and King County Board of Health Codes

cc: Mark Adams, Washington Department of Ecology
Bob Warren, Washington Department of Ecology
Jim Okel, Precision Equipment
Dick Morgan, Precision Equipment
Tom Newlon, Stoel Rives LLP
Chris Hermann, Stoel Rives LLP
Jim Maul, MFA

LIMITATIONS

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.

REFERENCES

AECOM, Crete Consulting, Inc., Dalton, Olmsted & Fuglevand, Inc., Integral Consulting, Inc., and WindWard Environmental LLC. 2010. Revised Engineering Evaluation/Cost Analysis. Prepared for The Port of Seattle and The City of Seattle. June 3.

Duwamish Coalition. 1998a. Duwamish industrial area hydrogeologic pathways project. Duwamish Basin groundwater pathways conceptual model report. Hart Crowser, Inc. and Floyd & Snider Inc. April.

Duwamish Coalition. 1998b. Duwamish industrial area hydrogeologic pathways project. Duwamish Basin shallow groundwater use designation. Hart Crowser, Inc. and Floyd & Snider Inc. April.

Duwamish Coalition. 1998c. Development of a three-dimensional, numerical groundwater flow model for the Duwamish river basin. August 1998.

Ecology. 2010. Electronic mail (re: Some questions on the April 21, 2010 FS for Precision) from M. Adams, Washington Department of Ecology, to M. Gibson, Maul Foster & Alongi, Inc. July 22.

MFA. 2008. Final remedial investigation and risk assessment report. Maul Foster & Alongi, Inc. July 21.

MFA. 2010. Feasibility study. Maul Foster & Alongi, Inc. April 21.

MFA. 2011. Final feasibility study. Maul Foster & Alongi, Inc. March 3.

ATTACHMENT A

CHIYODA PROPERTY AND PORT OF SEATTLE TERMINAL 117—BORING LOGS AND GEOLOGIC CROSS SECTIONS

BORING LOG

Date: January 26, 1990

Boring No. 3 MW-3

Project No. 1001

Depth Ft.	Soil Clas Smbl	Sample No.	Soil Description	Comments
			Sand and gravel road base material	
			Gray black clayey silt	
2				
4				
6				
8		S1		B3-S1-D8.5'
10			▽ Water table	
12				
14				
			Bottom of Boring 3 at 15 feet	
16				
18				
20				

APPLIED CONSULTANTS
environmental geology & engineering

Chiyoda Construction

Approved by [signature]
Date 2/22/90

MW-4

BORING LOG / MONITORING WELL DIAGRAM

Job Name and Number: CHIYODA CONSTRUCTION	Diameter and Type of Well Casing: N/A
Boring/Monitoring Well Identification: B-4 NORTH HOLE	Screen Size and Type: N/A
Date of Completion/Installation:	Filter Pack Type: N/A
Logged by: BERNARD LUTHER	Type of plug/Sanitary Seal: N/A
Elevation and Datum: N/A	Type of Monitoring Well Cap: N/A
Top of Casing Elevation: N/A	Well Cover Type: N/A
Water Level (Depth): 6 FT.	Notes:

DEPTH (FEET)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE I.D. NO.	OVM AND PID (PPM)	BLOW CNTS.	WELL DETAILS	NOTES
	GRAVEL ROAD BASE (3")						Soil Samples?
	LIGHT REDDISH GRAY, SILTY FINE-TO-MEDIUM SAND						
	BLACK, MEDIUM SAND						
5		V					5 -WATERTABLE
	GRAY, CLAY						
10							10
15	BOTTOM OF HOLE 15'						15
20							20
25							25
30							30

APPLIED CONSULTANTS
environmental/geology & engineering

Drawn By: WBM	Date: 11-29-90	Checked By:	Date:	Approved By:	Date: 12/4/90

MW-5

BORING LOG / MONITORING WELL DIAGRAM

Job Name and Number: CHIYODA CONSTRUCTION	Diameter and Type of Well Casing: N/A
Boring/Monitoring Well Identification: B-5 EAST HOLE	Screen Size and Type: N/A
Date of Completion/Installation:	Filter Pack Type: N/A
Logged by: BERNARD LUTHER	Type of plug/Sanitary Seal: N/A
Elevation and Datum: N/A	Type of Monitoring Well Cap: N/A
Top of Casing Elevation: N/A	Well Cover Type: N/A
Water Level (Depth): 4 FT.	Notes:

DEPTH (FEET)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE I.D. NO.	OVM AND PID (PPM)	BLOW CNTS.	WELL DETAILS	NOTES
	A/C ASPHALT (0-2") GRAVEL BASE (2"-6")						Soil Samples?
	BLACK, MEDIUM SAND	V					
	DARK GRAY, CLAY						-WATERTABLE
5							5
10							10
15	BOTTOM OF HOLE 15'						15
20							20
25							25
30							30

APPLIED CONSULTANTS
environmental geology & engineering

Drawn By: WBM	Date: 11-29-90	Checked By:	Date:	Approved By:	Date: 12/4/90

MW-6, 1

BORING LOG / MONITORING WELL DIAGRAM

Job Name and Number: CHIYODA CONSTRUCTION	Diameter and Type of Well Casing: N/A
Boring/Monitoring Well Identification: B-6 SOUTH HOLE	Screen Size and Type: N/A
Date of Completion/Installation:	Filter Pack Type: N/A
Logged by: BERNARD LUTHER	Type of plug/Sanitary Seal: N/A
Elevation and Datum: N/A	Type of Monitoring Well Cap: N/A
Top of Casing Elevation: N/A	Well Cover Type: N/A
Water Level (Depth): N/A	Notes:

DEPTH (FEET)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE I.D. NO.	OVM AND PID (PPM)	BLOW CNTS.	WELL DETAILS	NOTES
	GRAVEL			>10,000			RESIN SMELL
	REDDISH-BROWN, FINE-TO-MEDIUM SAND						Soil Samples ?
5	GRAY, SAND						Water Table ?
	PEAT LAYER						
	GRAY, CLAY						
10							
15	BOTTOM OF HOLE 15'						
20							
25							
30							

APPLIED CONSULTANTS
environmental/geology & engineering

Drawn By: WBM	Date: 11-29-90	Checked By:	Date:	Approved By:	Date: 12/4/90

BORING LOG / MONITORING WELL DIAGRAM

MW7

Job Name and Number: Chiyoda International - Seatac 1001	Diameter and Type of Well Casing: 2" SCH 40 PVC
Boring/Monitoring Well Identification: B7/MW7	Screen Size and Type: .010" Slot
Date of Completion/Installation: 18 April 1991	Filter Pack Type: #3/16 Sand
Logged by: BJL and KJS	Type of plug: Bentonite and Concrete
Water Level (Depth from ground surface): 6'	Type of Monitoring Well Cap: 2" Locking
Notes:	Well Cover Type: Steel monument - 6" square x 5'

DEPTH (FEET)	SOIL DESCRIPTION	SAMPLE I.D. NO.	OVM (PPM)	SOIL SYMBOLS	WELL DETAILS	NOTES
0	Dark gray to black, organic rich silty clay (CL)					STEEL MONUMENT COVER
						LOCKING WELL CAP
						CONCRETE/BENTONITE
	1 Composite Soil Sample					
5						PERFORATIONS BEGIN AT 4 FEET
						2" DIAMETER SCH. 40 SLOTTED PVC CASING SLOT SIZE: .010"
						FILTER PACK: #3/16 SAND
10						6" DIAMETER BORE HOLE
	Bottom of boring at 14'					THREADED PVC END CAP

LEGEND

- Silty clay
- Concrete and Bentonite
- Filter pack

APPLIED CONSULTANTS
environmental geology & engineering

Drawn By: KJS	Date: 4/25/91	Checked and Approved By:	Date: 6/10/91

BORING LOG / MONITORING WELL DIAGRAM

MW8

Job Name and Number: Chiyoda International - Seatac 1001	Diameter and Type of Well Casing: 2" SCH 40 PVC
Boring/Monitoring Well Identification: B8/MW8	Screen Size and Type: .010" Slot
Date of Completion/Installation: 18 April 1991	Filter Pack Type: #3/16 Sand
Logged by: BJL and KJS	Type of plug: Bentonite and Concrete
Water Level (Depth from ground surface): 4.5'	Type of Monitoring Well Cap: 2" Locking
Notes:	Well Cover Type: 12" diameter, water tight and flush mounted

DEPTH (FEET)	SOIL DESCRIPTION	SAMPLE I.D. NO.	OVM (PPM)	SOIL SYMBOLS	WELL DETAILS	NOTES
	Dark gray to brown silty sand (SM)					TRAFFIC RATED STEEL DRIVEOVER COVER; LOCKING WELL CAP; CONCRETE/BENTONITE
	Greenish gray sandy clay with cobbles (CL)					PERFORATIONS BEGIN AT 2 FEET
	1 Composite Soil Sample					
5	2" Peat layer (Pl)					2" DIAMETER SCH. 40 SLOTTED PVC CASING SLOT SIZE: .010"; FILTER PACK: #3/16 SAND
	Orangish brown silty clay (CL)					
10						THREADED PVC END CAP
	Bottom of boring at 12'				6" BORE HOLE DIAMETER	

LEGEND

- Silty sands
- Silty or sandy clay
- Peat
- Concrete and bentonite
- Filter pack

APPLIED CONSULTANTS
environmental geology & engineering

Drawn By: KJS	Date: 4/25/91	Checked and Approved By:	Date: 6/10/91

BORING LOG / MONITORING WELL DIAGRAM

MW9

Job Name and Number: Chiyoda International - Seatac 1001	Diameter and Type of Well Casing: 2" SCH 40 PVC
Boring/Monitoring Well Identification: B9/MW9	Screen Size and Type: .010" Slot
Date of Completion/Installation: 18 April 1991	Filter Pack Type: #3/16 Sand
Logged by: BJL and KJS	Type of plug: Bentonite and Concrete
Water Level (Depth from ground surface): 4'	Type of Monitoring Well Cap: 2" Locking
Notes:	Well Cover Type: Steel Monument - 6" square x 5'

DEPTH (FEET)	SOIL DESCRIPTION	SAMPLE I.D. NO.	OVM (PPM)	SOIL SYMBOLS	WELL DETAILS	NOTES
	Yelowish brown silty sand with cobbles(SM)					STEEL MONUMENT COVER
	1 Composite Soil Sample					LOCKING WELL CAP
						CONCRETE/BENTONITE
						PERFORATIONS BEGIN AT 3 FEET
5	Blueish gray, saturated, fine to medium sand (SW)					5
	Peat (Pl)					2" DIAMETER SCH. 40 SLOTTED PVC CASING
	Dark gray, saturated, organic rich silty clay (CL)					FILTER PACK: #3/16 SAND
10						10
						THREADED PVC END CAP
	Bottom of boring at 13'				6" BORE HOLE DIAMETER	

