Geotechnical and Environmental Data Review Report

Jefferson Avenue and Hood Street
Stormwater Upgrade Project
Tacoma, Washington

for
City of Tacoma

September 25, 2017

GeoEngineers
Earth Science + Technology

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1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

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September 25, 2017

Prepared for:

City of Tacoma
Engineering Department
326 East D Street
Tacoma, Washington 98421-1801

Attention: Kristy Beardemphl

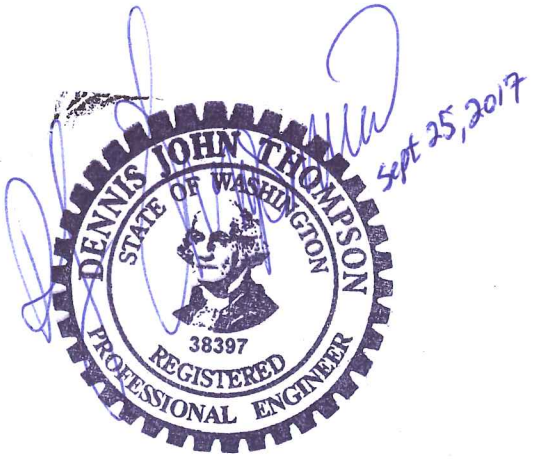
Prepared by:

GeoEngineers, Inc.
1101 South Fawcett Avenue, Suite 200
Tacoma, Washington
253.383.4940

Basel Kitmitto, EIT
Geotechnical Engineer

Tricia S. DeOme, LG
Environmental Geologist

Dennis (D.J.) Thompson, PE
Associate



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1.0 INTRODUCTION AND PROJECT UNDERSTANDING

GeoEngineers, Inc. (GeoEngineers) is pleased to present this preliminary study and data report to support the City of Tacoma's (COT) Progressive Design Build (PDB) efforts for the proposed Jefferson Avenue and Hood Street Stormwater Upgrade Project. Our services were completed in general accordance with our scope and contract dated March 17, 2017. We understand that this report will be used for informational purposes only by the City of Tacoma during the PDB process. Our understanding of the project is based on information provided by COT and review of a preliminary map dated March 20, 2017 showing the route of the stormwater conveyance system.

We understand that a new underground stormwater main conveyance system is proposed approximately between South 21st Street and South 13th Street within the downtown area of Tacoma, Washington. The stormwater main will be 48 to 60 inches in diameter. Both conventional cut and cover trenching and trenchless techniques are proposed for installation. The stormwater main alignment (the alignment) generally extends from South 21st Street to the northeast along Jefferson Avenue to the intersection of Jefferson Avenue and 17th Street. The alignment continues east along 17th Street to the intersection with Pacific Avenue. From the west side of the intersection, the alignment will extend in the northeast direction to cross below Pacific Avenue and continue parallel to the proposed Prairie Line Trail until it reaches the northeast corner of the intersection of Hood Street and 15th Street. Approximately at the northeast corner of the intersection of Hood Street and 15th Street the alignment is anticipated to take one of two route options.

- The first route option is to continue toward the northeast, essentially parallel and under the elevated highway section, for Interstate 705 (I-705) Highway. The alignment will extend north under the elevated highway section for approximately 500 feet along the path of the former Prairie Line Trail railway and then turn eastward toward the Thea Foss Waterway. The alignment crosses under the existing railroad tracks and Dock Street until it reaches the proposed outfall location on the Thea Foss Waterway.
- The second route option would extend eastward from the northeast corner of the intersection of 15th Street and Hood Street. The alignment generally crosses perpendicular and under I-705, the existing railroad tracks, and Dock Street. After crossing Dock Street, the alignment would continue along the 15th Street right-of-way (ROW) parallel to the existing stormwater main until it reaches the proposed outfall location on the Thea Foss Waterway.

We understand that trenchless methods are proposed below Pacific Avenue, and where the alignment crosses below the railroad tracks and Dock Street. The railroad tracks and Dock Street run parallel to the Thea Foss Waterway. The anticipated alignment areas and alternatives are shown on Figure 1. A geologic vicinity map with the proposed alignment is also shown on Figure 2.

As shown on Figure 1, there is a portion of the alignment that was previously installed approximately between the intersection of Court C and Jefferson Avenue and South 17th Street and Pacific Avenue. We understand that the project goals include connection to either ends of this portion of the stormwater main.

2.0 PROJECT LOCATION AND STORMWATER MAIN SECTION DESCRIPTIONS

For this study, we have divided the alignment in to four sections as shown on Figure 3. Because two outfall alternatives are being considered from the alignment, Section 4 is broken into two subsections, 4A and 4B. Section boundaries in Sections 1 and 2 are generally delineated by the sidewalks on either side of the roadways and Sections 3 to 4B are generally delineated by a 30-foot buffer on either side of the alignment. In local areas, Section 3 extends eastward and westward beyond a 30-foot buffer from the alignment. Extending the buffer locally allows the inclusion of borings close to the alignment and potentially pertinent to design.

In Figures 3A through 3D, borings within the delineated section boundaries are included in this report along with the report reference shown in Appendix A. Borings outside of the delineated section boundaries are shown but not included in this report. Borings and information outside of the delineated section boundaries are not included within this report but were reviewed for background information.

The sections and anticipated installation methods are as follows:

- Section 1: Jefferson Avenue/UWT (Cut and Cover)
- Section 2: South 17th Street and Pacific Avenue (Cut and Cover and Trenchless)
- Section 3: Prairie Line Trail/Hood Street/I-705 Corridor (Cut and Cover)
- Section 4A: I-705/BNSF/Dock Street/South 15th Street ROW (Cut and Cover and Trenchless)
- Section 4B: I-705/BNSF/Dock Street/1147 Dock Street (Cut and Cover and Trenchless)

2.1. Section 1: Jefferson Avenue/UWT (Cut and Cover)

Section 1 of the proposed alignment extends from South 21st Street to the previously installed stormwater main during work in the University of Washington Tacoma (UWT) campus area. The alignment is shown on Figure 3A. The connection is approximately located 60 feet northeast of the intersection of Jefferson Avenue and Court C. Approximately 800 feet of the approximately 1,100 total lineal feet of proposed stormwater main is 48 inches in diameter and approximately 290 feet is 60 inches in diameter.

2.2. Section 2: South 17th Street and Pacific Avenue (Cut and Cover and Trenchless)

Section 2 of the proposed alignment will start at the connection with the previously installed stormwater main approximately at the intersection of Jefferson Avenue and South 17th Street. The alignment extends east toward Pacific Avenue within the paved roadway of South 17th Street as shown on Figure 3B. South 17th Street slopes downward from the connection point with the previously installed alignment section to Pacific Avenue. The alignment then crosses under the existing Sound Transit light rail system and Pacific Avenue toward Hood Street and the Prairie Line Pedestrian Trail described below. Approximately 330 lineal feet of stormwater main with a 60-inch diameter pipe is proposed within this section.

2.3. Section 3: Prairie Line Trail/Hood Street/I-705 Corridor (Cut and Cover)

Figure 3C shows an overview of the proposed alignment. Section 3 extends north from the intersection of Pacific Avenue and the newly constructed Prairie Line Pedestrian Trail (formerly the Prairie Line railroad tracks) toward I-705. The Prairie Line Pedestrian Trail is parallel to Hood Street and is a newly constructed public open space area with landscaping and concrete sidewalks. The ground surface within Section 3 of

the proposed alignment generally has a gentle slope downward to the northeast as it extends away from Pacific Avenue toward the BNSF Railway. The southern portion of Section 3 extends from Pacific Avenue at the southern extent, to the northeast corner of the intersection of South 15th Street and Hood Street. Hood street is a paved road that slopes down to the northeast and parallel to the newly constructed Prairie Line Pedestrian Trail. The southern portion of the Section 3 alignment is currently located in the Prairie Line Pedestrian Trail.

At the northeast corner of the intersection of South 15th Street and Hood Street, the northern portion of the alignment continues along a gravel access road located approximately where the old Prairie Line railway existed. The gravel access road gently slopes down to the northeast. The gravel access road is covered with quarry spalls under I-705 until it intersects the first of two alternative alignments for the final section of the alignment. The two alternative sections outfall at different locations and are described below as Section 4A and Section 4B. Section 4A intersects Section 3 along the gravel access road approximately 100 feet northeast from the corner of the intersection of South 15th Street and Hood Street. Section 4B intersects Section 3 approximately 640 feet along the gravel access road measured from the same intersection corner, until it reaches the BNSF railroad. The total lineal footage of proposed alignment to be installed in Section 3 is approximately 2,220 feet.

An uphill slope begins to form to the west of the Section 3 alignment as the alignment extends north of the intersection of South 15th Street and Hood Street. The gravel access road eventually cuts into the slope to the west as it slightly curves westward. A retaining wall constructed to support the vertical cut was potentially made during the construction of the old Prairie Line railway or I-705 elevated highways. The retaining wall is located immediately west of the gravel access road and increases with height as the gravel road drops in elevation. A downhill slope to the east of the alignment is present at the northern portion of Section 3. The downhill slope decreases in height as the alignment extends north and decreases in elevation. The toe of the slope to the east of the northern portion of Section 3 is approximately at the western edge of the BNSF railway.

2.4. Section 4A: I-705/BNSF/Dock Street/South 15th Street ROW (Cut and Cover and Trenchless)

Section 4A alignment starts approximately 100 feet past the northeast corner of the intersection of Hood Street and 15th Street. Section 4A is a shorter distance to the waterway by approximately 500 to 550 feet in comparison to Section 4B. The anticipated alignment is shown on Figure 3D. The alignment generally crosses perpendicular and under I-705, down an east facing slope until it reaches the BNSF railway. The alignment extends toward and under the BNSF railroad tracks and Dock Street. The railroad tracks and Dock Street extend north and south parallel to the Thea Foss Waterway. The slope in the area of the alignment under I-705 appears to be covered in quarry spalls. Vegetation appears to cover the slope on either side of the area covered with quarry spalls. After crossing Dock Street, the alignment continues along the 15th Street ROW until it reaches the proposed outfall location at the Thea Foss Waterway. Along the 15th Street ROW and to the north there is public open park space, a part of the Thea Foss Esplanade. An apartment building is immediately south of the 15th Street ROW. The elevated bypass from the intersection of South 15th Street and Hood Street to Dock Street is also in close proximity north of the section's alignment. There are also various known utilities that the alignment crosses within and west of Dock Street. We anticipate trenchless technologies or a combination of trenchless technologies and conventional cut and cover installation will be considered in Section 4A. The total lineal footage of proposed stormwater main to be installed in Section 4A is approximately 550 feet.

2.5. Section 4B: I-705/BNSF/Dock Street/1147 Dock Street (Cut and Cover and Trenchless)

Section 4B intersects the northern most extent of Section 3 as shown on Figure 3D. The start of Section 4B is in the proximity of a gravel access road area under I-705 where the former Prairie Line railway was once located. From on-site observations, the gravel access road at the end of Section 3 or start of Section 4B is higher in elevation than the existing BNSF railway tracks. The alignment crosses under the existing BNSF railroad tracks and Dock Street until it reaches the proposed outfall location on the Thea Foss Waterway at the property of 1147 Dock Street. 1147 Dock Street currently is an open lot bordered to the north and south by a parking lot. The parking lot to the south is the location of the Former Colonial Fruit and Produce. The total lineal footage of proposed stormwater main to be installed in Section 4B is approximately 400 feet.

3.0 GEOLOGIC SETTING

GeoEngineers conducted an initial interpretation of geology and hydrogeology beneath the site based on our preliminary review of existing information. Geologic information included existing boring logs, current and historical geologic and topographic maps. We also reviewed information from the USDA SCS Soil Survey. No soils data was available for our area of interest according to the USDA SCS website.

The site is located within the Puget Lowlands. The Puget Lowlands lie between the Olympic Peninsula to the west and the Cascade Mountains to the east. Multiple periods of continental glaciation occurred in the region during the Pleistocene Epoch (2.5 million to 11,000 years ago) as Cordilleran glaciers advanced into the Puget Lowlands. The Puget Sound area is filled with deep deposits of glacial debris, which can reach thicknesses of 2,000 feet in the Tacoma Area (Alt and Hyndman 1984).

The most recent period of the glaciation in the Puget Sound was the Vashon Stade of Fraser Glaciation. The ice was approximately 5,000 feet thick near Seattle and approximately 1,500 feet thick in the Tacoma area. The terminus of the glaciers was approximately 12 miles south of Olympia (Borden and Troost 2001).

As the glacier advanced, a proglacial lake was formed over the entire Puget Sound (Lake Russell). Fine-grained sand and silts deposited in Lake Russell formed the Lawton clay formation. As the glacier pushed south, advance outwash (Esperance sands/Colvos sands) were deposited throughout the Puget Sound. Ice-contact deposits were deposited at the base and sidewalls of the glacier, likely during retreat. Ice-contact deposits consist of intermixed outwash (sand and gravel), lacustrine (fine-grained sand and silts) and till (unsorted, unstratified, highly compacted mixture of clay, silt, sand, gravel, and boulders). As the glacier retreated, recessional outwash (consisting of sand and gravel) was deposited near the toe of the glacier. Deposits from the Vashon Stade have been characterized as Vashon Drift (Borden and Troost 2001).

Typical stratigraphic sections of Vashon Drift in Tacoma consist of older silt overlain by advance outwash, till and recessional outwash (Borden and Troost 2001). Incision of the valleys in the Puget Sound Lowlands and the subsequent deposition of fluvial and alluvial deposits have occurred to the present after the end of the last glacier retreat (approximately 10,000 to 13,000 years ago). Surficial deposits have also been reworked by human activity. Additional human activity that affects site geology includes the import, placement and grading of non-native fill.

The project alignment is located on the eastern hillside of Tacoma, extends east toward Commencement Bay where the Thea Foss Waterway is located. Commencement Bay was formed by glaciers covering the

Puget Sound and retreated to the north, exposing deep marine valleys and leaving behind dense glacially consolidated material across Tacoma and the Commencement Bay area. Over time, alluvium from the Puyallup River has been deposited over this glacially consolidated material within Commencement Bay and has been filling in the marine valley. In general, the project alignment extends across glacially consolidated material located on the eastern hillside of Tacoma within the downtown area. As shown in Figure 2 the glacially consolidated material is mapped at the ground surface as ice contact deposits (Troost in review). As the project alignment extends toward the proposed outfall locations on the Thea Foss Waterway/ Commencement Bay (extending away from the hillside) the alignment transitions from glacial deposits at the ground surface to artificial fill (refer to Figure 2). Artificial fill typically overlies alluvial deposits, which typically overlie glacially consolidated materials along the western shoreline of the Thea Foss Waterway. In modern time, since the early 1900s, the Puyallup River delta and tide flats have been filled over to create usable land and dredged to improve shipping access.

3.1. Artificial Fill (af)

Artificial fill (af) consists of variable amounts of gravel, sand, silt, concrete, garbage, slag, and other materials. Soils vary in grain size and depending on compactive effort during placement and regrading the consistency can range from loose to dense. Artificial fill is reported to be variable in thickness ranging between 3 to 25 feet thick. Artificial fill in the Tacoma area can include large amounts of slag generated from the past smelter plant on the waterfront. Slag from the former smelter on the waterfront in Tacoma consists of angular and vesicular pieces of combusted rock and metal of fine to coarse grain sizes. Within the tide flats af can be up to 30 feet thick.

3.2. Alluvium (Qal)

Alluvium (Qal) consists of varying layers of silt, clean to silty sand, clean to silty gravels, cobbles and frequent localized peat and organic silt lenses. Qal can also range in consistency from very loose to dense. Thickness of Qal can reach up to 300 feet thick and can include shelly layers at depths corresponding to former bays or coves.

3.3. Glacial Deposits (Qvr), (Qvi), (Qvt), (Qva), (Qpf)

Recessional outwash deposits (Qvr) are described as a mixture of sand and gravel with variable silt content typically found in a medium dense to dense condition. Recessional outwash deposits often overlie glacial till but are typically not mapped if less than about 3 feet thick.

Ice contact deposits (Qvi) are described as intermixed outwash, lacustrine beds, and till that commonly occurs as outwash with lenses and pods of till and lacustrine deposits.

Glacial till (Qvt) is described as an unsorted mixture of sand, silt, clay and gravel. Glacial till is typically found in a weakly cemented dense to very dense condition. Glacial till thicknesses are generally on the order of 10 to 100 feet thick.

Advance outwash (Qva) in general, is described as being similar in composition to recessional outwash. Where observed beneath glacial till, a gradual transition may be present upward into the overlying glacial till. Advance outwash is generally observed in a dense to very dense condition.

Sedimentary deposits of pre-Fraser glaciation age (Qpf) is described as an unsorted mix of fine- and coarse-grained soils comprised of unoxidized to moderately oxidized sand, gravel, silt, and clay as well as

unoxidized to strongly oxidized clasts of unknown origin comprised of rounded gravel within a silt matrix. Pre-Fraser are typically very dense or hard. The thickness of Qpf can be up to or greater than 160 feet thick. Qpf is typically mapped where there is deficient knowledge of age and/or where there is no discernable differentiation of glacial or nonglacial origin.

3.4. Seismic Design Information

The following section provides seismic design information based on available information from the DNR site class maps and the USGS U.S. Seismic Design Maps in accordance with 2012/2015 International Building Codes (IBC).

3.4.1. Washington Department of Natural Resources Site Class

The 2004 DNR map *Site Class Map of Pierce County, Washington,* indicates that the site class ranges from site class C generally west of I-705 in Section 1 and Section 2, and site class D to E generally east of I-705 in Section 4. Section 3 is located at the transition of site class C as well as site class D to E. The map appears to have the majority of Section 3 in site class C. This would correspond with the geology of Section 3 transitioning from the glacial deposits on the eastern hillside of east Tacoma to the alluvium deposits located on the western side of Commencement Bay on the shores of the Thea Foss Waterway.

3.4.2. 2012/2015 IBC

We used map-based methods to develop seismic design parameters for use in design of the proposed stormwater main in general accordance with the 2012/2015 IBC, which refers to American Society of Civil Engineers (ASCE) 7. Preliminary seismic design parameters are provided in Tables 1 and 2 for the soils encountered along the Thea Foss Waterway and for the soils encountered upland and east of the Waterway, respectively.

TABLE 1. PRELIMINARY SEISMIC DESIGN PARAMETERS WATERWAY SOILS

2012/2015 IBC Parameter	Preliminary Value
Soil Profile Type	D/E
Short Period Spectral Response Acceleration, S_S	1.3 g
1-Second Period Spectral Response Acceleration, S_1	0.5 g
Design Peak Ground Acceleration (PGA)	0.50 g
Design Spectral Acceleration at 0.2 second period (S_{DS})	0.86 g
Design Spectral Acceleration at 1.0 second period (S_{D1})	0.5 g

TABLE 2. PRELIMINARY SEISMIC DESIGN PARAMETERS ICE CONTACT SOILS

2012/2015 IBC Parameter	Preliminary Value
Soil Profile Type	C
Short Period Spectral Response Acceleration, S_S	1.3 g
1-Second Period Spectral Response Acceleration, S_1	0.5 g
Design Peak Ground Acceleration (PGA)	0.50 g
Design Spectral Acceleration at 0.2 second period (S_{DS})	0.86 g
Design Spectral Acceleration at 1.0 second period (S_{D1})	0.44 g

4.0 SUBSURFACE CONDITIONS

The following provides a summary of soil, groundwater, and known or suspected contamination in soil and groundwater for each section designated. Our interpretation and descriptions are based on review of information and data contained in existing reports obtained for this study. We include additional interpretation where dissimilarities or modifications to subsurface conditions were reported.

4.1. Section 1: Jefferson Avenue /UWT (Cut and Cover)

4.1.1. Soil Conditions

The entire surface of the UWT campus area was recently mapped as ice-contact deposits (Qvi) (Troost in review). The typical geologic sequence in the Tacoma area consists of Vashon Drift that is composed of the following from youngest to oldest: recessional outwash deposits, recessional lacustrine deposits, ice-contact deposits, glacial till deposits, advance outwash deposits, and Lawton Clay deposits. The Vashon drift is underlain by pre-Fraser deposits (Troost in review).

Subsurface conditions along the alignment generally consist of fill, overlying ice-contact deposits, overlying a silt layer and advance outwash. The fill is present just below ground surface (bgs) to approximate depths of up to 15 feet bgs and generally consists of silt with sand and gravel and/or sand with silt and gravel. Native soil conditions underlying the fill consist of glacially consolidated ice-contact deposits to approximate depths ranging from 30 to 40 feet bgs. A gray silt layer approximately 2 to 10 feet thick was observed beneath the ice-contact deposits in the majority of the borings completed in the area. The silt layer is reported to be discontinuous and can exist from near the ground surface or anywhere in between 20 to 35 feet bgs. The silt layer is underlain by advance outwash primarily consisting of gravel with sand and silt.

The lithology observed in nearby borings at the intersection of Market Street and Jefferson Avenue is dissimilar to the information reviewed in wells UG-MW6 and UG-MW12 directly within or adjacent to the alignment. The lithology consists of sand and gravel and/or silty sand from beneath the fill to the base of the boring. It is possible a former drainage channel is present between UG-MW6 and UG-MW12. See Appendix A for pertinent boring logs with details on soils encountered in Section 1.

4.1.2. Groundwater Conditions

The results of the subsurface investigations appear to confirm that groundwater conditions consist of at least two separate aquifers (shallow [ice-contact deposits] and deep [advance outwash]). Groundwater was reported at depths ranging from approximately 5 to 15 feet bgs in the shallow aquifer. Groundwater was reported at depths ranging from approximately 15 to 25 feet bgs in the deep aquifer. The presence of the shallow or deep aquifer observed in select wells has not been confirmed as described in the Remedial Investigation Work Plan (see Appendix A for reference document). Groundwater was observed at depths ranging between 20 and 35 feet bgs within the unconfirmed aquifer wells. Artesian groundwater conditions have been observed in one well (UG-MW10) screened in the deep aquifer on the west side of Market Street. The connection of the shallow and deep aquifers in the area of the possible drainage channel mentioned above has not been evaluated. Groundwater levels may vary depending on season, precipitation and other factors. Based on experience within the area, pockets of sands or gravels with a low percentage of fines could act as a confined or semiconfined aquifer with water being generated from the western hillside potentially resulting in artesian pressures.

4.1.3. Known and Suspected Contamination

Trichloroethene (TCE), benzene, cholorobenzene, gasoline-range petroleum hydrocarbons and vinyl chloride are present in the groundwater along Jefferson Avenue. Figure 3A presents estimated extents in 2013 of the contaminant groundwater plume locations based on our studies. Additional excerpts of figures and data tables from recent reports are included in Appendix A.

4.2. Section 2: South 17th Street and Pacific Avenue (Cut and Cover and Trenchless)

4.2.1. Soil Conditions

Similar to the Section 1 alignment the entire surface area of Section 2 is mapped as ice-contact deposits (Qvi) (Troost in review). From review of the existing subsurface explorations shown on Figure 3B, we typically observed fill over glacial deposits consisting of till, and ice contact deposits interpreted in some cases as glacial drift and glacial outwash, typical of ice contact deposits. Thicknesses of fill observed in the reviewed explorations ranges from 8 inches to 15 feet thick and typically consist of loose to medium dense gravel with sand and varying silt content, silty sand with variable gravel content, and silty gravel. We also observed fill that contains deleterious materials (i.e., wood chunks and wood). Moisture contents within the fill ranges between 5 and 27 percent.

Underlying the fill, we typically observed ice-contact deposits. In areas up the hill along South 17th Street we typically observed glacial till. These glacial deposits were observed below the fill to the maximum depths explored by the borings ranging between 9 feet and 29 feet bgs. The glacial deposits typically consist of sands with variable amounts of silt and gravel. Localized silt with variable amounts of sand layers were also observed in the area. The glacial deposits contain a range of moisture contents between 6 and 44 percent. The upper portion of glacial deposits were observed to be in a medium dense or stiff condition, typical of a weathered layer. Below the weathered layer, the glacial deposits shortly transition and become very dense or hard as indicated by encountering practical drilling refusal in borings reviewed from the surrounding area. See Appendix A for pertinent boring logs with details on soils encountered in Section 2.

4.2.2. Groundwater Conditions

A boring to the north of Section 2, located within Pacific Avenue, indicate groundwater being encountered during drilling operations at a depth of 9 feet bgs. Explorations performed within Tollefson Plaza indicated water levels at the time of drilling at 5 feet bgs. From explorations in the area south of Section 2 groundwater was encountered approximately at a depth of 33 feet below Pacific Avenue at the time of drilling. Borings toward the west of Section 2 and uphill of the intersection of South 17th Street and Pacific Avenue only reached a depth of 10 feet bgs and did not encounter groundwater in the borings. Other explorations performed to the south of Section 2 encountered perched groundwater in the upper 5 feet.

Perched groundwater is typically found within discontinuous zones where less permeable soils are overlain by more permeable soils. Based on our observations and experience in the area, we anticipate that perched groundwater zones are isolated and discontinuous, and seasonal perched groundwater conditions may develop at various locations within the project area. We anticipate that groundwater levels will be lowest during the late summer and early fall months. Groundwater levels should be expected to fluctuate based on season and rainfall events. Based on experience within the area, pockets of sands or gravels with a low percentage of fines could act as a confined or semiconfined aquifer with water being generated from the western hillside potentially resulting in artesian pressures.

Overall the previous borings completed in the project area suggest that regional groundwater levels in Section 2 could be as shallow as 5 feet bgs and as deep as 33 feet bgs. See Appendix A for details on the pertinent reports reviewed and groundwater data in Section 2.

4.2.3. Known and Suspected Contamination

Three sites of concern for Section 2 and described in Table 1. Additional excerpts from reports are included in Appendix A. The sites of concern include:

- Site 2A – Former Depot – Known petroleum-contaminated soil and groundwater;
- Site 2B – Former Dry Cleaner – Potential perchloroethene (PCE)-contaminated groundwater;
- Site 2C – Existing storm line – Known PCE-contaminated water discharging into the existing storm utility.

4.3. Section 3: Prairie Line Trail/Hood Street/I-705 Corridor (Cut and Cover)

4.3.1. Soil Conditions

Similar to Sections 1 and 2, the majority of surface area within Section 3 is mapped as ice-contact deposits (Qvi) with a localized zone of pre-Fraser deposits (Qpf) (Troost in review) exposed at the surface under I-705. Subsurface information directly pertinent to this area is mapped on Figure 3C, and included in Appendix A.

From Pacific Avenue to the intersection of Hood Street and South 15th Street, fill thickness ranged from greater than 10 feet at the south end to 1.5 feet at the north end of the alignment. Fill soils observed in the explorations typically consisted of loose to medium dense silty sand with gravel and occasional organics. The fill contains a range of moisture contents between 14 and 30 percent. The fill deposits are likely associated with site grading that occurred during construction of the railroad. In its present condition, the fill is expected to vary due to additional work performed in the area of the Section 3 alignment for the new Prairie Line Trail.

Observed ice contact deposits underlying the fill were observed to the maximum depth explored in the explorations shown on Figure 3C. Ice-contact deposits in the section typically consisted of dense to very dense sand to silty sand with varying amounts of silt and gravel, fine to coarse gravel with silt and sand, or hard silt with sand. The glacial deposits contain a range of moisture contents between 5 and 20 percent.

An exception to the deposits within Section 3 is the area surrounding the intersection of South 15th Street and Hood Street where a gully reportedly used to exist and extend from the west to the east. The Section 3 alignment generally crosses perpendicular to the gully. Soils in this area appear to consist of loose fill over potential alluvium deposits or a continuation of fill, overlying glacial deposits. Distinguishable fill at this location consisted of loose sand with varying amounts of gravel and silt and debris (i.e., glass, brick, charcoal, wood, roots), as well as medium stiff to stiff clayey silt with varying amounts of sand. Fill that is potentially alluvium consisted of soft to medium stiff clayey silt with gravel and organic matter and loose to medium dense silty sand with silt lenses and organics. The fill and/or alluvium contain a range of moisture contents generally between 15 and 50 percent. The fill and/or alluvium deposits in this area are approximately 55 feet thick at the deepest portion but presently this thickness could deviate due to development within the area.

Glacial deposits encountered below the fill or alluvium within the gully consist of medium stiff sandy silt, dense to very dense sand with variable silt and gravel content, as well as very dense silty gravel with sand. The glacial deposits contain a range of moisture contents typically between 5 and 55 percent but as high as 85 percent. Glacial deposits underlying the fill were observed to the maximum depth of the borings reviewed within the area. See Appendix A for pertinent boring logs and laboratory data with details on soils encountered in Section 3.

4.3.2. Groundwater Conditions

In the area of Section 3, groundwater levels generally become shallower as the alignment extends north. Between Pacific Avenue and the intersection of South 15th Street and Hood Street groundwater was encountered between 19 and 28 feet bgs. Perched groundwater was encountered at various depth intervals above these depths. The alignment of Section 3 north of the intersection of South 15th Street and Hood Street groundwater was reported between 12 and 27 feet bgs. Based on the reviewed subsurface information within this section there is the potential for the groundwater level to fluctuate not only with the season but also with the tide from the Thea Foss Waterway. Tidal influences on groundwater is likely more significant to the northern position of the alignment. Groundwater measurements from monitoring wells installed in the areas of lower ground surface elevations near Section 3 and primarily to the south also indicate artesian groundwater pressures encountered in semi confined and confined aquifers where zones of clean to slightly silty sands and gravels were encountered. See Appendix A for details on pertinent groundwater levels.

4.3.3. Known and Suspected Contamination

Four sites of concern are present in Section 3 as described in Table 1. Additional excerpts from reports are included in Appendix A. The sites of concern include:

- Site 3A – Former Masonry/Dry Cleaner – Known petroleum-contaminated soil and groundwater;
- Site 3B – Former Sauros Dry Cleaner – Known PCE-, TCE-, and vinyl chloride-contaminated groundwater;
- Site 3C – Key Bank – Known petroleum-contaminated groundwater;
- Site 3D – Former Rail Line – Known cPAH-contaminated soil and potentially petroleum- and metal-contaminated soil.

It should also be noted that odors of petroleum were reported in the borings located in the area of the gully.

4.4. Section 4A: I-705/BNSF/Dock Street/South 15th Street ROW (Cut and Cover and Trenchless)

4.4.1. Soil Conditions

Section 4A is located on the west edge of the Commencement Bay, which is also the western edge of the delta formed at the mouth of the Puyallup River (see Figure 2). Based on our review of the geology and explorations performed in the area, the alignment appears to be within an old gully mentioned in Section 3. The old gully was previously filled in with material believed to have been fill or alluvium. Based on the geologic map, shown in Figure 2, there is no indication of the gully. Deposits mapped within this area consist of ice contacts (Qvi) and Pre-Fraser sedimentary deposits (Qpf) (Troost in review) near the base of the Tacoma's eastern hillside. Glacial deposits switch to artificial fill deposits (af) (Troost in review) from the base of the hillside toward the Thea Foss Waterway. The artificial fill typically overlies alluvium overlying

glacially consolidated deposits. Between the start of Section 4A and Dock Street, within the BNSF railway, we did not find any geotechnical information.

Explorations reviewed in the area of the gully west of the BNSF railway indicate that the area is underlain by fill and/or alluvium deposits that are difficult to differentiate. The fill and/or alluvium can range in thickness from 45 feet to 50 feet, and overlies glacial deposits. Presently, the fill and/or alluvium thickness could have been altered from development within the area. Distinguishable fill consisted of loose to medium dense sand with varying amounts of gravel, silt and debris (i.e., charcoal, organics, ash), as well as soft to medium stiff silt with varying amounts of sand, gravel and organics (i.e., peat). Fill and/or alluvium consisted of soft to medium stiff silt with varying amounts of sand, clay, shells, and organic matter (i.e., wood, charcoal, ash, and organics) as well as loose to medium dense sand with varying amounts of gravel, silt, shells, ash and organics. The fill and/or alluvium contain a range of moisture contents typically shown between 10 and 90 percent.

Below the fill and/or alluvium glacial deposits are reported. The glacial deposits consist of dense to very dense mixtures of sand and gravel with varying amounts of silt. Moisture contents of the glacial deposits are reported to be approximately 25 percent.

Explorations reviewed in the area east of the BNSF railway indicate that alluvium and fill deposits are also difficult to differentiate and could range in thickness from 10 feet to 21 feet and possibly thicker. The thickness of the fill corresponds to the continuation of the gully mentioned in Section 3 and above. The fill east of the BNSF railway consists of very loose to medium dense sands with varying amounts of silt, gravel, cobbles and construction debris (i.e., brick, wood, glass, wires), as well as very soft to medium stiff silts with varying amounts of sand, gravel, cobbles and construction debris. In general, soils appeared to range primarily from silty sands to sandy silts. Shell fragments were also encountered in local zones. The fill was observed to contain a range of moisture contents approximately between 20 and 30 percent. See Appendix A for pertinent boring logs and laboratory data with details on soils encountered in Section 4A.

4.4.2. Groundwater Conditions

Groundwater levels at the beginning of the alignment (west end) of Section 4A is similar to Section 3, which encountered groundwater between 6 and 27 feet bgs. Based on the reviewed information there is a potential for the groundwater level to fluctuate not only with the season but also with the tide from the Thea Foss Waterway. As the alignment extends east toward the Thea Foss Waterway, the influence of the tide on groundwater is potentially more significant. Reviewed information indicated that tidal influence on the groundwater level west of Dock Street could cause fluctuations of 0.5 foot to 1.0 foot between high and low tides. Groundwater pressures encountered in semi-confined and confined aquifers indicate artesian conditions. The artesian groundwater conditions were encountered from groundwater measurements taken from WSDOT monitoring wells. The monitoring wells were installed in and around the areas of lower ground surface elevations near Section 4A and primarily to the south where zones of clean to slightly silty sands and gravels were encountered. Artesian groundwater pressures were also noted in monitoring wells installed in the area of the gully. See Appendix A for details on pertinent groundwater levels.

4.4.3. Known and Suspected Contamination

Five sites of concern are present in Section 4A as described in Table 1. Additional excerpts from reports are included in Appendix A. The sites of concern include:

- Site 4A-A– Former Rail Line –Potentially petroleum-, cPAH-, and metal-contaminated soil;
- Site 4A-B – Former Lumber Yard – Known gasoline- and benzene-, arsenic- and cPAH-contaminated soil and benzene- and arsenic-contaminated groundwater;
- Site 4A-C – 15th Street ROW – Known cPAH- and lead-contaminated soil and potentially contaminated groundwater;
- Site 4A-D – Shoreline – Known cPAH-contaminated soil that is capped;
- Site 4A-E – Johnny's Seafood – Known cPAH-contaminated soil and arsenic-contaminated groundwater. Potential petroleum-contaminated soil and groundwater.

4.5. Section 4B: I-705/BNSF/Dock Street/1147 Dock Street (Cut and Cover and Trenchless)

4.5.1. Soil Conditions

Similar to Section 4A, Section 4B is located on the west edge of Commencement Bay (north end of the Thea Foss Waterway), which is also the western edge of the delta formed at the mouth of the Puyallup River. Based on our review of the geology and explorations performed in the area, the alignment appears to begin in a transition area of geologic deposits as it extends away from the toe of the east facing hillside. Section 4B crosses over the transition from glacial deposits near the ground surface by the east facing hillside to alluvial deposits near the ground surface at the waterway. Glacial deposits mapped around this section of alignment consist of ice contacts (Qvi) and Pre-Fraser sedimentary deposits (Qpf) (Troost in review) near the base of the Tacoma's eastern hillside. Glacial deposits switch to artificial fill deposits (af) (Troost in review) from the base of the hillside, east, toward the Thea Foss Waterway (see Figure 2). Toward the waterway, overlying the glacial and alluvial deposits, there is generally a layer of fill, which is also mapped as artificial fill (af) (Troost in review) in geologic information reviewed. Similar to Section 4A, between the start of the Section 4B and Dock Street, there is no information regarding the stratigraphy within the BNSF railway.

Between the start of Section 4B and the BNSF railway, a single boring indicates a layer of fill overlying what appears to be glacial deposits. The fill consists of loose silty sand with gravel and transitions to a medium dense layer consisting of similar materials. Glacial deposits below the fill consists of dense to very dense mixtures of sand and gravel with varying amounts of silt. The glacial deposits contain a range of moisture contents generally between 6 and 9 percent.