LEGEND

Sand | Silty sand | Peat | Silty clay | Concrete and Bentonite | Filter pack

APPLIED CONSULTANTS
environmental geology & engineering

Drawn By: KJS	Date: 4/25/91	Checked and Approved By:	Date: 6/10/91

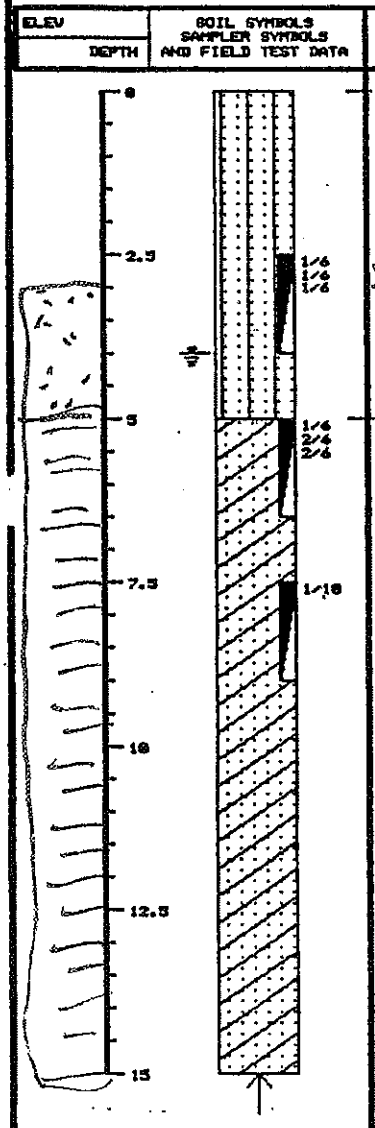
MW6, 2

LOG OF TEST BORING

BORING MW6

PROJECT: K&C Development
LOCATION: 1237 South Director Street, Seattle
DRILL METHOD: B-65 Truck-Mounted Drill Rig
GROUND WATER DEPTH: 4 feet
SAMPLE INTERVALS: 2.5 feet
REMARKS:

Cert. No.: 9401.6625
START: 1/25/94
FINISH: 1/25/94
BORING NO: MW6
ELEVATION: 0
SCALE: 2.5 feet per inch



USCS	Description	Remarks
	Silty sand dark color	
	← Soil Sample	
		Water
	Clayey sand, peat layer	PID = 5 ppm
		PID = 5 ppm

Figure Number 3

PACIFIC TESTING LABORATORIES

EXPLORATION BORING LOG

BORING 10

PROJECT: Chiyoda International Corporation

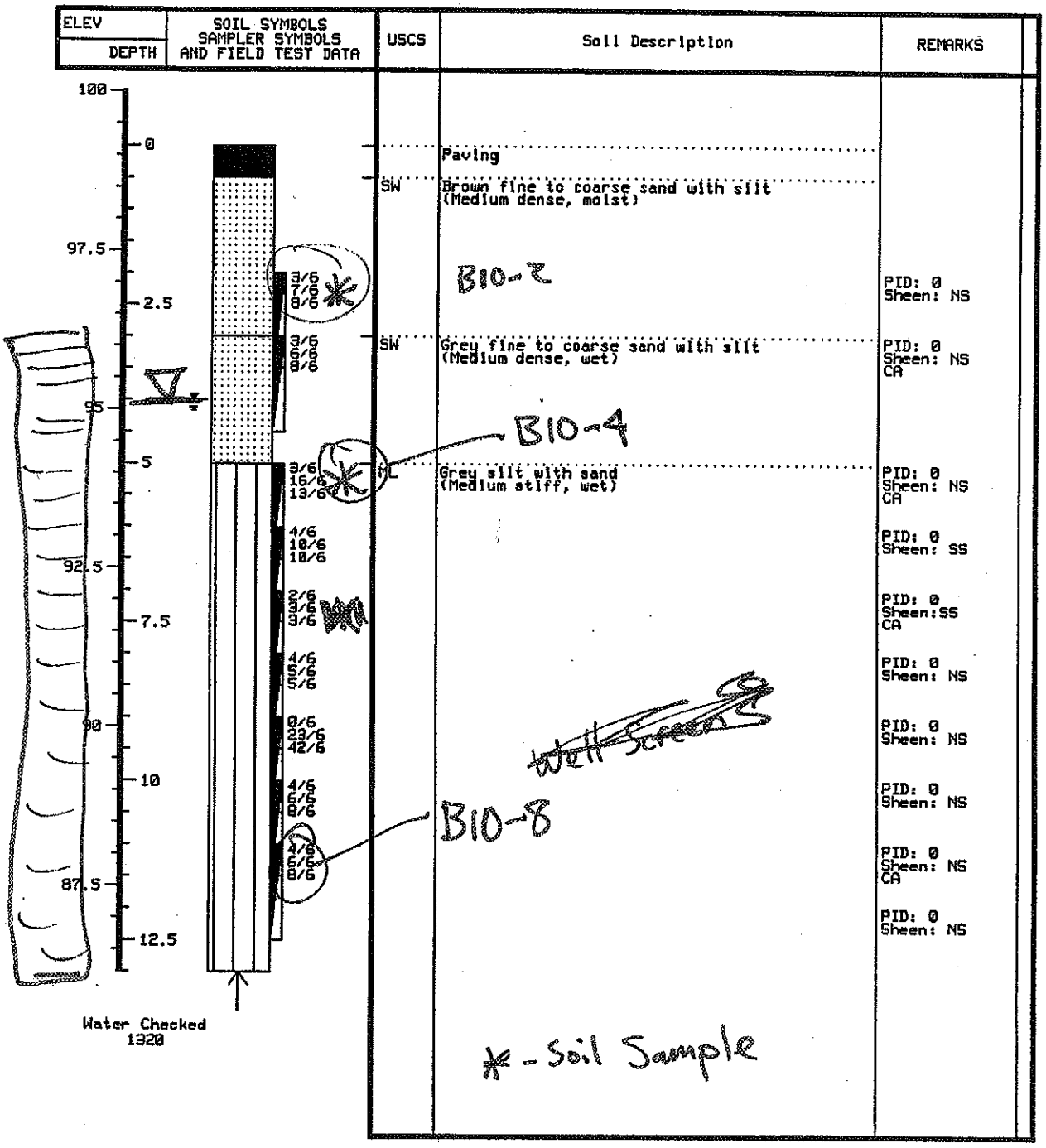
EXCAVATION DATE: Start: 1200 CERTIFICATION: 9411-6630

Finish: 1320

GROUND WATER DEPTH (ft): 4 ft

GEOLOGIST Kristen Burgess, Chris Argue

BORING:10 EL(ft):99.15 SCALE(ft/inch):2.5



Well installed at 13 feet.

Figure Number 1

PACIFIC TESTING LABORATORIES

EXPLORATION BORING LOG

BORING 11

PROJECT: Chiyoda International Corporation

EXCAVATION DATE: Start: 0945

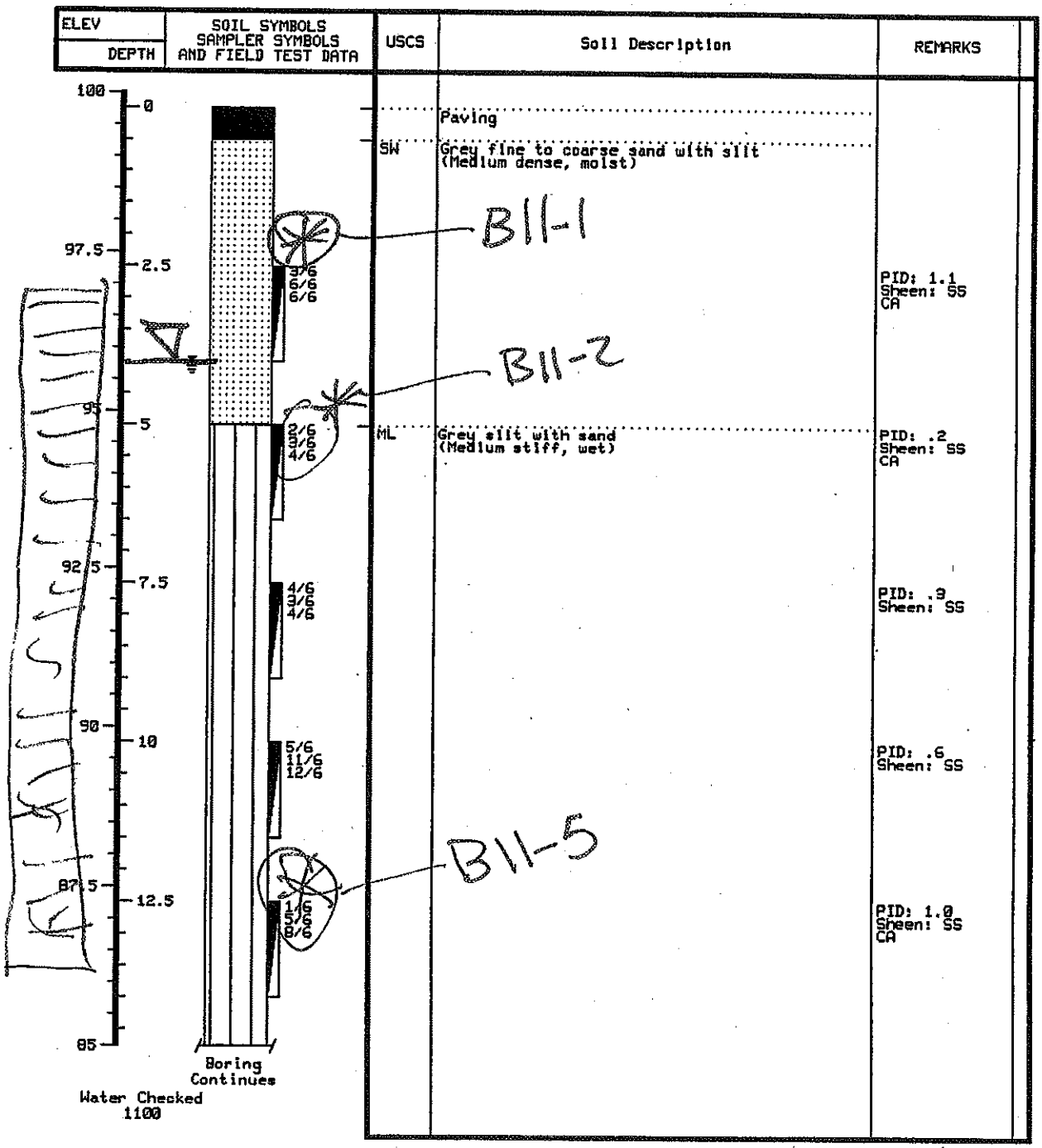
Finish: 1100

CERTIFICATION: 9411-6630

GROUND WATER DEPTH (ft): 4 ft

GEOLOGIST Kristen Burgess, Chris Argue

BORING:11 EL(ft):99.77 SCALE(ft/inch):2.5



Well installed at 13 feet.

Figure Number 2

PACIFIC TESTING LABORATORIES

EXPLORATION BORING LOG

BORING 11

PROJECT: Chiyoda International Corporation

EXCAVATION DATE: Start: 0945

Finish: 1100

CERTIFICATION: 9411-6630

GROUND WATER DEPTH (ft): 4 ft

GEOLOGIST Kristen Burgess, Chris Argue

BORING:11 EL(ft):99.77 SCALE(ft/inch):2.5

ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	REMARKS
85 — 15	2/6 4/6 6/6			

Well installed at 13 feet.

Figure Number 3

EXPLORATION BORING LOG

BORING 12

PROJECT: Chiyoda International Corporation

EXCAVATION DATE: Start: 1300

Finish: 1500

CERTIFICATION: 9411-6630

GROUND WATER DEPTH (ft): 6ft

GEOLOGIST Kristen Burgess, Chris Argue

BORING:12 EL(ft):99.72 SCALE(ft/inch):2.5

ELEV / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	REMARKS
85 / 15	4/6 12/6 12/6			PID: 0 Sheen: NS

Well installed at 15 feet.

Figure Number 5

PACIFIC TESTING LABORATORIES

EXPLORATION BORING LOG

BORING 12

PROJECT: Chiyoda International Corporation

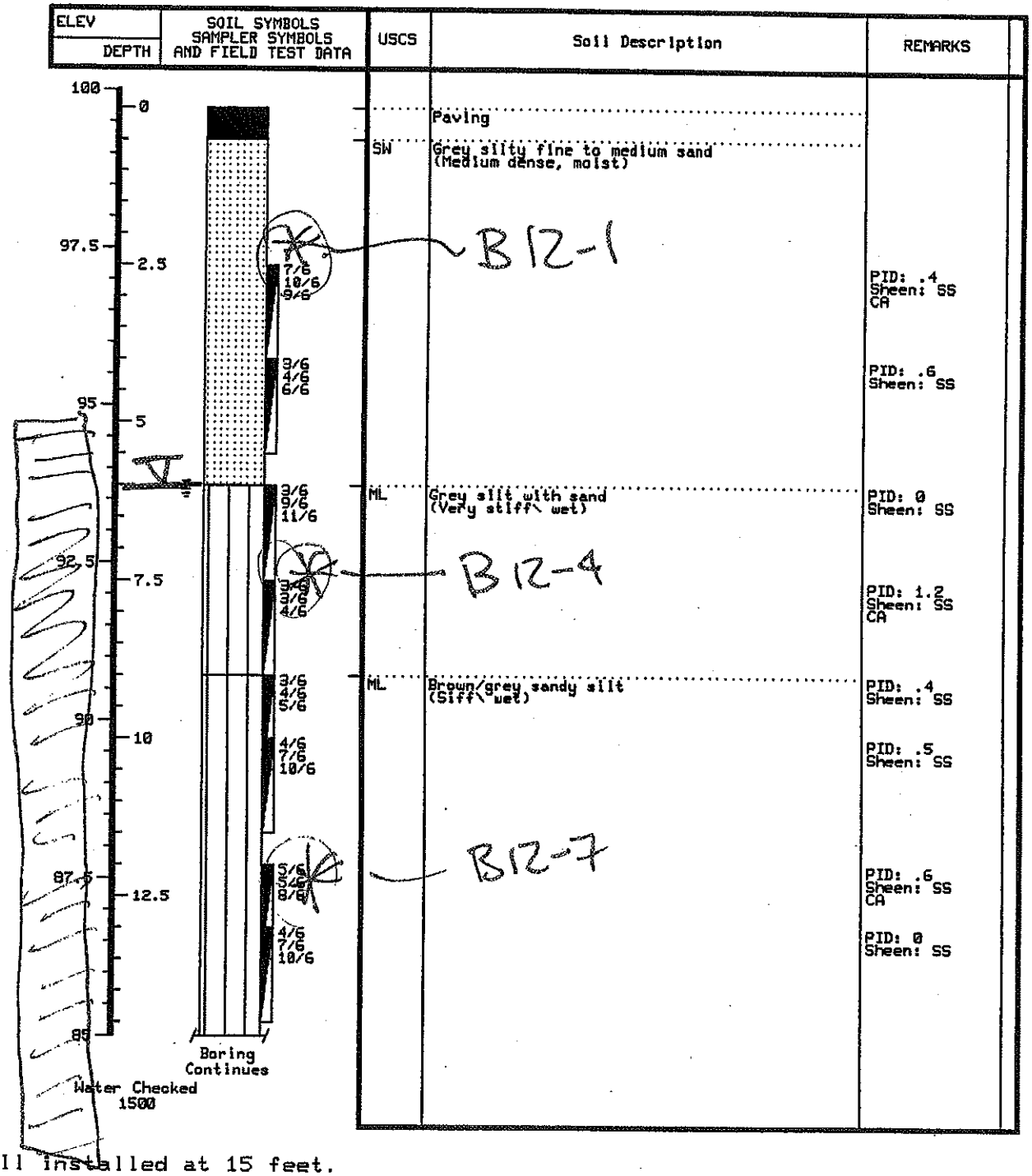
EXCAVATION DATE: Start: 1300
Finish: 1500

CERTIFICATION: 9411-6630

GROUND WATER DEPTH (ft): 6ft

GEOLOGIST Kristen Burgess, Chris Argue

BORING:12 EL(ft):99.72 SCALE(ft/inch):2.5



Well installed at 15 feet.

Figure Number 4

PACIFIC TESTING LABORATORIES

BORING LOG

Date: January 26, 1990

Boring No. 1 MW-1

Project No. 1001

Depth Ft.	Soil Clas Smbl	Sample No.	Soil Description	Comments
			Sand and gravel road base material	
			Gray black clayey silt	
2				
4				
6			Well Screen	
8			✱ – Soil Sample B1-S1	B1-S1-D9'
10			▽ Water table	
12				
14				
			Bottom of Boring 1 at 15 feet	
16				
18				
20				

APPLIED CONSULTANTS
environmental geology & engineering

Chiyoda Construction

Approved by
Date 2/22/90

BORING LOG

Date: January 26, 1990

Boring No. 2 MW-2

Project No. 1001

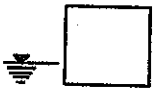
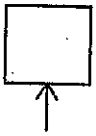
Depth Ft.	Soil Clas Smbl	Sample No.	Soil Description	Comments
			Sand and gravel road base material	
			Gray black clayey silt	
2				
4				
6		S1		B2-S1-D6'
8		S2		B2-S2-D9'
10			▽ Water table	
12				
14				
			Bottom of Boring 2 at 15 feet	
16				
18				
20				