Between the BNSF railway and the proposed outfall location of the Section 4B alignment, there is minimal geotechnical information. Reviewed subsurface explorations north and south of, but also within and near Section 4B, indicate the glacial deposits tend to dip downward toward commencement bay and away from the hillside. As the ground surface stays generally level from the BNSF railway to the waterway within the section of alignment we anticipate the alluvium to become thicker and is overlain by variable fill thicknesses throughout. Reviewed subsurface explorations from within and surrounding the area of Section 4B encountered fill consisting primarily of dredge soils with occasional debris. Debris noted in explorations reviewed within the property of 1147 Dock Street consisted of brick fragments and wood debris. Debris encountered at other sites along the Thea Foss Waterway also reported debris consisting of slag, bricks, wood, wood chips, burnt wood, creosote-treated wood, coal, cinders and asphalt.

Observed alluvium is reported to be comparable in structure and density to the overlying fill and generally consisted of loose to medium dense fine to medium sand to silty sand with varying amounts of shell

fragments gravel and interbeds of thin layers of silt. Moisture content information was not available in the explorations reviewed, but we anticipate that they could be similar to the soils encountered in Section 4A. See Appendix A for details on soils encountered in Section 4B.

4.5.2. Groundwater Conditions

Groundwater levels at the western portion of the alignment of Section 4B is anticipated to be similar to the northern extent of Section 3, which encountered groundwater between 10 and 20 feet bgs. Although not apparent from the groundwater levels recorded within this section, there is a potential for the groundwater level to fluctuate not only with the season but also with the tide from the Thea Foss Waterway. Influence of the tide on groundwater is anticipated to become more significant the closer the alignment gets to the waterway. As the alignment extends east toward the Thea Foss Waterway the groundwater was observed approximately between 10 and 13 feet bgs. However, reviewed information indicates that tidal influence on the groundwater can be a maximum of 1-foot fluctuation between high and low tides. See Appendix A for details on pertinent groundwater levels.

4.5.3. Known and Suspected Contamination

Three sites of concern are present in Section 4B as described in Table 1. Additional excerpts from reports are included in Appendix A. The sites of concern include:

- Site 4B-A– Former Rail Line – Potentially petroleum-, cPAH-, and metal-contaminated soil;
- Site 4B-B – 1147 Dock Street – Known cPAH-contaminated soil;
- Site 4B-C – Shoreline – Known cPAH-, lead- and mercury-contaminated soil that is capped.

5.0 POTENTIAL GEOLOGIC HAZARDS

Geologic hazards in the project area include, general regional seismicity, seismic ground motion amplification, seismically induced liquefaction and lateral spreading, slope instability, and erosion. The sections below provide a brief discussion of these hazards and where they have been identified.

5.1. Regional Seismicity

The site is located within the Puget Sound region, which is seismically active. Seismicity in this region is attributed primarily to the interaction between the Pacific, Juan de Fuca and North American plates. The Juan de Fuca plate is subducting beneath the North American plate. It is thought that the resulting deformation and breakup of the Juan de Fuca plate might account for the deep focus earthquakes in the region. Hundreds of earthquakes have been recorded in the Puget Sound area. In recent history, four of these earthquakes were large events: (1) in 1946, a Richter magnitude 7.2 earthquake occurred in the Vancouver Island, British Columbia area; (2) in 1949, a Richter magnitude 7.1 earthquake occurred in the Olympia area; (3) in 1965, a Richter magnitude 6.5 earthquake occurred between Seattle and Tacoma; and (4) recently in 2001, a Richter magnitude 6.8 occurred near Olympia.

Research has concluded that historical large magnitude subduction-related earthquake activity has occurred along the Washington and Oregon coasts. Evidence suggests several large magnitude earthquakes (Richter magnitude 8 to 9) have occurred in the last 1,500 years, the most recent of which occurred about 300 years ago. Local design practice in Puget Sound and local building codes now include

the possible effect of a very large subduction earthquake and local known faults mapped in the design of structures.

There are no known faults along the project alignment. Based on USGS Fault Maps, the closest fault to the site is the Tacoma Fault, which is located approximately 14 miles from the site. Based on the location of the project site relative to the nearest mapped faults, the risk of adverse impacts resulting from surface displacement due to faulting is considered to be low.

5.2. Site Response

Depending on the soil conditions, ground motion amplification during seismic events can occur. Site classification, or site class, is a simplified system of characterizing the ground-motion amplifying effects of soft soils in the upper 100 feet of the soil-rock column. Site class designation and the corresponding site class factors are used in conjunction with seismic deaggregation analyses to calculate the seismic values used for design of structures.

As previously mentioned in Section 4.4, the 2004 Washington DNR map *Site Class Map of Pierce County, Washington,* indicates that the site class at the site ranges from site class C generally west of I-705 in Section 1 and Section 2, and site class D to E generally east of I-705 in Section 4. Section 3 is located at the transition of site class C to D as well as site class D to E. The map appears to have the majority of Section 3 in site class C. This would correspond with the geology of Section 3 transitioning from the glacial deposits on the eastern hillside of east Tacoma to the artificial fill and alluvial deposits located on the western side of Commencement Bay along the shores of the Thea Foss Waterway. The fill and alluvial deposits correspond with the classification of the site class D to E.

5.3. Liquefaction

Soil liquefaction refers to the condition by which vibration or shaking of the ground, usually from earthquake forces, results in the development of excess pore pressures in saturated soils with subsequent reduction in soil shear strength. The evaluation of liquefaction potential is complex and dependent on numerous parameters, including soil type, grain-size distribution, soil density, depth to groundwater, in-situ static ground stresses, earthquake magnitude, peak ground acceleration (PGA), earthquake-induced ground stresses and excess pore water pressure generated during seismic shaking. In general, soils that are susceptible to liquefaction include very loose to medium dense, clean to silty sands and very soft to stiff non-plastic silts that are below the water table.

The 2004 Washington DNR map *Liquefaction Susceptibility Map of Pierce County, Washington,* indicates that the liquefaction susceptibility at the site ranges from very low in the alignment sections generally to the west of I-705 (i.e., Section 1 and Section 2), to very high in the area generally east of I-705 in Section 4A and Section 4B. Section 3 is located at the transition of very low to very high liquefaction susceptibility. Although, the map appears to have the majority of Section 3 in a very low liquefaction susceptibility region, portions of Section 3 closest to the waterway could have the potential for liquefaction. Loose soil conditions noted within the old gully found in Section 3 near the intersection of South 15th Street and Hood Street also exhibit potential for liquefaction depending on groundwater conditions. This would correspond with the geology of Section 3 transitioning from the glacial deposits on the hillside east of the alignment to the alluvium deposits located on the western side of Commencement Bay and the shores of the Thea Foss Waterway.

Areas along the Thea Foss Waterway that are susceptible to liquefaction could also experience lateral spreading toward the waterway as a result. Lateral spreading involves lateral displacements of large volumes of liquefied soil. Lateral spreading can occur on near-level ground as blocks of surface soils are displaced relative to adjacent blocks. Lateral spreading also occurs as blocks of surface soils are displaced toward a nearby slope or free-face such as the banks of a waterway. The Thea Foss Waterway borders the eastern extents of Sections 4A and 4B.

5.4. Slope Instability

Slopes steeper than about 15 degrees (27 percent grade) are often considered hazardous especially during seismic events. When planning to construct in areas with significant slopes, regrading of the slopes, or trenching at the bottom of a slope, temporarily reinforcing the toe of the slopes may be required in order to improve or maintain slope stability. From the start of the gravel access road, the slope to the west of the Section 3 alignment increases in height. As the slope increases in height the gravel access road appears to cut into the hillside supported by retaining walls. Although retaining walls are present this does not ensure a large excavation would be supported near or at the toe along the gravel access road. Surcharges from buildings at the top of this slope may increase the risk of slope instability if a large trench or excavation is cut at the toe.

5.5. Erosion

Erosional forces such as rivers/streams/shorelines or surface water runoff can weaken the face of trenches or toe of slopes leading to stability issues. Generally speaking, erosion on the face of slopes or excavations can cause smaller surficial sloughing failures that generally have a low impact to surrounding improvements. Erosional forces at the toe of slopes or at the bottom of a trench excavation can cause larger global-type slope or sidewall failures, respectively. Global failures have deeper slide planes compared to sloughing failures and as a result have a higher potential to impact structures and construction. Generally, erosion of slope or trench faces can be controlled and managed with a properly implemented erosion and sedimentation control plan and routine maintenance. Although not expected, erosion at the toe of slopes or bottom of trenches can be comparatively more difficult to address especially if the erosion is caused by concentrated sheet flows or seepage, respectively. Engineered solutions such as armored slopes or proper shoring and dewatering are commonly used to prevent or reduce the rate of erosion or seepage. Other options could include re-routing or re-directing surface water runoff away from the erosion prone area.

6.0 DISCUSSION OF PROPOSED STORMWATER MAIN SECTIONS

This section provides as discussion of some of the environmental contamination and geotechnical considerations for each section of the alignment. It also provides potential suggestions for additional explorations for all sections mentioned.

6.1. Section 1: Jefferson Avenue /UWT (Cut and Cover)

6.1.1. Environmental Contamination and Considerations

Preliminary environmental considerations during design and construction activities within Section 1 may include:

- Contaminated soil management in accordance with local, state and federal regulations if contaminated soil is encountered during construction.
- Cross contamination between the shallow and deep aquifer if the alignment extends beneath the silt layer separating the shallow and deep aquifers.
- Contaminated-groundwater management in accordance with local, state and federal regulations if the depth of the alignment extends into the groundwater and contaminated groundwater is encountered during construction.
- The potential for the alignment to create a preferential pathway for contaminated groundwater if the depth of the alignment extends into the groundwater and contaminated groundwater intersects the alignment.

6.1.2. Geotechnical and Construction Considerations

Some of the preliminary geotechnical considerations anticipated during design and construction activities within Section 1 could arise during the following: demolition and stripping of asphalt; excavation and shoring of trench excavations; installation of the stormwater main; and backfill placement and compaction.

Based on the review of subsurface information (see appendix A for details) within Section 1 (refer to Figure 3A) we identified the following preliminary geotechnical considerations regarding the stormwater main installation:

- Southern explorations performed in the roadway indicate that the asphalt concrete that comprises the roadway is potentially underlain by cement concrete.
- Excavations deeper than 4 feet should be shored or laid back at a stable slope if workers are required to enter. Excavations greater than 4 feet may require temporary shoring such as trench boxes. Other shoring options could be needed, particularly where structures and utilities that are sensitive to settlements are present near the excavation.
- Controlling perched groundwater with sumps, pumps, or diversion ditches may be adequate for shallow excavations open for a short amount of time. For deeper excavations or excavations required to be open for an extended period of time, dewatering using well points or other methods may need to be considered.
- Soils in the excavation zone of the alignment may consist of fill overlying hard or dense glacial ice contact deposits. Hard or dense conditions, large cobbles or even boulders may be encountered.
- If contamination levels do not warrant off-site disposal, soil reuse could be considered primarily during periods of dry weather. The soils will likely contain a significant amount of fines and is anticipated to be moisture sensitive and difficult to compact if already over optimum moisture content. Moisture conditioning of on-site soil could be required before considered suitable for use as structural backfill. Moisture conditioning may require staging areas or space for drying.

6.1.3. Considerations for Additional Subsurface Investigation

6.1.3.1. Environmental

Predesign Investigation. The existing information within the UWT campus should be sufficient for design if the alignment does not extend into the groundwater and/or below the silt layer. However, a predesign investigation should be considered if the alignment extends into the groundwater and/or below the silt

layer to further evaluate the impacts as described above. The predesign investigation should consider an evaluation of the depth of the silt layer within the alignment and the potential to create a preferential pathway along the alignment, thus connecting the shallow and deep aquifers. We anticipate an additional three to four soil borings will be sufficient within Section 1 during the predesign investigation. Consideration should be given to converted borings to permanent monitoring well(s) to evaluate groundwater conditions in the future.

Soil Characterization For Disposal/Reuse Purposes. Soil characterization should be anticipated to evaluate soil for disposal or reuse purposes. This sampling frequency and procedures should be, in part, based on the final design to evaluate the soil that will be excavated during construction. Soil characterization could be completed prior to construction or during construction. If completed during construction, stockpiling and/or extra handling of soil should be anticipated.

6.1.3.2. Geotechnical

For proposed construction, it is our opinion that the existing subsurface information within the area should be sufficient for design considerations. This section is given a "low uncertainty" based on existing information and anticipated consistency of glacial deposits.

For project estimation purposes, potential goals of further study options include, but are not limited to, determining the thicknesses of existing asphalt concrete pavement, and the potential existence of cement concrete pavement under the asphalt pavement. Options could include coring the asphalt concrete pavement, and if present, the concrete cement pavement at intervals on the order of 50 to 200 feet.

6.2. Section 2: South 17th Street and Pacific Avenue (Cut and Cover and Trenchless)

6.2.1. Environmental Contamination and Considerations

Preliminary environmental considerations during design and construction activities within Section 2 may include:

- Contaminated soil management in accordance with local, state and federal regulations if contaminated soil is encountered during construction.
- Contaminated groundwater management in accordance with local, state and federal regulations if the depth of the alignment extends into the groundwater and contaminated groundwater is encountered during construction.
- The potential for the alignment to create a preferential pathway for contaminated groundwater if the depth of the alignment extends into the groundwater and contaminated groundwater intersects the alignment.

6.2.2. Geotechnical and Construction Considerations

Some of the preliminary geotechnical considerations anticipated during design and construction activities within Section 2 could arise during the following: demolition and stripping of asphalt; deep excavations for trenchless installation on either side of the section alignment; shoring for the deep excavations; installation of stormwater main under Pacific Avenue using trenchless technologies; and backfill placement and compaction in deep excavations.

Based on the review of subsurface information (see Appendix A for details) within Section 2 (refer to Figure 3B) we identified the following preliminary geotechnical considerations regarding the stormwater main installation:

- Locating trenchless technologies below infrastructure and existing utilities primarily within Pacific Avenue, which may cause eastern excavations on the South 17th Street to be significantly deep.
- Borings in the area indicate that the asphalt concrete that comprises the roadway is potentially underlain by cement concrete.
- Excavations deeper than 4 feet should be shored or laid back at a stable slope if workers are required to enter. Deep excavations along the alignment that may require temporary shoring other than trench boxes to accommodate trenchless technologies. In addition, excavations to the east and west of Pacific Avenue may need to be evaluated for global stability and appropriate lateral earth pressures, particularly where slopes, structures and utilities that are sensitive to settlements are present near the excavation.
- Controlling perched groundwater with sumps, pumps, or diversion ditches may be adequate for shallow excavations open for a short amount of time. For deeper excavations or excavations required to be open for an extended period of time, there is a potential to encounter groundwater. If excavations are deep enough, dewatering using well points or other methods may need to be considered.
- Soils in the excavation zones along the alignment may consist of fill overlying hard or dense glacial ice contact deposits. Hard or dense conditions, large cobbles or even boulders may be encountered.
- If contamination levels do not warrant off-site disposal, soil reuse could be considered primarily during periods of dry weather. The soils will likely contain a significant amount of fines and is anticipated to be moisture sensitive and difficult to compact if already over optimum moisture content. Moisture conditioning of on-site soil could be required before considered suitable for use as structural backfill. Moisture conditioning may require staging areas or space for drying.

6.2.3. Considerations for Additional Subsurface Investigations

6.2.3.1. Environmental

Predesign Investigation. It is our opinion that the existing subsurface information within Section 2 is not sufficient because the alignment will likely extend into the groundwater. A predesign investigation could be necessary to evaluate the lateral extent of the groundwater plumes in the area. Options for further investigations include but are not limited to three to four soil borings that could be converted into temporary monitoring wells along the alignment.

Soil Characterization For Disposal/Reuse Purposes. Soil characterization should be anticipated to evaluate soil for disposal or reuse purposes. This sampling frequency and procedures should be, in part, based on the final design to evaluate the soil that will be excavated during construction. Soil characterization could be completed prior to construction or during construction. If completed during construction, stockpiling and/or extra handling of soil should be anticipated.

6.2.3.2. Geotechnical

In our opinion, there is a lack of subsurface information directly located on the proposed alignment with a single boring just within the section boundary. Because of the lack of information available for the anticipated method of installation and based on an apparent risk associated with the lack of information

and method of utility installation along the alignment, Section 2 of the alignment is given a rating of "high uncertainty" as shown in Figure 3.

Options for additional investigations may include, but are not limited to, three to four borings drilled directly on or close to the alignment. Borings could be located at entry and exit locations and spaced at intervals of approximately 150 lineal feet along the alignment to depths of approximately 30 to 40 feet bgs. To gain additional understanding of the groundwater conditions along the alignment and to determine the need for dewatering of deep excavations, borings performed in this section could be converted into monitoring wells depending on the depth of the utility. Borings could include continuous sampling options to gain the most knowledge of the soils beneath the proposed alignment. Borings ideally would identify the potential for boulders, cobbles or other obstructions.

6.3. Section 3: Prairie Line Trail/Hood Street/I-705 Corridor (Cut and Cover)

6.3.1. Environmental Contamination and Considerations

Preliminary environmental consideration during design and construction activities within Section 3 may include:

- Contaminated soil management in accordance with local, state and federal regulations if contaminated soil is encountered during construction.
- Contaminated groundwater management in accordance with local, state and federal regulations if the depth of the alignment extends into the groundwater and contaminated groundwater is encountered during construction.
- The potential for the alignment to create a preferential pathway for contaminated groundwater if the depth of the alignment extends into the groundwater and contaminated groundwater intersects the alignment.

6.3.2. Geotechnical and Construction Considerations

Some of the preliminary geotechnical considerations anticipated during design and construction activities within Section 3 could arise during the following: demolition and stripping of asphalt; excavation and shoring of trench excavations; installation of stormwater main; and backfill placement and compaction.

Based on the review of subsurface information (see Appendix A for details) within Section 3 (refer to Figure 3C) we identified the following preliminary geotechnical considerations regarding the stormwater main installation for Section 3 of the alignment:

- Borings outside the designated alignment that were performed in the roadway of Pacific Avenue indicate that the asphalt concrete is potentially underlain by cement concrete. If the alignment of Section 3 is moved to be within Hood Street, there is a potential for the asphalt concrete to be underlain by cement concrete.
- Excavations deeper than 4 feet should be shored or laid back at a stable slope if workers are required to enter. Excavations greater than 4 feet may require temporary shoring such as trench boxes. Other shoring options could be needed, particularly where slopes, structures and utilities that are sensitive to slope instability and/or settlements are present near the excavation.

- Excavating at the base of the slope or retaining wall west of the northern portion of the section's alignment could potentially cause slope instabilities and may need to be evaluated during design.
- Controlling perched groundwater with sumps, pumps, or diversion ditches may be adequate for shallow excavations open for a short amount of time. For deeper excavations or excavations required to be open for an extended period of time, there is a potential to encounter and manage groundwater. If deep enough, dewatering using well points or other methods may need to be considered.
- Artesian groundwater pressures could exist. Construction documents indicate dewatering was required to install the drilled shafts supporting I-705 within this section.
- Soils in the excavation zone of the alignment may consist of fill overlying hard or dense glacial ice contact deposits. Hard or dense conditions, large cobbles or even boulders may be encountered. Within the area of the gully, loose to medium dense fill or alluvium is documented which may also contain debris and/or large particles and boulders.
- Based on the review of the *Liquefaction Susceptibility Map of Pierce County, Washington,* the northern portion of Section 3 may have the potential for liquefaction and associated concerns such as lateral spreading during an earthquake event.
- If contamination levels do not warrant off-site disposal, soil reuse could be considered primarily during periods of dry weather. The soils will likely contain a significant amount of fines and is anticipated to be moisture sensitive and difficult to compact if already over optimum moisture content. Moisture conditioning of on-site soil could be required before considered suitable for use as structural backfill. Moisture conditioning may require staging areas or space for drying.
- Use of fill and or alluvium materials for on-site reuse is typically not recommended for backfill due to the potentially high moisture content, high fines content, and potential for deleterious debris and excessive organics. Import soil for use as structural backfill may be necessary.

6.3.3. Preliminary Additional Investigation Options

6.3.3.1. Environmental

Predesign Investigation. The existing information within the Section 3 should be sufficient for design if the alignment does not extend into the groundwater. However, a predesign investigation should be considered if the alignment extends into the groundwater to further evaluate the impacts as described above. The predesign investigation should consider an evaluation of the extent of the PCE, TCE, vinyl chloride and petroleum hydrocarbon groundwater plumes in the area and the potential to create a preferential pathway along the alignment. Options for further investigations include but are not limited to four to five soil borings that could be converted into temporary or permanent monitoring wells along the alignment to evaluate groundwater conditions.

City of Tacoma should plan to coordinate with Ecology to evaluate the design requirements for impacts to Sauros Agreed Order (Site 3B). Requirements may include best management practices during construction and appropriate notifications.

Soil Characterization For Disposal/Reuse Purposes. Soil characterization should be anticipated to evaluate soil for disposal or reuse purposes. This sampling frequency and procedures should be, in part, based on the final design to evaluate the soil that will be excavated during construction. Soil characterization could be completed prior to construction or during construction.

6.3.3.2. Geotechnical

It is our opinion that the existing subsurface information within the southern portion of Section 3 should be sufficient for design if the alternative alignment in Section 4A is chosen. However, if the alignment in Section 3 extends to Section 4B then additional information may need to be gathered for assessing the soil properties and groundwater conditions necessary to evaluate global stability of excavations performed at the toe of the existing retaining wall and slope, and to determine the overall character of subsurface conditions. Borings performed for this purpose could be paired with the purpose of designing shoring. The section would generally be given a "low uncertainty" with the general consistency of glacial deposits and amount of existing information of the area's subsurface conditions within the area of the Section 3 alignment. However, because most of the data in the section is over 20 to 30 years old the section is given a "medium uncertainty" as the area has been modified since explorations were completed.

Options for additional investigations may include, but are not limited to, performing approximately four to five additional explorations to confirm conditions found within the existing borings, and refining project estimations of fill thicknesses along the alignment. Borings drilled along the alignment are initially estimated to extend approximately 20 to 30 feet bgs. Two of the four or five borings may be used for Sections 4A and 4B if placed strategically. These borings are initially estimated to extend approximately 30 to 40 feet bgs. To gain additional understanding of the groundwater conditions along the alignment and to determine the need for dewatering of deep excavations, borings performed in this section could be converted into monitoring wells depending on the depth of the utility. Borings at the intersections of Sections 4A and 4B could include continuous sampling options to gain the most knowledge of the soils beneath the proposed alignment.

6.4. Section 4A: I-705/BNSF/Dock Street/South 15th Street ROW (Cut and Cover and Trenchless)

6.4.1. Environmental Contamination and Considerations

Preliminary environmental considerations during design and construction activities within Section 4A may include:

- Contaminated soil management in accordance with local, state and federal regulations if contaminated soil is encountered during construction.
- Contaminated groundwater management in accordance with local, state and federal regulations if the depth of the alignment extends into the groundwater and contaminated groundwater is encountered during construction.
- Notification to Ecology of disturbance and completion of restoration of capped soil along the shoreline.

6.4.2. Geotechnical and Construction Considerations

Some of the preliminary geotechnical considerations anticipated during design and construction activities within Section 4A could arise during the following: installation of stormwater main under BNSF railway and dock street via trenchless technologies; deep excavations for trenchless technology stormwater main installation on either side of the section alignment; shoring for the deep excavations in support of the trenchless technologies; backfill placement and compaction; and potentially repaving Dock Street and restoring 15th Street Park appurtenances.

Based on the review of subsurface information (see Appendix A for details) within Section 4A (refer to Figure 3D) we identified the following preliminary geotechnical considerations regarding the stormwater main installation:

- Locating trenchless technologies below existing utilities and infrastructure and maintaining utilities and other infrastructure.
- Excavations deeper than 4 feet should be shored or laid back at a stable slope if workers are required to enter. Deep excavations along the alignment may require temporary shoring other than trench boxes to accommodate trenchless technologies. In addition, excavations and shoring located on or near slopes to the west of the alignment, may need to be evaluated for global stability and appropriate lateral earth pressures, particularly where slopes, structures and utilities that are sensitive to settlements are present near the excavation.
- In areas where cut and cover techniques are proposed and excavation depths are greater than 4 feet, temporary shoring such as trench boxes may be required. Other options could be needed particularly where slopes, structures and utilities that are sensitive to settlements are present near the excavation.
- Controlling perched groundwater with sumps, pumps, or diversion ditches may be adequate for shallow excavations open for a short amount of time. For deeper excavations or excavations required to be open for an extended period of time, dewatering using well points or other methods may need to be considered, especially when considering the proximity to the waterway. Depending on the location of excavations near the waterway, dewatering may not be practical.
- Soils in the excavation zones along the alignment may initially consist of fill overlying loose to medium dense alluvium associated with the gully. The alluvium and fill overlie hard or dense glacial deposits at depth. Large cobbles, boulders or debris may be encountered in any of these soil units.
- Fill and/or alluvium materials is typically not suitable for on-site reuse as backfill due to the potentially high moisture content, high fines content, and potential for deleterious debris and excessive organics.
- If contamination levels do not warrant off-site disposal, some soil reuse could be considered primarily during periods of dry weather. The soils will likely contain a significant amount of fines which could cause it to generally be moisture sensitive and difficult to compact if already over optimum moisture content. Moisture conditioning of on-site soil could be required before considered suitable for use as structural backfill. Moisture conditioning may require staging areas or space for drying.
- Based on the review of the *Liquefaction Susceptibility Map of Pierce County, Washington,* Section 4A has a high potential for liquefaction and associated concerns, such as lateral spreading, during an earthquake event.

6.4.3. Preliminary Additional Investigation Options

6.4.3.1. Environmental

Predesign Investigation. It is our opinion that the existing subsurface information within the northern portion of Section 4A should be sufficient for design if City of Tacoma assumes all soil generated will be characterized as contaminated and disposed at a Subtitle D landfill.

City of Tacoma should plan to coordinate with Ecology to evaluate the design requirements for impacts to the shoreline cap. Requirements will likely include best management practices during construction and restoration of the shoreline.

Soil Characterization For Disposal/Reuse Purposes. Soil characterization should be anticipated to evaluate soil for disposal or reuse purposes. This sampling frequency and procedures should be, in part, based on the final design to evaluate the soil that will be excavated during construction. Soil characterization could be completed during prior to construction or during construction. If completed during construction, stockpiling and/or extra handling of soil should be anticipated.

6.4.3.2. Geotechnical

As shown on Figure 3D, there is a lack of subsurface information directly located on the proposed alignment. Because of the lack of information available for the anticipated method of installation, Section 4A of the alignment is given a rating of "high uncertainty" as shown in Figure 3. In the areas where cut and cover installation is anticipated, west of Dock Street, borings that exist within the immediate area of the alignment appear to be over 15 years old. The age of the borings adds to the level of uncertainty of current conditions and affirms our opinion on the "high uncertainty" rating for the section.

Options for additional investigations may include, but are not limited to, three to four borings drilled directly on or near the alignment in the area of trenchless technology installation and one confirmation boring in the area of cut and cover installation. Borings for the trenchless technology could be located at the entry and exit locations and spaced at intervals of approximately 150 lineal feet along the alignment. Initial estimates of boring depths are approximately 40 to 60 feet bgs. The large range is due to the location of the deep excavation at the start of the section's alignment and topography. To gain additional understanding of the groundwater conditions along the alignment and to determine the need for dewatering of deep excavations, borings performed in this section could be converted into monitoring wells. Borings could include continuous sampling to gain the most knowledge of the soils beneath the proposed alignment. Borings could identify the potential for boulders, cobbles or other obstructions within the layers that the stormwater main would pass through. In addition, borings could serve the dual purpose for evaluating liquefaction potential and the effects due to liquefaction.

6.5. Section 4B: I-705/BNSF/Dock Street/1147 Dock Street (Cut and Cover and Trenchless)

6.5.1. Environmental Contamination and Considerations

Preliminary environmental considerations during design and construction activities within Section 4B include:

- Contaminated soil management in accordance with local, state and federal regulations if contaminated soil is encountered during construction.
- Contaminated groundwater management in accordance with local, state and federal regulations if the depth of the alignment extends into the groundwater and contaminated groundwater is encountered during construction.
- Notification to Ecology of disturbance and completion of restoration of capped soil along the shoreline.

6.5.2. Geotechnical and Construction Considerations

Some of the preliminary geotechnical considerations anticipated during design and construction activities within Section 4B could arise during the following: deep excavations for trenchless technology installations where trenchless technology is being considered; shoring for the deep excavations in support of the trenchless technologies, potential cut and cover areas; backfill placement and compaction; and potentially repaving of Dock Street.

Based on the review of subsurface information (see Appendix A for details) within Section 4B (refer to Figure 3D) we identified the following preliminary geotechnical considerations regarding the stormwater main installation:

- Locating trenchless technologies below existing utilities and infrastructure while maintaining utilities and other infrastructure.
- Excavations deeper than 4 feet should be shored or laid back at a stable slope if workers are required to enter. Deep excavations along the alignment may require temporary shoring other than trench boxes to accommodate trenchless technologies. In addition, excavations and shoring located on or near slopes to the west of the alignment may need to be evaluated for global stability and appropriate lateral earth pressures, particularly where slopes, structures and utilities that are sensitive to settlements are present near the excavation.
- In areas where cut and cover techniques are proposed and excavation depths are greater than 4 feet, temporary shoring such as trench boxes may be required. Other options could be needed particularly where slopes, structures and utilities that are sensitive to settlements are present near the excavation.
- Controlling perched groundwater with sumps, pumps, or diversion ditches may be adequate for shallow excavations open for a short amount of time. For deeper excavations or excavations required to be open for an extended period of time, dewatering using well points or other methods may need to be considered especially considering the proximity to the waterway. Depending on the location of excavations near the waterway, dewatering may not be practical.
- Soils in the excavation zones along the alignment may initially consist of fill overlying hard or dense glacial deposits. Once the alignment starts extending toward the waterway, fill likely overlies loose to medium dense alluvium associated with deposits from the Puyallup River and waterway. The alluvium and fill overlie hard or dense glacial deposits at depth. Large cobbles, boulders or debris may be encountered.
- Fill and/or alluvium materials is typically not suitable for on-site reuse as backfill due to the potentially high moisture content, high fines content, and potential for deleterious debris and excessive organics.
- If contamination levels do not warrant off-site disposal, soil reuse of glacial materials could be considered primarily during periods of dry weather. The soils will likely contain a significant amount of fines and will be moisture sensitive and could be difficult to compact if already over optimum moisture content. Moisture conditioning of on-site soil could be required before it could be considered suitable for use as structural backfill. Moisture conditioning may require staging areas or space for drying.
- Based on the review of the *Liquefaction Susceptibility Map of Pierce County, Washington,* Section 4B has a high potential for liquefaction and associated concerns such as lateral spreading during an earthquake event.

6.5.3. Preliminary Additional Investigations Options

6.5.3.1. Environmental

Predesign Investigation. It is our opinion that the existing subsurface information within the northern portion of Section 4B should be sufficient for design if City of Tacoma assumes all soil generated will be characterized as contaminated and disposed at a Subtitle D landfill.

City of Tacoma should plan to coordinate with Ecology to evaluate the design requirements for impacts to the shoreline cap and 1147 Dock Street agreed order (Site 4B-B). Requirements will likely include best management practices during construction, appropriate notifications and restoration of the shoreline.

Soil Characterization For Disposal/Reuse Purposes. Soil characterization should be anticipated to evaluate soil for disposal or reuse purposes. This sampling frequency and procedures should be, in part, based on the final design to evaluate the soil that will be excavated during construction. Soil characterization could be completed prior to construction or during construction. If completed during construction, stockpiling and/or extra handling of soil should be anticipated.

6.5.3.2. Geotechnical

As shown on Figure 3D, borings are located in the surrounding area of the proposed alignment in the section, but only two subsurface borings are within the area boundary of the section. Although one of the two borings is shown on the alignment, in our opinion both borings contain insufficient information for the design of trenchless technologies and for assessing the geotechnical considerations of the alignment within Section 4B. It should also be noted that borings in this section appear to be approximately 10 years old or older. Because of the lack of information available for the anticipated method of installation along the alignment and the age of the explorations, Section 4B of the alignment is given a rating of "high uncertainty" as shown in Figure 3.

Options for further investigations may include, but are not limited to, four to five borings drilled directly on the alignment in the area where trenchless technologies are being considered, and one confirmation boring in areas of cut and cover installation. Borings for the trenchless technology could be spaced at intervals of approximately 150 lineal feet of alignment and at entry and exit points. Initial estimates of boring depths are approximately 30 to 40 feet bgs. To gain additional understanding of the groundwater conditions to support the potential design of dewatering operations within this area, borings could be converted into monitoring wells. Borings could include continuous sampling to gain the most knowledge of the soils beneath the proposed alignment. Borings ideally would identify potential for boulders or cobbles or other zones of concern for trenchless technologies. In addition, borings could serve the dual purpose for evaluating liquefaction potential and the effects due to liquefaction.

In addition, further investigations may also include borings at the top of or on the hillside west of section 4B to determine the soil properties of the slope west of excavations to evaluate global stability where the toe of the slope may be disturbed from construction activities.

7.0 LIMITATIONS

We have prepared this data report for City of Tacoma in support of the Progressive Design Build process for the Jefferson Avenue and Hood Street Stormwater Main Upgrade Project located in Tacoma, Washington. The City of Tacoma may distribute copies of this report to design contractors and authorized agents and regulatory agencies as may be required for the project.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices for geosciences and geotechnical engineering in this area at the time this report was prepared. No warranty, express or implied, applies to the services or this report.