APPLIED CONSULTANTS
environmental geology & engineering

Chiyoda Construction

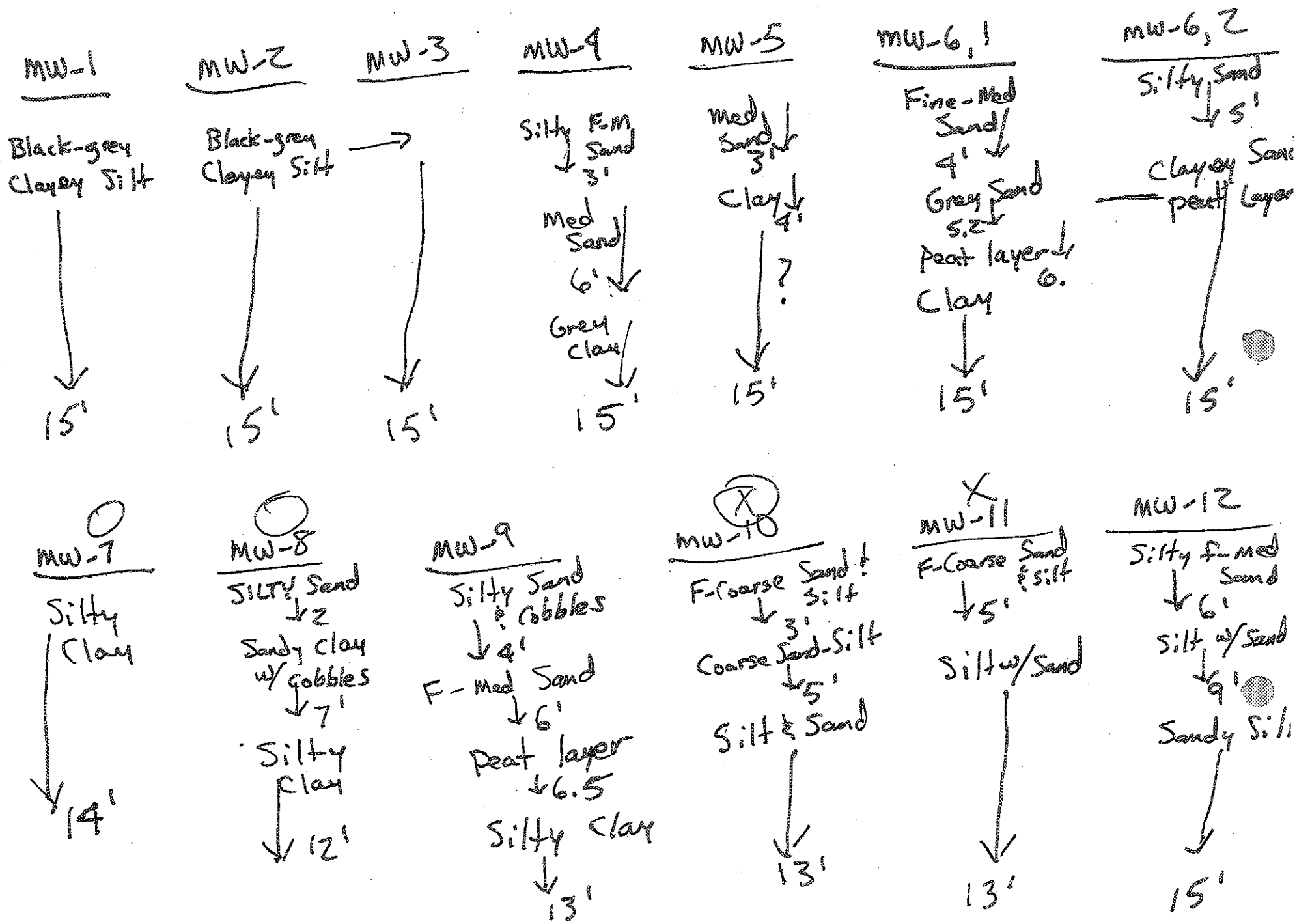
Approved by
Date 2/22/90

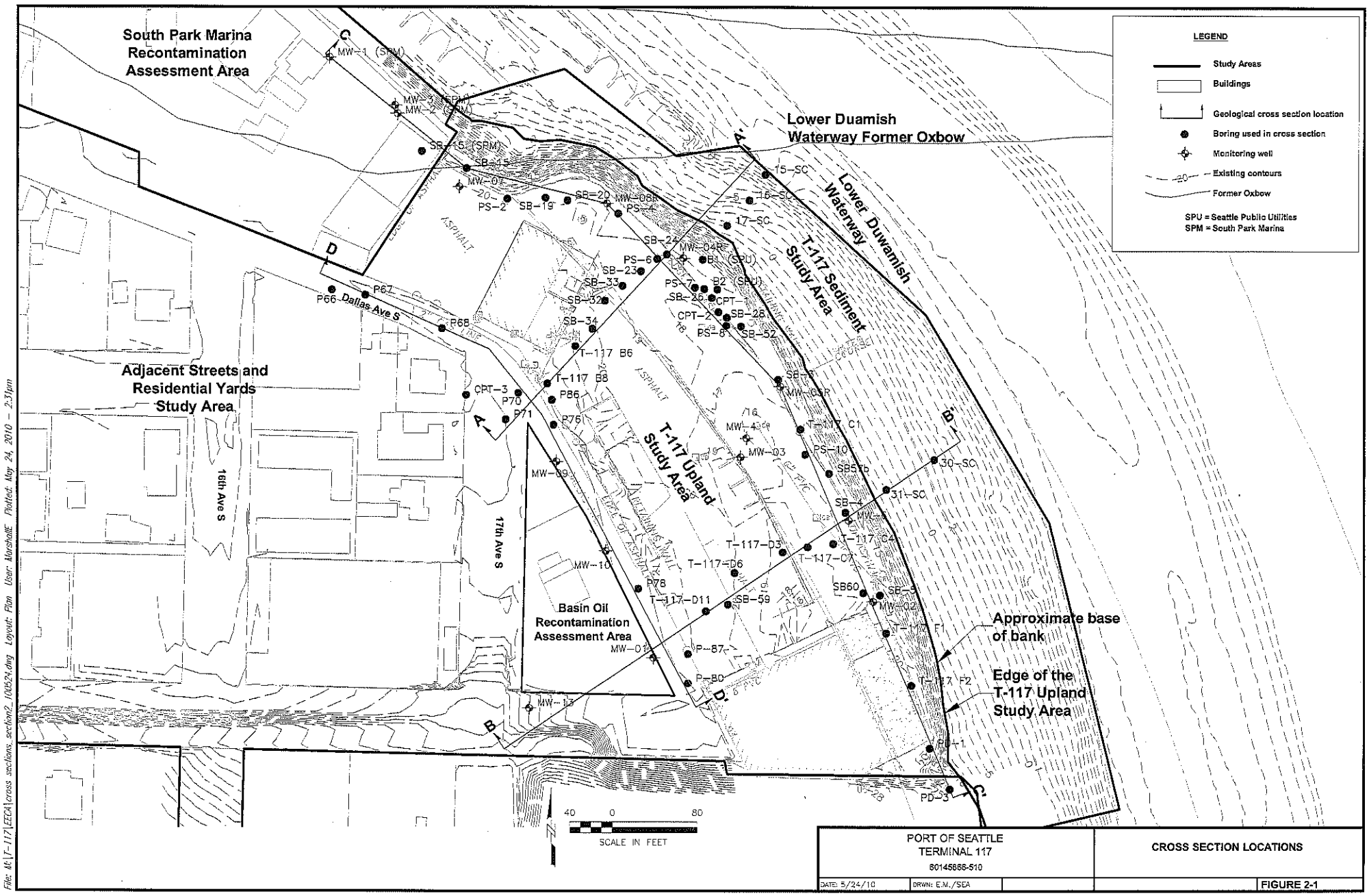
Legend:

Symbol:	Description:	Symbol:	Description:
	Paving		
	Grey fine to coarse sand with silt (Medium dense, moist)		
	Grey silt with sand (Medium stiff, wet)		Paving
	Standard penetration test. 140 lb. hammer dropped 30"		Water measured at time indicated
	End of Boring		

Notes:

1. Exploratory borings were made using a truck mounted hollow stemm auger.
2. A sketch of the boring locations is included.
3. Boring, sampling, and recording was completed as per ASTM D 420
4. These logs are subject to the limitations, conclusions, and recommendations in this report.
5. PID = Headspace vapor test using a photoionization detector
6. Sheen Key: NS = no sheen, SS = slight sheen
7. CA = Chemical analysis


MW-1
Black-grey Clayey Silt
15'
MW-2
Black-grey Clayey Silt
15'
MW-3
15'
MW-4
Silty F-M Sand
3'
Med Sand
6'
Grey Clay
15'
MW-5
Med Sand
3'
Clay
4'
?
15'
MW-6, 1
Fine-Med Sand
4'
Grey Sand
5.2'
Peat layer
6.
Clay
15'
MW-6, 2
Silty Sand
5'
Clayey Sand
peat layer
15'
MW-7
Silty Clay
14'
MW-8
SILTY Sand
2'
Sandy clay w/ cobbles
7'
Silty Clay
12'
MW-9
Silty Sand & cobbles
4'
F-Med Sand
6'
Peat layer
6.5
Silty Clay
13'
MW-10
F-Coarse Sand & Silt
3'
Coarse Sand-Silt
5'
Silt & Sand
13'
MW-11
F-Coarse Sand & Silt
5'
Silt w/ Sand
13'
MW-12
Silty f-med Sand
6'
Silt w/ Sand
9'
Sandy Silt
15'



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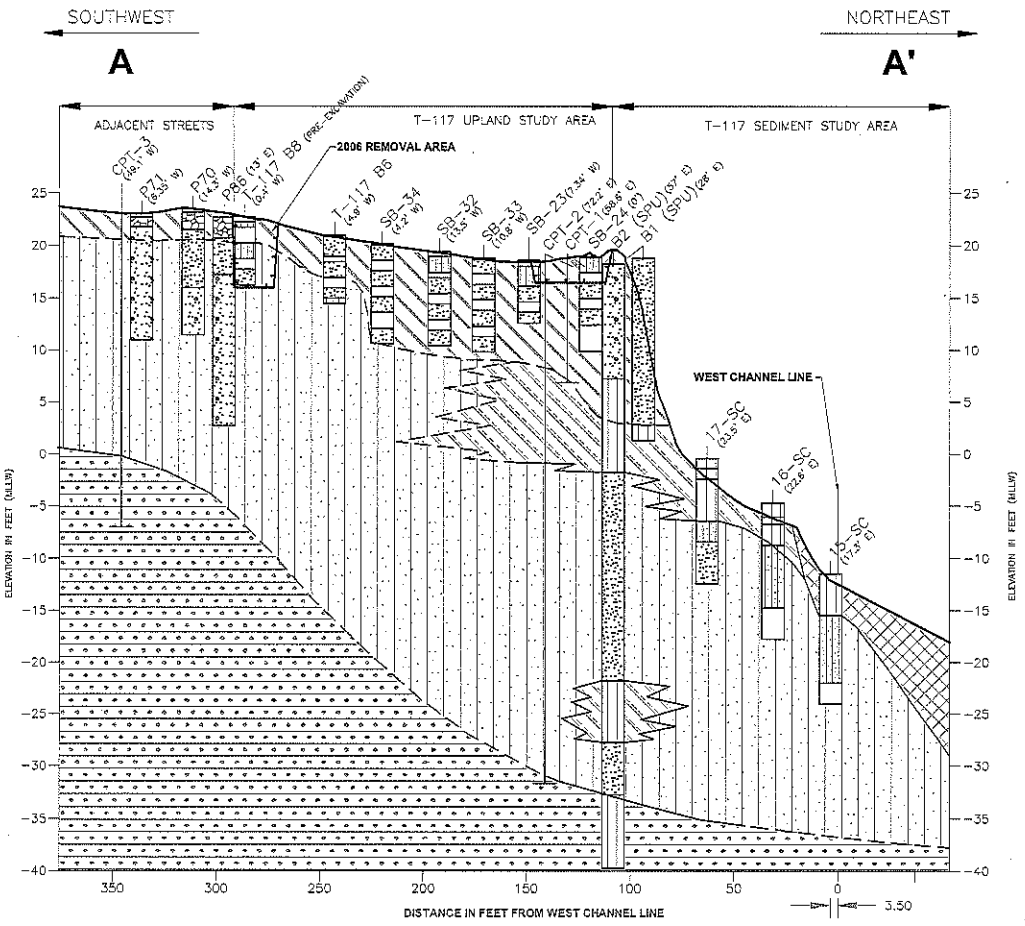
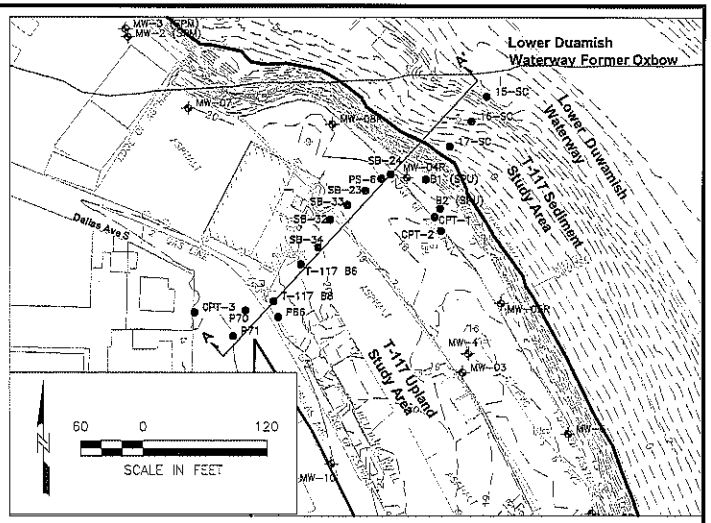




BORING (DISTANCE FROM SECTION PLANE)

LITHOLOGY PATTERNS

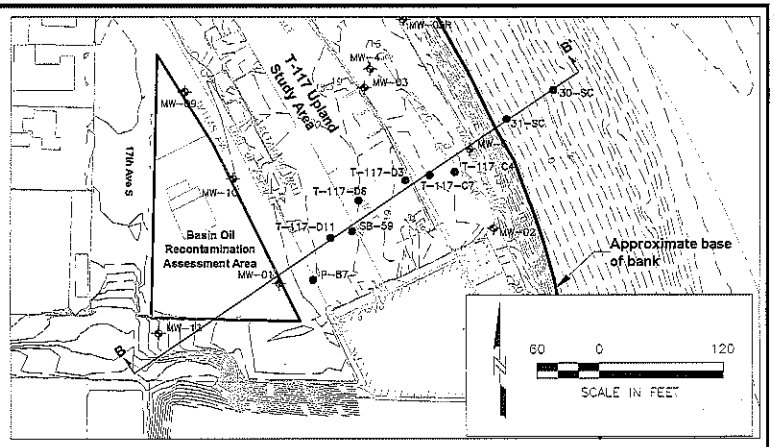
- ASPHALT
- GRAVEL
- WELL GRADED SAND
- POORLY GRADED SAND
- SILTY SAND
- SANDY SILT
- SILT
- NO RECOVERY
- FILL - SAND WITH VARYING AMOUNTS OF SILT, GRAVEL, AND DEBRIS
- ALLUVIUM - RECENT RIVER DEPOSIT
- ALLUVIUM - SAND AND SILTY SAND
- ALLUVIUM - SILT AND SANDY SILT
- TILL - SILTY SAND TO SANDY SILT WITH GRAVEL (HARD)
- 1999 OR 2006 EXCAVATION

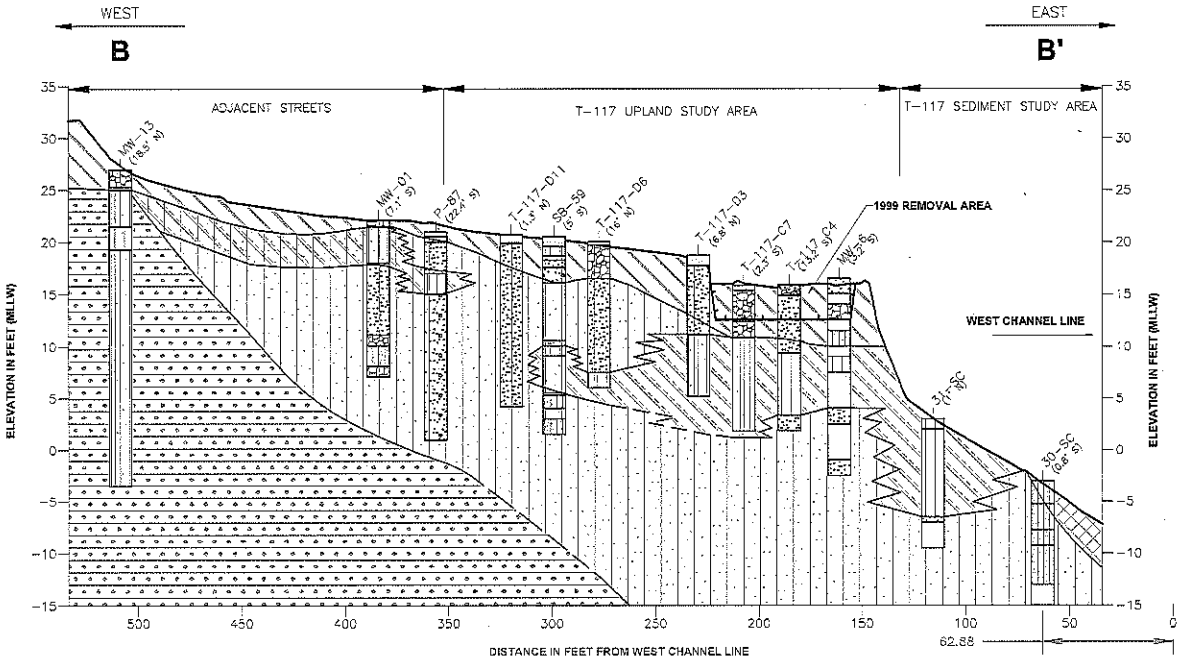
SPU = SEATTLE PUBLIC UTILITIES

30 0 60
SCALE IN FEET
VERTICAL EXAGGERATION: 5

PORT OF SEATTLE TERMINAL 117 60145666-510			GEOLOGIC CROSS SECTION A-A' OF THE T-117 EAA
DATE: 5/24/10	DRWN: E.M./SEA		FIGURE 2-2

File: M:\T-117\EECA\cross sections_section2_100524.dwg Layout: A User: MarshallE Plotted: May 24, 2010 - 2:31pm





BORING
(DISTANCE FROM SECTION PLANE)

LITHOLOGY PATTERNS

- ASPHALT
- GRAVEL
- WELL GRADED SAND
- POORLY GRADED SAND
- SILTY SAND
- SANDY SILT
- SILT
- NO RECOVERY
- FILL - SAND WITH VARYING AMOUNTS OF SILT, GRAVEL, AND DEBRIS
- ALLUVIUM - RECENT RIVER DEPOSIT
- ALLUVIUM - SAND AND SILTY SAND
- ALLUVIUM - SILT AND SANDY SILT
- TILL - SILTY SAND TO SANDY SILT WITH GRAVEL (HARD)
- 1999 OR 2006 EXCAVATION

SPU = SEATTLE PUBLIC UTILITIES

SPM = SOUTH PARK MARINA

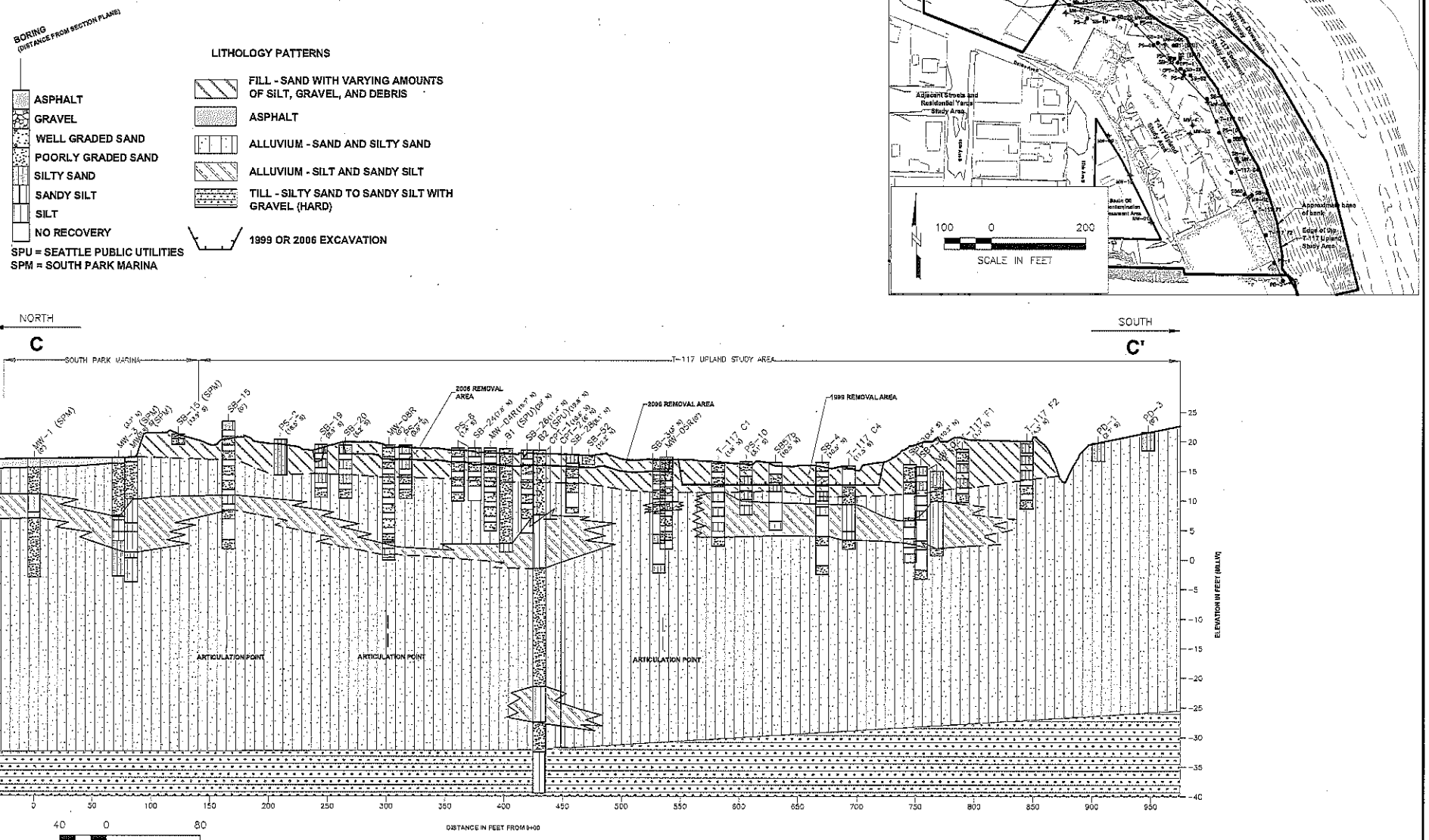
30 0 60

SCALE IN FEET

VERTICAL EXAGGERATION: 5

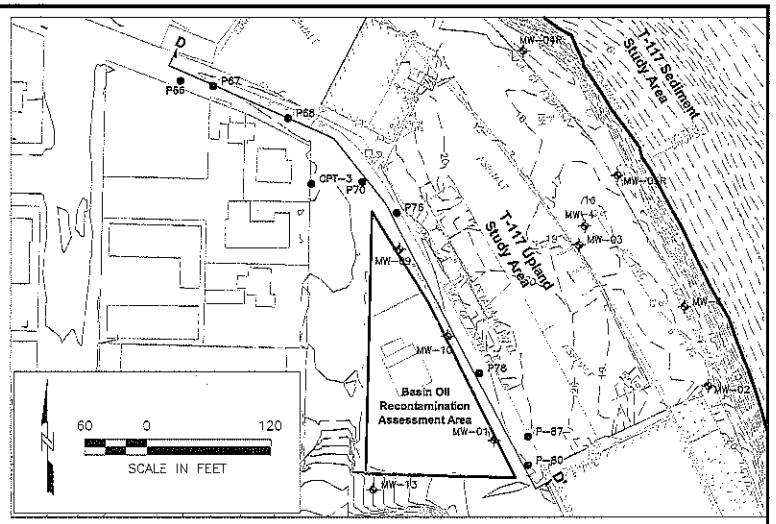
PORT OF SEATTLE TERMINAL 117 60145666-510	**GEOLOGIC CROSS SECTION B-B' OF THE T-117 EAA**
DATE: 5/24/10 | DRWN: E.M./SEA	FIGURE 2-3