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

Table 1

Sites of Concern

Jefferson Avenue and Hood Street Stormwater Upgrade Project

Tacoma, Washington

Map ID	Address	Listing Name	Database	Depth to Groundwater (feet bgs)	Summary	Area of Concern	Anticipated Design and Construction Impacts
Section 1							
N/A	Market Street/Jefferson Avenue Trichloroethene (TCE), Chlorobenzene, Benzene , Gasoline and Vinyl Chloride Groundwater Plumes			Shallow aquifer = 5 to 15 Deep aquifer = 15 to 25 Unconfirmed aquifer = 20 to 35	TCE, chlorobenzene, benzene , gasoline and vinyl chloride are known to be present at the intersection of Market Street and Jefferson Avenue. The estimated extent of the groundwater plumes is shown on Figure 3A. It also appears a shallow and deep aquifer are present in the area, but connection between the aquifers has not been evaluated. Additional background information including chemical concentrations, cross sections and groundwater elevation is available Appendix A.	The full lateral extent of the contaminated groundwater has not been evaluated. The contaminated groundwater is located within the new alignment.	- Cross contamination between the shallow and deep aquifers - Contaminated groundwater management - Contaminated soil management - Alignment creates a preferential pathway for contaminated groundwater
N/A	Former Trolley Rail Line			Unknown	A trolley rail line was formerly located along Jefferson Avenue as shown Figure 3A based on aerial photography and photographs obtained from the Tacoma Public Library. The remnants and construction technique of the rail line is not known.	The presence of the former rail tracks and associated railroad ties is not known. Soil and groundwater contamination directly associated with the former rail operations has not been documented. Diesel-range petroleum hydrocarbons, carcinogenic polycyclic aromatic hydrocarbons (cPAHs), lead and arsenic are typically associated with rail activities due to creosote-treated ties, dust from brakes and leaking engines.	- Soil management
Section 2							
2A	1500 Broadway	Convention Center	CSCSL	Unknown	PCE and oil-range petroleum hydrocarbons were detected at concentrations greater than the Model Toxics Control Act (MTCA) Method A groundwater cleanup level in water samples collected from the storm drains near the convention center. The storm drain is oriented adjacent and parallel to the alignment and discharges to the Thea Foss Waterway.	The footing drain is connected to the storm sewer which is oriented adjacent to the alignment. Soil conditions in the vicinity of the these storm drains have not been evaluated.	- Contaminated- water management - Contaminated soil management - Alignment creates a preferential pathway for contaminated groundwater
2B	1548 Pacific Avenue	Pacific Quickstop	CSCSL, HSL, ALLSITES, LUST, UST	5 to 12	A former service station was located on the site. USTs and the majority of the petroleum-contaminated soil was removed from the site in 1999. Petroleum-contaminated soil remains on Pacific Avenue. Free product and diesel- and gasoline-range petroleum hydrocarbons were detected at concentrations greater than the respective MTCA cleanup levels in groundwater samples collected along Pacific Avenue prior to the remediation of the site. Groundwater was encountered at an approximate depth of 5 feet bgs. Groundwater monitoring has not been completed following the removal of the petroleum-contaminated soil.	The eastern lateral extent of the known petroleum-contaminated groundwater and soil is not known and may impact these media within the alignment.	- Contaminated groundwater management - Contaminated soil management - Alignment creates a preferential pathway for contaminated groundwater
2C	1514 Pacific Avenue	Palace Cleaning and Preoing Dry Cleaners	EDR US Hist Cleaners	Unknown	A dry cleaner was listed on the site between 1974 and 1983.	Groundwater conditions associated with a former dry cleaner have not been evaluated and may impact these media within the alignment.	- Contaminated groundwater management - Contaminated soil management - Alignment creates a preferential pathway for contaminated groundwater
2D	In Pacific Avenue ROW	N/A	Not Listed	Unknown	The rail alignment crosses Pacific Avenue. It is unknown if the former rail alignment is still present within alignment.	The presence of the former rail tracks and associated rail road ties is not known. Soil and groundwater contamination directly associated with the former rail operations has not been documented. Diesel-range petroleum hydrocarbons, cPAHs, lead and arsenic are typically associated with rail activities due to creosote-treated ties, dust from brakes and leaking engines.	- Soil management

Map ID	Address	Listing Name	Database	Depth to Groundwater (feet bgs)	Summary	Area of Concern	Anticipated Design and Construction Impacts
Section 3							
3A	1501 Pacific Avenue	Pioneer Masonry Restoration Bette Martin	RCRA NonGen / NLR, FINDS, ALLSITES, CSCSL NFA, VCP	Groundwater was observed at an approximate depth of 6 on the western portion of the site and 18 on the eastern portion of the site.	Tacoma Iron Works is listed on the parcel from 1885 to 1888. A building covers the entire site in 1896 to 1950 with multiple stores/office/bank. The property is identified as vacant in the 1969 Sanborn map. The site was granted an NFA from Ecology in 2005 after removal of two USTs and installation of wells for groundwater monitoring. Minor remnant diesel-contaminated soil and groundwater remain on the site at depths between approximately 15 and 30 feet bgs. Petroleum-contaminated soil may extend to the east based on information in the reviewed reports. Diesel -range petroleum hydrocarbons were detected at concentrations greater than MTCA Method A groundwater cleanup level in groundwater samples collected in wells on the northwest portion of the site. Diesel-range petroleum hydrocarbons were not detected in samples collected from monitoring wells on the eastern portion of the site.	Petroleum-contaminated soil and groundwater is present on the site, but the eastern extent is not known. The petroleum-contaminated soil and groundwater may impact soil and groundwater within the alignment.	- Contaminated water management - Contaminated soil management
	1537 Pacific Avenue	Avenue Cleaners and Dryers	EDR US Hist Cleaners	Unknown	A dry cleaner was listed on the site between 1947 and 1953.	Groundwater conditions associated with a former dry cleaner have not been evaluated and may have impacted the soil and groundwater within the alignment.	- Contaminated water management - Contaminated soil management
3B	Sauros Cleanarama	1407 Pacific Avenue	HSL, CSCSL, RCRA	15 to 30	Historical operations conducted by the former dry cleaner resulted in releases of chlorinated solvents into soil and groundwater that impacted adjacent and downgradient properties. An interim action was completed between 2001 and 2009 to remove the majority of the PCE-contaminated soil. A PCE, TCE and vinyl chloride groundwater plume extends east from the site as shown on Figure 3C. The preferred cleanup action is monitored natural attenuation, groundwater monitoring and a restrictive covenant on the property. The site is also within an agreed order with the Department of Ecology.	PCE, TCE, and vinyl chloride maybe encountered in soil and groundwater based on the proposed depth of the alignment.	- Contaminated groundwater management - Contaminated soil management - Alignment creates a preferential pathway for contaminated groundwater - Notifications to Ecology for Agreed Order
3C	Key Bank	1301 A Street	VCP, CSCSL NFA	50 to 60 (Elevation 7 to 15 feet)	A gasoline- and benzene-contaminated groundwater plume extends from the northeast portion of this property. The groundwater flow direction is to the southeast. The eastern extent of the groundwater plume is not known and may extend into the alignment.	Gasoline- and benzene-contaminated groundwater may be encountered based on the proposed depth of the alignment.	- Contaminated groundwater management - Contaminated soil management - Alignment creates a preferential pathway for contaminated groundwater
3D	Rail Lines	Along Rail Alignment	None	Unknown	The alignment crosses existing and former rail road tracks. Soils along the new Prairie Line Trail pedestrian path is known to be contaminated with cPAHs and lead based on testing completed in 2014 for the City of Tacoma. Furthermore a tool shed and oil house were located along the rail road tracks at the approximate location of the South 15th Street alignment as shown in the 1912 to 1960 Sanborn maps.	Known cPAH-contaminated soil is present along the Prairie Line Trail pedestrian path. Soil and groundwater contamination on the remainder of the site and directly associated with the former rail operations has not been documented. Diesel-range petroleum hydrocarbons, cPAHs, lead and arsenic are typically associated with rail activities due to creosote-treated ties, dust from brakes and leaking engines.	- Soil management

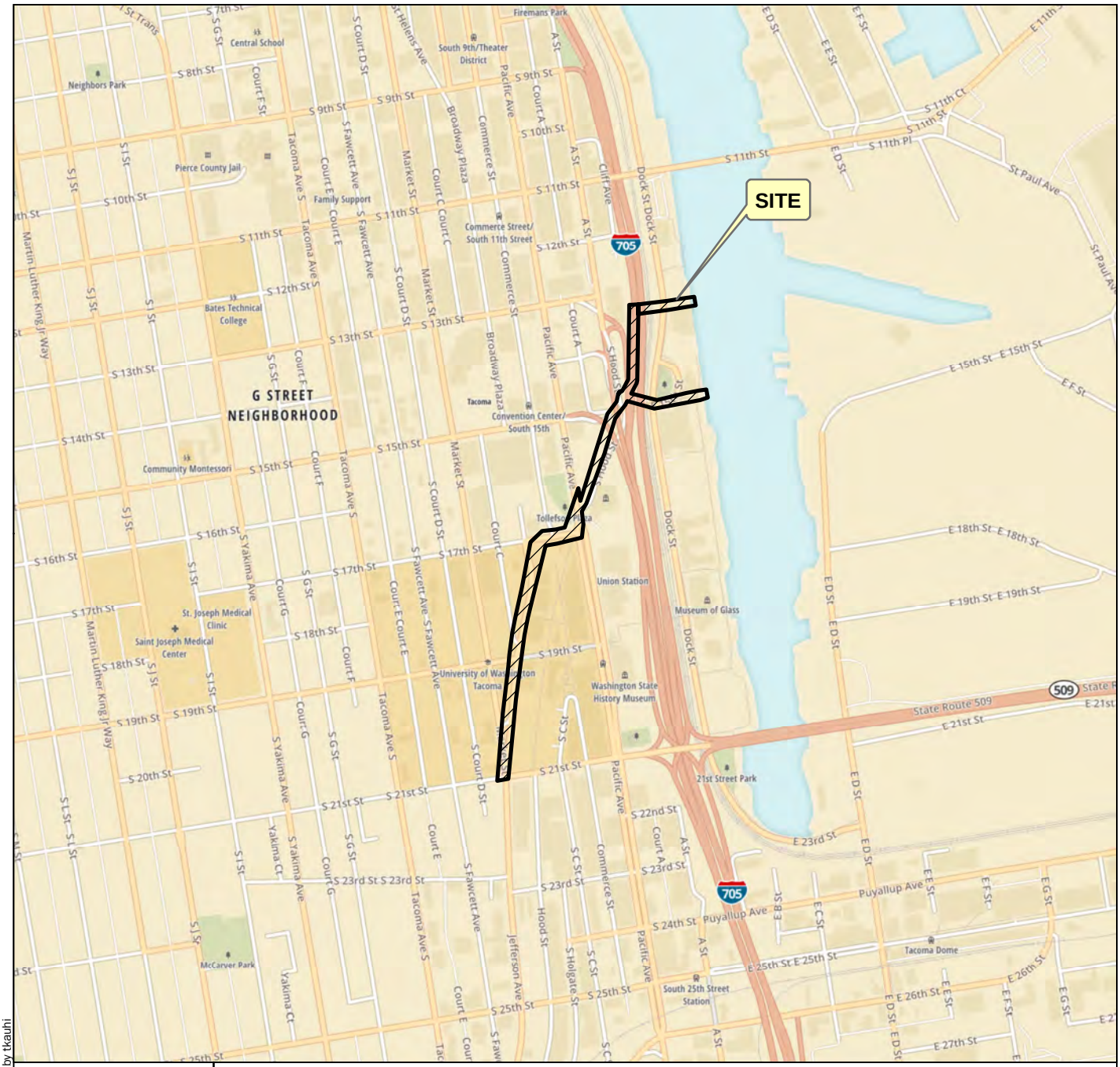
Map ID	Address	Listing Name	Database	Depth to Groundwater (feet bgs)	Summary	Area of Concern	Anticipated Design and Construction Impacts
Section 4A							
4A-A	Existing Rail Lines	Along Rail Alignment	None	Unknown	The existing rail lines have been present since at least the late 1800's.	Soil and groundwater contamination directly associated with the former rail operations has not been documented. Diesel-range petroleum hydrocarbons, cPAHs, lead and arsenic are typically associated with rail activities due to creosote-treated ties, dust from brakes and leaking engines.	- Contaminated groundwater management - Contaminated soil management
4A-B	1501 Dock Street	Dock Street, 1501 Dock Street	LUST, Spills, CSCSL, UST	6 to 11	The site is part of an area-wide Consent Decree between the City of Tacoma and Ecology. The site is a former lumber yard. Three USTs were removed from the area between 2000 and 2007. Two USTs were known to contain gasoline. The product in one tank was unknown. Petroleum-contaminated soil was removed, but gasoline- and benzene-contaminated soil was left in place in all three excavations due to access constraints. Follow-up investigation was completed along Dock Street. Arsenic was detected at a concentration greater than the MTCA Method A Unrestricted Land Use (ULU) cleanup level in one soil sample collected within the mixed fill unit from the ground surface to 4 feet bgs in boring DSN-B07. cPAHs were detected in the soil at concentrations greater than the MTCA method A ULU cleanup level in soil samples collected from DSN-B12 and DSN-B14 from 5 to 6 feet bgs. Arsenic and benzene were detected at concentrations greater than the current MTCA Method A groundwater cleanup level in a groundwater sample collected from DSN-B08. The June 2001 Hart Crowser report indicates the source of the benzene was likely from a former manufactured gas line or a former truck repair in the area. The arsenic concentration was similar to background levels observed within the upland area based on information provided in the June 2001 Hart Crowser report and likely present throughout the area.	Former USTs were located in the direct path of the alignment along Dock Street. Gasoline- and benzene-, arsenic- and cPAH-contaminated soil and benzene- and arsenic-contaminated groundwater was present in the early 2000's in the area.	- Contaminated groundwater management - Contaminated soil management - Alignment creates a preferential pathway for contaminated groundwater
4A-C	15th Street and Dock Street		CSCSL	10 to 11	A remedial investigation was completed on 15th Street right-of-way (ROW) consisting of three borings (R15-B01, R15-B02 and R15-B03) . CPAHs were detected at concentrations greater than the MTCA Method A ULU cleanup level from the ground surface up to 11 feet bgs within the mixed fill unit in borings R15-B01, R15 B02 and R15-B03. Lead was detected at a concentration greater than the MTCA Method A ULU cleanup level in a soil sample collected from 4.5 to 6 feet bgs in boring R15-B02. CPAHs were detected at concentrations greater than the current MTCA Method A groundwater cleanup level in a groundwater sample collected from boring R15-B01. The April 2000 Hart Crowser report indicates the elevated concentration was related to turbidity in the water sample. A SCAP was developed in June 2000 to aid cleanup activities during redevelopment of the 15th Street ROW. The SCAP indicated the area would be redeveloped with a wetland and pond areas. Cleanup alternatives included excavation of impacted soil as necessary for construction plans and/or a 3-foot cap over remaining contamination.	cPAH- and lead-contaminated soil and potentially cPAH-contaminated groundwater s present in the direct path of the alignment.	- Contaminated groundwater management - Contaminated soil management - Alignment creates a preferential pathway for contaminated groundwater
4A-D	Johnny's Seafood	1199 Dock Street	UST	10 to 11	A UST was closed in place in 1986. Subsurface investigations were completed on the subject property in 2001. Three test pits (JS-TP01, JS-TP02 and JS-TP03), three direct-push borings (JS-B01, JS-B02 and JS-B04) and one hand auger (JS-B03) were located on the subject property as shown on Figure 2. Three of the borings (JS-B01, JS-B02 and JS-B04) were converted to temporary monitoring wells to allow for groundwater sample collection. Chemicals of concern were either not detected or were detected at concentrations less than the respective current MTCA Method A ULU cleanup level or MTCA Method B criteria in the analyzed soil samples with one exception. cPAHS were detected at a concentration greater than the MTCA Method A ULU cleanup level in one soil sample collected in boring JS-B04 from 2 to 3 feet bgs. The soil sample was collected within the mixed fill unit containing brick and coal fragments. Coal was not observed in the other soil samples collected within the mixed fill unit on the subject property. Arsenic was detected at concentrations greater than the MTCA Method A groundwater cleanup level in the analyzed groundwater samples collected from borings JS-B01, JS-B02 and JS-B04. Hart Crowser indicated the metal-contaminated groundwater is related to the area-wide contamination.	The UST was closed-in-place in 1986. Additional evaluation of the UST has not been completed for gasoline and associated byproducts. The boring where cPAH-contaminated soil was detected is not located near the alignment. However, CPAH-contaminated soil may be present within the fill material throughout the area. Arsenic-contaminated groundwater encountered on the site is also indicative of an area-wide issue.	- Contaminated groundwater management - Contaminated soil management
4A-E	Thea Foss Waterway Superfund		N/A	N/A	Sediment samples were collected along the bank of the waterway in 1994 and 1995. CPAHs were detected at concentrations greater than the MTCA Method A ULU cleanup level in two composite sediment samples (RD-B27 and RD-B28). The area was capped with is continually monitoring by the City of Tacoma. Conformational monitoring during the most recent survey in 2014 identified movement of riprap but did not identify cap integrity issues or stability concerns.	The cPAH-contaminated soil and the integrity of the remedial cap will likely impact the project.	- Environmental regulations with cap on shoreline - Contaminated soil management

Map ID	Address	Listing Name	Database	Depth to Groundwater (feet bgs)	Summary	Area of Concern	Anticipated Design and Construction Impacts
Section 4B							
4B-A	Existing Rail Lines	Along Rail Alignment	None	Unknown	The existing rail lines have been present since at least the late 1800's.	Soil and groundwater contamination directly associated with the former rail operations has not been documented. Diesel-range petroleum hydrocarbons, cPAHs, lead and arsenic are typically associated with rail activities due to creosote-treated ties, dust from brakes and leaking engines.	- Contaminated groundwater management - Contaminated soil management
4B-B	1147 Dock Street			12	A flour warehouse and hay storage was present on the southern portion of the subject property from 1936 to 1963 based on information provided in the city directories and Sanborn maps. Pesticides were typically sprayed on grain and hay products during the storage process and there is potential for remnant pesticides to be present in soil and groundwater; however, testing to date has not been completed for pesticides. Two 35,000-gallon bunker-C USTs were removed in 1992. TPH and cPAHs were detected at concentrations greater than the MTCA Method A cleanup level in one or more of the base and sidewall samples collected for chemical analysis to depth of 15 feet bgs. Additional remedial excavation activities were completed within the southern portion of the excavation in 1992. Two confirmation samples were collected from the southeast sidewall following the additional remedial excavation. The two sidewall samples were only analyzed for TPH and not for cPAHs. TPH was detected at concentrations less than the respective current MTCA Method A cleanup level and CAP criteria. The stockpile samples were not analyzed for cPAHs. The stockpiled soil was subsequently used as backfill material following the additional remedial excavation activities and may contain cPAHs. One boring (B-1, Hart Crowser) was completed within the former UST area in 1994. CPAHs were detected in soil at concentrations greater than the current MTCA Method A cleanup level at a depth of approximately 15 to 16.5 feet bgs, which is beneath the base of the former UST excavation. V Environmental completed one soil boring (B-12) near the southeastern corner of the excavation in 2007. CPAHs were submitted for chemical analysis in one soil sample collected from 5 feet bgs in boring B-12. CPAHs were not detected in the analyzed soil sample. Furthermore, approximately 120 cubic yards of soil excavated during the UST removal activities was stockpiled for chemical analysis of TPH. Ecology indicated the cPAH concentration is not considered a chemical of concern for the site because of limited detections but Ecology compared the cPAH concentrations to the 1996 MTCA cleanup level during their review. The petroleum-contaminated soil extended to 15 feet bgs, but groundwater was encountered at 12 feet bgs during the UST excavation. Four groundwater monitoring wells were installed on the subject property following removal of two USTs. Groundwater collected from the monitoring wells was analyzed for TPH by EPA method 418.1. TPH was not detected at the laboratory reporting limit (1.0 mg/L) in the analyzed groundwater samples. However, the laboratory reporting limit is listed at a concentration greater than the current MTCA Method A groundwater cleanup level (0.5 mg/L). Petroleum hydrocarbons might be present in groundwater at concentrations greater than the current MTCA Method A cleanup level. The site was removed from the list of hazardous sites in 2007 by Ecology based on findings to date and risk of human health. The property was filled with dredge material from the Thea Foss in the early 1900s. Contaminants discharged through storm water and industry waste tend to accumulate in sediment. Several soil samples have been collected from 4 to 16.5 feet bgs throughout the subject property. The soil samples were analyzed for TPH, PAHs, PCBs and metals. Chemicals of concern were either not detected or were detected at concentrations less than the respective MTCA Method A cleanup level. However, the laboratory reporting limit for cPAHs was equivalent to current MTCA Method A cleanup level. Soil samples have not been collected and analyzed for chemicals of concern from the ground surface to 4 feet bgs during the previous investigations. The fill material may contain chemicals of concern including metals and PAHs gased on findings on nearby sites.	Known cPAH contaminated soil is present on the site. There is a potential for other contaminants in the soil and groundwater based on historical site use and the presence of fill.	- Contaminated groundwater management - Contaminated soil management - Notifications to Ecology for Agreed Order
4B-C	Thea Foss Waterway Superfund - 1147 Dock Street			N/A	Mercury, lead and cPAHs were detected at concentrations greater than the MTCA Method A cleanup level along the shoreline. The slope was capped during remedial efforts by Ecology and City of Tacoma. The slope is under the jurisdiction of the EPA as part of the Thea Foss and Wheeler-Osgood Waterways remediation project. The area was capped and is continually monitored by the City of Tacoma. Confirmational monitoring during the most recent survey in 2014 did not identify cap integrity issues or stability concerns along the subject property.	The metal- and cPAH-contaminated soil and the integrity of the remedial cap will likely impact the project.	- Contaminated- water management - Environmental regulations with cap on shoreline - Contaminated soil management

Map ID	Address	Listing Name	Database	Depth to Groundwater (feet bgs)	Summary	Area of Concern	Anticipated Design and Construction Impacts
General							
General	Fill	Site Wide	Not Listed	N/A	Areas of fill material are present throughout corridor with varying amounts of debris.	Fill material is present throughout the corridor. Metals, cPAHs and petroleum hydrocarbons are typically associated with fill.	

Notes:

TPCHD = Tacoma-Pierce County Health Department
bgs = below ground surface
Ecology = Washington State Department of Ecology
TCE = Trichloroethylene
PCE = Perchloroethylene
RCRA = Resource Conservation and Recovery Act
EDR US Hist Cleaners = EDR Exclusive Historic Dry Cleaners
ALLSITES = Ecology Facility/Site Identification System Listing
MANIFEST = Hazardous Waste Manifest Data
RCRA SQG - RCRA Small Quantity Generator
RCRA NonGen/NLR = RCRA - Non Generators
SPILLS = Reported Spills
VCP = Voluntary Cleanup Program
TCE = Trichloroethene
SCAP = Site Cleanup Action Plan
MTCA = Model Toxics Control Act
ROW = Right-of-Way
NFA = No Further Action determination
UST = Underground Storage Tank
PLT = Prairie Line Trail
EDR US Hist Auto Stat = EDR Exclusive Historic Gas Stations
FINDS = EPA Facility Index System/Facility Registry System
CSCSL = Confirmed and Suspected Contaminated Sites List
HSL = Hazardous Sites List
NPDES = Water Quality Permit System Data
cPAHS = Carcinogenic polycyclic aromatic hydrocarbons
ULU = Unrestricted Land Use
CAP= Cleanup Action Plan



N
W E
S

1,000 0 1,000

Feet

Notes:

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

Data Source: Mapbox Open Street Map, 2016

Projection: NAD 1983 UTM Zone 10N

Vicinity Map

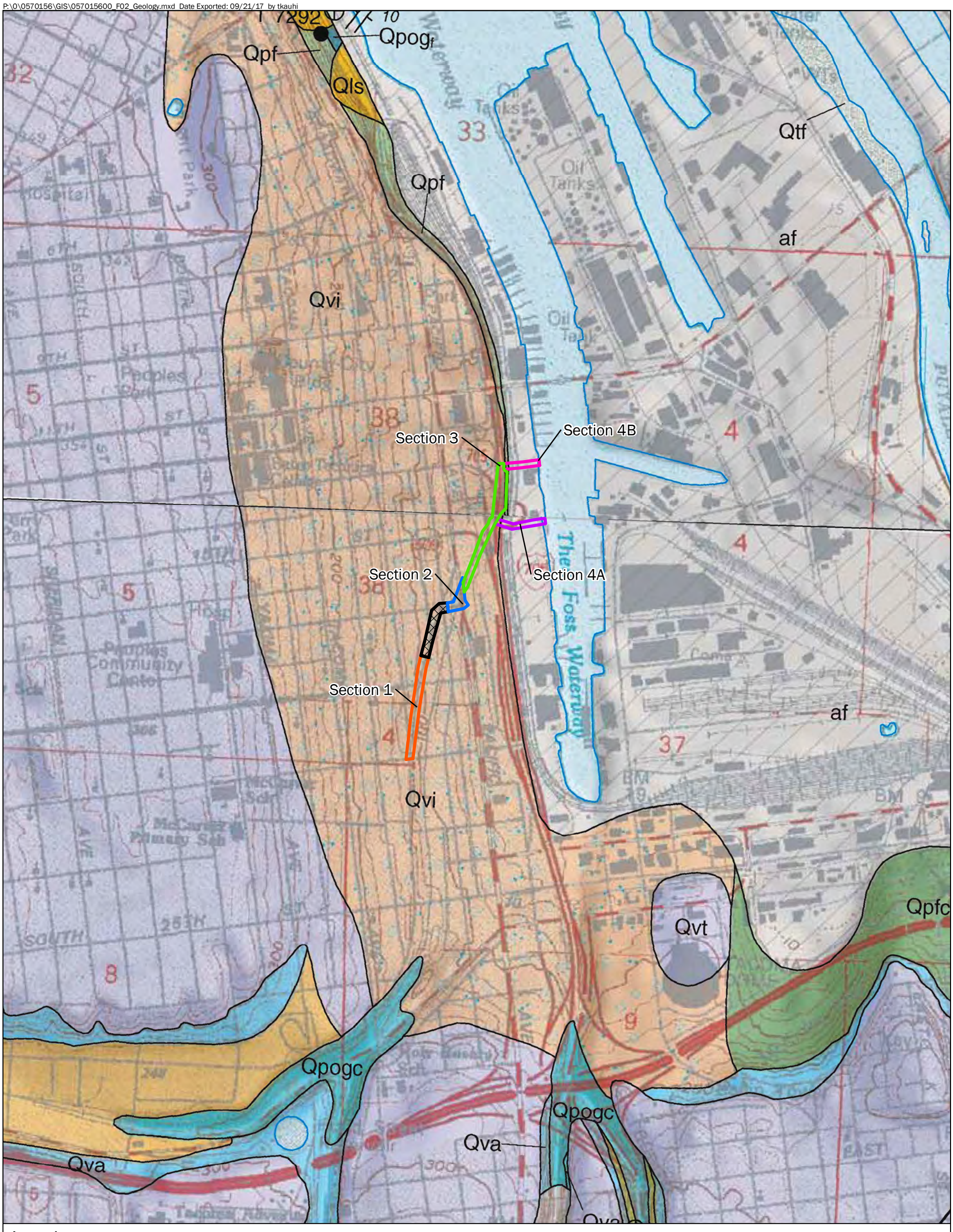
Jefferson Avenue & Hood Street
Stormwater Upgrade Project
Tacoma, Washington

GeoEngineers

Figure 1

P:\0\057015\6\GIS\057015600_F01_VicinityMap.mxd Date Exported: 06/21/17 by tkauhi

P:\0\0570156\GIS\057015600_F02_Geology.mxd Date Exported: 09/21/17 by tkauhi



Legend

Approximate Site Boundary

- Section 1: Jefferson Avenue/UWT (Cut and Cover)
- Section 2: South 17th Street & Pacific Avenue (Cut and Cover and Trenchless)
- Section 3: Prairie Line Trail/Hood Street/I-705 Corridor (Cut and Cover)
- Section 4A: I-705/BNSF/Dock Street/South 15th Street ROW (Cut and Cover and Trenchless)
- Section 4B: I-705/BNSF/Dock Street/1147 Dock Street (Cut and Cover and Trenchless)
- Previously Installed Stormwater Main

Geologic Unit Description

- Qpf — Sedimentary deposits of pre-Fraser glaciation age, undifferentiated—Mixed fine- and coarse-grained deposits, too thin or intermixed to differentiate at map scale
- Qvi — Ice-contact deposits - Intermixed outwash, lacustrine beds, and till; brown and gray to lightly oxidized in color.
- af — Artifical fill (holocene) - Variously consists of gravel, sand, silt, concrete, garbage, slag, and other materials; variable grain size; loose to dense depending on degree of compaction required during placement and regrading; variable thickness from 1 to 8 meters (3 to 25 ft); variable elevations from 3 to 104 meters (10 to 340 ft).

Notes:

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

Data Source: Geologic Map of North and South Tacoma by Derek B. Booth and Kathy Goetz Troost, 2007 (in review).
Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

N W E S

1,000 0 1,000

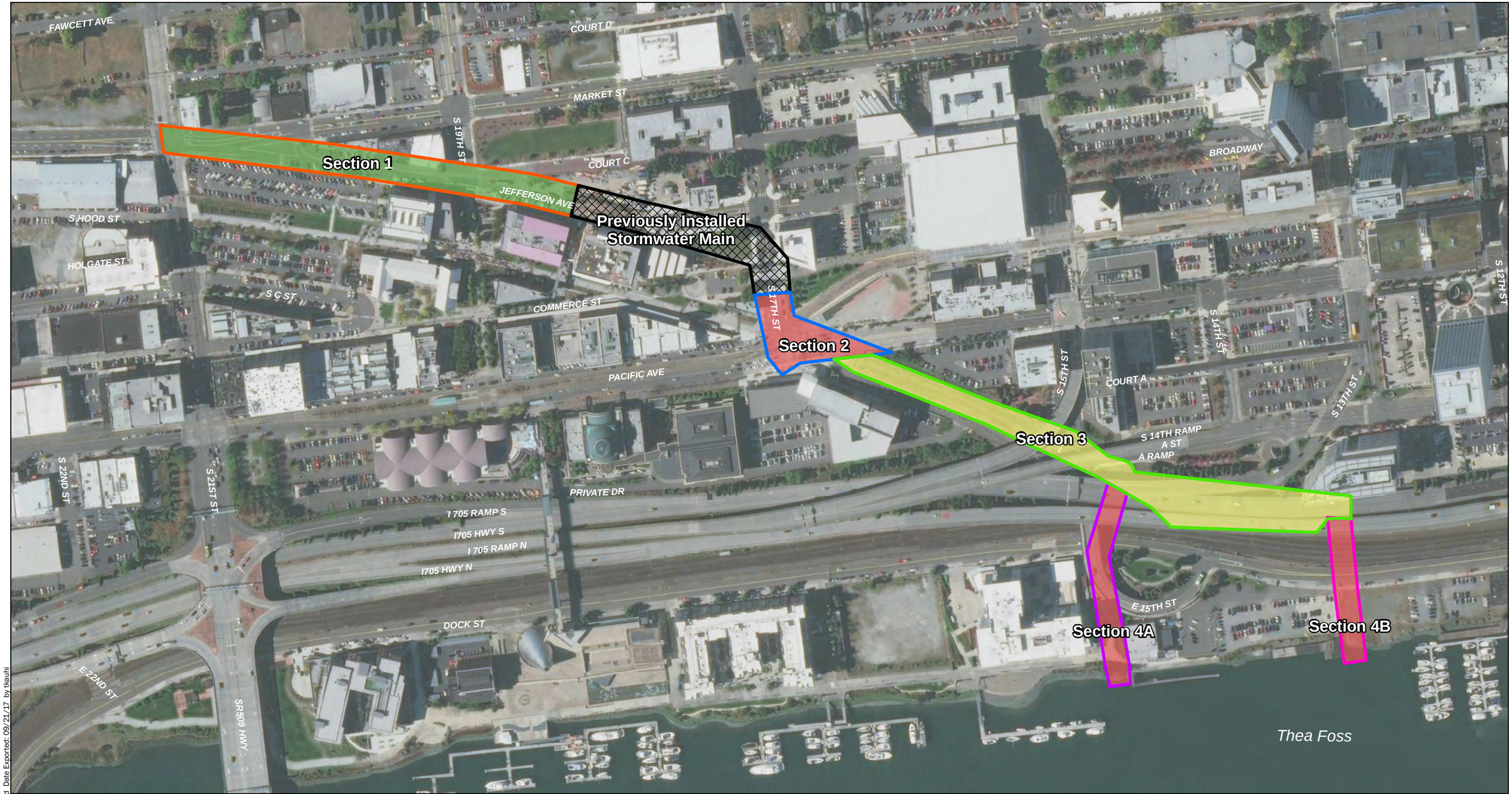
Feet

Geologic Vicinity Map

Jefferson Avenue & Hood Street
Stormwater Upgrade Project
Tacoma, Washington

GeoEngineers

Figure 2



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

Data Source: Aerial imagery from NAIP and provided by Esri (dated 2015).

Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

Uncertainty of Subsurface Information
- High Uncertainty
- Medium Uncertainty
- Low Uncertainty

Approximate Site Boundary
- Section 1: Jefferson Avenue/UWT (Cut and Cover)
- Section 2: South 17th Street & Pacific Avenue (Cut and Cover and Trenchless)
- Section 3: Prairie Line Trail/Hood Street/I-705 Corridor (Cut and Cover)
- Section 4A: I-705/BNSF/Dock Street/South 15th Street ROW (Cut and Cover and Trenchless)
- Section 4B: I-705/BNSF/Dock Street/1147 Dock Street (Cut and Cover and Trenchless)
- Previously Installed Stormwater Main

N S W E

300 0 300
Feet

Site Plan - Index Sheet

Jefferson Avenue & Hood Street
Stormwater Upgrade Project
Tacoma, Washington

GeoEngineers

Figure 3

Notes:
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Data Source: Stormwater main and manholes from City of Tacoma. Aerial imagery from NAIP and provided by Esri (dated 2015).

Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

Approximate Boring Location
- GeoEngineers, 2013
- GeoEngineers, 2015
- URS Corporation, 2002

Approximate Location of Well
- GeoEngineers, 2014
- URS Corporation, 2002
- URS Corporation, 2007
- URS Corporation, 2008

Approximate Site Boundary
- Section 1: Jefferson Avenue/UWT (Cut and Cover)
- Other Sections
- Explorations Reviewed Outside Section Boundaries
- Approximate Location of Former Railline
- Potential Manhole (Stormwater)
- Potential Stormwater Main

Approximate Lateral Extent of Contaminated Groundwater Plumes (as shown in the UWT Remedial Investigation Site Plan)
- Gasoline-range Hydrocarbons in Unconfirmed Aquifer
- Benzene in Estimated Deep Aquifer
- Vinyl Chloride in Deep Aquifer
- Vinyl Chloride in Shallow Aquifer
- TCE in Shallow Aquifer
- TCE in Deep Aquifer

Key to Exploration Name
HC-B01-2013
Consultant - Exploration Name - Year of Report

GEI = GeoEngineers
URS = URS Corporation

Site Plan - Section 1

Jefferson Avenue & Hood Street
Stormwater Upgrade Project
Tacoma, Washington

GeoEngineers

Figure 3A

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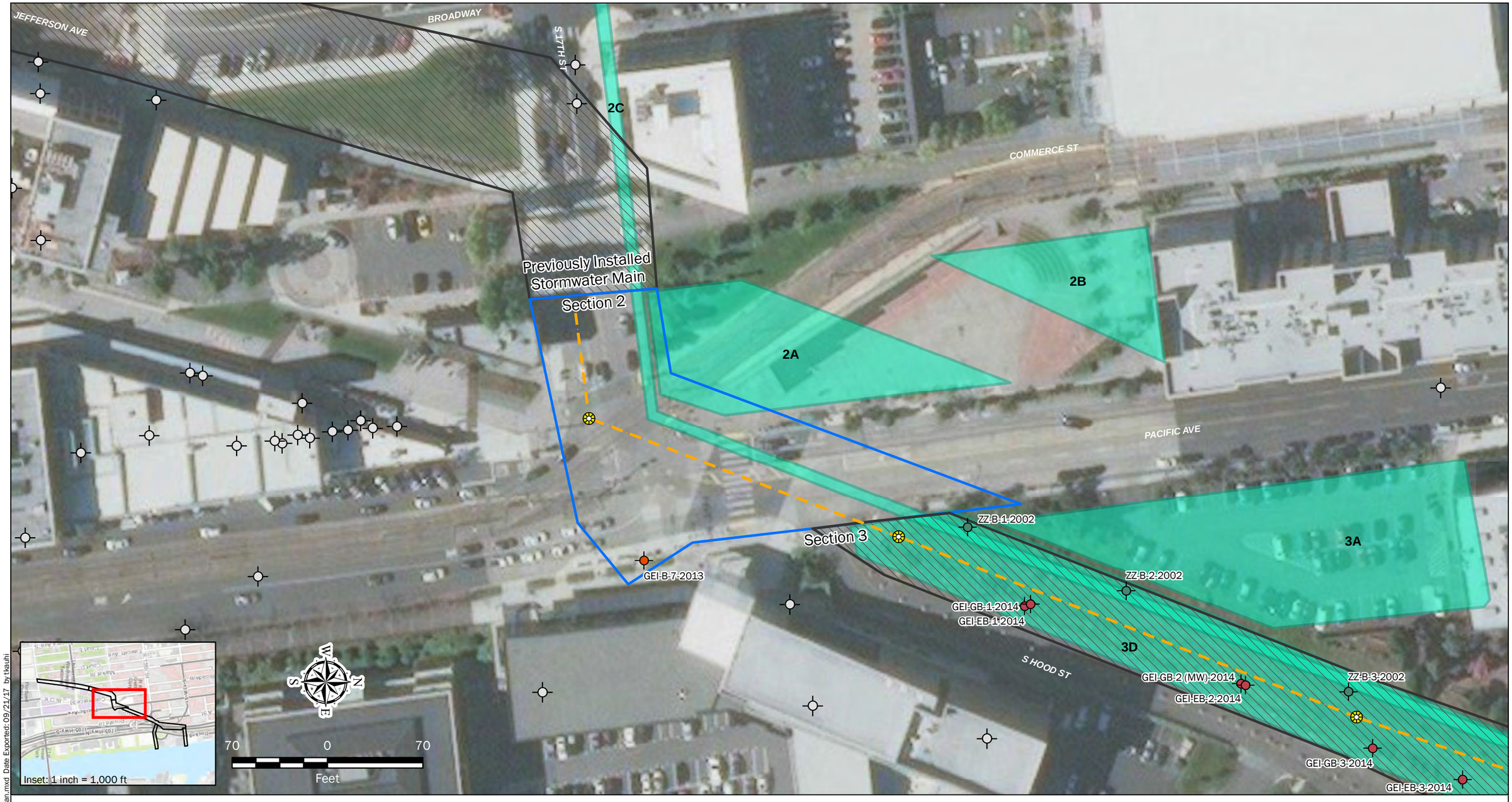

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Notes:

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Data Source: Stormwater main and manholes from City of Tacoma. Aerial imagery from NAIP and provided by Esri (dated 2015).

Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

Approximate Boring Location
- GeoEngineers, 2013
- GeoEngineers, 2014
- Zipper Zeman Associates, 2002

Approximate Site Boundary
- Section 2: South 17th Street & Pacific Avenue (Cut and Cover and Trenchless)
- Other Sections

- Explorations Reviewed Outside Section Boundaries
- Potential Manhole (Stormwater)
- Potential Stormwater Main
- Site of Concern

Key to Exploration Name
HC-B01-2013
Consultant - Exploration Name - Year of Report

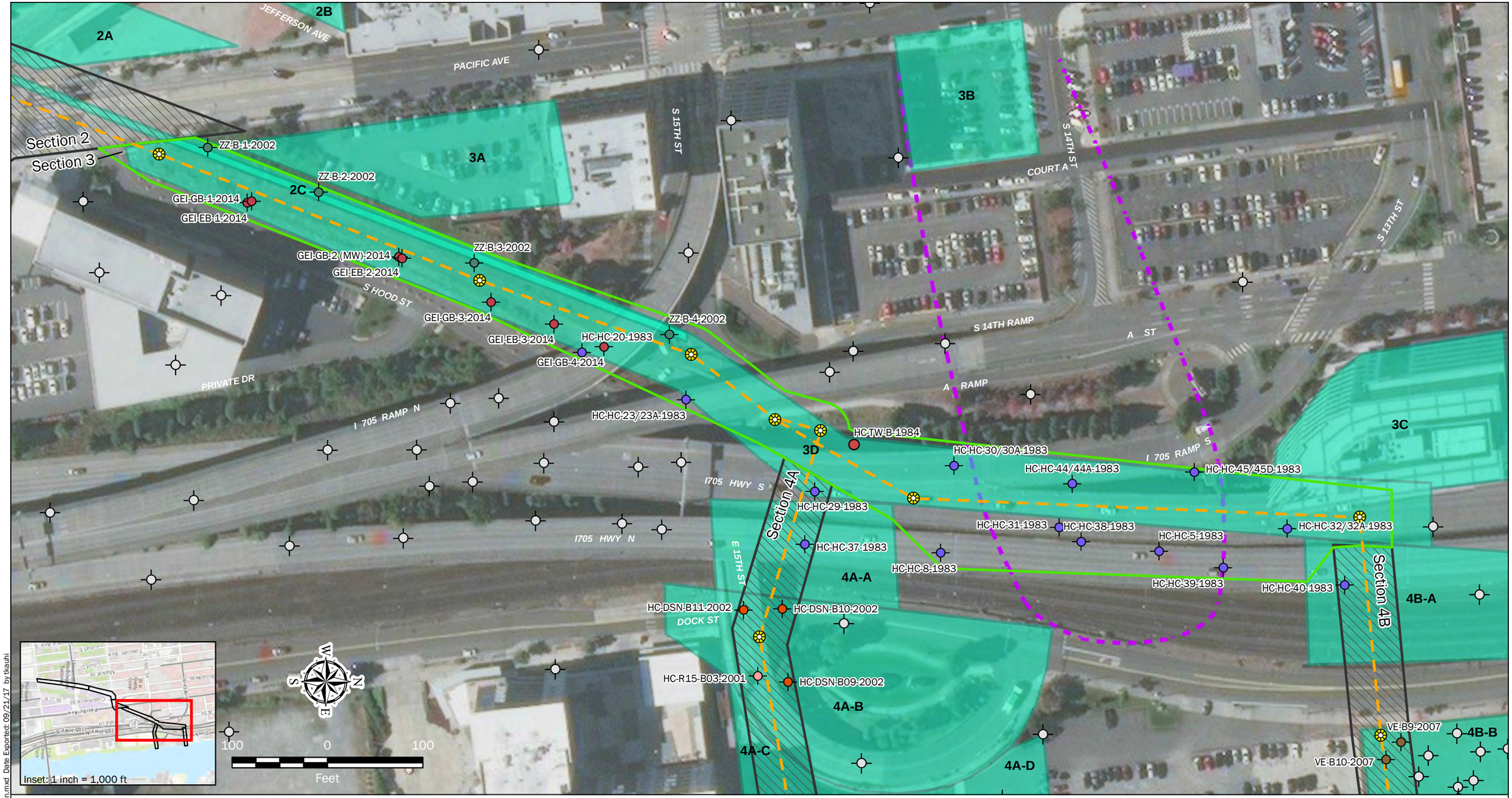
GEI = GeoEngineers
ZZ = Zipper Zeman

Site Plan - Section 2

Jefferson Avenue & Hood Street
Stormwater Upgrade Project
Tacoma, Washington

GeoEngineers

Figure 3B



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Notes:

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Data Source: Stormwater main and manholes from City of Tacoma. Aerial imagery from NAIP and provided by Esri (dated 2015).

Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

Approximate Boring Location
- GeoEngineers, 2014
- Hart Crowser, 1983
- Hart Crowser, 2001
- Hart Crowser, 2002
- V Environmental, 2007
- Zipper Zeman Associates, 2002

Approximate Location of Well
- Hart Crowser, 1984

Approximate Site Boundary
- Section 3: Prairie Line Trail/Hood Street/I-705 Corridor (Cut and Cover)
- Other Sections
- Explorations Reviewed Outside Section Boundaries
- Potential Manhole (Stormwater)
- Potential Stormwater Main

Estimated Lateral Extent of PCE, TCE or Vinyl Chloride Groundwater Plume in January 2017

Site of Concern

Key to Exploration Name
HC-B01-2013
Consultant - Exploration Name - Year of Report

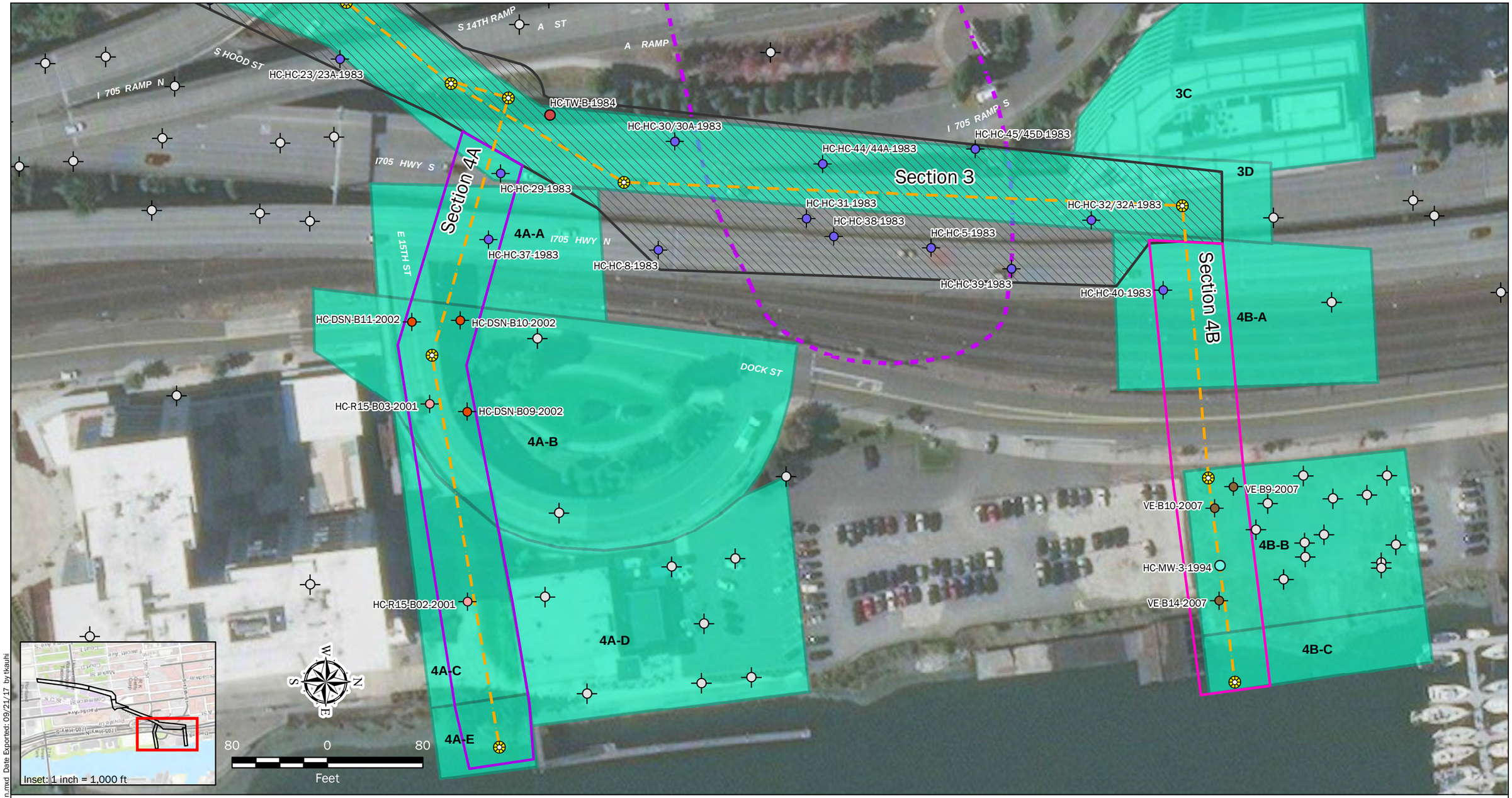
GEI = GeoEngineers
HC = Hart Crowser
VE = V Environmental
ZZ = Zipper Zeman

Site Plan - Section 3

Jefferson Avenue & Hood Street
Stormwater Upgrade Project
Tacoma, Washington

GeoEngineers

Figure 3C



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Notes:

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Data Source: Stormwater main and manholes from City of Tacoma. Aerial imagery from NAIP and provided by Esri (dated 2015).

Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Legend

Approximate Boring Location
- Hart Crowser, 1983
- Hart Crowser, 2001
- Hart Crowser, 2002
- V Environmental, 2007

Approximate Location of Well
- Hart Crowser, 1984
- Hart Crowser, 1994

Approximate Site Boundary
- Section 4A: I-705/BNSF/Dock Street/South 15th Street ROW (Cut and Cover and Trenchless)
- Section 4B: I-705/BNSF/Dock Street/1147 Dock Street (Cut and Cover and Trenchless)
- Other Sections

- Explorations Reviewed Outside Section Boundaries
- Potential Manhole (Stormwater)
- Potential Stormwater Main
- Estimated Lateral Extent of PCE, TCE or Vinyl Chloride Groundwater Plume in January 2017
- Site of Concern

Key to Exploration Name
HC-B01-2013
Consultant - Exploration Name - Year of Report

GEI = GeoEngineers
HC = Hart Crowser
VE = V Environmental
ZZ = Zipper Zeman

Site Plan - Section 4

Jefferson Avenue & Hood Street
Stormwater Upgrade Project
Tacoma, Washington

GeoEngineers

Figure 3D

APPENDIX A
Reference Material for Delineated Sections

APPENDIX A
SECTION 1. JEFFERSON AVENUE/UWT (CUT AND COVER)

Geotechnical

URS. 2002. Draft Remedial Investigation Report, Volume II, Appendices A-C. Prepared for University of Washington.

URS. 2002. Results of Supplemental Remedial Investigation: Jet Parking and Jefferson Street Association, UW Tacoma, Memo #1. For University of Washington. April 30, 2002

URS. 2007. Report Investigation of Upgradient Groundwater Solvent Plumes UW Tacoma Campus. Prepared for University of Washington and Washington State Department of Ecology. June 28, 2007.

URS. 2008. Additional Investigation of Market Street (Upgradient) (Rev. 1) Groundwater TCE Plumes, UW Tacoma Campus. September 12, 2008.

GeoEngineers., Inc. 2013. Phase I and II Environmental Site Assessments, Frederick Wilds Building, 1910 through 1916 Jefferson Avenue, Tacoma, Washington. Prepared for University of Washington Real Estate. August 7, 2013.

GeoEngineers, Inc. 2013. Environmental Subsurface Investigation, University of Washington – Tacoma, CPO Project NO. 204277, South 17th Street to South 21st Street and South Tacoma Avenue to Pacific Avenue, Tacoma, Washington. Prepared for University of Washington. December 19, 2014.

GeoEngineers, Inc. 2015. Geotechnical Engineering Services, UW Tacoma – 19th Street Crash Barrier, Tacoma, Washington. Prepared for University of Washington Capital Projects Office. February 13, 2015.

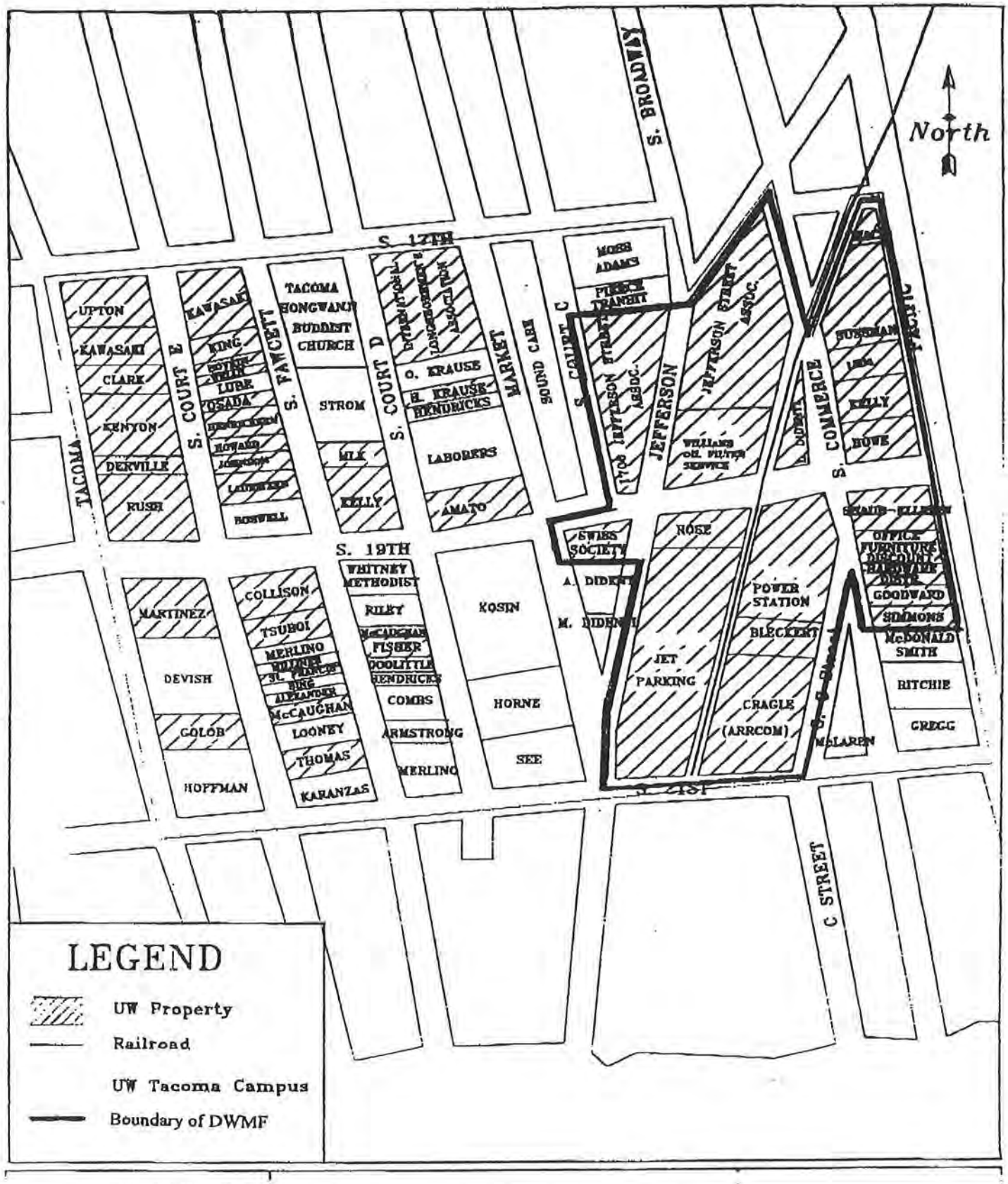
Environmental

GeoEngineers Inc. 2016. Agreed Order Remedial Investigation Work Plan University of Washington Tacoma Campus CPD Project No. 205062 Tacoma, Washington, July 6, 2016

GeoEngineers., Inc. 2013. Phase I and II Environmental Site Assessments, Frederick Wilds Building, 1910 through 1916 Jefferson Avenue, Tacoma, Washington. Prepared for University of Washington Real Estate. August 7, 2013.

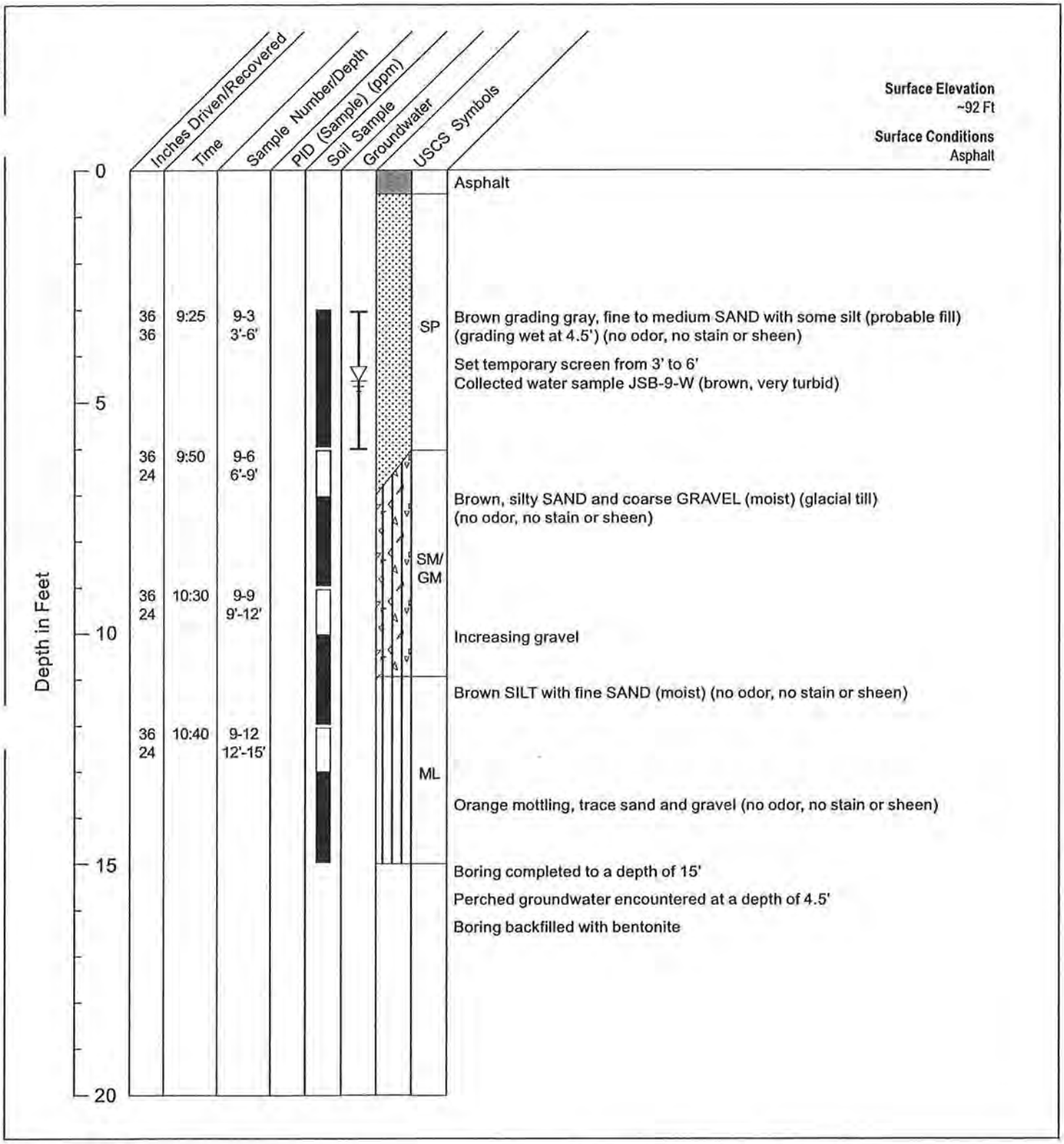
GeoEngineers, Inc. 2013. Environmental Subsurface Investigation, University of Washington – Tacoma, CPO Project NO. 204277, South 17th Street to South 21st Street and South Tacoma Avenue to Pacific Avenue, Tacoma, Washington. Prepared for University of Washington. December 19, 2014.

Geotechnical Reference Material



Attachment Number 1	**Boundary of Dangerous Waste Management Facility**

00681B33.CDR



Geologist: VDA
Drilling method: StrataProbe
Sampling method: Split Spoon

Drill contractor: TEG Northwest
Drill date: 3/26/99

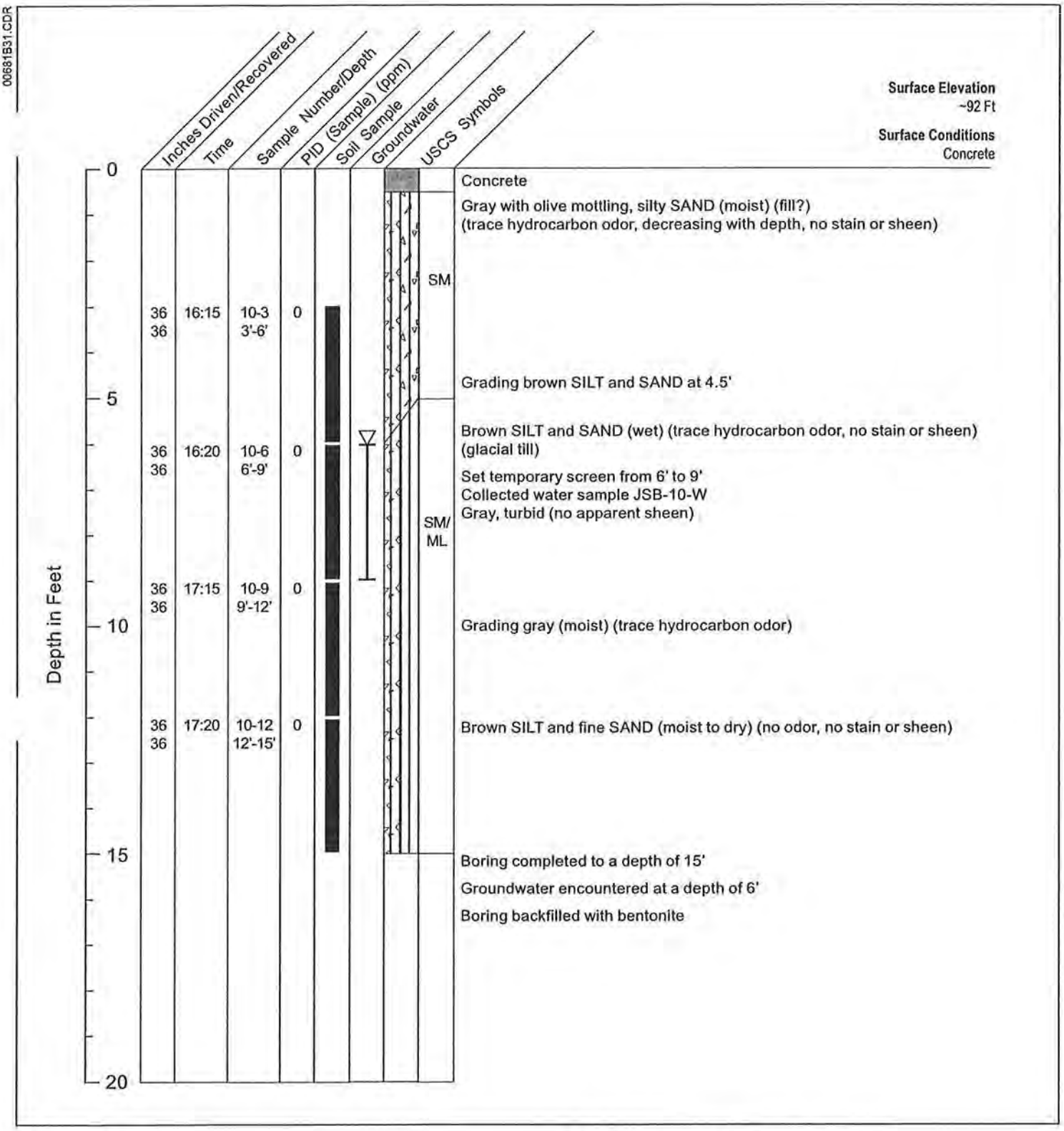
JS-B9
GEOLOGIC BORING LOG

No. 53-00681094.00

URS

University of Washington Tacoma Campus
Remedial Investigation Report

00681B31.CDR



Geologist: VDA
Drilling method: StrataProbe
Sampling method: Split Spoon

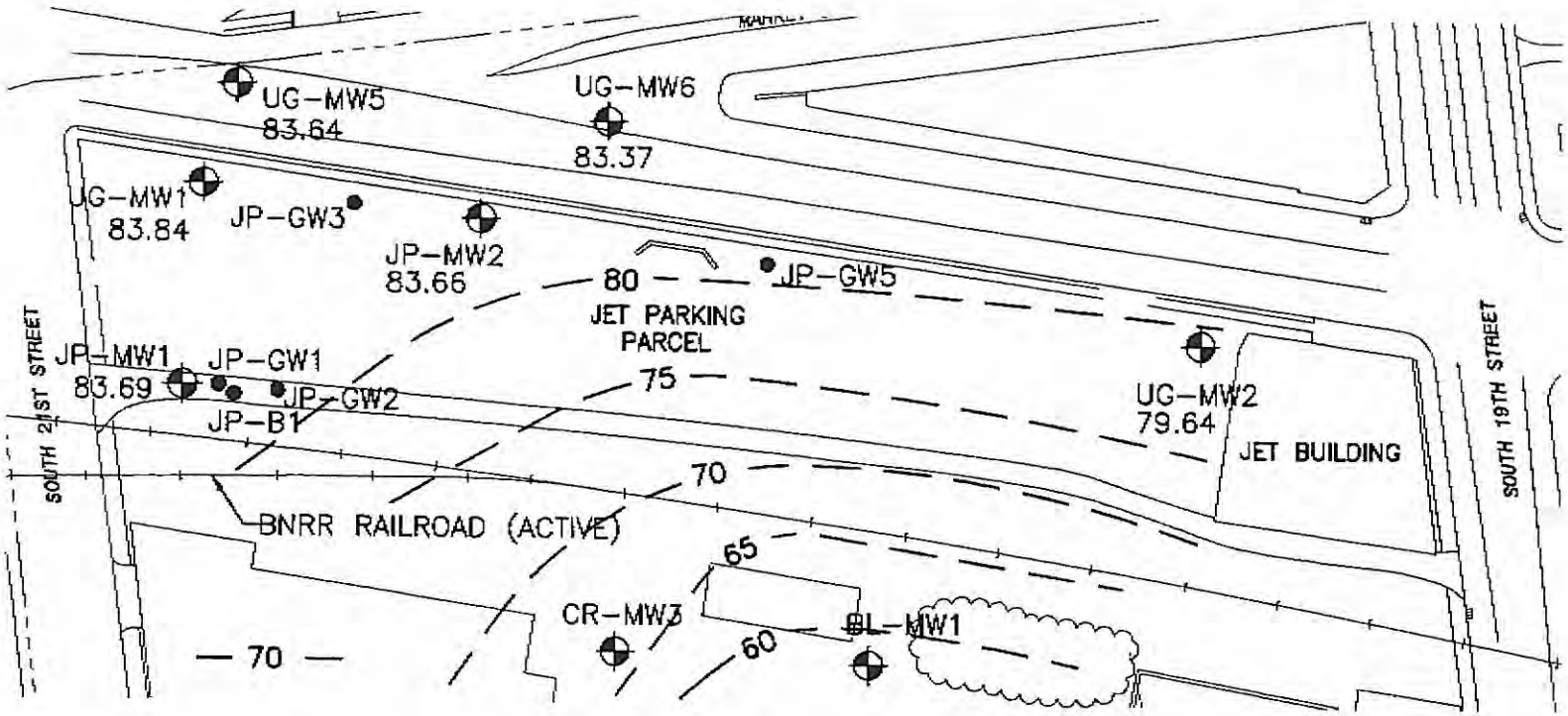
Drill contractor: TEG Northwest
Drill date: 3/25/99

JS-B10
GEOLOGIC BORING LOG

No. 53-00681094.00

URS

University of Washington Tacoma Campus
Remedial Investigation Report



LEGEND

UG-MW1 ⊕ MONITORING WELL

JP-B1 ● SOIL AND/OR GROUNDWATER BORING

— 70 — INTERPRETED CONTOUR OF EQUAL ELEVATION ON GROUNDWATER SURFACE

83.66 GROUNDWATER SURFACE ELEVATION

Figure 1

GROUNDWATER ELEVATIONS, APRIL 2002
JET PARKING PARCEL

University of Washington Tacoma Campus
Supplemental Remedial Investigation Memorandum #1

Post-it® Fax Note 7671

To Erin McPherson	Date
Co./Dept.	From Dave
Phone #	Co.
Fax # 5-2915	Phone #
	Fax #

# of pages ▶ 1

MAY-01-2002 15:03 P.01/01
TOTAL P.01

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-5

Sheet 1 of 3

Date(s) Drilled	3/26/02	Logged By	Gary Stoyka	Checked By	MPM
Drilling Method	Hollow Stem Auger	Drilling Contractor	Cascade Drilling, Inc.	Total Depth of Borehole	43 feet
Drill Rig Type	CME 75	Drill Bit Size/Type	8"	Ground Surface Elevation	115 feet
Groundwater Level	33 ft bgs	Sampling Method	D&M Split Spoon	Hammer Data	300#/30"
Borehole Backfill	Completed as monitoring well	Location	S 21st Street/Jefferson Avenue/Market		

Elevation, feet	Downhole Depth, feet	SAMPLES Type	SAMPLES Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0							Asphalt	
							GM	Brown, silty SAND with gravel	
								Concrete	
	1						SM	Dark gray, silty SAND with gravel (moist) (no apparent stain or odor) (fill)	
	2				6.2				
	3						ML/ CL	Greenish gray SILT/CLAY with pockets of medium sand, abundant roots (moist) (no apparent stain or odor)	
	4								
	5								9:05
	6		UGMW-5-5A	4 6 50/5"	3.2				
	7								
	8						SM	Olive brown, silty, fine to medium SAND with gravel (moist) (no apparent stain or odor)	
	9								
	10								9:10
	11		UGMW-5-10A	20 40 41	2.4				
	12								
	13						SM/ ML	Dark gray, silty, fine SAND/fine sandy SILT with gravel (slightly moist) (no apparent stain or odor)	
	14								
	15								

ENV W/O WELL ,,\URS\OB-153-006-1.XXU\UWTAC.GPJ URSSEA3.GLB URSSEA3.GDT 6/18/02

URS

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-5

Elevation, feet	Downhole Depth, feet	SAMPLES Type Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	15							9:15
	16	UGMW-5-15A	26 42 43	4.3				
	17							
	18							
	19							
	20						As above (very moist to wet)	9:20
	21	UGMW-5-20A	26 40 41	2.3				
	22							
	23							
	24							
	25					ML	Grades to sandy SILT (moist)	9:30
	26	UGMW-5-25A	42 50/6"	0.7				
	27							
	28					ML/ SM	Grades to fine, sandy SILT/silty, fine SAND (moist)	
	29							
	30							Add ~ 5 gal. water during well installation
	31	UGMW-5-30A	45 50/5"	1.3				9:40
	32							

ENV W/O WELL ...\RSJOB~1\153-006~1.XXU\UWTAC.GPJ URSSEA3.GLB URSSEA3.GDT 6/18/02

URS

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-5

Sheet 3 of 3

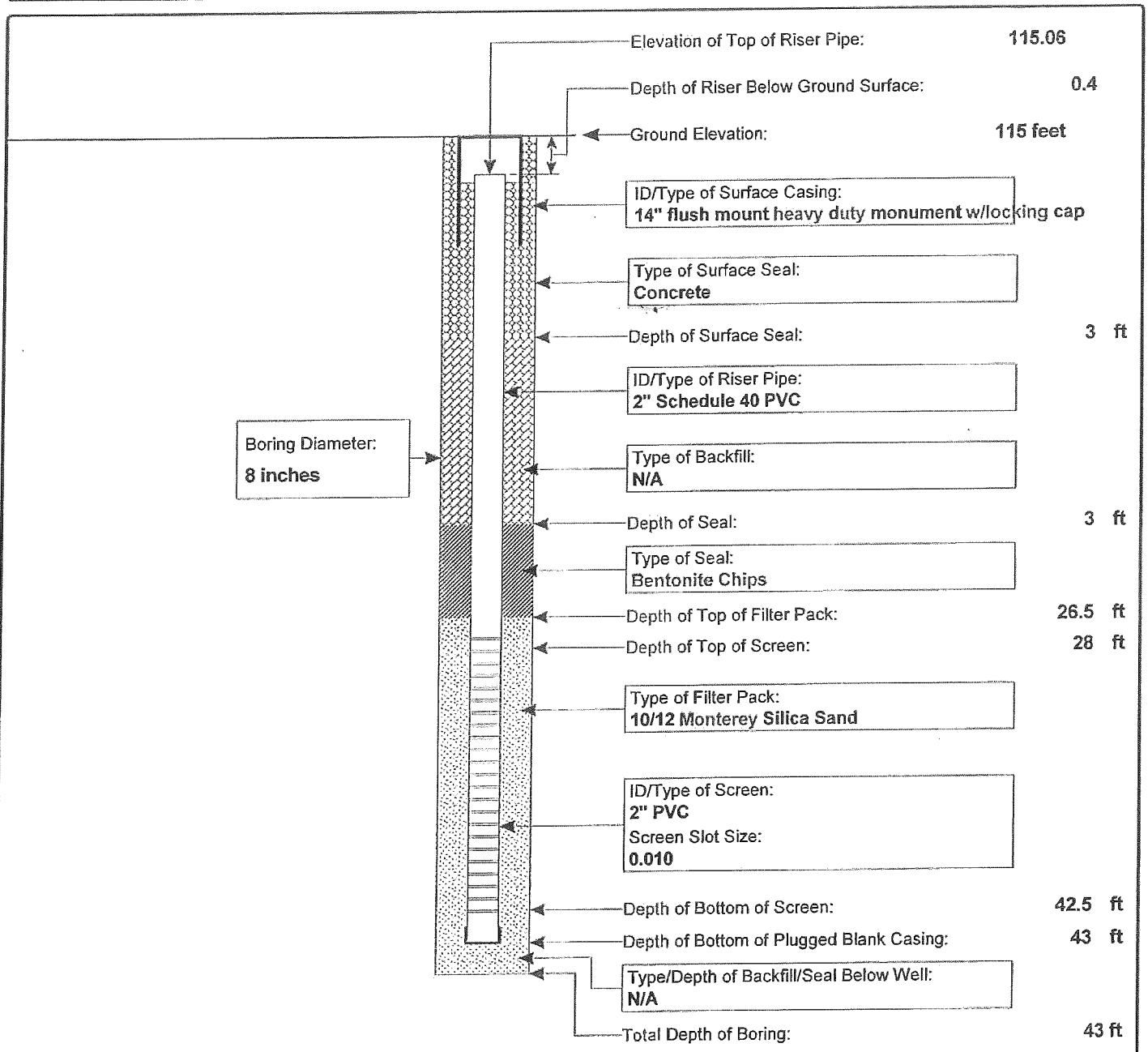
Elevation, feet	Downhole Depth, feet	SAMPLES Type Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	33						33 ft ▼	Measured after letting stand ~30 minutes
	34							
	35	UGMW-5-35B	42 50/4"	1.6			As above (moist to wet)	9:40
	36							
	37					SP/ GP	Gray, poorly graded coarse SAND/poorly graded medium to coarse GRAVEL (wet) (no apparent stain or odor)	Difficult drilling at 37' (cobbles/gravel?)
	38							
	39							
	40							No recovery
	41		20 28 21					
	42	UGMW-5-42B	50/5"	1.2				10:15
	43						Boring was completed to 43' bgs. Groundwater was encountered at 33' bgs. Boring was completed as monitoring well.	
	44							
	45							
	46							
	47							
	48							
	49							
	50							