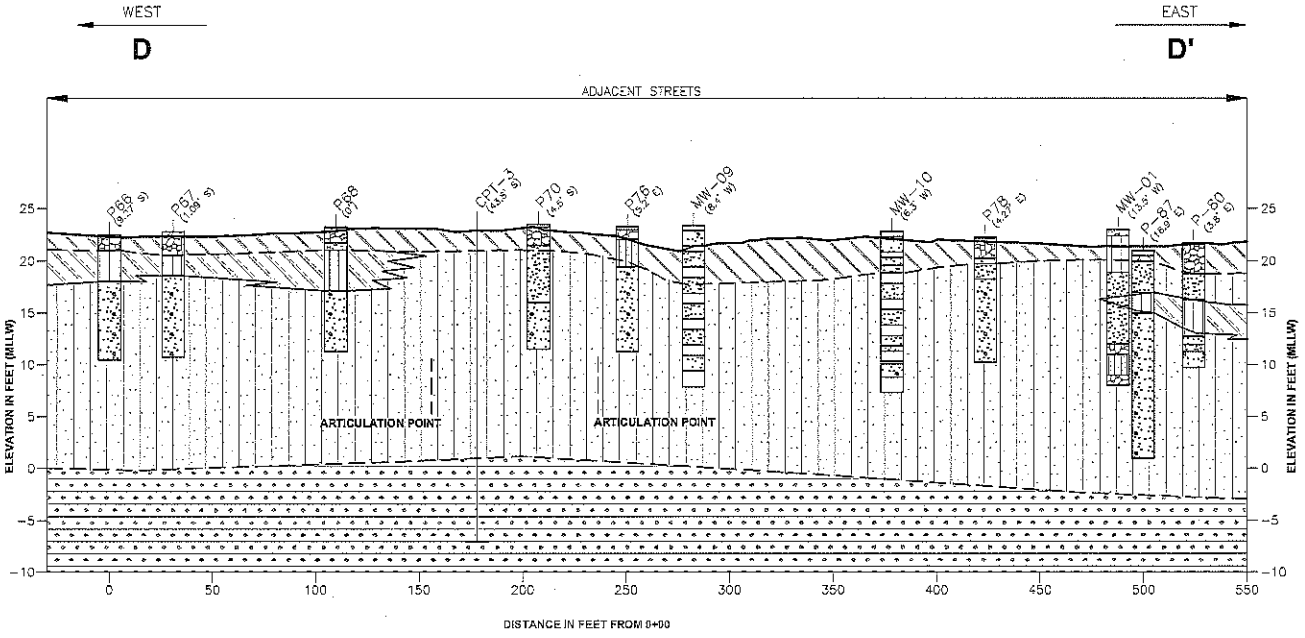
File: N:\T-117\EIC\cross sections_section2_100524.dwg Layout: B User: MarshallE Plotted: May 24, 2010 - 2:32pm



File: M:\T-117\EECA\cross sections_section2_100524.dwg Layout: C User: MarshallE Plotted: May 24, 2010 - 2:32pm

PORT OF SEATTLE TERMINAL 117 50145666-510		GEOLOGIC CROSS SECTION C-C' OF THE T-117 EAA
DATE: 5/24/10	DRWN: E.M./SEA	FIGURE 2-4





BORING
(DISTANCE FROM SECTION PLANE)

- ASPHALT
- GRAVEL
- WELL GRADED SAND
- POORLY GRADED SAND
- SILTY SAND
- SANDY SILT
- SILT
- NO RECOVERY

LITHOLOGY PATTERNS

- FILL - SAND WITH VARYING AMOUNTS OF SILT, GRAVEL, AND DEBRIS
- ALLUVIUM - SAND AND SILTY SAND
- ALLUVIUM - SILT AND SANDY SILT
- TILL - SILTY SAND TO SANDY SILT WITH GRAVEL (HARD)

SPU = SEATTLE PUBLIC UTILITIES

SPM = SOUTH PARK MARINA

30 0 60
SCALE IN FEET
VERTICAL EXAGGERATION: 5

PORT OF SEATTLE TERMINAL 117 60145666-510	GEOLOGIC CROSS SECTION D-D' OF THE T-117 EAA
DATE: 5/24/10 DRWN: E.M./SEA	FIGURE 2-5

File: M:\T-117\FEOA\cross sections_section2_100524.dwg Layout: D User: MarshallE Plotted: May 24, 2010 - 2:32pm

ATTACHMENT B

DUWAMISH INDUSTRIAL AREA HYDROGEOLOGIC PATHWAYS PROJECT USER GUIDE AND ECOLOGY ACCEPTANCE LETTER

DUWAMISH COALITION

Duwamish Industrial Area
Hydrogeologic Pathways Project

User's Guide

Prepared for:
City of Seattle Office of Economic Development and
King Country Office of Regional Policy and Planning

Produced by:
The Floyd & Snider Team

October 1999

TABLE OF CONTENTS

ABSTRACT

The two documents listed below and included on this CD as the "Duwamish Basin Groundwater Pathways Guidance Documents" have been reviewed by Ecology and found to be suitable for use by consultants, property owners and site managers who will make site-specific cleanup decisions under the Model Toxics Control Act (MTCA) for sites within the Duwamish Industrial valley. These documents define regional groundwater flow patterns and provide necessary information for making site-specific arguments that, within the delineated area (Figure 1), the highest beneficial use of shallow groundwater is the protection of beneficial uses of adjacent surface waters. While the documents are expected to be useful in providing the context for evaluating contaminant pathways at individual sites, the documents do not supercede any site-specific evaluation requirement under MTCA.

Duwamish Basin Groundwater Pathways Guidance Documents:

1. Duwamish Basin Shallow Groundwater Use Designation Technical Memorandum
2. Duwamish Basin Groundwater Pathways Conceptual Model Report

Other documents on the CD that provide support materials, either for the Conceptual Model Report or for determining historical uses in the area, include the hydrogeologic database, an associated numerical modeling report, historical mapping, bibliographies, and data tables.

1.0 PREPARATION OF THE GUIDANCE MATERIALS

1.1 Project History

The Duwamish Industrial Area Hydrogeologic Pathways Project was conceived by the Duwamish Coalition Subcommittee - Preserve and Reclaim Industrial Land. The project was jointly funded by the City of Seattle and King County Offices of Economic Development. The City and County contracted with an environmental consulting team led by Floyd & Snider Inc., as well as the University of Washington's Center for Urban Water Resources Management. Both the Washington State Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (USEPA) Region 10 Brownfields Office were active participants in the scoping and execution of the project.

The goal of the Duwamish Hydrogeologic Pathways Project was to facilitate the redevelopment of brownfields in the Duwamish Corridor by improving the quality and pace of cleanup-related decision-making for the area. This goal was met in part by establishing a conceptual framework for the area-wide hydrogeologic and contaminant transport setting, and in part by developing a mathematical model in support of the conceptual hydrogeologic framework. These documents are intended to assist consultants, property owners, and site managers in making site-specific arguments for sites within the study area that the highest beneficial use of groundwater in the shallow aquifer is the protection of beneficial uses of adjacent surface waters and not the protection of a current or potential drinking water source.

2.0 SUMMARY OF GUIDANCE MATERIALS CONTENT

2.1 Guidance Materials and Content

Two documents make up the guidance materials:

- **Duwamish Basin Groundwater Pathways Conceptual Model Report.** This Report defines the hydrogeologic systems associated with the industrial area of the Duwamish River Valley. It substantiates the conclusion that shallow groundwater in the valley area discharges to the Duwamish River and is not hydraulically connected to deeper or adjacent aquifers that could potentially be used for drinking water supply.

- **Duwamish Basin Shallow Groundwater Use Designation Technical Memorandum.** This memorandum proposes that the highest beneficial use of shallow groundwater in the Duwamish River Valley could be the protection of beneficial uses of adjacent surface waters rather than the protection of a current or potential source of drinking water.

3.0 APPROPRIATE USE OF GUIDANCE MATERIALS

3.1 Use of the Guidance Materials

The purpose of the Duwamish Industrial Area Hydrogeologic Pathways Project guidance documents is to provide property owners, consultants and site managers with information on the hydrogeology of the Duwamish Industrial Valley. The guidance documents provide the regional setting for evaluating hydrogeologic information for individual properties within the study area. The material is meant to streamline the process for determining, on a site-specific basis, the highest beneficial use of groundwater in the shallow aquifer within the study area and setting the appropriate cleanup standards. The guidance documents provide a consistent and accepted understanding of area-wide groundwater flow patterns and boundaries, allowing users to understand, at a regional scale, horizontal groundwater flows in the valley, downward and upward flows, location of aquifers, and tidal influence. The material provides the user with data and a regional interpretation to assist in understanding site information in the regional context. Provision of this material should streamline the evaluation and regulatory process for individual sites by reducing the expenditures of individual property owners to replicate this information, and by eliminating redundant and sometimes conflicting interpretation of regional information by multiple consultants and Site Managers.

For example, a small business owner of a potentially contaminated site in the Duwamish Valley could use this report to understand geologic and hydrogeologic conditions in the area of a particular site.

In all areas of the valley, the guidance material would identify that groundwater underlying the site discharges into the surface waters of the Duwamish River, and that shallow groundwater is unlikely to flow into deeper zones because of upward hydraulic gradients.

If the business was located in the upper valley, the guidance materials would identify that groundwater is generally within 50 feet, in sandy alluvium. Bedrock is expected at depths of 50 feet or shallower as well. Flow is generally towards the river, but the possibility exists that bedrock knobs could skew flow patterns in localized areas.

If the business was located in the central valley within 1000 feet of the river, the business owner would find that tidal fluctuations have an effect on the direction of flow patterns at different times, and natural water quality is more saline.

This information could be used by the business owner to develop and justify a site exploration program to evaluate site-specific flow and contaminant conditions, and to negotiate appropriate soil and groundwater cleanup action levels based on a determination that the highest beneficial use of groundwater is the protection of beneficial uses of adjacent surface waters.

> ***Important notes about use of the mapping:*** *The mapping can be used either by purchasing hard-copy images from the City of Seattle (how to order directions are found on the home page) or by viewing the mapping using the GIS files accessible on the CD (how to use the CD directions are also on the home page). In either case, the hydrogeologic and contextual information on the maps does not get more detailed as you "zoom in" to your particular site area. It is frequently very hard to understand the hydrogeologic graphics at a "zoomed in" view. You need to "zoom out" to see the whole map, and at that scale you will be able to see the legend on the map identifying the line types. Confirmation of contextual information at a site-specific scale must be done with site specific information (see Section 4 of this document).*

3.2 Relationship to MTCA

The requirements of MTCA are unchanged by the availability of this guidance material. MTCA criteria for site-specific characterization, data acceptability and cleanup decision-making remain unaffected by the availability of these materials.

The guidance material does not include any data about area contamination. This information is provided only to help streamline the process for determining appropriate ground water cleanup levels based on highest beneficial use and to provide contextual hydrogeologic information to support site-specific decisions.

3.3 Highest Beneficial Use of Groundwater

MTCA determines groundwater cleanup levels based on a determination of the highest beneficial use of groundwater and the reasonable maximum exposure expected to occur under both current and potential future site use conditions. In most areas, water needs to meet drinking water standards. In other areas, water needs to meet standards appropriate to protect the beneficial uses of receiving surface water bodies.