ENV W/O WELL ...\RSJOB~1\53-006~1.XXU\UWTAC.GPJ URSSEA3.GLB URSSEA3.GDT 6/18/02

URS

Project: UW Tacoma RI Project Location: Tacoma, Washington Project Number: 53-00681094.01	MONITORING WELL CONSTRUCTION LOG FOR WELL UGMW-5

Well Location	S 21st Street/Jefferson Avenue/Market		Date(s) Installed	3/26/02	Time 10:30
Installed By	Cascade Drillling, Inc.	Observed By	Gary Stoyka		Total Depth (ft) 43
Method of Installation	Hollow Stem Auger				
Screened Interval	28'-43'	Completion Zone			
Remarks	Original monument destroyed - replaced on 6/6/02				



NOTE: DIAGRAM IS NOT TO SCALE

URS

WELL_CONSTR_BELOW_GROUND I:\URS\JOB~1\153-006~1.XXU\UWTAC.GPJ URSSEA3.GLB URSSEA3.GDT 6/18/02

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-6

Sheet 1 of 3

Date(s) Drilled	3/27/02	Logged By	Gary Stoyka	Checked By	MPM
Drilling Method	Hollow Stem Auger	Drilling Contractor	Cascade Drilling, Inc.	Total Depth of Borehole	35 feet
Drill Rig Type	CME 75	Drill Bit Size/Type	8"	Ground Surface Elevation	111 feet
Groundwater Level	26.5 ft bgs	Sampling Method	D&M Split Spoon	Hammer Data	300#/30"
Borehole Backfill	Completed as monitoring well	Location	Intersection of Jefferson/Market		

Elevation, feet	Downhole Depth, feet	SAMPLES Type	SAMPLES Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	0							Asphalt	
								Concrete	
	1						SM/ ML	Olive gray, silty, fine SAND/fine sandy SILT with fine to coarse gravel (moist) (no apparent stain or odor)	
	2								
	3								
	4								
	5								
	6		UGMW-6-5A	16 21 43	2.9				8:45
	7								
	8								
	9						SM	Grades to silty fine sand (moist to very moist)	
	10								8:50
	11		UGMW-6-10A	30 50/5"	1.2				
	12								
	13						GM		
	14								
	15								

ENV W/O WELL ..\Rs..\8-1\53-006-1.XXUUWTAC.GPJ URSSEA3.GLB URSSEA3.GDT 6/18/02

URS

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-6

Elevation, feet / Downhole Depth, feet	SAMPLES Type Number	Blows/ 6in.	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
15	UGMW-6-15B	50/6"	0.7			Gray, silty gravel with sand (moist)	8:55
16							
17							
18							
19							
20	UGMW-6-20B	50/6"	5.5		SM/ ML	Olive gray, silty, interbedded fine SAND/fine, sandy SILT with fine to coarse gravel (moist) (no odor)	9:00
21							
22							
23					SM		
24							
25	UGMW-6-25B	36 50/6"	1.7			Grades to less silt (wet)	9:05
26						26.5 ft ▼	
27							Measured after 30 min. still rising
28							
29							
30	UGMW-6-30B	50/6"	1.9		GP/ GM	Poorly graded GRAVEL with silt and medium to coarse SAND (wet) (no apparent stain or odor)	9:10
31							
32							

ENV W/O WELL ...\RSJOB~1\53-006~1.XXU\UWTAC.GPJ URSSEA3.GLB URSSEA3.GDT 6/18/02

Project: UW Tacoma RI
Project Location: Tacoma, Washington
Project Number: 53-00681094.01

Log of Boring UGMW-6

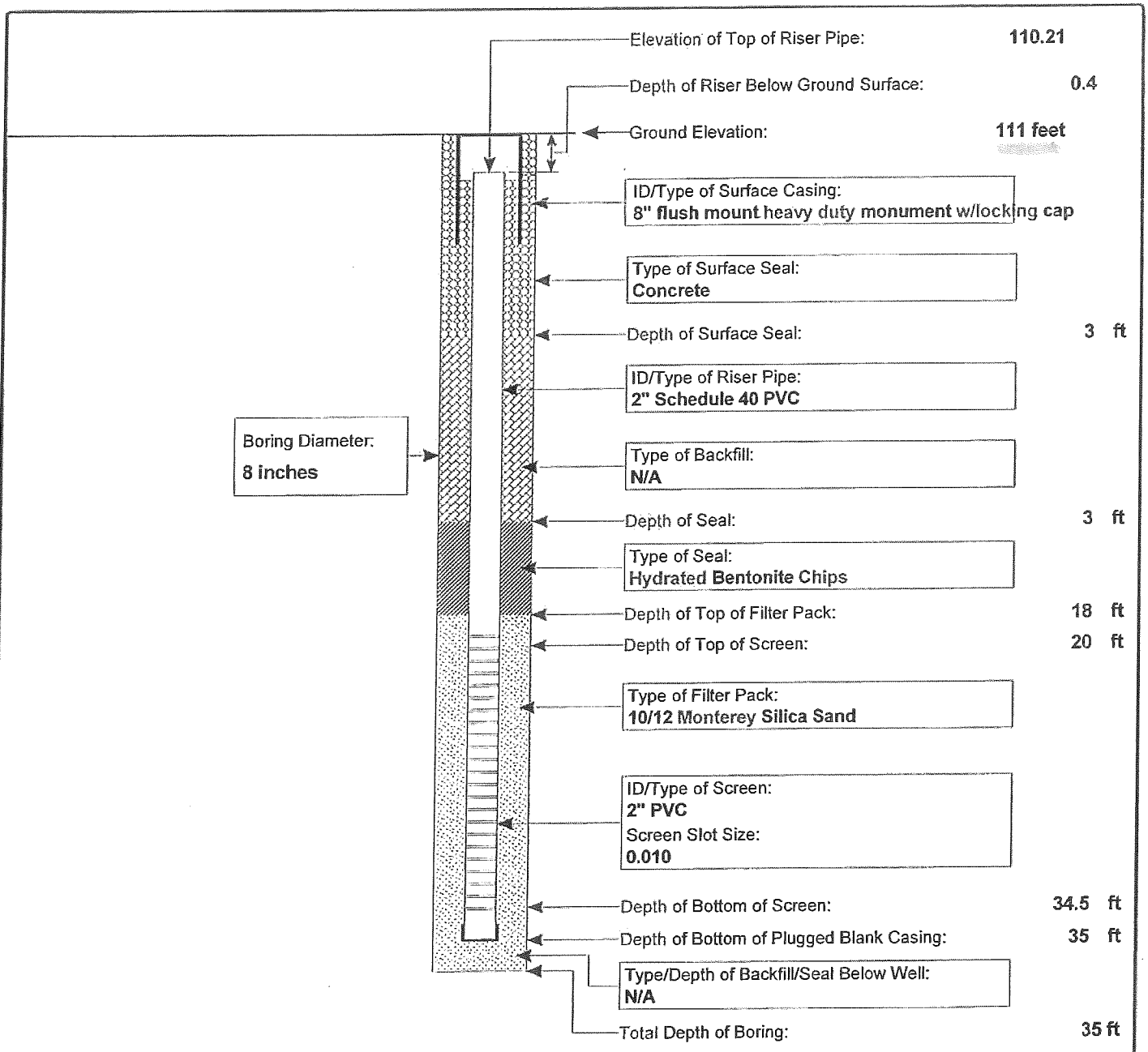
Sheet 3 of 3

Elevation, feet	Downhole Depth, feet	SAMPLES Type Number	SAMPLES Blows/ 6in.	SAMPLES OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND OTHER TESTS
	33					GM	Olive gray, silty GRAVEL/COBBLES with silt and fine to medium coarse sand	
	34							
	35	UGMW-6-35A	50/6"	0.5			Boring was completed to 35' bgs. Groundwater was encountered at 26.5' bgs. Boring was completed as monitoring well. See monitoring well log for details.	9:45
	36							
	37							
	38							
	39							
	40							
	41							
	42							
	43							
	44							
	45							
	46							
	47							
	48							
	49							
	50							

ENV W/O WELL ...\RSJOB~1\53-006~1.XXU\UWTAC.GPJ URSSEA3.GLB URSSEA3.GDT 6/18/02

Project: UW Tacoma RI Project Location: Tacoma, Washington Project Number: 53-00681094.01	MONITORING WELL CONSTRUCTION LOG FOR WELL UGMW-6

Well Location	Jefferson/Market			Date(s) Installed 3/27/02	Time 11:30
Installed By	Cascade Drillling, Inc.	Observed By	Gary Stoyka	Total Depth (ft)	35
Method of Installation	Hollow Stem Auger				
Screened Interval	20'-35'	Completion Zone			
Remarks					



NOTE: DIAGRAM IS NOT TO SCALE

WELL_CONSTR_BELOW_GROUND I:\URS\JOB~1\53-006~1.XXU\UWTAC.GPJ URSSEA3.GLB URSSEA3.GDT 6/18/02

URS

-3759791_21.CDR

COURT "D"

LABORERS PARCEL

O' HALECK PARCEL

KOSIN PARCEL

Market Street

SOUTH 17TH STREET

SOUND CARE

MARKET STREET

COURT "C"

JEFFERSON ST. ASSOCIATION PARCEL

JEFFERSON AVENUE

SOUTH 21ST STREET

JET PARKING PARCEL

SOUTH 19TH STREET

WILLIAMS PARCEL

CRAGLE PARCEL

BLECKERT PARCEL

POWER STATION PARCEL

"C" STREET

RAILROAD TRACK (ACTIVE)

RAILROAD TRACK (ABANDONED)

HOWE PARCEL

SHAUB-ELLISON PARCEL

CHERRY

Pacific Avenue

DD-MW2
BA-MW1
UG-MW10
UG-MW11
MS-SB04
MS-SB05
MS-SB06
UG-MW5
UG-MW12
UG-MW6
UG-MW1
JP-GW3
JP-MW2
JP-GW5
JP-MW1
JP-GW2
UG-MW2
CR-MW3
BL-MW5
BL-MW1
CR-MW5
CR-MW6
CR-MW7
BL-MW6
BL-GW3
BL-GW4
BL-MW3
DMB-21
BL-GW5
BL-MW7
CR-MW13
CP-B4A
PS-MW7
PS-MW6
PS-GW4
PS-GW1
PS-GW5
PS-MW8
PS-MW9
SH-MW6
H-MW1
H-MW2 (GW4)
UG-MW9
BA-MW2
MS-SB01
MS-SB02
MS-SB03
UG-MW13
UG-MW8
UG-MW7
DD-MW1
UG-MW4
UG-MW3
JS-MW2
JS-MW1
JS-MW3

A B C D E F G H A' B' C' D' E' F' G' H'

LEGEND

- UG-MW9 — Monitoring well location and number
- MS-SB01 — Soil and/or groundwater boring location and number
- A — A' — Line of geologic cross section, Figures 9-16
- 72.40 — Elevation of groundwater piezometric surface
- UW parcel

N

0 50 100

Scale in Feet

Source: UW Tacoma basemap

Job No. 33759791

Figure 8

Site Plan and Lines of Geologic Cross Sections

URS

University of Washington Tacoma Campus
Upgradient Groundwater Plume Investigation Report

Project: UW Tacoma - TCE Assessment
Project Location: Tacoma, Washington
Project Number: 33759791

Log of Boring UG-MW12

Sheet 1 of 2

Date(s) Drilled	**5/10/07**	Logged By	**MHH**	Checked By	**MPM**
Drilling Method	**Hollow Stem Auger, 4-1/4" ID**	Drilling Contractor	**Cascade Drilling, Inc. (SK)**	Total Depth of Borehole	**35 feet bgs**
Drill Rig Type	**CME-75, truck mounted**	Drill Bit Size/Type	**9" OD 4-tooth HSA**	Ground Surface Elevation	**112.67 feet MSL**
Groundwater Level	**~23 ft (encountered while drilling)**	Sampling Method	**D&M split spoon, 2-1/2" ID**	Hammer Data	**300 lb. downhole hammer**
Borehole Backfill	**Monitoring well installed**	Location	**"Jet Parking" plume, north of Market St/S 21st St intersection**		

Elevation, feet	Downhole Depth, feet	SAMPLES Type	SAMPLES Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	Well Completion Schematic	REMARKS AND WELL DETAILS
110	0								Asphalt 0-3" Concrete 3-9"		Commence drilling (09:57)
								SM	Very dark grayish brown (2.5Y 3/2) SILTY fine to medium SAND, some coarse sand, trace gravel, very dense, moist, slight odor, pervasive greenish gray staining		Concrete surface seal
											Neat cement
105	5			25 35 38 N=73	89	63.8					2" Sched. 40 PVC casing
100	10			44 50/6"	100	109			Olive gray - dark gray (5Y 5/2-4/1) SILTY fine SAND, some medium sand, trace coarse sand, gravel, and clay, very dense, moist, slight odor, trace greenish gray staining		Soil sample: UG-MW12-10
								ML	Dark greenish gray (10Y 4/1) GRAVELLY SILT, some fine to coarse sand, hard, dry, non-plastic to low plasticity, no odor, no stain		
95	15			36 50/6"	83	32.7					Soil sample: UG-MW12-15
											Bentonite seal
											#2/12 sand
90	20			32 50/6"	0	--			No recovery from 20 ft-bgs.		Screen 0.010" slotted
									(Groundwater encountered at ~23 ft-bgs.)	23 ft ▼	
25								GM/ ML	Dark greenish gray (10Y 4/1) interbedded fine to coarse SANDY SILTY GRAVEL and GRAVELLY SILT with fine to coarse sand, very dense/hard, wet, low plasticity, no odor, no stain		

ENV2 WITH WELL K:\005\UWTACO~1\2007TC~1\050_TE~1\055_BO~1\33759791.GPJ URSSEA3B.GLB URSSEA3.GDT 6/28/07

URS

Project: UW Tacoma - TCE Assessment
Project Location: Tacoma, Washington
Project Number: 33759791

Log of Boring UG-MW12

Elevation, feet	Downhole Depth, feet	SAMPLES Type	SAMPLES Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
85	25			43 50/6"	100	--		GM/ ML	Dark greenish gray (10Y 4/1) interbedded fine to coarse SANDY SILTY GRAVEL and GRAVELLY SILT with fine to coarse sand, very dense/hard, wet, low plasticity, no odor, no stain	
80	30			43 50/5"	73	--			Becoming moist to wet	
	35			32 50/6"	100	--		ML	Dark greenish gray (10Y 4/1 - 5GY 4/1) SILT with clay, trace fine sand, hard, dry, low to medium plasticity, no odor, no stain Boring completed to 35 feet below ground surface on 5/10/07. Monitoring well installed, screened from 20 to 35 ft-bgs. Top of well casing elevation = 112.29 feet MSL (NGVD-29). Heavy duty flush-mount surface monument.	Terminate drilling (10:24)
75	40									
70	45									
65	50									
60										

ENV2 WITH WELL K:\005\UWTACO~1\2007TC~1\050_TE~1\055_BO~1\33759791.GPJ URSSEA3B.GLB URSSEA3.GDT 6/28/07

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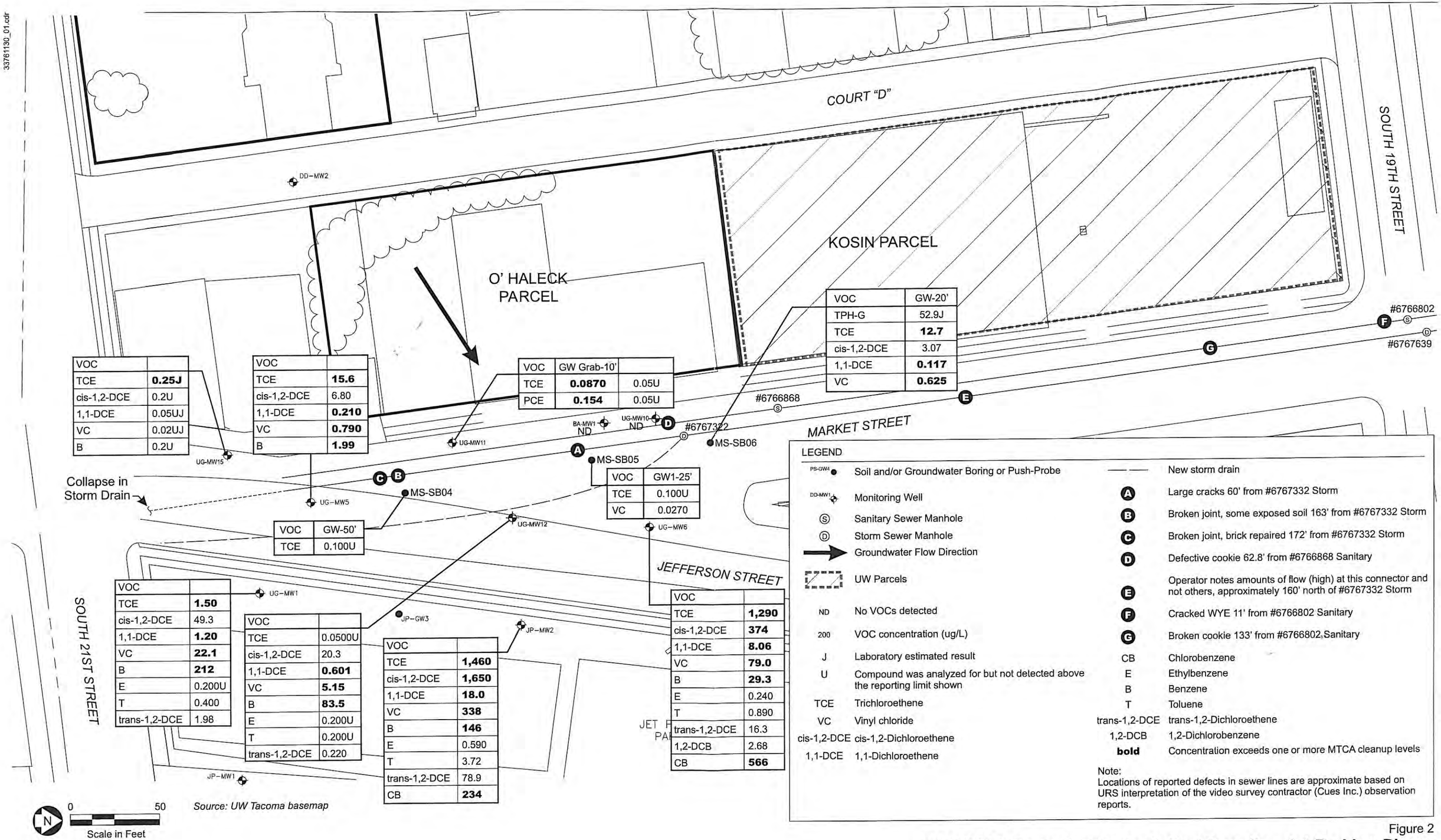


LEGEND

PS-GW4 ●	Soil and/or Groundwater Boring or Push-Probe	—— ——	New storm drain
DD-MW1	Monitoring Well	A	Large cracks 60' from #6767332 Storm
Ⓢ	Sanitary Sewer Manhole	B	Broken joint, some exposed soil 163' from #6767332 Storm
Ⓓ	Storm Sewer Manhole	C	Broken joint, brick repaired 172' from #6767332 Storm
→	Groundwater Flow Direction	D	Defective cookie 62.8' from #6766868 Sanitary
	UW Parcels	E	Operator notes amounts of flow (high) at this connector and not others, approximately 160' north of #6767332 Storm
ND	No VOCs detected	F	Cracked WYE 11' from #6766802 Sanitary
200	VOC concentration (ug/L)	G	Broken cookie 133' from #6766802 Sanitary
J	Laboratory estimated result	CB	Chlorobenzene
U	Compound was analyzed for but not detected above the reporting limit shown	E	Ethylbenzene
		B	Benzene
TCE	Trichloroethene	T	Toluene
VC	Vinyl chloride	trans-1,2-DCE	trans-1,2-Dichloroethene
cis-1,2-DCE	cis-1,2-Dichloroethene	1,2-DCB	1,2-Dichlorobenzene
1,1-DCE	1,1-Dichloroethene	**bold**	Concentration exceeds one or more MTCA cleanup levels

Note:
Locations of reported defects in sewer lines are approximate based on URS interpretation of the video survey contractor (Cues Inc.) observation reports.

Figure 2

2007/2008 Groundwater Analytical Results - Jet Parking Plume

Job No. 33761130

URS

University of Washington Tacoma Campus
Upgradient Groundwater Plume Investigation Report

Project: UW Tacoma 2008 TCE Assessment
Project Location: Tacoma, Washington
Project Number: 33761130

Log of Boring UG-MW15

Sheet 1 of 2

Date(s) Drilled	7/25/08	Logged By	EL	Checked By	MPM
Drilling Method	HSA	Drilling Contractor	Cascade Drilling	Total Depth of Borehole	40 feet bgs
Drill Rig Type	CME 75	Drill Bit Size/Type	9" OD 4-tooth	Ground Surface Elevation	
Groundwater Level	12 ft bgs	Sampling Method	Dames & Moore	Hammer Data	300 lb
Borehole Backfill	Well installed	Location	Parking Lane on Market Street Next to See Parcel		

Elevation, feet	Downhole Depth, feet	SAMPLES Type	SAMPLES Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	Well Completion Schematic	REMARKS AND WELL DETAILS
	0								Asphalt		09:35 Precleared to 5' with air knife
								SM	Concrete Brown silty fine SAND (fill)		
	5			50/5"		0.0		SM	Brown and gray silty fine SAND, mottled oxidation (very dense) (moist) (no odor, no stain) (fill)		10:35
	10			50/3"		0.0		ML	Dark gray to dark greenish gray N 4/1-10Y 4/1 SILT, trace fine gravel (hard) (non-plastic) (dry) (no odor, no stain)		10:45
									12 ft ▼		Driller notes very hard drilling
	15			50/6"		0.0			Same as above, increasing fine gravel (damp to moist) (no odor, no stain)		10:50
	20			50/5"		0.0			Same as above, little fine to coarse sand (no odor, no stain)		10:55
	25			50/6"		0.0			Dark greenish gray 5 GY 4/1 SILT, trace fine sand, trace fine gravel (hard) (non-plastic) (dry) (no odor, no stain)		Driller notes softer drilling starting at 24' 11:05 Driller notes harder drilling again Driller notes softer drilling
	30										

URS

'VORLD\33761130 UW TACOMA\33761130.GPJ URSSEA3B.GLB URSSEA3.GDT 8/22/08
ENV2 WITH WEL

Project: UW Tacoma 2008 TCE Assessment
Project Location: Tacoma, Washington
Project Number: 33761130

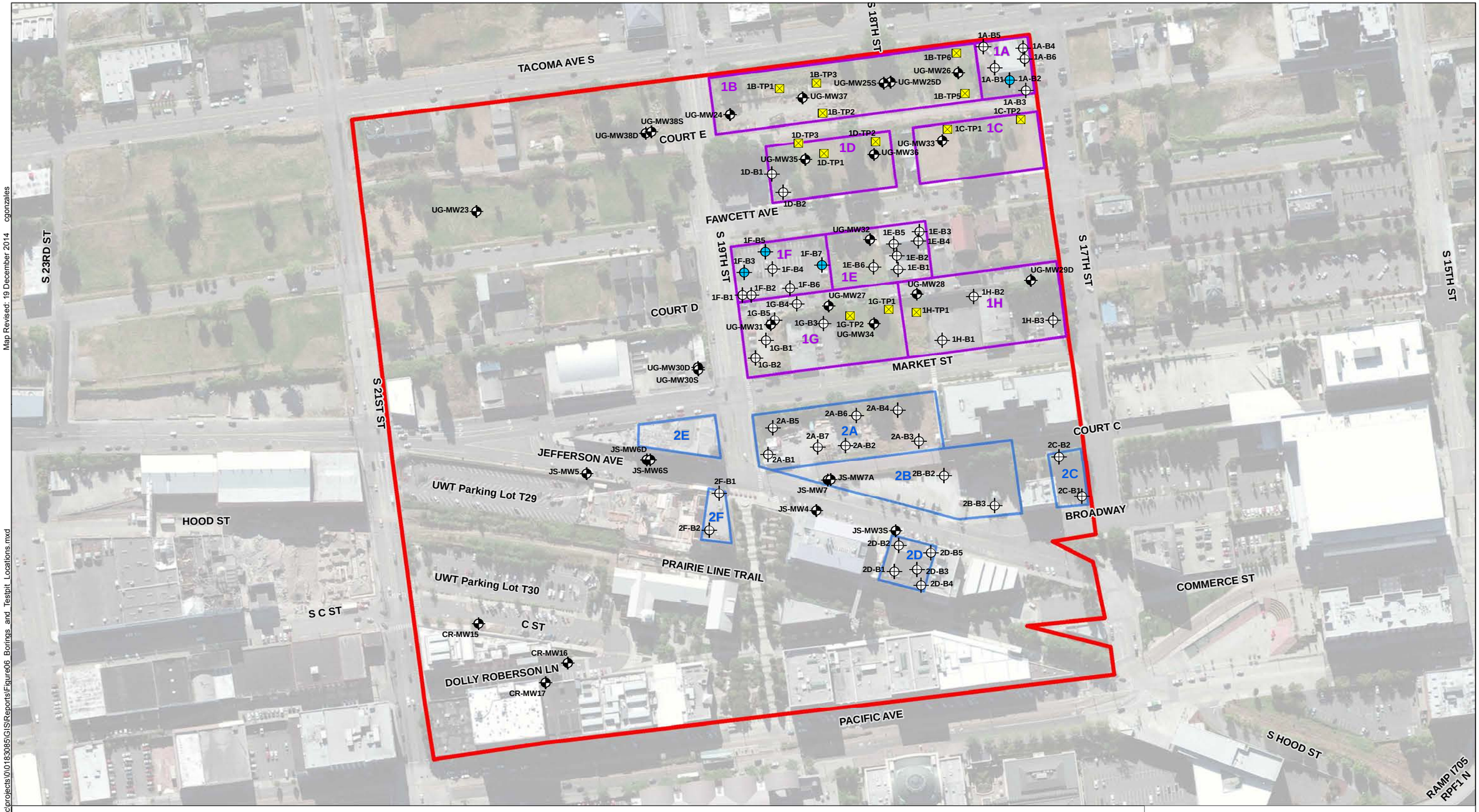
Log of Boring UG-MW15

Sheet 2 of 2

Elevation, feet	Downhole Depth, feet	SAMPLES Type	SAMPLES Number	Blows/ 6in.	Recovery (%)	OVM (ppm)	Graphic Log	USCS	MATERIAL DESCRIPTION	REMARKS AND WELL DETAILS
	30			50/1"						11:15 No recovery
								GM	Dark greenish gray 5 GY 4/1 gravelly, silty fine SAND (dense) (wet) (no odor, no stain)	Driller believes water at 32' during drilling
										Water at 33.5' bgs in augers at 11:40
	35			37 50/4"		0.0				11:25
								ML	Dark greenish gray 10Y 4/1 to 5 GY 4/1 SILT, little gravel, trace fine sand, trace large gravel (2"+), broken/fractured cobble in slough (hard) (dry) (non-plastic) (no odor, no stain)	Driller notes hard drilling at 39'
	40			50/4"						11:35
									Boring was completed to 40' bgs. Groundwater was encountered at 12' bgs. Boring was completed as monitoring well. Schedule 20 0.010 slot screen: 40'-25' 2/12 Monterey sand: 40'-22' Pure Gold medium bentonite 22'-18' Neat cement 18'-3' Concrete 3'-0' Flush mount monument	
	45									
	50									
	55									
	60									
	65									

'ORLD\33761130 UW TACOMA\33761130.GPJ URSSEA3B.GLB URSSEA3.GDT 8/22/08
ENV2 WITH WELL

URS



Map Revised: 19 December 2014 cgonzales

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Office: TAC

Notes:
PDA = Priority Development Area
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Legend

- UWT Master Plan Campus Boundary
- PDA 1
- PDA 2

Investigation Completed in 2013 (Location and Identification)

- Sonic Core Boring - Permanent Monitoring Well
- Direct Push Boring Completed as Temporary Well
- Direct Push Boring
- Test Pit

W S N E

200 0 200
Feet

New Boring and Test Pit Locations

2013 Environmental Subsurface Investigation
University of Washington – Tacoma
Tacoma, Washington

GeoEngineers

Figure 6

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
6/20/2013	6/20/2013	4	JCD / TSD	Holt Drilling	Direct Push

Surface Elevation (ft) Vertical Datum	Hammer Data	Drilling Equipment
Undetermined	Pneumatic	Hand operated microsampler

Easting (X) Northing (Y)	System Datum	Groundwater: Date Measured	Depth to Water (ft)	Elevation (ft)

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Temperature (°C)	Collected Sample / Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		10		2F-B1-0-1 CA			ML	Brown to gray fine to medium sandy silt with occasional coarse sand (moist) (Fill)	NS	<1	
			10						Brown to gray fine to coarse sandy silt with gravel (moist)			
									Practical refusal at 4 feet			

Notes: See Figure A-1 for explanation of symbols

Log of Boring 2F-B1

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-76
Sheet 1 of 1

Tacoma: Date:12/19/14 Path:C:\USERS\KJANC\DESKTOP\0183085000.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Map Revised: 19 December 2014 cgonzales

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Office: TAC

TACOMA AVE S
S 18TH ST
S 15TH ST
S 23RD ST
S 19TH ST
S 17TH ST
S 21ST ST
COURT E
FAWCETT AVE
COURT D
MARKET ST
COURT C
JEFFERSON AVE
HOOD ST
S C ST
C ST
PRAIRIE LINE TRAIL
DOLLY ROBERSON LN
BROADWAY
COMMERCE ST
PACIFIC AVE
S HOOD ST

1A 1B 1C 1D 1E 1F 1G 1H 2A 2B 2C 2D 2E 2F

UG-MW18 UG-MW21 UG-MW38S UG-MW19 UG-MW38D UG-MW23 UG-MW20 UG-MW22 DD-MW2 UG-MW30D UG-MW30S UG-MW11 BA-MW1 UG-MW10 UG-MW15 UG-MW5 UG-MW12 UG-MW6 UG-MW1 JP-MW2 JS-MW5 JS-MW6D JS-MW6S UG-MW2R JP-MW1R JP-MW1 PL-MW1 PL-MW2 CR-MW3 BL-MW5 BL-MW1 CR-MW9 CR-MW8 CR-MW5 CR-MW6 CR-MW15 BL-MW6 BL-MW3 CR-MW16 CR-MW17 CR-MW11 CR-MW12 BL-MW4 SH-MW8 SH-MW7 SH-MW6 PS-MW9 PS-MW8 PS-MW6 PS-MW7 UG-MW24 UG-MW37 UG-MW25S UG-MW25D UG-MW26 1A-B2 UG-MW36 UG-MW35 UG-MW33 UG-MW32 1F-B5 1F-B7 1F-B3 UG-MW17 UG-MW16 UG-MW31 UG-MW27 UG-MW34 UG-MW28 UG-MW29D UG-MW29S Y-MW4S Y-MW5S Y-MW6S Y-MW7S Y-TMW1 Y-TMW2 Y-MW1D Y-MW2S Y-MW1S Y-MW2D Y-MW3S Y-MW3D UG-MW14 BA-MW2 UG-MW9 UG-MW13 DD-MW1 UG-MW8 UG-MW7 UG-MW4 UG-MW3 JS-MW7A JS-MW1 JS-MW2 JS-MW4 JS-MW3 JS-MW3S

Monitoring wells installed as part of Y Student Center project. Chemical analytical results are not included in this report.

Notes:
PDA = Priority Development Area
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Legend

- UWT Master Plan Campus Boundary
- PDA 1
- PDA 2
- New Permanent Monitoring Well (2013)
- Direct Push Boring Completed as Temporary Well (2013)
- Existing Monitoring Permanent Well Installed by Others
- Well Screened Within Ice-Contact Deposit
- Well Screened within Advance Outwash
- Lithology of Well Screen Not Determined
- Well Decomissioned During this Investigation Due to Damage Observed in the Well

W S N E

200 0 200
Feet

Monitoring Well Locations

2013 Environmental Subsurface Investigation
University of Washington – Tacoma
Tacoma, Washington

GeoEngineers

Figure 7

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	TS	Topsoil/ Forest Duff/Sod

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Material Description Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

A "P" indicates sampler pushed using the weight of the drill rig.

Laboratory / Field Tests

%F	Percent fines
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PP	Pocket penetrometer
PPM	Parts per million
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen
NT	Not Tested

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

KEY TO EXPLORATION LOGS

GeoEngineers

FIGURE D-1

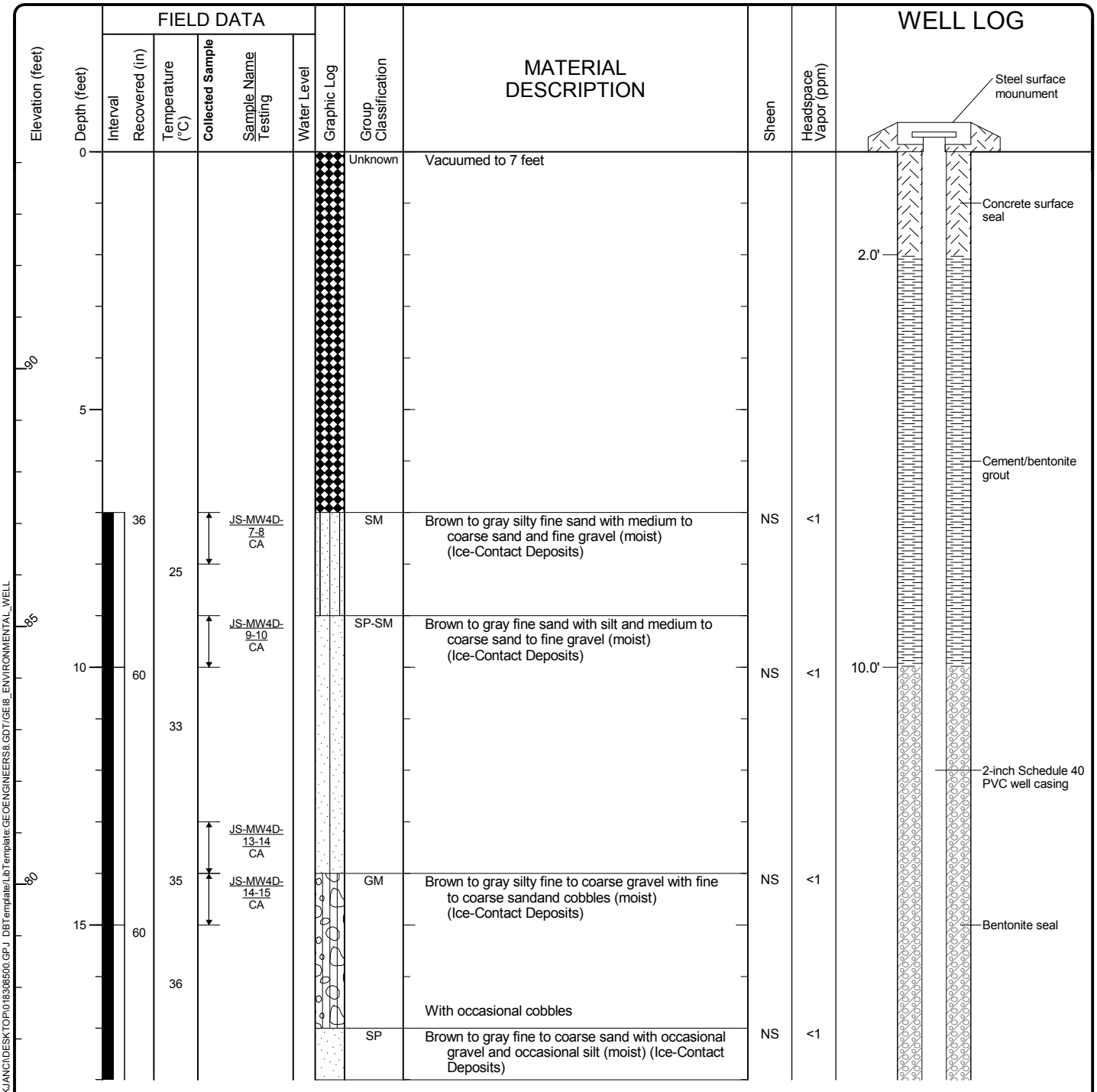
Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	9/5/2013	9/5/2013	55	JCD	TSD	Holt Drilling	Rotosonic

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft) Vertical Datum	94.21 NGVD29	Top of Casing Elevation (ft)	93.66
Easting (X) Northing (Y)	1158864.61717 703210.750304	Horizontal Datum	WA State Plane,South Harn

A 2 (in) well was installed on 9/5/2013 to a depth of 53 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	40.18	53.48

Notes: Elevation based on survey completed by AHBL on 11/6/13



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well JS-MW4

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-6
Sheet 1 of 3

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\0183085000.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	WELL LOG
75				47		JS-MW4D-18-19 CA			GP	Brown to gray gravel with fine to coarse sand and silt (moist) (Ice-Contact Deposits)			
	20		60	32					SP-SM	Brown to gray fine to medium sand with silt and coarse sand to fine gravel (moist) (Ice-Contact Deposits)	NS	<1	
				43		JS-MW4D-22-23 CA					NS	<1	
70				55					SP-SM	Brown to gray fine sand with silt (moist) (Ice-Contact Deposits)			
	25		60						GM	Brown/gray silty fine gravel with fine to medium sand (moist) (Ice-Contact Deposits)	NS	<1	
				61		JS-MW4D-27-28			SP-SM	Brown to gray fine sand with silt and occasional medium to coarse sand (moist) (cemented) (Ice-Contact Deposits)			
											NS	<1	
65				64		JS-MW4D-29-29.3 CA			SP	Brown to gray fine sand, trace silt (moist) (Ice-Contact Deposits)			
						JS-MW4D-29.5-30 CA			SP-SM	Brown to gray fine sand with silt and medium to coarse sand (moist) (Ice-Contact Deposits)			
	30		60						ML	Brown silt with fine sand (moist) (cemented) (Silt)			
				23		JS-MW4D-31-32 CA					NS	<1	
						JS-MW4D-32-32.3 CA							
									SM	Brown silty fine sand with trace coarse sand and occasional gravel (moist) (Transition Zone)			
60				25					ML	Brown silt with fine sand with fine sand laminations (moist) (Transition Zone)	NS	<1	
	35		60										
				24		JS-MW4D-36-37 CA							
						JS-MW4D-37-38 CA			SP	Brown to gray fine to medium sand, trace silt (moist) (Transition Zone)		<1	
				26					SP-SM	Brown to gray fine to coarse sand with silt and occasional gravel (moist) (Transition Zone)	NS		
55						JS-MW4D-38.5-39.5 CA			ML	Brown to gray silt with fine sand and occasional medium to coarse sand with fine to medium sand laminations; iron staining (moist) (Transition Zone)			
	40		60				▼		SP	Brown to gray fine to medium sand with coarse sand to fine gravel (moist) (Advance			

Notes: See Figure A-1 for explanation of symbols

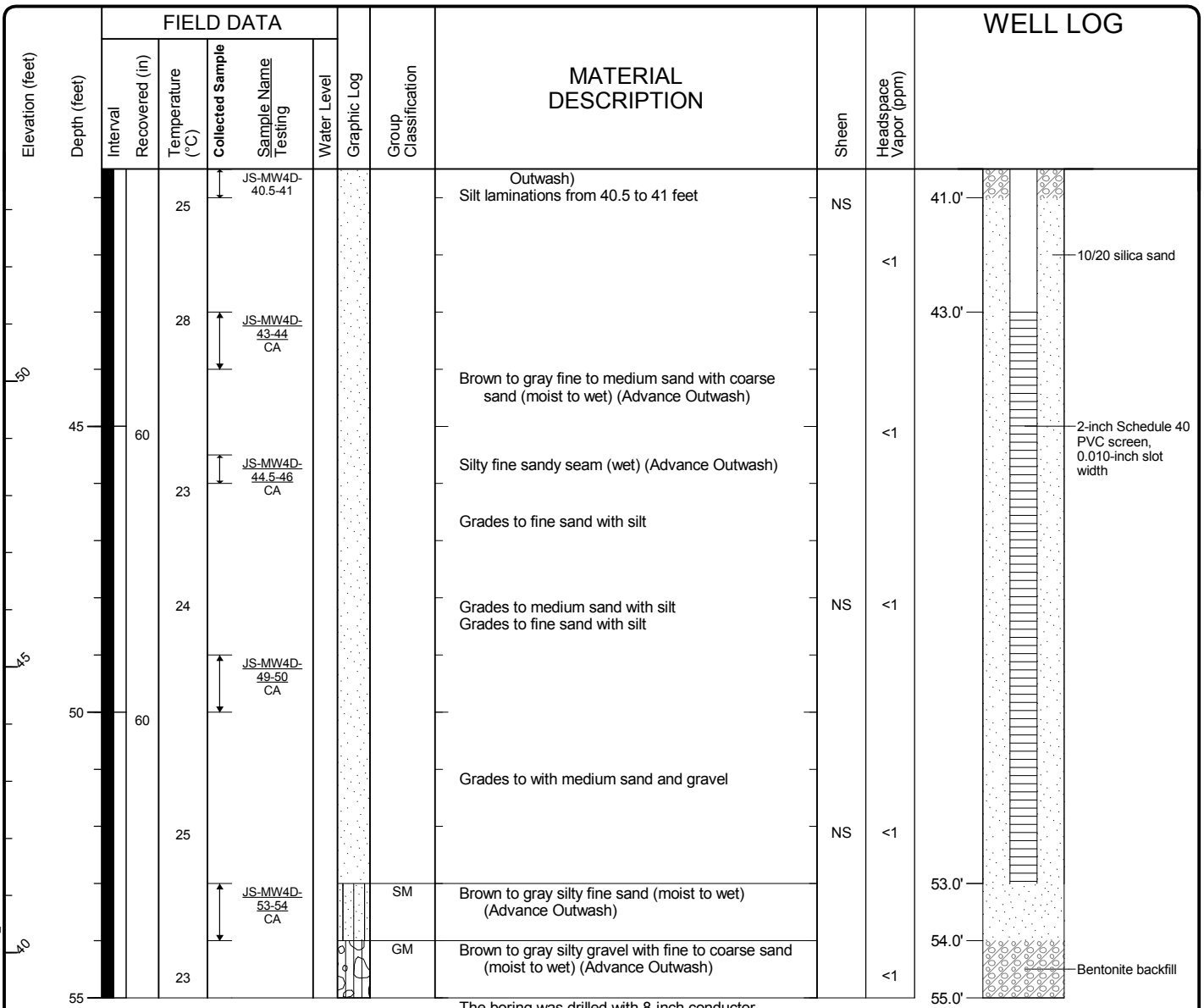
Log of Monitoring Well JS-MW4 (continued)

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-6
Sheet 2 of 3

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\0183085500.GPJ DBTemplate/LibTemplate.GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well JS-MW4 (continued)

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-6
Sheet 3 of 3

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\0183085000.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

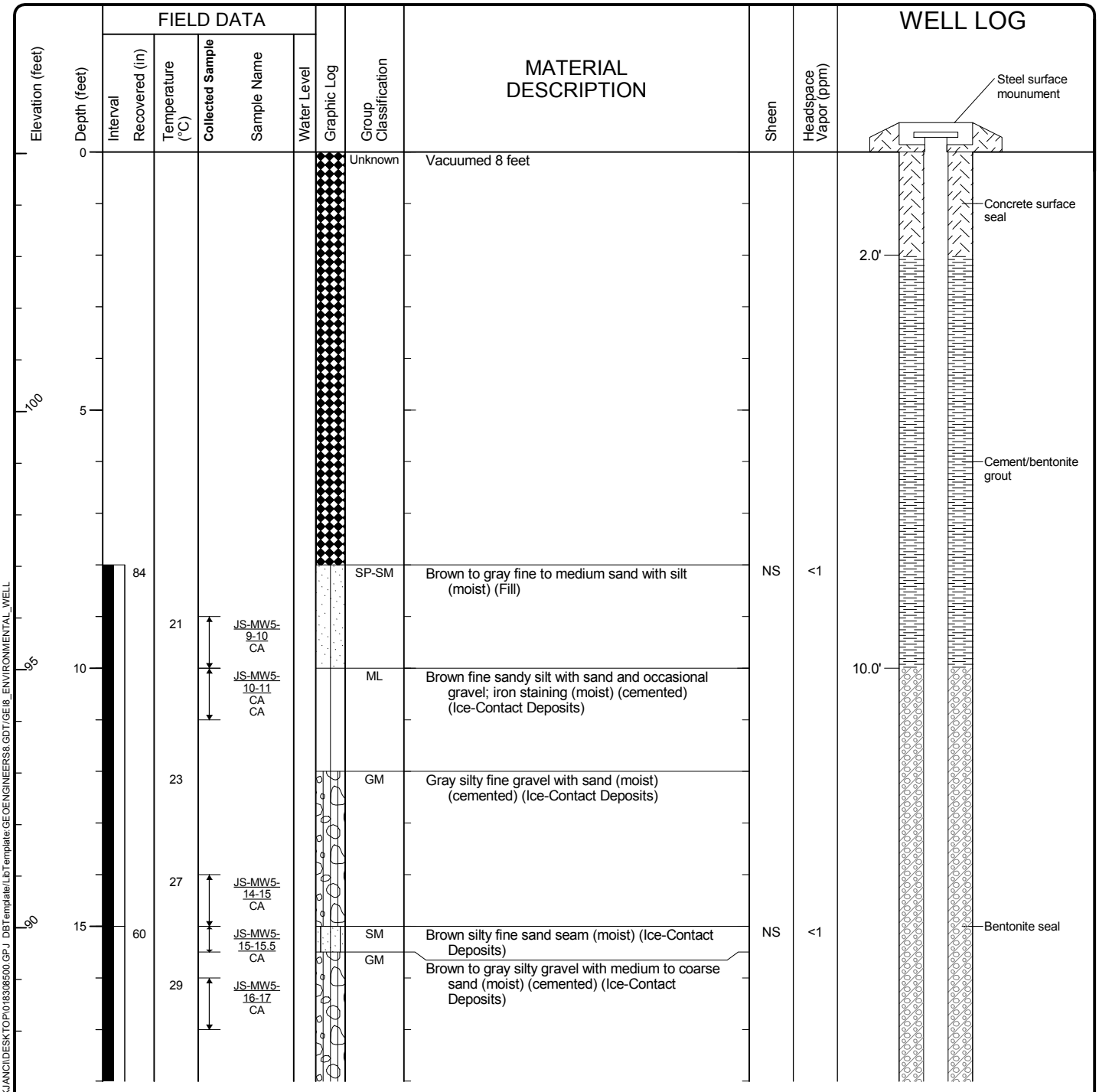
Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	8/29/2013	8/29/2013	40	JCD	TSD	Holt Drilling	Rotosonic

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft) Vertical Datum	105.03 NGVD29	Top of Casing Elevation (ft)	104.67
Easting (X) Northing (Y)	1158851.37593 702700.283161	Horizontal Datum	WA State Plane,South Harn

A 2 (in) well was installed on 8/25/2013 to a depth of 37 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	21.87	82.80

Notes: Elevation based on survey completed by AHBL on 11/6/13



Notes: See Figure A-1 for explanation of symbols

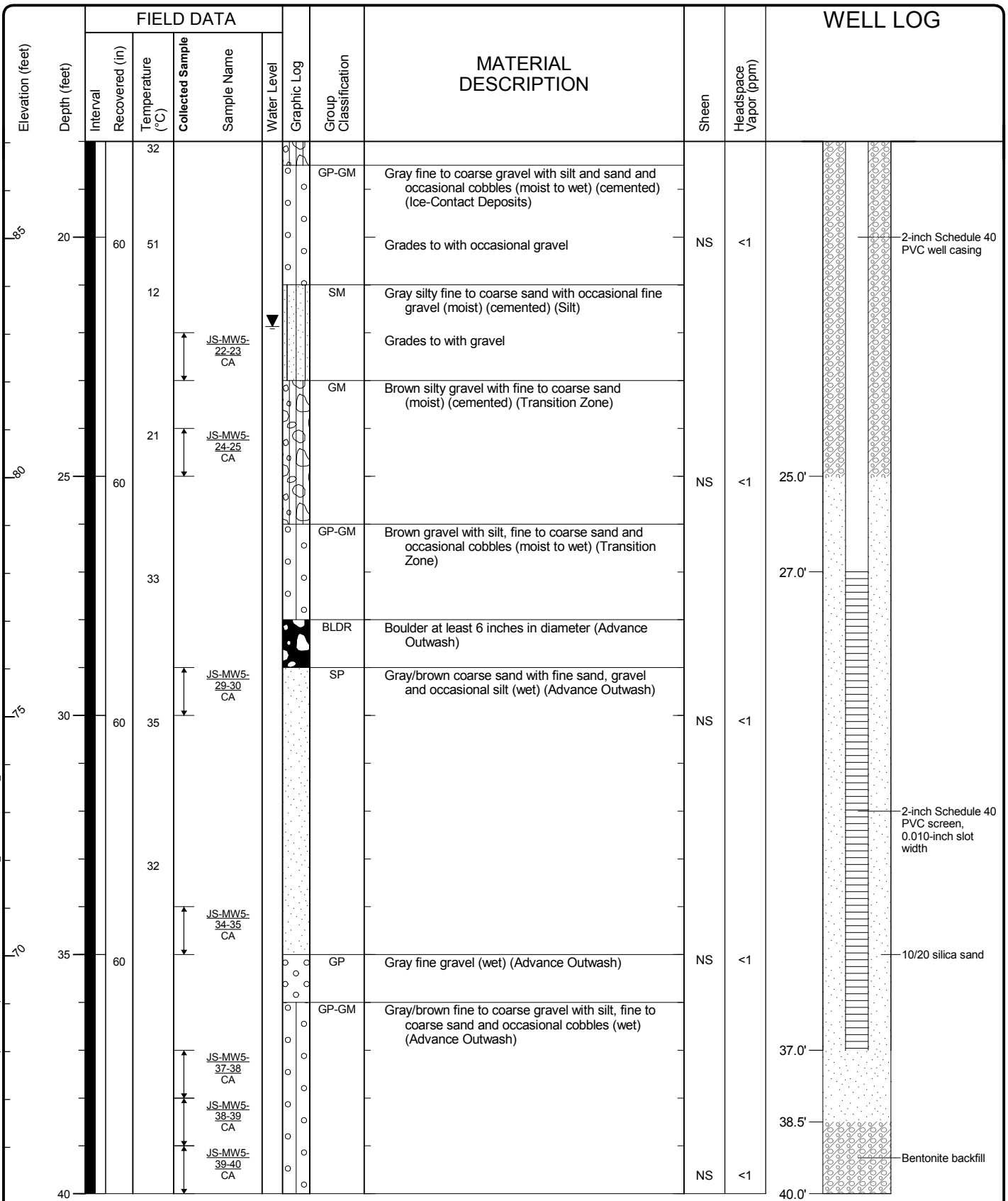
Log of Monitoring Well JS-MW5

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-7
Sheet 1 of 2

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\0183085000.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well JS-MW5 (continued)

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-7
Sheet 2 of 2

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\0183085000.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

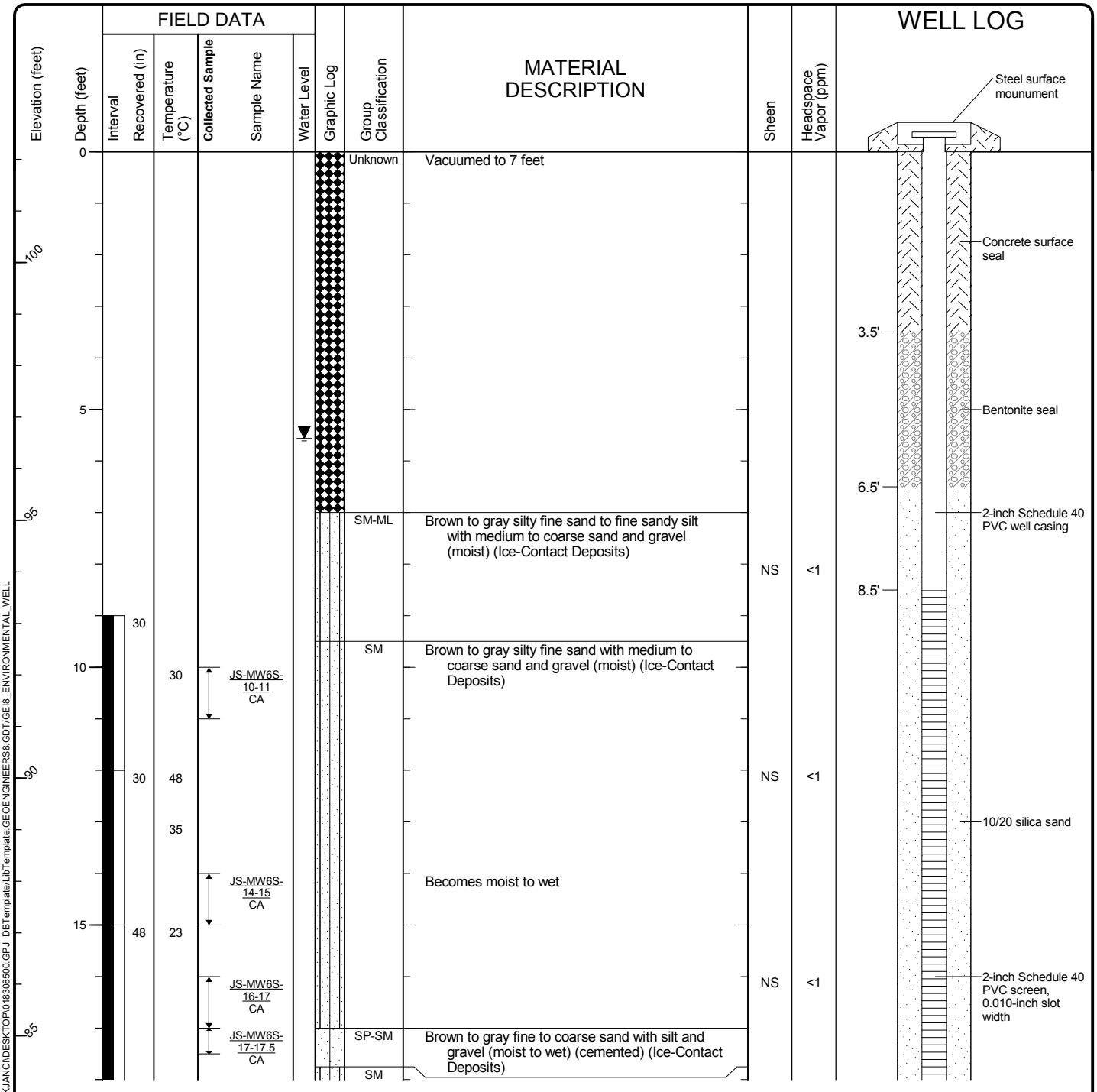
Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	9/3/2013	9/3/2013	19	JCD	TSD	Holt Drilling	Rotosonic

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft) Vertical Datum	102.15 NGVD29	Top of Casing Elevation (ft)	101.85
Easting (X) Northing (Y)	1158822.93508 702834.761492	Horizontal Datum	WA State Plane,South Harn

A 2 (in) well was installed on 9/3/2013 to a depth of 18.5 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	5.56	96.29

Notes: Elevation based on survey completed by AHBL on 11/6/13



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well JS-MW6S

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-8
Sheet 1 of 2

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\0183085500.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Temperature (°C)	Collected Sample	Sample Name	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	WELL LOG
				35		JS-MW6S-18-19 CA				Brown to gray silty fine sand with medium to coarse sand and gravel (moist) (cemented) (Ice-Contact Deposits)	NS	<1	18.5' 19.0'

Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well JS-MW6S (continued)

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-8
Sheet 2 of 2

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\0183085000.GPJ DBTemplate/LibTemplate.GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

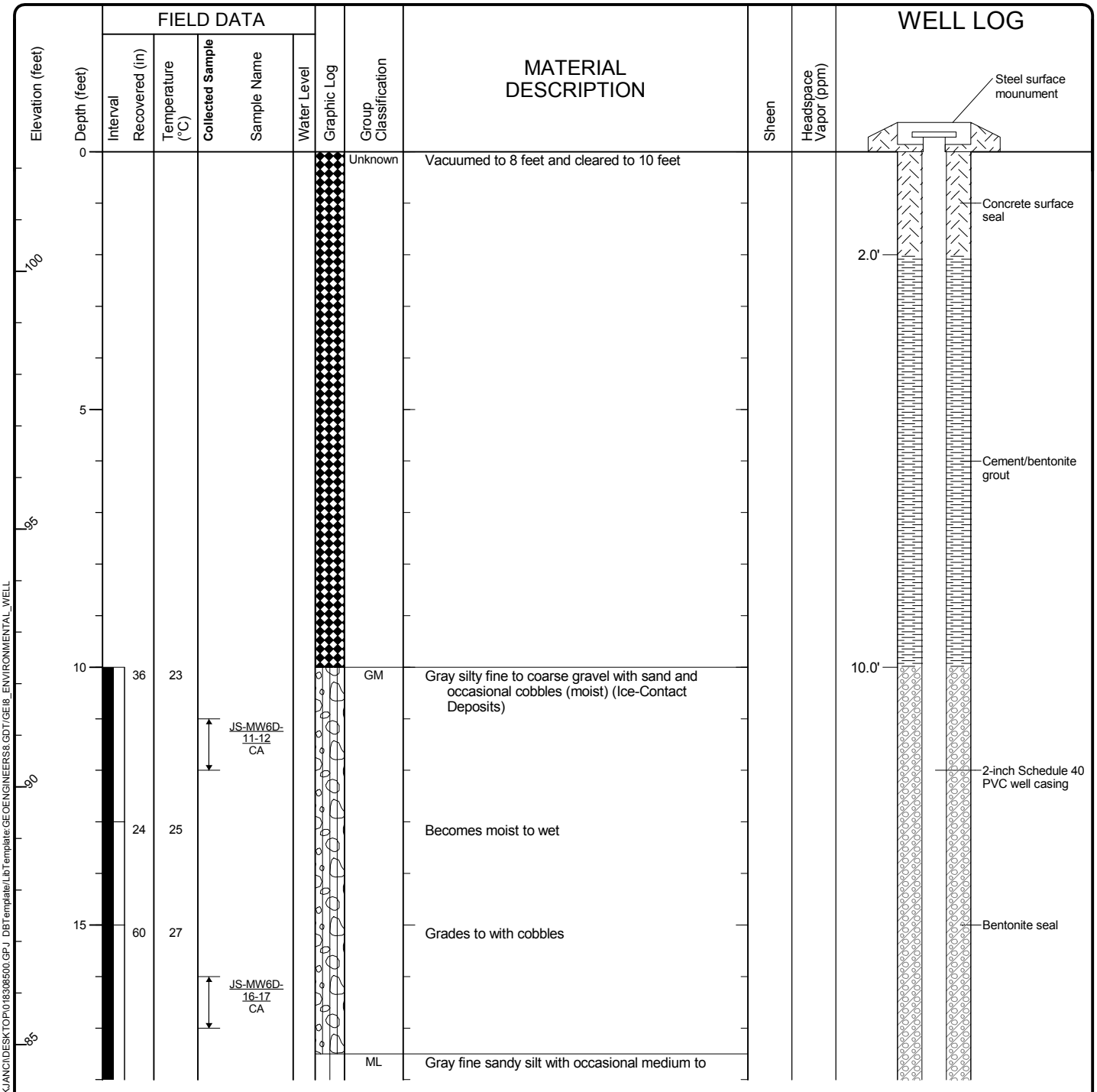
Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	8/30/2013	8/30/2013	50	JCD	TSD	Holt Drilling	Rotosonic

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft) Vertical Datum	102.32 NGVD29	Top of Casing Elevation (ft)	101.99
Easting (X) Northing (Y)	1158822.071 702827.688397	Horizontal Datum	WA State Plane,South Harn

A 2 (in) well was installed on 8/30/2013 to a depth of 40 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	19.22	82.77

Notes: Elevation based on survey completed by AHBL on 11/6/13



Notes: See Figure A-1 for explanation of symbols

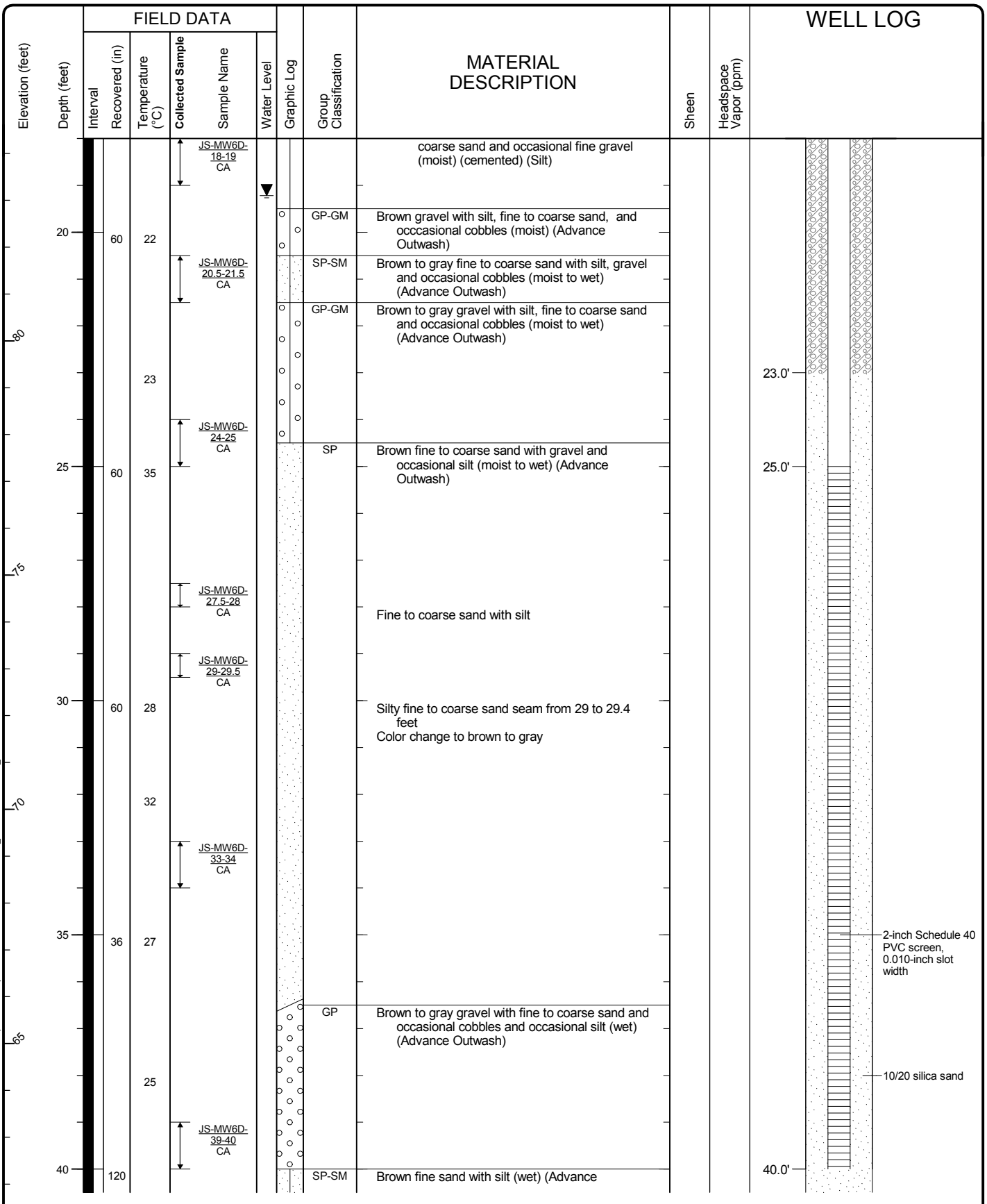
Log of Monitoring Well JS-MW6D

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-9
Sheet 1 of 3

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\0183085500.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL



Notes: See Figure A-1 for explanation of symbols

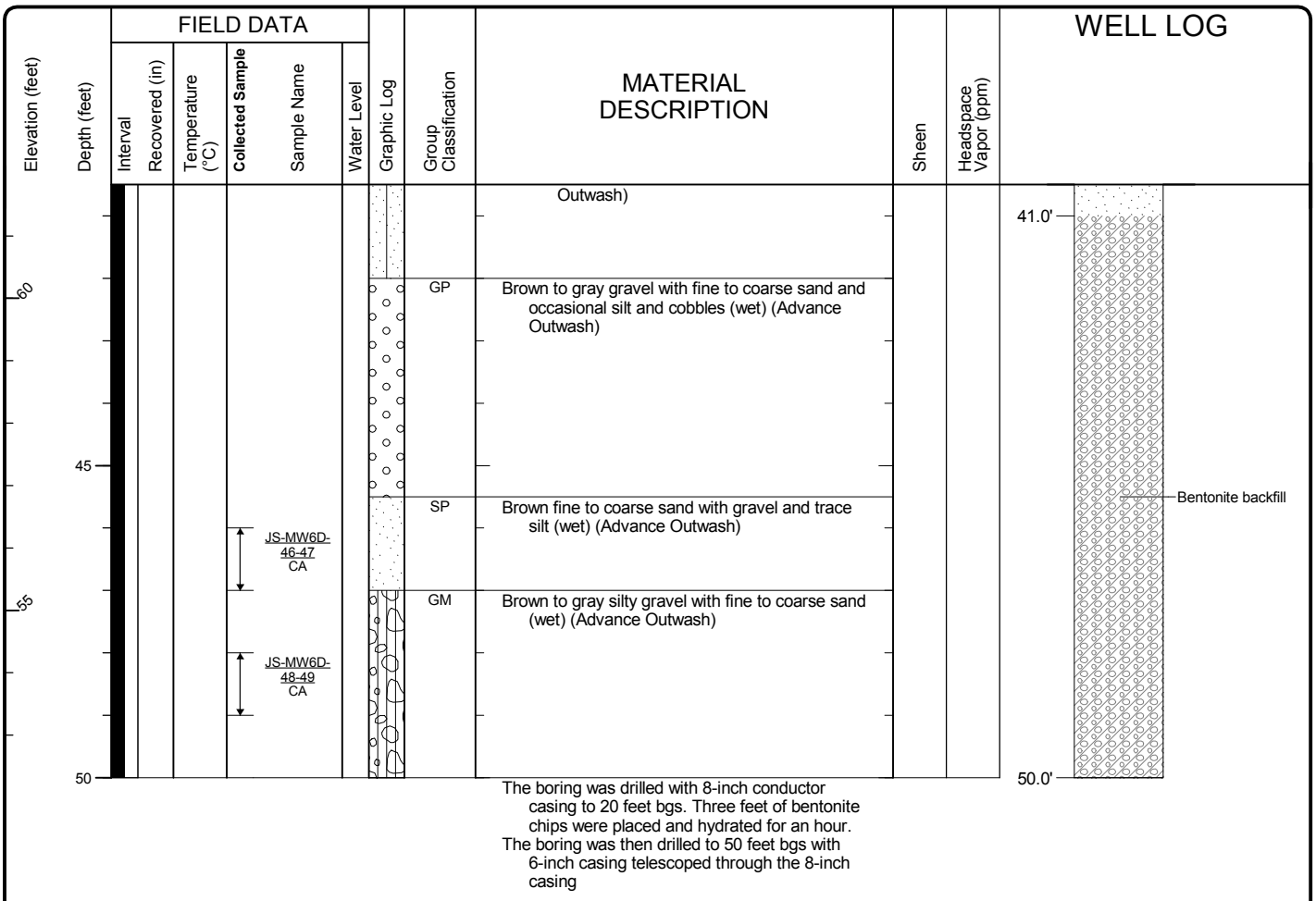
Log of Monitoring Well JS-MW6D (continued)

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-9
Sheet 2 of 3

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\0183085500.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well JS-MW6D (continued)

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-9
Sheet 3 of 3

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\0183085000.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
9/12/2013	9/12/2013	13	JCD / TSD	Holt Drilling	Rotosonic

Hammer Data	N/A	Drilling Equipment	Geoprobe 8140 LC
Surface Elevation (ft) / Vertical Datum	97.00 NGVD29	Top of Casing Elevation (ft)	96.75
Easting (X) / Northing (Y)	1158863.792 703216.486608	Horizontal Datum	WA State Plane,South Harn

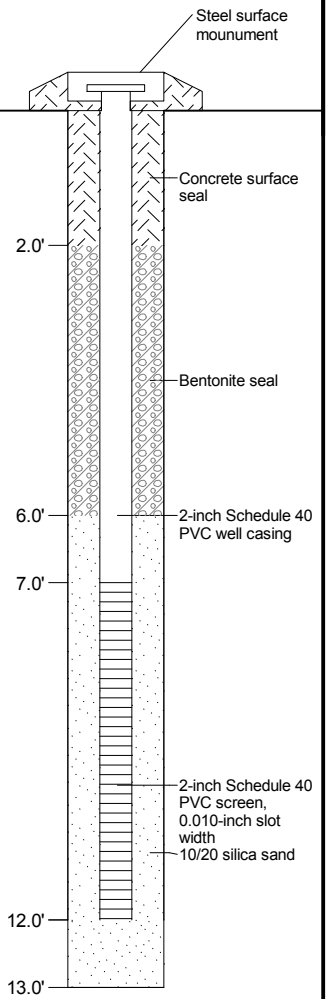
A 2 (in) well was installed on 9/12/2013 to a depth of 12 (ft).

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
11/8/2013	11.02	85.73

Notes: Elevation based on survey completed by AHBL on 11/6/13

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Temperature (°C)	Collected Sample / Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)
	0		60	23	JS-MW7A-0-1 CA			SP-SM	Dark brown fine to medium sand with silt, coarse sand and occasional organics (moist) (Fill)		<1
					JS-MW7A-1-2 CA			ML	Brown silt with fine sand; iron staining (moist) (Fill)		
95				23				SM	Brown silty fine to medium sand with coarse sand (moist) (Fill)	NS	<1
					JS-MW7A-3-4 CA						
				25				SP-SM	Brown to gray fine to medium sand with silt and occasional coarse sand (moist) (Ice-Contact Deposits)	NS	
	5		24		JS-MW7A-5-6 CA						
				31							
90			36					SM	Brown to gray silty fine sand with medium to coarse sand and gravel (moist) (cemented) (Ice-Contact Deposits)	NS	<1
				25							
	10		36	26		▼				NS	<1
85				28				ML	Brown to gray fine sandy silt with occasional medium to coarse sand; iron staining (moist) (cemented) (Silt)	NS	

WELL LOG



Notes: See Figure A-1 for explanation of symbols

Log of Monitoring Well JS-MW7A

GeoEngineers

Project: UWT 2013 Environmental Investigation
Project Location: Tacoma, Washington
Project Number: 0183-085-00

Figure D-11
Sheet 1 of 1

Tacoma: Date:12/18/14 Path:C:\USERS\KJANC\DESKTOP\0183085000.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_WELL

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	TS	Topsoil/ Forest Duff/Sod

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Material Description Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

A "P" indicates sampler pushed using the weight of the drill rig.

Laboratory / Field Tests

%F	Percent fines
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PP	Pocket penetrometer
PPM	Parts per million
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen
NT	Not Tested

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

KEY TO EXPLORATION LOGS

GeoEngineers

FIGURE H-1

Drilled Start 7/15/2013 End 7/15/2013	Total Depth (ft) 8	Logged By JCD Checked By TSD	Driller ESN	Drilling Method Direct Push
Surface Elevation (ft) Vertical Datum Undetermined		Hammer Data		Drilling Equipment Kubota LAR
Easting (X) Northing (Y)		System Datum		Groundwater Date Measured / Depth to Water (ft) / Elevation (ft)
Notes:				

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		40			B3-0-1			AC	Asphalt	SS	<1	
									SM	Black fine to coarse sand with silt and occasional gravel (moist) (fill)	NS	<1	
									SM	Brown to gray silty fine to medium sand with occasional coarse sand to fine gravel (wet)			
			20						SP	Brown to gray fine to medium sand, trace silt (moist to wet)			
	5					B3-5-6 CA					NS	<1	
			20						SM	Brown to gray silty fine sand (wet)			
						B3-7-8 CA			ML	Light gray fine sandy silt wtih occasional medium sand to fine gravel (moist)	NS	<1	
										Practical refusal at 8 feet			

Note: See Figure H-1 for explanation of symbols.