The first step in setting a cleanup level for groundwater is to determine whether or not it is potable as defined by regulation. For most sites, drinking water is the highest beneficial use for groundwater unless it can be demonstrated that:

- The ground water does not serve as a current source of drinking water;

- The groundwater is not a potential future source of drinking water (due to insufficient quantity, poor natural quality or it is inaccessible); **and**

- The department determines it is unlikely that hazardous substances will be transported from the contaminated ground water to ground water that is a current or potential future source of drinking water at concentrations which exceed ground water quality criteria published in Chapter 173-200 WAC; or

- More stringent concentrations are necessary to protect human health or the environment.

In determining whether contaminated ground water is a current or potential future source of drinking water, the Department considers site-specific factors, including:

- The extent of affected ground water;
- The distance to existing water supply wells;
- The likelihood of interconnection due to well construction practices in the area of the state where the site is located;
- The physical and chemical characteristics of the hazardous substance;
- The hydrogeologic characteristics of the site;
- The presence of discontinuities in the affected geologic stratum; and
- The degree of confidence in any predictive modeling performed.

At sites where there is an extremely low probability that ground water classified as a potential future source of drinking water will actually be used for that purpose, the department may approve ground water cleanup levels that are based on the protection of beneficial uses of adjacent surface waters if **all of the following can be demonstrated**:

(i) There are known or projected points of entry of the ground water into the surface water;

(ii) The surface water is not classified as a suitable domestic water supply source under Chapter 173-201 WAC;

(iii) The ground water flow into surface waters will not result in exceedances of surface water cleanup levels at the point of entry or at any downstream location where it is reasonable to believe that hazardous substances may accumulate;

(iv) The cleanup action includes institutional controls that will prevent the use of contaminated ground water between the source of hazardous substances and the point(s) of entry of ground water into the surface water; and

(v) The Department determines it is unlikely that hazardous substances will be transported from the contaminated ground water to ground water that is a current or potential future source of drinking water at concentrations which exceed ground water quality criteria published in Chapter 173-200 WAC.

For more information regarding the criteria used for the Duwamish Industrial Corridor, refer to the Duwamish Basin Shallow Groundwater Use Designation Technical Memorandum included on the CD and the Model Toxics Control Act Regulations, Chapter 173-340, as amended. Since regulations change over time, check the Department of Ecology's website (http://www.wa.gov/ecology/) for recent information on regulatory criteria for establishing cleanup levels for groundwater.

The guidance materials on the CD provide the documentation necessary to help establish whether or not the groundwater is potable as defined by regulation. The materials on the CD document that:

- The ground water does not serve as a current source of drinking water;
- The groundwater is not a potential future source of drinking water (due to insufficient quantity, poor natural quality, or inaccessibility),
- It is unlikely that hazardous substances will be transported from the contaminated ground water to ground water that is a current or potential future source of drinking water.
- The surface water is not classified as a suitable domestic water supply source;

The materials on the CD also document the known or projected points of entry of the ground water the surface waters. Other issues, such as demonstrating ground water will not result in exceedances of surface water cleanup levels and appropriate institutional controls must be demonstrated on a site-specific basis.

4.0 REQUIREMENTS FOR SITE-SPECIFIC INFORMATION

4.1 Site-Specific Hydrogeologic Information

While providing valuable context, these documents do not take the place of site-specific work. Users of these documents should expect to gather additional site-specific data for their properties to confirm site-specific hydrogeologic and groundwater flow properties in their area of interest, and the position of the property within the valley context. Criteria for collection and evaluation of site-specific information are defined in the MTCA regulation, Chapter 173-340 WAC.

> ***Important notes about use of the mapping:*** *As discussed above in Section 3, the hydrogeologic and contextual information on the maps does not get more detailed as you "zoom in" to your particular site area. If you are looking at the mapping electronically, it is very hard to understand the hydrogeologic graphics at a "zoomed in" view. You need to "zoom out" to see the whole map, and at that scale you will be able to see the legend on the map identifying the line types.*
>
> *The mapping can assist you in identifying monitoring wells in the vicinity of your particular property that were used in this study. This does not mean they are the only monitoring wells in the area. Once you have identified the wells used in this study that are close to your property, you can look them up in the tables included in the reports on the homepage, to see references of what site or project specific reports they came from. Most of these reports are available through the*

Ecology library. Well log information is stored in data files at ECOSS (see Section 5 of this document).

4.2 Contamination Information

The guidance documents do not address contamination, and site-specific data is the only vehicle to characterize the magnitude and extent of contamination as well as provide the specific information needed to develop the appropriate cleanup decisions for a particular site. Criteria for collection and evaluation of site-specific characterization information are defined in MTCA.

5.0 DATA USED TO PRODUCE GUIDANCE

The scope of work for data collection was determined jointly by the Project Team, Ecology, and USEPA. Key members from these parties worked closely together to identify optimal use of the project budget to collect a representative set of data from which to develop the conceptual model. It was agreed that "all" publicly available information could not be collected within the constraints of the available budget. Rather, criteria were developed by all parties to define what subset of data collection would be acceptable for conceptual model development.

Data was compiled between 1995 and 1997. The principal data sources included regional geologic and hydrogeologic studies, major geotechnical studies, and contaminated site investigations (especially MTCA Remedial Investigations and RCRA Corrective Action Investigations) as these typically contained the greatest quantity of hydrogeologic information with desired quality. Ecology, USEPA, and the U.S. Geological Survey (USGS) were the primary sources for data.

Data collection focused on review of material in documented regional studies and Agency approved studies of individual contaminated sites. The work includes summary and interpretation of hydrogeologic conclusions from 23 documented reports evaluating site or regional areas (such as Highline Well Field, North Boeing Field, Rhone-Poulenc, and RETS/Duwamish Alignment) as well as individual boring logs.

The principal data used in preparing this report included:

- All well log files on record with Ecology including the Resource Protection Well Reports, the Water Well Reports, and the old card files on water wells;
- Selected Ecology and USEPA site investigations based on a review of contaminated databases for USTs, LUSTs, CERCLA, MTCA and RCRA. The most comprehensive studies were identified and copied with the assistance of Dan Cargill at Ecology and Howard Orlean at USEPA;
- Regional water resource reports, especially those prepared by the USGS and for the South King County Groundwater Management Plan;
- Regional geologic reports;
- Highline well field reports;

- Metro studies prepared for the Renton Effluent Transfer System and the Metro Duwamish Groundwater Study; and

- Reports on the Duwamish River Estuary by the USGS and Muckleshoot Indian Tribe.

The Conceptual Model Report includes a complete list of references and figures showing coverage of the well data and study area reports used in the project. The database used in development of the Conceptual Model Report is included on the CD. The Environmental Coalition of South Seattle (ECOSS) library (8201 10th Avenue S, Seattle, WA 98108, 206-767-0432) houses copies of reports used in the study.

5.1 Data Variability and Quality Assurance

The purpose of this data review was to look at regional conditions and flow patterns, based on review of studies where a large number of data points had been compiled and synthesized. The goal was to collect and review enough information to substantiate a Conceptual Model for the area. The variability of individual data points is not critical for this type of review.

Individual data points used in the study have not been reviewed in a formal Quality Control (QC) process. Material in the database or report should not be relied on for individual data point information.

In addition to the data and reports reviewed, the Conceptual Model Report used the collective efforts of regional experts on geology and groundwater flow to develop as complete a picture as the available data and scope of work allowed. The authors believe this study provides the best picture of the Duwamish Groundwater Pathways as is currently known. Future work should be able to build on this effort; however, it is not anticipated that any substantive augmentation of the existing data would materially change the elements of the conceptual model.

5.2 Numerical Modeling

A numerical model was developed by the Center of Urban Water Resources Management at the University of Washington to quantitatively define and validate predictions of the Conceptual Model Report using water balance methodologies.

The pattern of water level contours, groundwater flow and gradients predicted by the numerical model are qualitatively similar to the material presented in the Conceptual Model Report.

- The numerical model produced a groundwater flow budget (i.e., how much water leaves the groundwater system through groundwater seeps and through direct discharge to surface water bodies), and classified types of surface water discharge pathways in the study area.

5.3 Limitations of This Material

These documents address only hydrogeologic behavior in the Duwamish valley, and do not address groundwater or soil contamination characteristics.

This material is useful only at a regional scale, to provide area-wide context for site-specific evaluations. This material is not a substitute for site-specific documentation of groundwater flow or site conditions.

Individual data points used in this project have not been reviewed in a formal QC process. Material in the database or report should not be relied on for individual data point information.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
P.O. Box 47600 • Olympia, Washington 98504-7600
(360) 407-6000 • TDD Only (Hearing Impaired) (360) 407-6006

May 1, 2000

Ms. Stephanie Warden, Director
King County Office
of Regional Policy and Planning
516 Third Avenue, Rm. 402
Seattle, WA 98104

Ms. Mary Jean Ryan, Director
City of Seattle Office
of Economic Development
600 Fourth Avenue, Rm. 205
Seattle, WA 98104

RE: Duwamish Industrial Area Hydrogeologic Pathways Project

Dear Ms. Warden and Ms. Ryan:

On behalf of the Washington Department of Ecology, I would like to commend the Duwamish Coalition project team on the outcome of the Duwamish Industrial Area Hydrogeologic Pathways Project. The success of this project is a result of the hard work of the many individuals who developed this information and the support of their agencies and employers. I would also like to acknowledge the City of Seattle and King County, who jointly sponsored the project for the Duwamish Coalition and who contributed significant financial and staff resources to the effort.

The three products of this project, *Duwamish Industrial Area Technical Memorandum – Shallow Groundwater Use Designation*; *Duwamish Basin Groundwater Pathways Conceptual Model Report* and *Numerical Groundwater Flow Model for the Duwamish River Basin* have been reviewed by Ecology and found to be suitable for use by site managers and others in making site-specific cleanup decisions under the Model Toxics Control Act (MTCA) for sites within the Duwamish Industrial area. These documents provide a detailed characterization of the hydrogeologic conditions of a large portion of the Duwamish River basin and fill a long-standing need for a comprehensive understanding of groundwater in this area.

Once again , congratulations on your accomplishment and your contribution to promoting economic development while protecting the environment.

Sincerely,

James J. Pendowski, Manager
Toxics Cleanup Program

JJP:dc

ATTACHMENT C

STOEL RIVES MEMORANDUM ON ECOLOGY AND KING COUNTY BOARD OF HEALTH CODES

STOEL RIVES LLP
ATTORNEYS AT LAW

MEMORANDUM

June 1, 2007

TO: THOMAS A. NEWLON

FROM: JASON T. MORGAN

CLIENT: Precision Engineering, Inc.