Log of Boring B-3

GeoEngineers

Project: UWT 1910 Jefferson
Project Location: Tacoma, Washington
Project Number: 0183-090-00

Figure H-4
Sheet 1 of 1

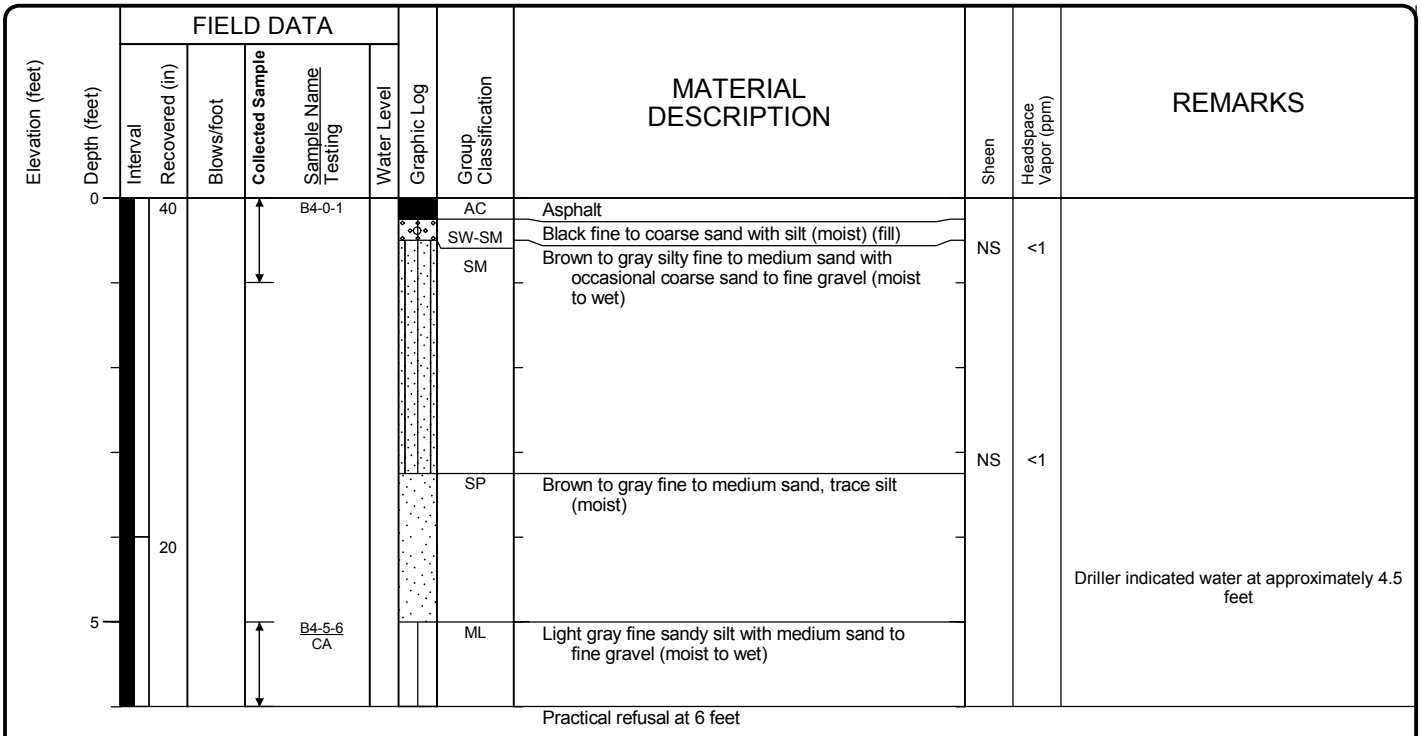
Tacoma: Date:8/7/13 Path:P:\0\0183090\00\GINT\0183090000.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
7/15/2013	7/15/2013	6	JCD / TSD	ESN	Direct Push

Surface Elevation (ft) Vertical Datum	Hammer Data	Drilling Equipment
Undetermined		Kubota LAR

Easting (X) Northing (Y)	System Datum	Groundwater: Date Measured	Depth to Water (ft)	Elevation (ft)

Notes:



Note: See Figure H-1 for explanation of symbols.

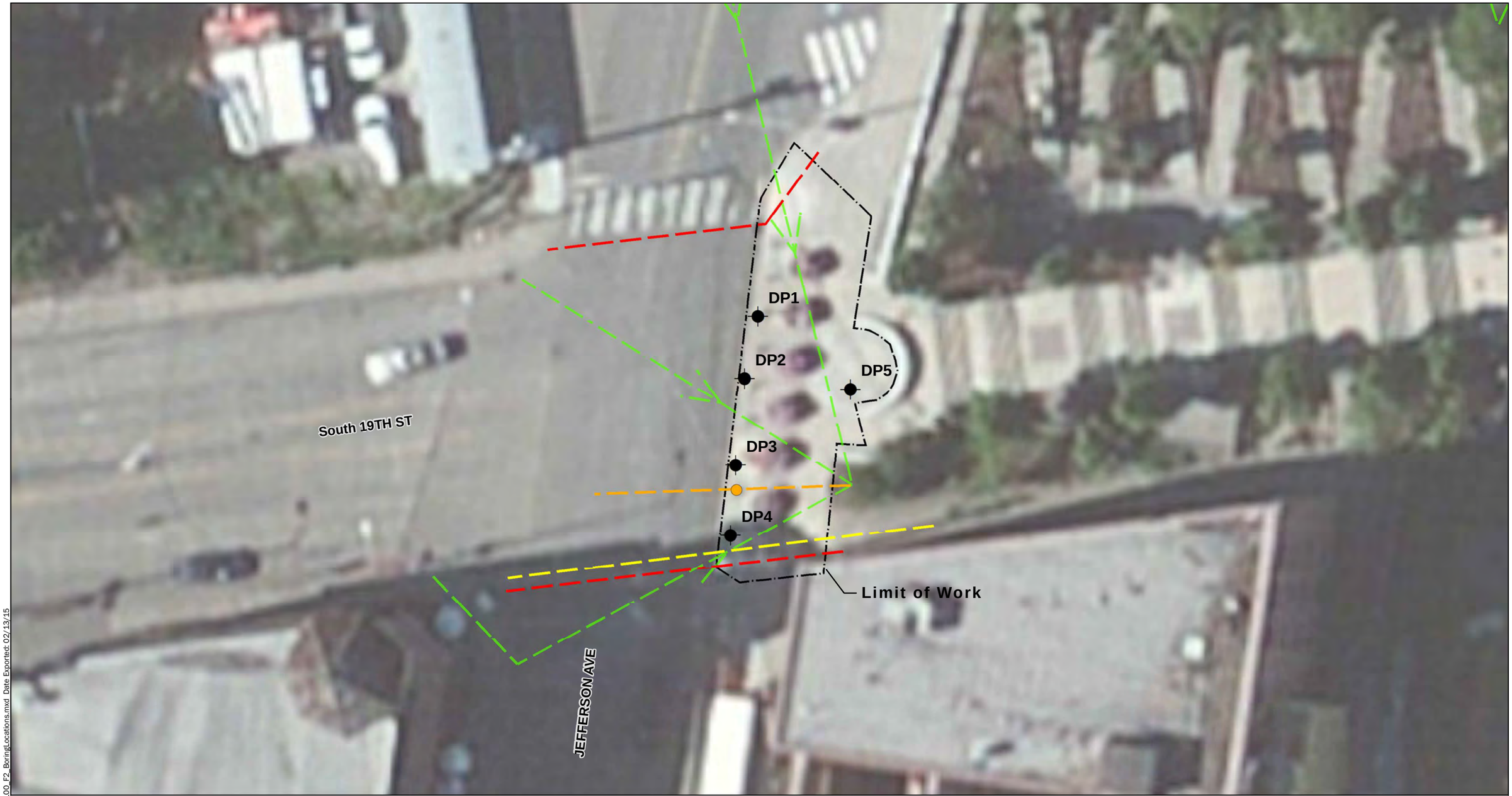
Log of Boring B-4

GeoEngineers

Project:	UWT 1910 Jefferson
Project Location:	Tacoma, Washington
Project Number:	0183-090-00

Figure H-5
Sheet 1 of 1

Tacoma: Date:8/7/13 Path:P:\0\0183090\00\GINT\0183090000.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD



Data Source: Aerial from ESRI, Storm sewer from Pierce County

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

Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Legend

DP1 Boring Location

Limit Of Work

Approximate Location of Public Utility As Marked In Field

- Storm Sewer
- Power
- Gas
- Communication
- Communication Vault

N W E S

20 0 20
Feet

Boring Locations

UWT Campus South 19th Street Crash Barrier
Tacoma, Washington

GeoEngineers

Figure 2

\\tac\projects\0\0183107\GIS\0183107001_T100_F2_BoringLocations.mxd Date Exported: 02/13/15

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	TS	Topsoil/ Forest Duff/Sod

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Material Description Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

A "P" indicates sampler pushed using the weight of the drill rig.

Laboratory / Field Tests

%F	Percent fines
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PP	Pocket penetrometer
PPM	Parts per million
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen
NT	Not Tested

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

KEY TO EXPLORATION LOGS

GeoEngineers

FIGURE A-1

Drilled	Start 1/19/2015	End 1/19/2015	Total Depth (ft) 13	Logged By BMB / Checked By TSD	Driller Environmental Services Northwest	Drilling Method Continuous
Surface Elevation (ft) / Vertical Datum	Undetermined		Hammer Data		Drilling Equipment	Track-Mounted Probe
Easting (X) / Northing (Y)			System Datum		Groundwater: Date Measured	Depth to Water (ft): None encountered
Notes:						Elevation (ft)

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		24			DP-1 0.5-5			CC	6 inches concrete			
									SP	Brown fine to coarse sand with gravel, trace silt (moist) (fill)	NS	<1	
									SP-SM	Brown silty fine to medium sand (moist) (fill)			
									SP	Brown fine to coarse sand with gravel, trace silt (moist) (fill)	NS	<1	
	5		60			DP-1 5-13			WD	Dark brown organic debris (woody material)			
									SP-SM	Gray silty fine to medium sand with occasional gravel (moist) (native)			
									ML	Gray silt with red staining			
									SP	Gray fine to medium sand, trace silt and occasional gravel (moist) (native)	NS	<1	
	10		54						SM	Gray to brown silty fine to medium sand with occasional gravel (moist) (native)			
									GM	Brown silty medium gravel with sand (moist) (native)			

Note: See Figure A-1 for explanation of symbols.

Log of Boring DP-1

GeoEngineers

Project: University of Washington 19th Street Barrier
Project Location: Tacoma, Washington
Project Number: 0183-107-00

Figure A-2
Sheet 1 of 1

Tacoma: Date:1/28/15 Path:\\TAC\PROJECTS\0\0183107\GINT\0183107.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
1/19/2015	1/19/2015	4	BMB / TSD	Environmental Services Northwest	Continuous

Surface Elevation (ft) Vertical Datum	Hammer Data	Drilling Equipment
Undetermined		Track-Mounted Probe

Easting (X) Northing (Y)	System Datum	Groundwater: Date Measured	Depth to Water (ft)	Elevation (ft)
			None encountered	

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		30						AC	6 inches asphalt concrete			
						DP-2 0.5-2			SP	Brown fine to medium sand with occasional gravel and trace silt (moist) (fill)	NS	<1	
						DP-2 2-4			SM	Gray fine silty sand (moist) (native)			

Note: See Figure A-1 for explanation of symbols.

Log of Boring DP-2

GeoEngineers

Project: University of Washington 19th Street Barrier
Project Location: Tacoma, Washington
Project Number: 0183-107-00

Figure A-3
Sheet 1 of 1

Tacoma: Date:1/28/15 Path:\\TAC\PROJECTS\0\0183107\GINT\0183107.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled	Start 1/19/2015	End 1/19/2015	Total Depth (ft)	4	Logged By	BMB	Driller	Environmental Services Northwest	Drilling Method	Continuous
					Checked By	TSD				

Surface Elevation (ft) Vertical Datum	Undetermined	Hammer Data		Drilling Equipment	Track-Mounted Probe
Easting (X) Northing (Y)		System Datum		Groundwater	Date Measured: None encountered

Notes:

Elevation (feet) / Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample / Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
0		24		DP-3 0.5-4			AC	6 inches asphalt concrete	NS	<1	
							SP	Brown fine to coarse sand, occasional gravel and trace silt (moist) (fill)			

Note: See Figure A-1 for explanation of symbols.

Log of Boring DP-3

GeoEngineers

Project: University of Washington 19th Street Barrier
Project Location: Tacoma, Washington
Project Number: 0183-107-00

Figure A-4
Sheet 1 of 1

Tacoma: Date:1/28/15 Path:\\TAC\PROJECTS\0\0183107\GINT\0183107.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
1/19/2015	1/19/2015	14	BMB / TSD	Environmental Services Northwest	Continuous

Surface Elevation (ft) Vertical Datum	Hammer Data	Drilling Equipment	Groundwater
Undetermined		Track-Mounted Probe	Date Measured / Depth to Water (ft) / Elevation (ft): See remarks
Easting (X) Northing (Y)	System Datum		

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		12			DP-4 0.5-5			AC	6 inches asphalt concrete			
									SP	Brown fine to coarse sand with gravel and trace silt (moist) (fill)	NS	<1	
	5		60			DP-4 5-14			SM	Brown with red staining fine silty sand and occasional gravel (moist) (native)	NS	<1	
									ML	Gray with red staining sandy silt with occasional gravel (moist) (native)			
									SM	Gray silty fine sand with occasional gravel (moist) (native)			
	10		48						SP	Gray fine to coarse sand with gravel and trace silt (wet) (native)	NS	<1	Groundwater encountered at approximately 10 feet at time of drilling
										Gray silty fine to medium sand with occasional gravel (moist) (native)			

Note: See Figure A-1 for explanation of symbols.

Log of Boring DP-4

GeoEngineers

Project: University of Washington 19th Street Barrier
Project Location: Tacoma, Washington
Project Number: 0183-107-00

Figure A-5
Sheet 1 of 1

Tacoma: Date:1/28/15 Path:\\TAC\PROJECTS\0\0183107\GINT\0183107.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
1/19/2015	1/19/2015	4	BMB / TSD	Environmental Services Northwest	Continuous

Surface Elevation (ft) Vertical Datum	Hammer Data	Drilling Equipment
Undetermined		Track-Mounted Probe

Easting (X) Northing (Y)	System Datum	Groundwater: Date Measured	Depth to Water (ft)	Elevation (ft)
			None encountered	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		36			DP-5 0.5-3.5			AC	6 inches asphalt concrete	NS	<1	
									SP	Brown fine to coarse sand with gravel and trace silt (moist) (fill)			
						DP-5 3.5-4			ML	Gray sandy silt (moist) (native)			

Note: See Figure A-1 for explanation of symbols.

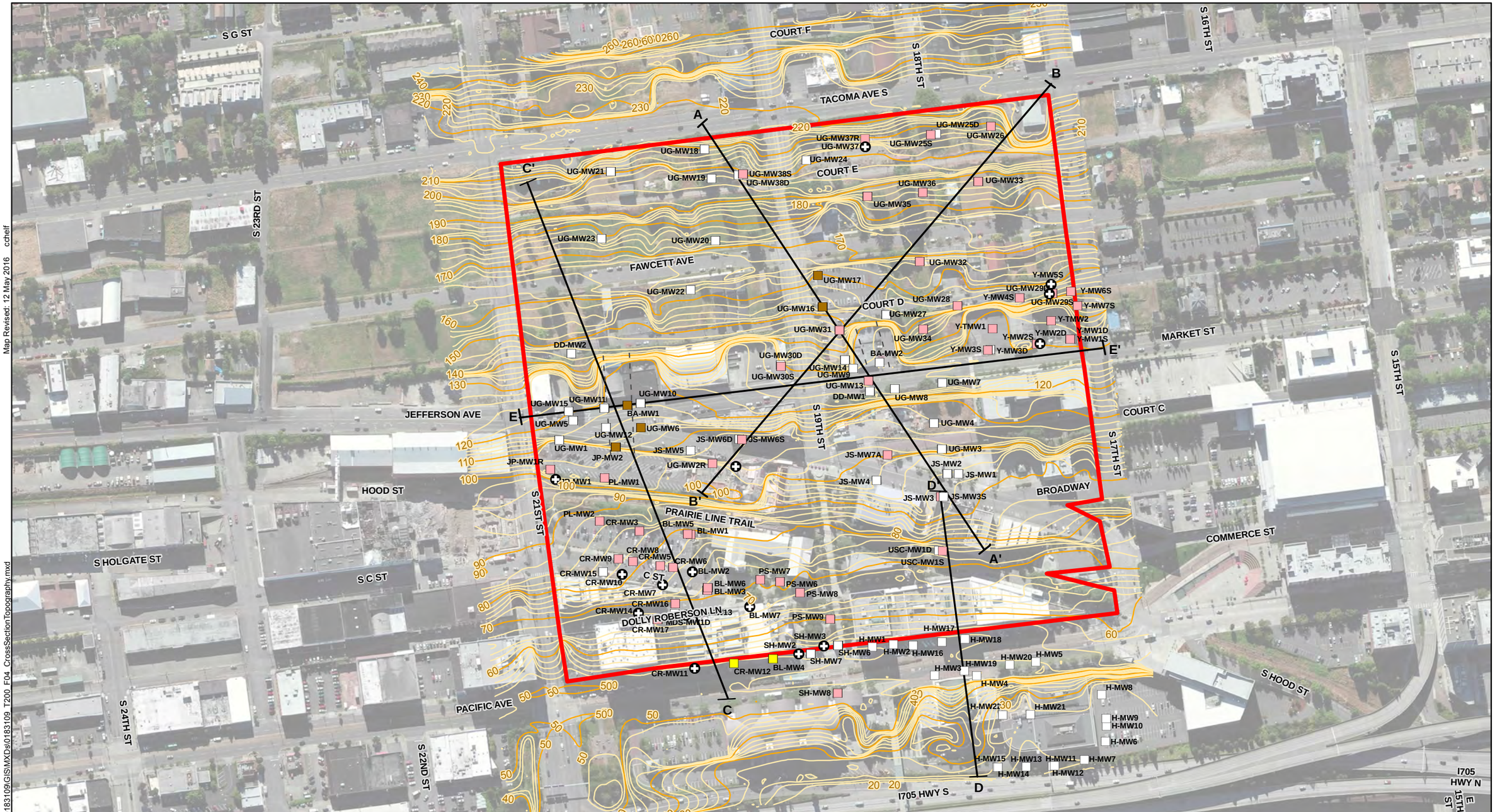
Log of Boring DP-5

GeoEngineers

Project: University of Washington 19th Street Barrier
Project Location: Tacoma, Washington
Project Number: 0183-107-00

Figure A-6
Sheet 1 of 1

Tacoma: Date:1/28/15 Path:\\TAC\PROJECTS\0\0183107\GINT\0183107.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD



Map Revised: 12 May 2016 cdhelf

Path: P:\00\0183109\GIS\MXDs\0183109_T200_F04_CrossSectionTopography.mxd

Office: TAC

Notes:
1. Contours interpretted from LiDAR provided by Pierce County 2010 and downloaded through the Puget Sound LiDAR Consortium.
2. The locations of all features shown are approximate.
3. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Legend

- UWT Master Plan Campus Boundary
- A — A' Cross Section Location
- Well Decomissioned In the Past Due to Damage Observed in the Well or Prior Construction Activities
- Major Topographic Contours - 10-foot Interval
- Minor Topographic Contours - 2-foot Interval
- Potential Former Drainage Channel

Existing Monitoring Wells

- Shallow Aquifer Monitoring Well
- Deep Aquifer Monitoring Well
- Shallow and Deep Aquifer Monitoring Well
- Unconfirmed Aquifer Monitoring Well

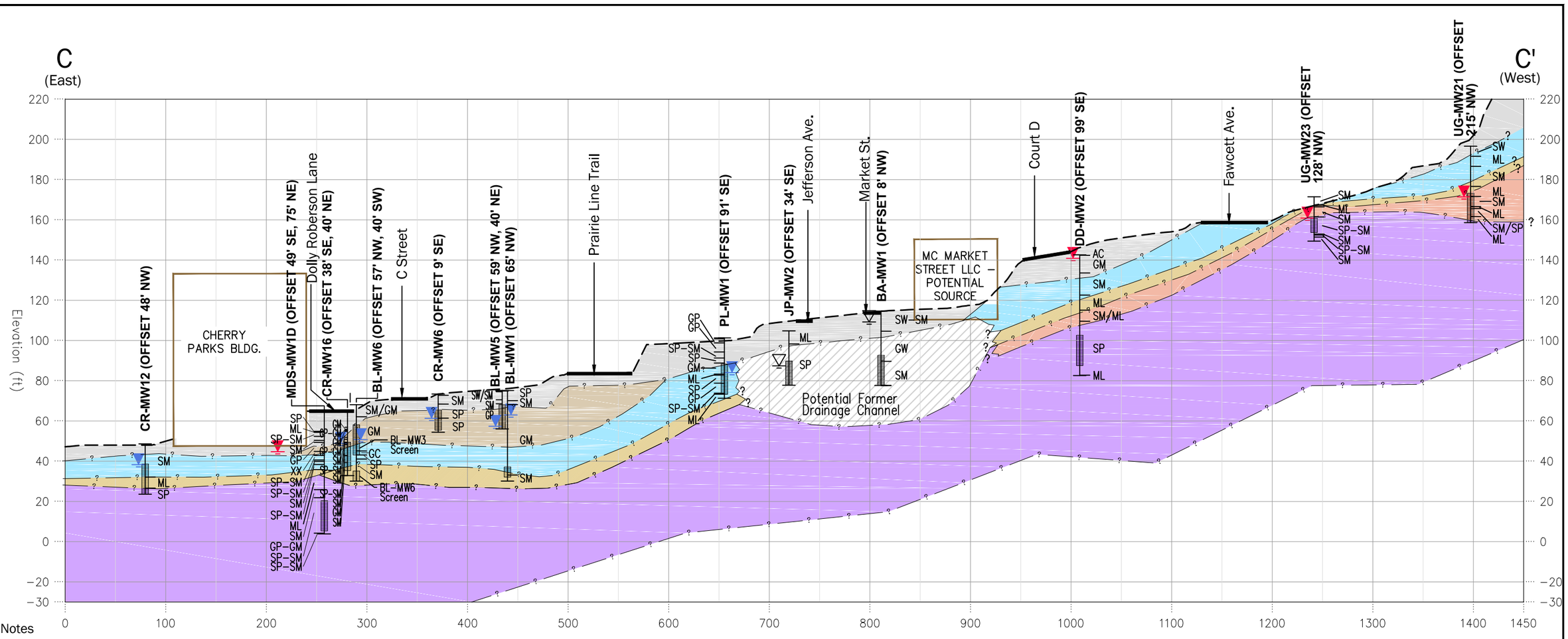
250 0 250
Feet

Topography and Cross Section Location Map

Agreed Order Remedial Investigation Work Plan
University of Washington – Tacoma
Tacoma, Washington

GeoEngineers

Figure 4



Notes

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. Horizontal datum - NAD 83/91 Washington State Plane - South Zone (City of Tacoma Horizontal control Holding City Monument Numbers 411 and 414). Vertical datum NGVD 29 (brass monument at South 19th and Fawcett Avenue, elevation 165.15).
4. Ground surface elevation based on LiDAR obtained from the Puget Sound LiDAR consortium. The surface topography in the areas of existing buildings was adjusted as necessary. Well elevations for the wells installed in 2013 were based on a survey completed by AHBL November 6, 2013. Well elevations for wells installed prior to 2013 are based on the elevations reported in the previous reports.
5. Storm sewer and sanitary sewer elevations and locations are estimated manhole and pipe elevations obtained from City of Tacoma govme.com.
6. Lithology shown on borings completed by GeoEngineers. Refer to boring logs for lithologic symbol descriptions provided in Appendix D.

Reference: Projection NAD 1983 State Plane Washington South, feet.

Legend

- Existing Ground Surface
- Fill
- Recent Fluvial Deposits
- Recessional Outwash (Qro)
- Ice-Contact Deposits (Qvi)
- Silt Layer (Semi-Confining to Confining)
- Advance Outwash (Qva)

JS-MW3S (OFFSET 8' SE)

- Borehole Number (Offset Distance and Direction)
- SM-ML Borehole Lithology (See Appendix D)
- Shallow Aquifer Water Level
- Deep Aquifer Water Level
- Unconfirmed Aquifer Water Level
- Well Screen
- Soil contact line (Inferred)

bgs = Below Ground Surface

HORIZONTAL SCALE: 1"= 100'
VERTICAL SCALE: 1"= 50'
VERTICAL EXAGGERATION: 2X

50 0 50
Vertical Scale in Feet

100 0 100
Horizontal Scale in Feet

Cross Section C-C'

Agreed Order Remedial Investigation Work Plan
University of Washington - Tacoma
Tacoma, Washington

GeoEngineers

Figure 7

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Map Revised: 12 May 2016 cchelf

Path: P:\0\0183109\GIS\MXDs\0183109_T200_F10_GroundwaterElevationContoursShallow.mxd

Office: TAC

Notes:
1. Groundwater levels were measured on November 8, 2013 with the exception of USC-MW1S which was measured on October 27, 2014.
2. Water level contours were created in Surfer 8 (Golden Software) using the kriging interpolation method.
3. The locations of all features shown are approximate.
4. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Legend

- UWT Master Plan Campus Boundary
- Generalized Shallow Groundwater Flow Direction
- Shallow Groundwater Level Elevation Contour (5-foot interval)
- Potential Former Drainage Channel
- UG-MW2R 81.34 — Shallow Aquifer Monitoring Well Location Identification and Approximate Water Level (feet) on November 8, 2013
- Shallow and Deep Aquifer Monitoring Well Monitoring Well Location Identification and Approximate Water Level (feet) on November 8, 2013
- Unconfirmed Aquifer Monitoring Well Monitoring Well Location Identification and Approximate Water Level (feet) on November 8, 2013 (Not used in Contouring)

W N S E

200 0 200
Feet

Groundwater Elevation Contours - Shallow Aquifer

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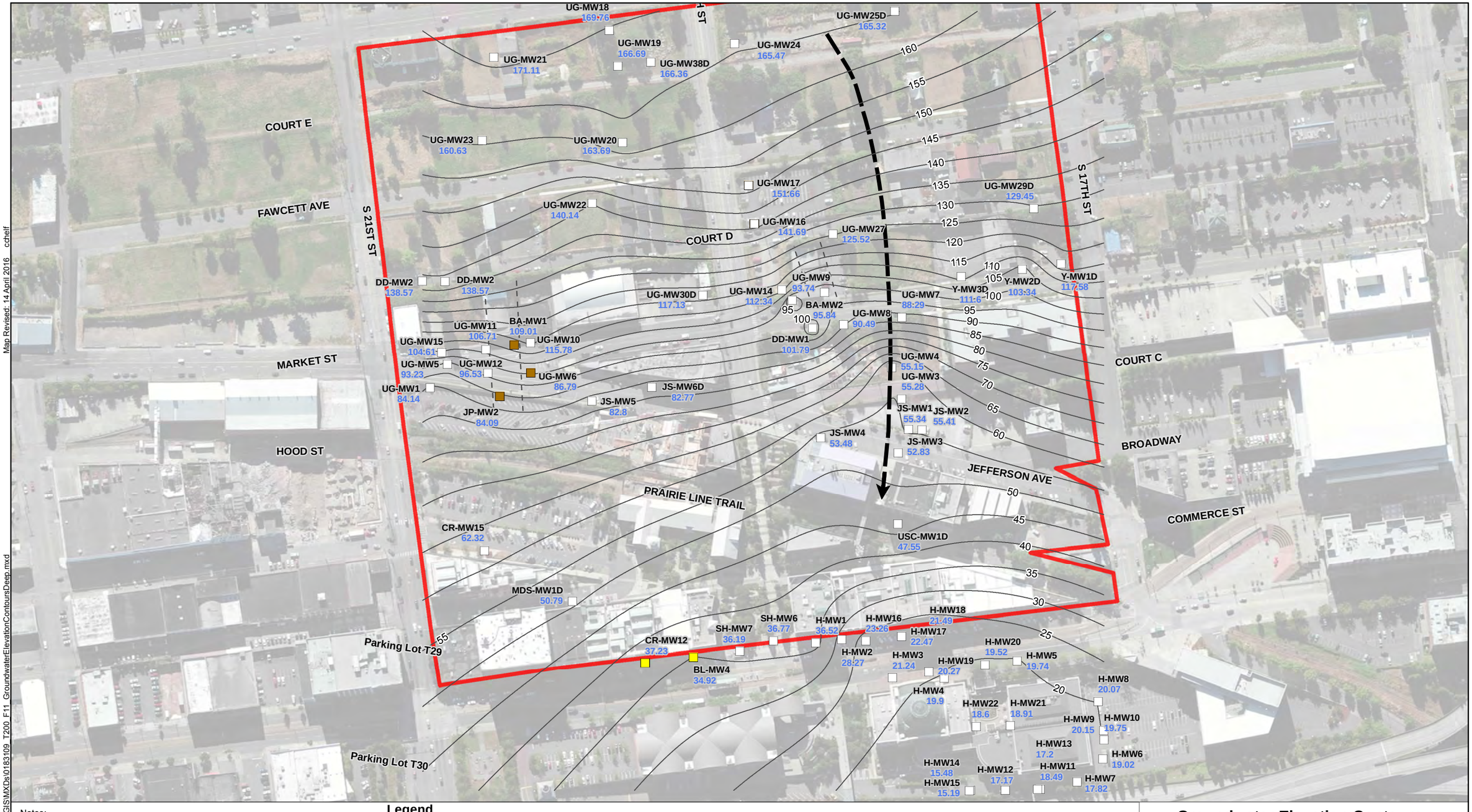
University of Washington – Tacoma
Tacoma, Washington

GeoEngineers

Figure 10



Map Revised: 14 April 2016 cdhelf

Path: P:\0\183109\GIS\MXDs\0183109_T200_F11_GroundwaterElevationContoursDeep.mxd

Office: TAC

Notes:
1. Groundwater measurements were collected on November 8, 2013 with the exception of all the H-MW# wells which were measured on December 22, 2015; MDS-MW1D which was measured on October 30, 2014 and USC-MW1D which was measured on October 27, 2014.
2. Water level contours were created in Surfer 8 (Golden Software) using the kriging interpolation method.
3. The locations of all features shown are approximate.
4. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Legend

- UWT Master Plan Campus Boundary
- Generalized Deep Groundwater Flow Direction
- Deep Groundwater Level Elevation Contour (5-foot interval)
- Potential Former Drainage Channel

JS-MW5
82.80
Deep Aquifer Monitoring Well Location Identification and Approximate Water Level (feet) on November 8, 2013

Shallow and Deep Aquifer Monitoring Well Monitoring Well Location Identification and Approximate Water Level (feet) on November 8, 2013

Unconfirmed Aquifer Monitoring Well Monitoring Well Location Identification and Approximate Water Level (feet) on November 8, 2013 (Not used in Contouring)

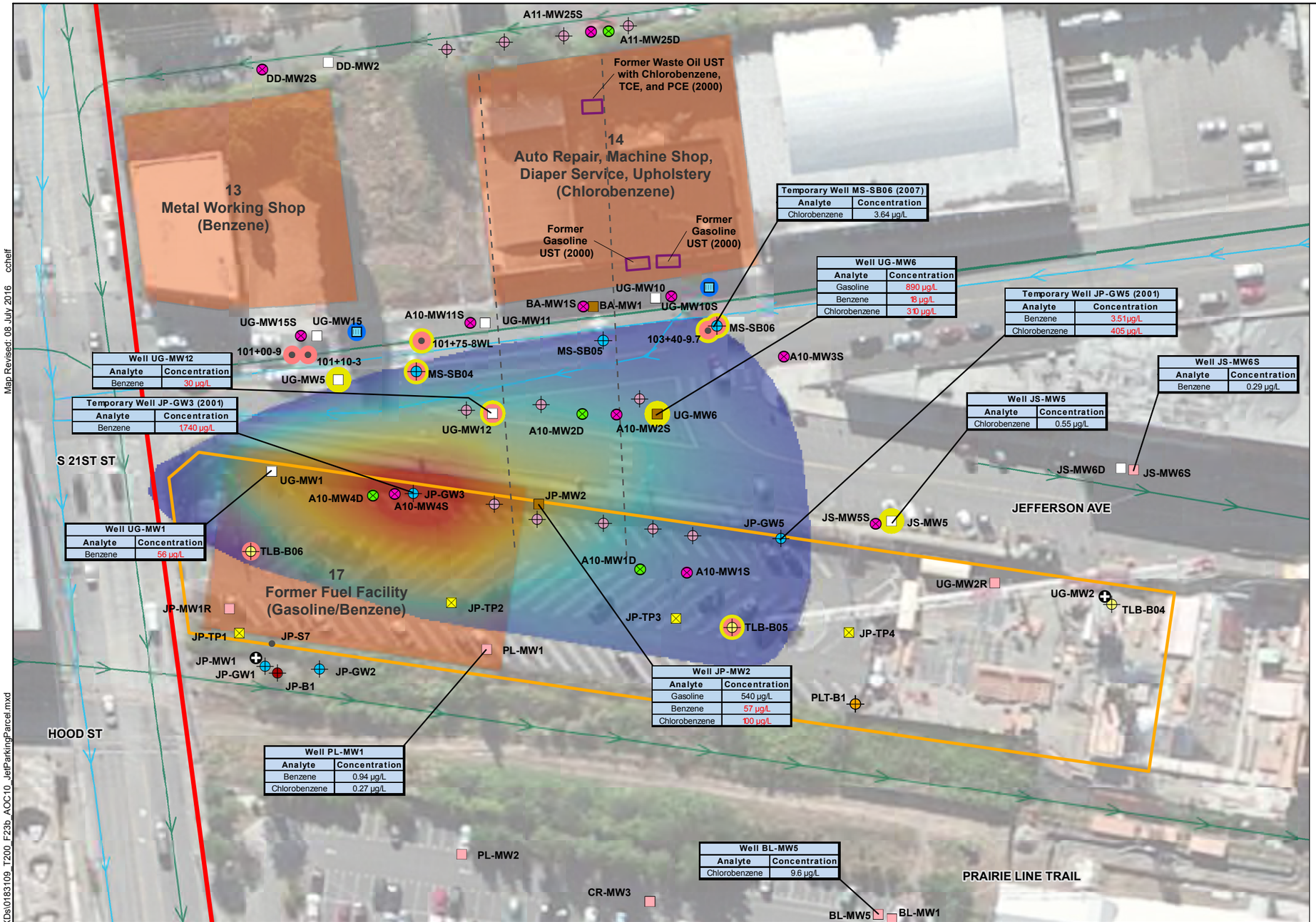
200 0 200
Feet

Groundwater Elevation Contours - Deep Aquifer

Agreed Order Remedial Investigation Work Plan
University of Washington – Tacoma
Tacoma, Washington

GeoEngineers

Figure 11



Map Revised: 08 July 2016 cchelf

Office: TAC Path: P:\0018309\GIS\MXDs\0183109_T200_F23b_AOC10_JetParkingParcel.mxd

Groundwater Results

Well BL-MW5	
Analyte	Concentration
Chlorobenzene	9.6 µg/L

Analytical results of the chemicals of concern for groundwater (Benzene, Chlorobenzene, Gasoline) are shown if detected. Other chemicals that were analyzed and detected are not shown unless detected at concentrations greater than the respective Site Specific Screening Levels. Groundwater samples results were collected in 2013 unless noted on callout box.

Chemicals shown in red were detected at concentrations greater than the respective Site Specific Screening Levels.

Soil callout boxes are not shown for benzene and chlorobenzene however the boring is highlighted if benzene or chlorobenzene were detected.