MATTER: Environmental

RE: Legality of well drilling on properties downgrade from Precision's Duwamish facility

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I. BACKGROUND

Precision Engineering, Inc. ("Precision") is the owner of a facility located within the urban growth area ("UGA") in unincorporated King County. Precision's property sits several hundred yards from the Duwamish River. The property also sits adjacent to the border of the City of Seattle. The Washington State Department of Ecology ("Ecology") has indicated concern that a zone of contaminated ground water may exist downgrade of Precision's property approaching the Duwamish River (hereinafter "zone of concern"). There are numerous individual lots, both residential and commercial/industrial, located in the zone of concern between Precision's property and the Duwamish River. Some of these properties are in the City of Seattle and some are in unincorporated King County. All of the lots within the zone of concern are currently connected to a public water supply. As part of the cleanup of the Precision facility, Ecology has indicated that Precision may need to obtain institutional controls within the zone of concern sufficient to prevent future withdrawals of groundwater.

II. QUESTIONS PRESENTED

1. Under existing state and local regulations, may property owners in the zone of concern legally install and operate groundwater wells?

2. Are these existing regulations sufficient to satisfy Ecology's institutional control requirements?

III. DISCUSSION

Existing local regulations would prohibit any well drilling activity in the zone of concern.[1] Principally, the King County Board of Health's ("KCBOH") Code would prohibit any proposed groundwater supply well drilling in the zone of concern 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 groundwater supply wells. Under these regulations there is no conceivable way for property owners in the zone of concern to legally install and operate groundwater wells. These legal prohibitions on locating and using wells with the zone of concern satisfy the need for institutional controls by restricting the use of wells for drinking water.

A. Jurisdiction Over Wells in the Zone of Concern

Well construction and operation activities in the zone of concern are regulated by two different agencies: Ecology and the KCBOH.[2] Ecology's role is somewhat limited to setting minimum standards for well construction and maintenance,[3] licensing well construction contractors,[4] and certifying water permits where necessary. The authority of the KCBOH is much more broad, and includes "all matters pertaining to the preservation of the life and health of the people."[5] The jurisdiction of the KCBOH includes both unincorporated King County as well as the City of Seattle.[6] The KCBOH, through Title 12 of the KCBOH Code, restricts

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[1] These regulations apply to extractive groundwater uses such as drinking water, and do not apply to monitoring wells, which are considered "resource conservation" wells under the authority of Ecology.

[2] Additionally, the properties located within King County, but outside the City of Seattle, will be subject to the Water and Sewer Comprehensive Plan of Title 13 of the King County Code, which requires all new development within the UGA to be served by the appropriate existing Group A water supplier, unless service cannot be timely and reasonably provided. *See* KCC § 13.24.140. Given that all the properties are already connected to public water, any new development on the King County portions in the zone of concern must hook up to public water.

[3] *See* Chapter 173-160 WAC (providing minimum standards).

[4] *See* Chapter 173-162 WAC (regulation and licensing of well contractors and well operators).

[5] RCW § 70.05.060.

[6] *See* RCW § 70.05.035 ("jurisdiction of the local board of health shall be coextensive with the boundaries of the county").

locations and sources of wells, and requires certain landowners to connect to public water supply.[7] No wells may be drilled in King County without a location approval by the KCBOH.

B. Public Service Connection Requirements

The KCBOH Code requires certain property owners to connect to existing public water supplies. First, all lots created by subdivision, short subdivision, rezone or lot line adjustment created after 1972 which are less than 5 acres, must be connected to a public water supply.[8] To the extent that any of the properties in the zone of concern were created after 1972, they must be on public water supply.

Additionally, the KCBOH Code requires property owners undertaking new construction or *other new development* to connect to public water supply when certain conditions are met.[9] The Code interprets development broadly to include "land utilization as permitted by zoning laws, building codes, community plans and comprehensive plans, including subdivisions, short subdivisions, lot line adjustments, rezones, building permits, ULID's and PUD's."[10] Properties undertaking new development are required to connect to public water supply when (1) the land is within an existing public water supply system; (2) the public water supply system meets applicable water quality requirements; and (3) the public water system is willing and able provide service in a timely and reasonable manner.[11] There can be little argument that these conditions are met within the zone of concern. The properties are located within either the Seattle Water District or Water District #20,[12] the quality of Seattle PUD's water is not subject to reasonable dispute, and because the properties are already being supplied public water, there is no possibility that the public purveyor is unable to provide service in a timely manner. Consequently, if any of the properties have undergone new construction or other new development since this rule was passed in 1989, they are required to be connected to the public water source. Moreover, because the Code defines "development" so broadly, the very proposal to add a new well to the lands in question would be considered a new development requiring connection to a public water supply.[13]

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[7] *See* Title 12 KCBOH Code, current through Rule & Regulation No. 05-09, adopted December 9, 2005, and effective January 9, 2006.

[8] *See* KCBOH Code § 12.32.010.D.

[9] *See* KCBOH Code § 12.32.010.A.

[10] *See* KCBOH Code § 12.08.090.

[11] *See* KCBOH Code § 12.32.010.A.

[12] *See* attached map "Water Utilities' Service Planning Areas."

[13] Personal communication between King County staff and Jason T. Morgan, Stoel Rives, LLP.

C. Source Protection Requirements Preclude Use of Groundwater in Zone of Concern

Even assuming that the property was not required to connect to a public service connection, the KCBOH Code places additional limitations on the sources of drinking water. The Code provides: "Drinking water shall be obtained from the highest quality source feasible."[14] All of the properties within the zone of concern are served by Seattle Public Utilities ("Seattle PUD").[15] Seattle PUD's water is certainly a higher and better source. Water captured from snowmelt in the Cedar River watershed and monitored and treated by Seattle PUD is almost invariably a higher quality source than groundwater pumped from an historically industrial area of a major city. Consequently, any proposed drinking water well in the zone of concern would fail the KCBOH's highest quality source requirement.

D. Well Location Restrictions Preclude Well Construction

Finally, even assuming that properties within the zone of concern are not required to connect to a public connection and the groundwater in the area is deemed the highest source available, location restrictions on wells mandated by the KCBOH make placement of a well in these areas infeasible.

KCBOH Code section 12.24.10.C requires a sanitary control area protecting a drinking water well site from all possible contamination sources. This includes 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 underground storage tanks.[16] Even a cursory review of the aerial photograph of the zone of concern reveals that no property has a 200 foot diameter area free of roads and buildings sufficient to provide the sanitary control area required to protect the well site. Factor in underground tanks, sewer lines, power and gas lines, and other possible sources of contamination, and it will be impossible to legally locate a groundwater supply well within the zone of concern.[17]

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[14] KCBOH Code § 12.24.010.A.

[15] *See* attached map "Water Utilities' Service Planning Areas."

[16] *See* KCBOH Code § 12.24.010.C.4. Setback may be even larger where geological and hydrological data supports such a decision. *Id.* at 12.24.010.C.3. The road setback requirement also applies to private road easements, but those private road easements under 60' in width, that show no apparent or potential contamination possibilities and are graded away from the well source may be exempted if permitted by the health officer. *See Id*. at 12.24.010.C.4(4).

[17] Ecology has similar, but broader well location restrictions, requiring that a well must be located at least one hundred feet from sources of contamination or potential contamination. *See* WAC 173-160-171. Ecology broadly defines contamination to include any chemical or biological agent that could render waters harmful, detrimental, or injurious to public use, or otherwise interfere with any legitimate beneficial use. *See* WAC 173-160-111 (13) (incorporating the definition of contamination from RCW § 90.48.020) ("such contamination, or other alteration of the physical, chemical or biological properties, of any waters of the state . . .

(...continued)

E. Existing Well Location Restrictions Satisfy Institutional Control Requirements

The groundwater cleanup standards allow for Method C or Method B groundwater cleanup levels that exceed potable standards under certain conditions. These conditions include providing institutional controls sufficient to "prevent the use of contaminated groundwater for drinking water purposes at any point between the source of the hazardous substances and the point(s) of entry of groundwater into the surface water."[18] Institutional controls include "use restrictions" under WAC 173-340-440(1)(b). In the context of groundwater contamination underlying the property of non-liable land owners, these use restrictions include "restrictive covenants or other legal and/or administrative mechanisms."[19] Legal and administrative mechanisms include things such as "zoning ordinances, planning notices in local zoning or building department records or state land records, public notices and educational mailings," and are intended to apply to properties near the source of contamination not owned by the potentially liable party.[20] A potentially liable party must first make a good faith effort to obtain a restrictive covenant prior to using other legal or administrative mechanisms.[21]

The existing pervasive regulation of groundwater wells in the KCBOH code clearly goes well beyond the types of limitations given as examples that satisfy the requirements of "other legal and/or administrative restrictions." The ordinances apply directly to property owners in the zone of concern and effectively prohibit the location or use of wells in that area, and also mandate connection to the readily-available public water supply. These outright legal prohibitions are significantly more restrictive than a covenant in a deed or the lesser legal and administrative restrictions provided as examples of legal and/or administrative mechanisms" in the regulations. There is no need for deed restrictions or other additional institutional controls beyond the existing prohibitions in order to prevent ground water development in the zone of concern. Moreover, given the public health reasons supporting public water delivery and the long term planning of both King County and Seattle PUD to provide for the future water development needs of this region, there is no reason to suppose that the region's push towards public water supply will change course, leading to amendment of county ordinances to allow more pervasive use of private wells in urban areas. Unlike local land use zoning or planning requirements of the kind mentioned in the regulations, which can change over time with evolving

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(...continued)
[which] render such waters harmful, detrimental or injurious to the public health, safety or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish or other aquatic life.")

[18] *See* WAC 173-340-720(6)(c)(iii)(B).

[19] *See* WAC 173-340-440(8)(c).

[20] *Id*.

[21] *Id*.

land uses, a change in the requirement that urban landowners use available public water supplies is not even remotely foreseeable.

While regulations do specifically state that a PLP must first make a good faith effort to obtain a restrictive covenant before relying on other legal restrictions, this additional formal step seems unnecessary in this situation. Attempting to obtain deed restrictions in this instance would be futile, as property owners would be asked to record a restriction on their deed that would prohibit them from carry out an act that is already illegal. Even if any property owners did record such a restriction, it would provide no additional protection value, since the property owners are already prohibited in numerous ways by the KCBOH from using the groundwater at issue. Requiring Precision to negotiate for deed restriction to prohibit an activity that is already illegal would be little more than an exercise in rigid formalism, and elevate form over substance. Simply stated, the regulations should not be interpreted to require the doing of a useless thing. A "good faith effort" to obtain a deed restriction should, in this instance, be no effort at all.

IV. CONCLUSION

Based on the pervasive restrictions in the KCBOH code, there is no legal way for property owners to operate and maintain groundwater wells in the zone of concern. The properties within the zone of concern either are already required to be connected to public water supply by virtue of being new development or new construction since 1989, or the very proposal to install a new well will constitute "new development" requiring connection to public water supply. Even assuming that the public connection requirements are not met, the source restriction requirements would mandate use of the higher quality Seattle PUD water over the Duwamish aquifer water. Finally, the physical location restrictions alone preclude the possibility of groundwater development on the properties at issue. Collectively, these existing regulations satisfy the requirements for institutional controls by prohibiting withdrawal of groundwater for drinking water within the zone of concern.