Legend

- UWT Master Plan Campus Boundary
- AOC 10 - Jet Parking Parcel Boundary
- Existing Deep Aquifer Monitoring Well
- Existing Shallow Aquifer Monitoring Well
- Existing Unconfirmed Aquifer Monitoring Well
- Soil Sample (2012 Market Street Utility Replacement Project)
- Boring Completed as Temporary Well (URS, 2002 and 2007)
- Direct-Push Boring (URS, 1998)
- Hollow-Stem Auger Boring (GeoEngineers, 2008)
- Test Pit (URS, 1997)
- Direct-Push Boring (GeoEngineers, 2013)
- Well Decommissioned Due to Construction
- Benzene Impacted Soil in the Fill or Ice-Contact Deposits (Detected)
- Chlorobenzene Impacted Soil in the Fill or Ice-Contact Deposits (Detected)
- 14 Potential Source Property of Benzene/Chlorobenzene (Defined in Figure 27 and Table 11)
- Potential Former Drainage Channel
- Storm Drain Utility
- Sanitary Sewer Utility

Benzene Concentration Plume (µg/L)

High : 60 µg/L

Low : 2.4 µg/L

Planned Remedial Investigation

- Sonic Core Boring
- Shallow Aquifer Monitoring Well
- Deep Aquifer Monitoring Well
- Stormwater Catchbasin or Manhole to be Sampled
- Catchbasin Sampling Planned to Be Completed in 2015-2017 Biennium (Wells Not Outlined Are Planned to Be Completed in the 2017-2019 Biennium)

TCE = tricloroethene
PCE = tetrachlorethene
µg/L = microgram per Liter
bgs = below grade surface
UST = Underground Storage Tank
cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbons
TTEC = Total Toxicity Equivalent Concentration
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and contentof electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Wells shown were sampled in 2013 and analyzed for VOCs, unless otherwise indicated.

Other Market Street 2012 Utility Replacement Project soil samples collected but not shown.

Site Specific Screening Levels (Groundwater):
Benzene = 2.4 µg/L
Chlorobenzene = 100 µg/L
Gasoline = 800 µg/L

W S E N

60 0 60

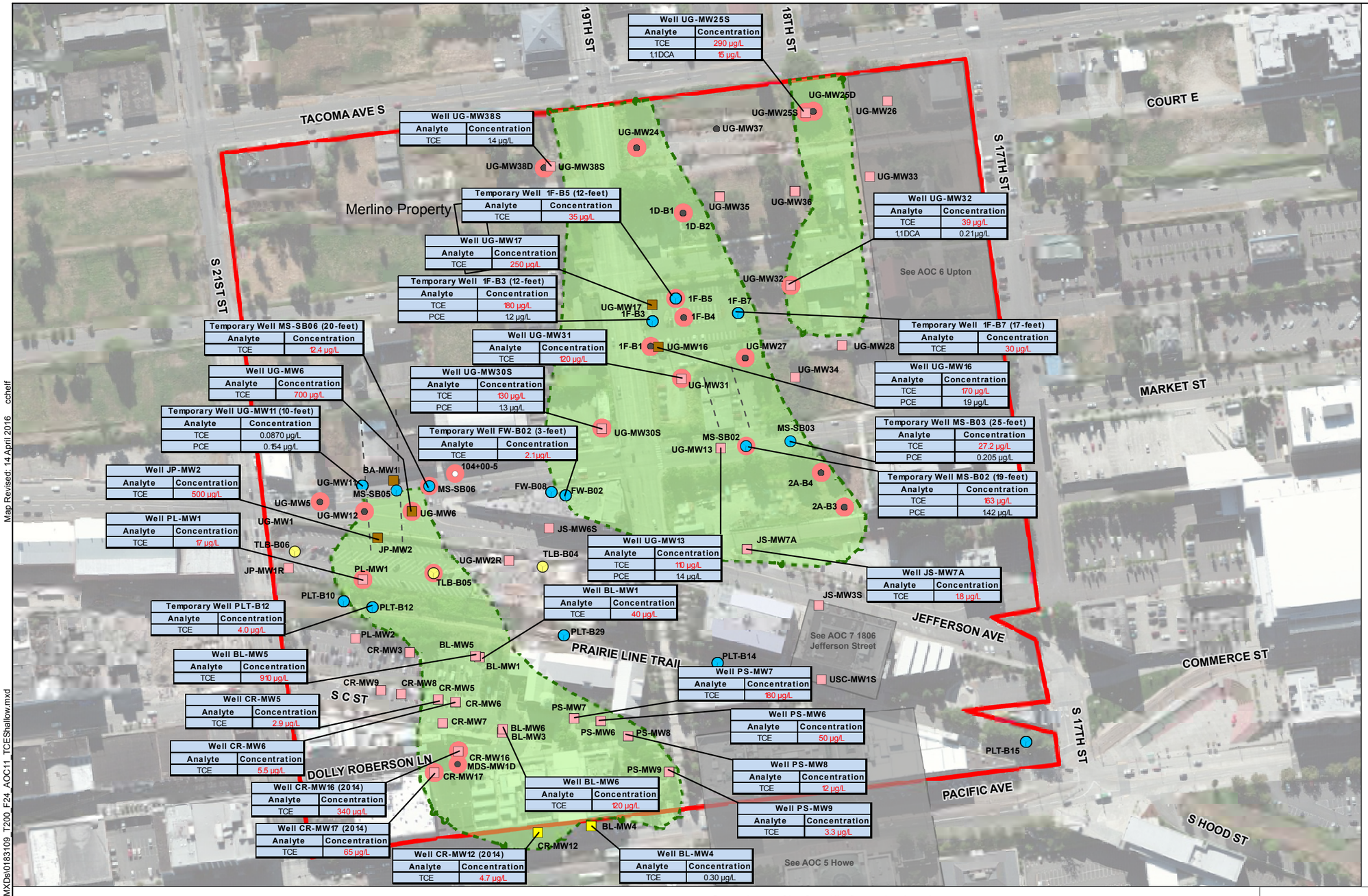
Feet

AOC 10 - Jet Parking Parcel

Agreed Order Remedial Investigation Work Plan
University of Washington – Tacoma
Tacoma, Washington

GeoEngineers

Figure 23b



Groundwater Results in Shallow or Unconfirmed Aquifer

Well JP-MW2	
Analyte	Concentration
TCE	500 µg/L

If callout boxes are not shown then PCE and TCE were not detected greater than laboratory reporting limits

Chemicals shown in red were detected at concentrations greater than the respective Site Specific Screening Levels.

All wells shown were sampled in 2013 unless noted as 2014 in call out and analyzed for VOCs.

Legend

- UWT Master Plan Campus Boundary
- Existing Shallow Aquifer Monitoring Well
- Existing Shallow and Deep Aquifer Monitoring Well
- Existing Unconfirmed Aquifer Monitoring Well
- Previous Boring Completed as Temporary Well
- Previous Hollow-Stem Auger Boring (GeoEngineers, 2008)
- Sample Location and Identification
- Soil Sample (2012 Market Street Utility Replacement Project)
- TCE-Impacted Soil in Fill and Ice-Contact Deposits (Detected)
- Potential Former Drainage Channel
- Approximate Lateral Extent of TCE in Shallow Aquifer

TCE = tricloroethene
PCE = tetrachlorethene
DCA = Dichloroethane
µg/L = microgram per Liter
PDA = Priority Development Area
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and contentof electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Groundwater Site Specific Screening Levels:
PCE = 5 µg/L
TCE = 1.5 µg/L
1,1 DCA = 7.7 µg/L

200 0 200
Feet

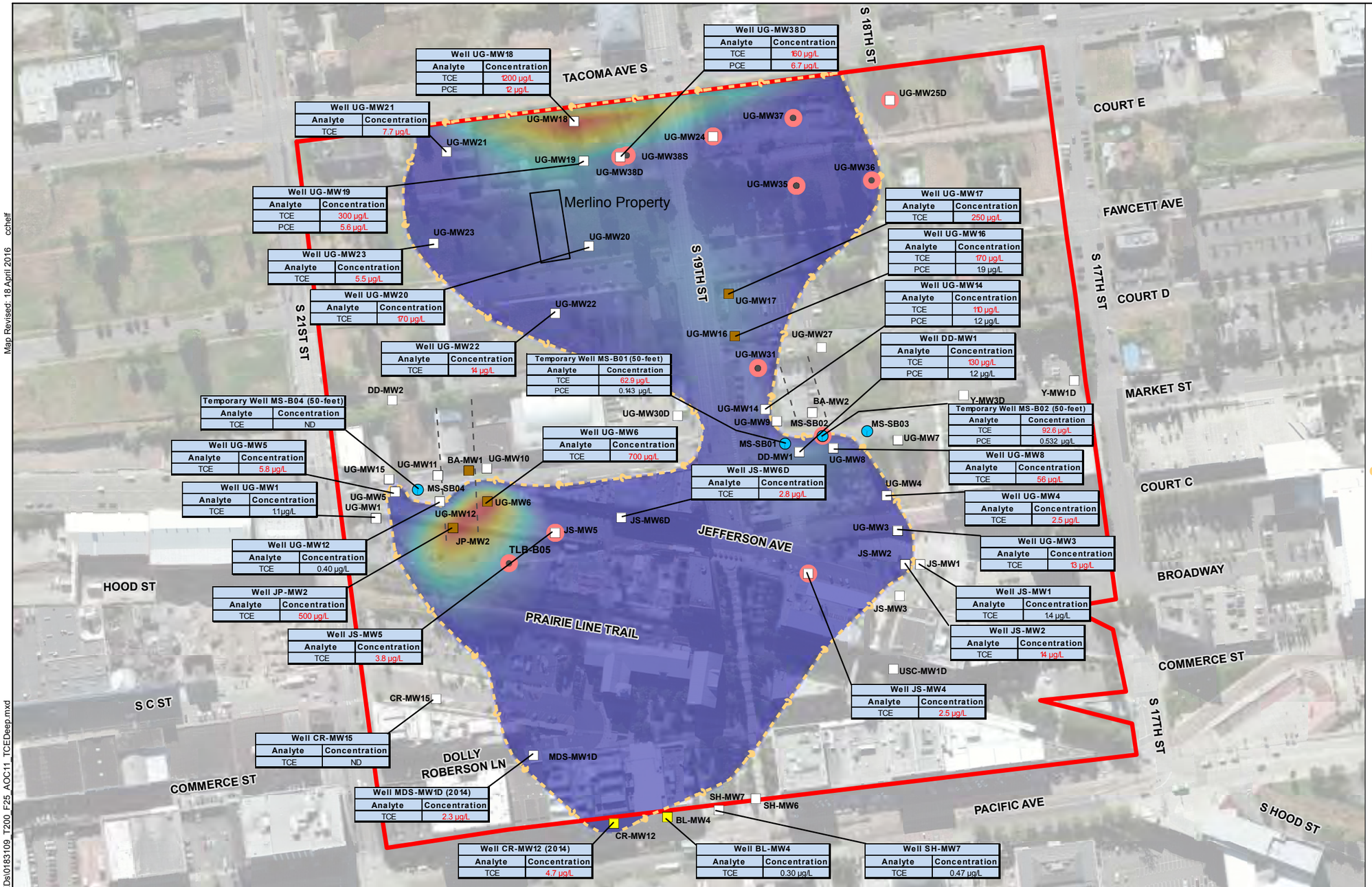
AOC 11 - TCE in Shallow Aquifer

Agreed Order Remedial Investigation Work Plan
University of Washington – Tacoma
Tacoma, Washington

GeoEngineers

Figure 24

Office: TAC Path: P:\00183109\GIS\MXDs\0183109_T200_F24_AOC11_TCEShallow.mxd Map Revised: 14 April 2016 cchelf



Groundwater Results in Deep Aquifer and Unconfirmed Aquifer

Well UG-MW17	
Analyte	Concentration
TCE	250 µg/L

If callout boxes are not shown than PCE and TCE were not detected greater than laboratory reporting limits

Chemicals shown in red were detected at concentrations greater then the respective Site Specific Screening Levels.

All wells shown were sampled in 2013 unless noted as 2014 in callout and analyzed for VOCs.

Legend

- UWT Master Plan Campus Boundary
- Existing Deep Aquifer Monitoring Well
- Existing Shallow and Deep Monitoring Well
- Existing Unconfirmed Aquifer Monitoring Well
- Direct-Push Boring Completed as Temporary Well
- Soil Sample Location and Identification
- TCE-Impacted Soil in Silt/Transition Zone or Advance Outwash (Detected)
- Potential Former Drainage Channel
- Approximate Lateral Extent of TCE in Deep Aquifer

TCE Concentration in Deep Aquifer (µg/L)

High : 1200

Low : 1.5

Notes:
TCE = tricloroethene
PCE = tetrachlorethene
µg/L = microgram per liter
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and contentof electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. CR-MW 16 and CR-MW17 are shown in Easterly Plume, but are to be screened in the shallow aquifer based on geology observed during drilling.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Groundwater Site Specific Screening Levels:
PCE = 5 µg/L
TCE = 1.5 µg/L

200 0 200
Feet

AOC 11 - TCE in Deep Aquifer

Agreed Order Remedial Investigation Work Plan
University of Washington – Tacoma
Tacoma, Washington

GeoEngineers

Figure 25

Map Revised: 18 April 2016 cchelf

Office: TAC Path: P:\0\0183109\GIS\MXDs\0183109_T200_F25_AOC11_TCEDeep.mxd

Groundwater Results

Well CR-MW12	
Analyte	Concentration
cis-12-DCE	3.8 µg/L
1,1DCE	ND
Vinyl Chloride	0.64 µg/L

Concentration shown in red exceed the Site Specific Screening Level for the analyzed COC.

Legend

- UWT Master Plan Campus Boundary
- Existing Shallow Aquifer Monitoring Well
- Existing Shallow and Deep Aquifer Monitoring Well
- Existing Unconfirmed Aquifer Monitoring Well
- Boring Completed as Temporary Well
- Potential Former Drainage Channel
- 18 — Potential Source Property of TCE/PCE Contaminated Groundwater (Defined in Figure 29 and Table 11)

Vinyl Chloride Concentration in Shallow Aquifer (µg/L)

High : 120

Low : 0.29

Notes:
DCE = dichloroethene
TCE = tricloroethene
PCE = tetrachlorethene
µg/L = microgram per liter
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Groundwater Site Specific Screening Levels:
cis-1,2-DCE= 16 µg/L
trans-1,2-DCE = 640 µg/L
Vinyl Chloride = 0.29 µg/L
1,1 DCE = 3.2 µg/L

100 0 100
Feet

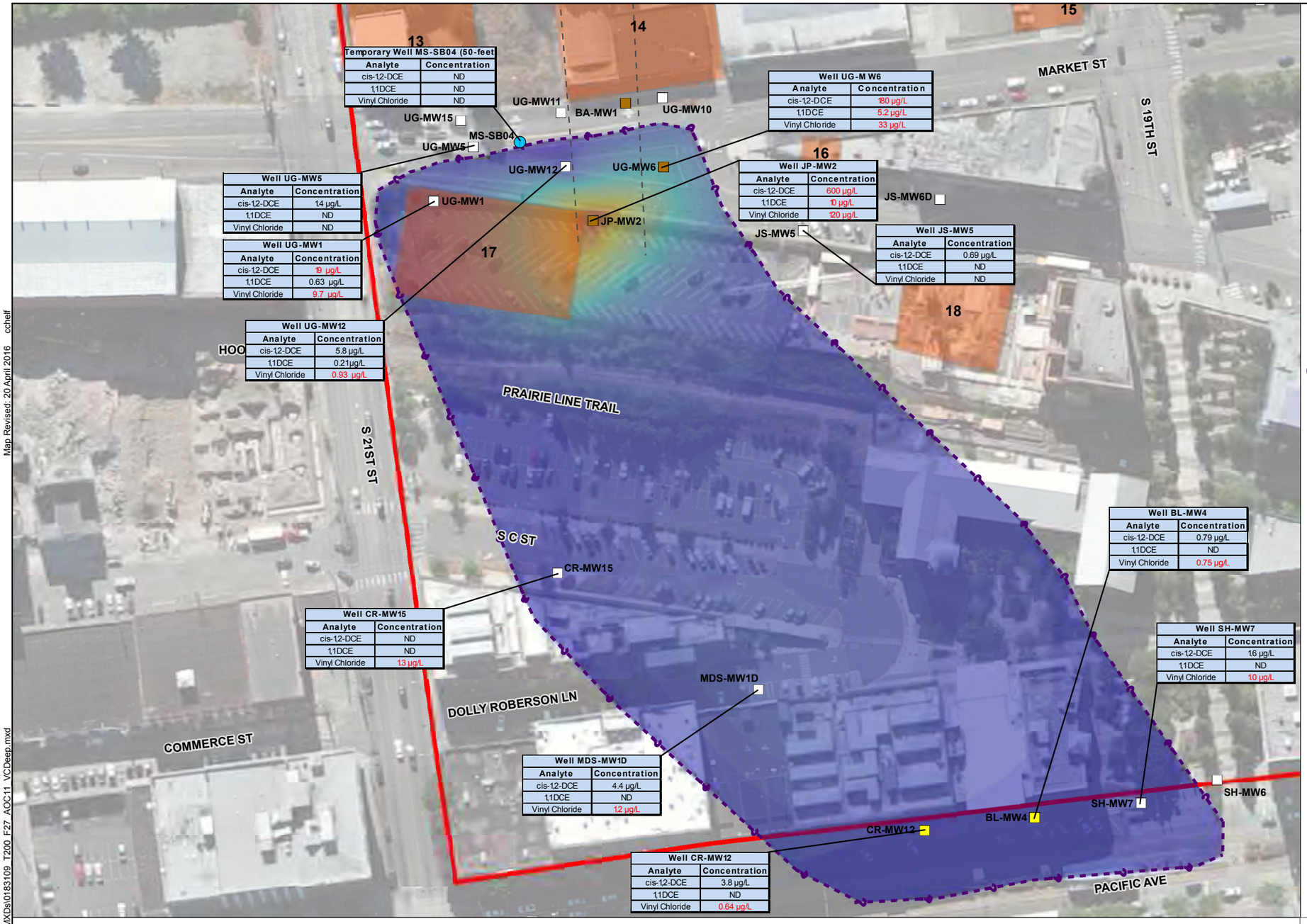
AOC 11 - Easterly Plume - Vinyl Chloride in Shallow Aquifer

Agreed Order Remedial Investigation Work Plan
University of Washington – Tacoma
Tacoma, Washington

GeoEngineers

Figure 26

Map Revised: 14 April 2016 cchelf
Office: TAC Path: P:\00\0183109\GIS\MXDs\0183109 T200 F26 AOC11 VCShallow.mxd



Groundwater Results

Well UG-MW1

Analyte	Concentration
cis-1,2-DCE	19 µg/L
1,1DCE	0.63 µg/L
Vinyl Chloride	9.7 µg/L

Concentration shown in red exceed the Site Specific Screening Level for the analyzed COC.

Legend

- UWT Master Plan Campus Boundary
- Existing Deep Aquifer Monitoring Well
- Existing Shallow and Deep Aquifer Monitoring Well
- Existing Unconfirmed Aquifer Monitoring Well
- Boring Completed as Temporary Well
- Potential Former Drainage Channel
- 18 — Potential Source Property of TCE/PCE Contaminated Groundwater (Defined in Figure 29 and Table 11)
- Vinyl Chloride in Deep Aquifer

Vinyl Chloride Concentration in Deep Aquifer (µg/L)

High : 120

Low : 0.29

Notes:
DCE = dichloroethene
TCE = tricloroethene
PCE = tetrachlorethene
µg/L = microgram per liter
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Projection: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Groundwater Site Specific Screening Levels:
cis-1,2-DCE= 16 µg/L
trans-1,2-DCE = 640 µg/L
Vinyl Chloride = 0.29 µg/L
1,1 DCE = 3.2 µg/L

100 0 100
Feet

AOC 11 - Easterly Plume - DCE and Vinyl Chloride in Deep Aquifer

Agreed Order Remedial Investigation Work Plan
University of Washington – Tacoma
Tacoma, Washington

GeoEngineers

Figure 27

Map Revised: 20 April 2016 cchelf
Office: TAC Path: P:\00\183109\GIS\MXDs\0183109 T200 F27 AOC11 VCDeep.mxd

Table 2

Summary of Existing and Decommissioned Monitoring Wells

Agreed Order Remedial Investigation Work Plan - University of Washington-Tacoma

Tacoma, Washington

Monitoring Well Identification	Lithology of Aquifer	Ground Surface Elevation (feet, AMSL [1])	Top of Casing Elevation [1]	Screen Intervals				Total Boring Depth (feet bgs)	Consultant Observing Well Installation	Date of Installation	Recent Water Level Measurements		
				Top of Well Screen Elevation (feet, AMSL) [2]	Bottom of Well Screen Elevation (feet, AMSL) [2]	Depth of Top of Well Screen (bgs)	Depth of Bottom of Well Screen (bgs)				Water Level (feet below top of casing)	Water Level Elevation (feet AMSL)	Date Water Level Measured
Existing Wells													
BA-MW1	Unconfirmed	114.66	114.44	93	78	22	37	37	Weston	January 18, 2005	5.43	109.01	11/08/13
BA-MW2	Advance Outwash	124.60	124.28	80	65	45	60	61.5	Weston	January 22, 2004	28.44	95.84	11/08/13
BL-MW1	Fill/Recessional Outwash	75.05	74.69	68	53	7.5	22.5	15	AGI	July 21, 1993	17.66	57.03	11/08/13
BL-MW3	Fill/Recessional Outwash	67.57	66.76	58	43	10	25	25	URS	September 11, 1998	12.55	54.21	11/08/13
BL-MW4	Qvi/Silt/Advance Outwash	48.39	47.80	38	18	10	30	30	URS	October 12, 1999	12.88	34.92	11/08/13
BL-MW5	Recessional Outwash/Qvi/Silt	75.13	74.71	37	32	38	43	45	URS	March 3, 2000	12.12	62.59	11/08/13
BL-MW6	Qvi	68.10	67.11	35	30	33	38	38	URS	March 21, 2000	20.15	46.96	11/08/13
CR-MW3	Qvi	79.34	78.56	74	64	5	15	15.5	AGI	May 27, 1993	8.92	69.64	11/08/13
CR-MW5	Fill/Qvi	74.91	74.13	67	57	8	18	19	AGI	March 30, 1994	9.98	64.15	11/08/13
CR-MW6	Fill/Recessional Outwash	73.24	72.83	65	55	8	18	19	AGI	May 26, 1994	12.10	60.73	11/08/13
CR-MW8	Fill/Recessional Outwash	77.67	76.28	70	60	8	18	18.5	AGI	December 15, 1994	8.42	67.86	11/08/13
CR-MW9	Fill/Recessional Outwash	79.09	78.25	72	59	7	20	20.5	AGI	December 15, 1994	11.65	66.60	11/08/13
CR-MW12	Qvi/Silt/Advance Outwash	48.26	47.54	38	23	10	25	25	URS	October 12, 1999	10.31	37.23	11/08/13
CR-MW15	Advance Outwash	79.84	79.45	65	50	15	30	35	GeoEngineers	August 28, 2013	17.13	62.32	11/08/13
CR-MW16	Qvi	65.36	64.71	50	35	15	30	32.5	GeoEngineers	August 27, 2013	16.45	48.26	11/08/13
CR-MW17	Qvi	64.32	64.11	54	39	10	25	30	GeoEngineers	August 27, 2013	18.57	45.54	11/08/13
DD-MW1	Advance Outwash	121.83	122.12	77	62	45	60	60	URS	May 23, 2002	20.33	101.79	11/08/13
DD-MW2	Advance Outwash	140.60	140.30	101	86	40	55	60	URS	May 24, 2002	1.73	138.57	11/08/13
H-MW1	Advance Outwash	--	48.23	36	21	12	27	27	URS	September 15, 1998	12.17	36.06	03/25/15
H-MW2	Advance Outwash	--	48.58	33	19	15	30	30	URS	September 15, 1998	20.81	27.77	03/25/15
H-MW3	Advance Outwash	--	49.02	23	8	25	40	41	URS	October 13, 1999	27.89	21.13	03/25/15
H-MW4	Advance Outwash	49.96	49.06	31	11	20	40	40	URS	October 13, 1999	29.21	19.85	03/25/15
H-MW5	Advance Outwash	--	50.20	24	9	26	41	41	URS	March 22, 2000	30.64	19.56	03/25/15
H-MW6	Advance Outwash	--	21.50	16.5	6.5	5	15	15	URS	March 21, 2000	2.69	18.81	03/25/15
H-MW7	Advance Outwash	20.26	19.82	15	5	4.5	14.5	16.5	URS	June 22, 2008	2.16	17.66	03/25/15
H-MW8	Advance Outwash	21.27	20.74	16	6	4.5	14.5	16	URS	June 22, 2008	0.96	19.78	03/25/15
H-MW9	Advance Outwash	21.07	20.64	6	-4	15	25	25	URS	June 22, 2008	0.80	19.84	03/25/15
H-MW10	Advance Outwash	21.07	20.69	16	6	4.5	14.5	15.5	URS	June 22, 2008	1.26	19.43	03/25/15
H-MW11	Advance Outwash	19.63	19.31	5	-5	15	25	25	URS	April 11, 2009	1.18	18.13	03/25/15
H-MW12	Advance Outwash	19.59	19.18	15	5	5	15	15	URS	April 11, 2009	1.63	17.55	03/25/15
H-MW13	Advance Outwash	19.52	19.09	15	5	5	15	15	URS	April 11, 2009	2.18	16.91	03/25/15
H-MW14	Advance Outwash	22.09	21.79	7	-3	15	25	25	URS	April 18, 2009	6.68	15.11	03/25/15
H-MW15	Advance Outwash	22.18	21.69	17	7	5	15	15	URS	April 18, 2009	6.82	14.87	03/25/15
H-MW16	Advance Outwash	48.86	48.60	24	9	25	40	40	GeoEngineers	June 19, 2013	25.52	23.08	03/25/15
H-MW17	Advance Outwash	49.64	49.42	27	11	23	39	39	GeoEngineers	June 19, 2013	27.50	21.92	03/25/15

Monitoring Well Identification	Lithology of Aquifer	Ground Surface Elevation (feet, AMSL [1])	Top of Casing Elevation [1]	Screen Intervals				Total Boring Depth (feet bgs)	Consultant Observing Well Installation	Date of Installation	Recent Water Level Measurements		
				Top of Well Screen Elevation (feet, AMSL) [2]	Bottom of Well Screen Elevation (feet, AMSL) [2]	Depth of Top of Well Screen (bgs)	Depth of Bottom of Well Screen (bgs)				Water Level (feet below top of casing)	Water Level Elevation (feet AMSL)	Date Water Level Measured
H-MW18	Advance Outwash	49.90	49.36	30	15	20	35	35.5	GeoEngineers	June 17, 2013	25.99	23.37	03/25/15
H-MW19	Advance Outwash	49.46	49.07	21	6	28	43	44	GeoEngineers	June 20, 2013	28.86	20.21	03/25/15
H-MW20	Advance Outwash	49.32	48.86	23	8	26	41	41	GeoEngineers	June 20, 2013	29.42	19.44	03/25/15
H-MW21	Advance Outwash	22.33	22.17	20	15	2	7	7	URS	September 18, 2013	3.53	18.64	03/25/15
H-MW22	Advance Outwash	21.94	21.75	18	13	4	9	12	URS	September 18, 2013	3.33	18.42	03/25/15
JP-MW1R	Qvi	101.96	101.64	87	77	14.5	24.5	50	GeoEngineers	March 28, 2013	17.67	83.97	11/08/13
JP-MW2	Unconfirmed	--	101.45	--	--	15	27	27	URS	March 29, 2001	17.36	84.09	11/08/13
JS-MW1	Advance Outwash	90.27	90.15	55	40	35	50	50	URS	September 14, 1998	34.81	55.34	11/08/13
JS-MW2	Advance Outwash	90.56	90.33	57	42	34	49	50	URS	September 15, 1998	34.92	55.41	11/08/13
JS-MW3	Advance Outwash	89.97	89.35	51	36	39	54	54	URS	March 30, 2001	36.52	52.83	11/08/13
JS-MW3S	Qvi	89.36	88.86	77	67	12	22	25	GeoEngineers	September 4, 2013	18.81	70.05	11/08/13
JS-MW4	Advance Outwash	94.21	93.66	51	41	43	53	55	GeoEngineers	September 5, 2013	40.18	53.48	11/08/13
JS-MW5	Advance Outwash	105.03	104.67	78	68	27	37	40	GeoEngineers	August 29, 2013	21.87	82.80	11/08/13
JS-MW6D	Advance Outwash	102.32	101.99	77	62	25	40	50	GeoEngineers	August 30, 2013	19.22	82.77	11/08/13
JS-MW6S	Qvi	102.15	101.85	94	84	8.5	18.5	19	GeoEngineers	September 3, 2013	5.56	96.29	11/08/13
JS-MW7A	Qvi	97.00	96.75	90	85	7	12	13	GeoEngineers	September 12, 2013	11.02	85.73	11/08/13
MDS-MW1D	Advance Outwash	64.87	64.29	20	5	45	60	61	GeoEngineers	October 26, 2014	13.50	50.79	10/30/14
PL-MW1	Qvi	101.32	101.02	88	73	13	28	30	GeoEngineers	March 29, 2013	17.25	83.77	11/08/13
PL-MW2	Qvi	83.19	82.92	77	57	6	26	30	GeoEngineers	March 28, 2013	7.13	75.79	11/08/13
PS-MW6	Recessional Outwash/Qvi	67.89	66.20	57	42	11	26	26	URS	September 11, 1998	19.09	47.11	11/08/13
PS-MW7	Recessional Outwash/Qvi	66.75	66.03	59	44	8	23	26	URS	September 11, 1998	13.85	52.18	11/08/13
PS-MW8	Recessional Outwash/Qvi	65.36	64.84	54	39	11	26	26	URS	October 5, 1998	19.81	45.03	11/08/13
PS-MW9	Recessional Outwash/Qvi	56.89	55.33	45	30	12	27	27	URS	October 25, 1999	12.06	43.27	11/08/13
SH-MW6	Silt/Advance Outwash	49.16	48.82	35	20	14	29	30	URS	September 25, 1998	12.05	36.77	11/08/13
SH-MW7	Silt/Advance Outwash	48.94	48.41	33	18	16	31	32	URS	September 15, 1998	12.22	36.19	11/08/13
SH-MW8	Qvi	48.00	47.85	38	18	10	30	30	URS	October 13, 1999	NM	NM	NM
UG-MW1	Advance Outwash	104.41	103.76	81	66	23	38	42	URS	September 28, 1998	19.62	84.14	11/08/13
UG-MW2R	Qvi	97.53	97.90	83	62	15	36	37.5	GeoEngineers	August 9, 2012	16.56	81.34	11/08/13
UG-MW3	Advance Outwash	100.28	99.63	62	47	38	53	55	URS	September 28, 1998	44.35	55.28	11/08/13
UG-MW4	Advance Outwash	105.31	105.67	60	45	45	60	60	URS	March 25, 2002	50.52	55.15	11/08/13
UG-MW5	Advance Outwash/Transition Zone	116.47	115.10	88	73	28	43	43	URS	March 26, 2002	21.87	93.23	11/08/13
UG-MW6	Unconfirmed	111.27	110.27	91	76	20	35	35	URS	March 27 , 2002	23.48	86.79	11/08/13
UG-MW7	Advance Outwash	124.29	123.97	69	54	55	70	70	URS	May 21, 2002	35.68	88.29	11/08/13
UG-MW8	Advance Outwash	123.29	123.50	68	53	55	70	70	URS	May 22, 2002	33.01	90.49	11/08/13
UG-MW9	Advance Outwash	--	123.80	80	65	50	65	65	URS	April 10, 2007	30.06	93.74	11/08/13
UG-MW10	Advance Outwash/Silt	115.70	114.25	96	81	20	35	35	URS	April 11, 2007	-1.53	115.78	11/08/13
UG-MW11	Advance Outwash	116.65	114.59	97	82	20	35	35	URS	April 12, 2007	7.88	106.71	11/08/13
UG-MW12	Advance Outwash/Silt	113.72	112.29	94	79	20	35	35	URS	May 10, 2007	15.76	96.53	11/08/13
UG-MW13	Qvi	123.26	122.96	99	79	24	44	44	URS	May 11, 2007	21.15	101.81	11/08/13
UG-MW14	Advance Outwash	134.47	133.75	112	97	22.5	37.5	37.5	URS	July 25, 2008	21.41	112.34	11/08/13
UG-MW15	Advance Outwash/Silt	116.43	116.43	91	76	25	40	40	URS	July 25, 2008	11.82	104.61	11/08/13

Monitoring Well Identification	Lithology of Aquifer	Ground Surface Elevation (feet, AMSL [1])	Top of Casing Elevation [1]	Screen Intervals				Total Boring Depth (feet bgs)	Consultant Observing Well Installation	Date of Installation	Recent Water Level Measurements		
				Top of Well Screen Elevation (feet, AMSL) [2]	Bottom of Well Screen Elevation (feet, AMSL) [2]	Depth of Top of Well Screen (bgs)	Depth of Bottom of Well Screen (bgs)				Water Level (feet below top of casing)	Water Level Elevation (feet AMSL)	Date Water Level Measured
UG-MW16	Unconfirmed	151.39	150.99	144	129	7	22	25	URS	May 4, 2009	9.30	141.69	11/08/13
UG-MW17	Unconfirmed	155.98	155.46	153	138	3	18	18	URS	May 4, 2009	3.80	151.66	11/08/13
UG-MW18	Advance Outwash	204.28	203.95	170	155	34	49	50.5	URS	May 5, 2009	34.19	169.76	11/08/13
UG-MW19	Advance Outwash	192.12	191.75	168	153	24	39	40	URS	May 5, 2009	25.06	166.69	11/08/13
UG-MW20	Advance Outwash	170.12	169.64	163	148	7	22	26.6	URS	May 4, 2009	5.95	163.69	11/08/13
UG-MW21	Advance Outwash	196.63	196.31	174	159	23	38	38	URS	May 6, 2009	25.20	171.11	11/08/13
UG-MW22	Advance Outwash	159.26	158.82	144	129	15	30	36.5	URS	May 4, 2009	18.68	140.14	11/08/13
UG-MW23	Advance Outwash	171.45	171.18	160	153	11	18	22	GeoEngineers	September 17, 2013	10.55	160.63	11/08/13
UG-MW24	Advance Outwash	197.08	196.80	132	117	65	80	100	GeoEngineers	June 27, 2013	31.33	165.47	11/08/13
UG-MW25D	Advance Outwash	202.64	202.05	158	148	45	55	55	GeoEngineers	August 22, 2013	36.73	165.32	11/08/13
UG-MW25S	Qvi	203.08	202.60	195	185	8	18	22	GeoEngineers	August 23, 2013	2.07	200.53	11/08/13
UG-MW26	Qvi	202.62	202.18	196	186	7	17	25	GeoEngineers	September 11, 2013	-0.25	202.43	11/08/13
UG-MW27	Advance Outwash	149.28	148.68	109	93	40	56	56	GeoEngineers	June 26, 2013	23.16	125.52	11/08/13
UG-MW28	Qvi	151.80	151.14	143	128	9	24	46.5	GeoEngineers	June 25, 2013	18.62	132.52	11/08/13
UG-MW29S	Qvi	149.56	149.17	141	131	9	19	21	GeoEngineers	June 26, 2013	11.11	138.06	11/08/13
UG-MW30D	Advance Outwash	123.24	122.94	85	75	38	48	55	GeoEngineers	July 1, 2013	5.81	117.13	11/08/13
UG-MW30S	Qvi	123.10	122.70	114	104	9	19	20	GeoEngineers	July 2, 2013	4.44	118.26	11/08/13
UG-MW31	Qvi	143.35	142.92	135	125	8	18	35	GeoEngineers	August 26, 2013	5.20	137.72	11/08/13
UG-MW32	Qvi	160.38	159.88	150	145	10	15	15	GeoEngineers	September 18, 2013	6.91	152.97	11/08/13
UG-MW33	Qvi	183.91	183.57	177	172	6.5	11.5	15	GeoEngineers	September 18, 2013	6.61	176.96	11/08/13
UG-MW34	Qvi	142.23	142.03	133	123	9	19	35	GeoEngineers	September 6, 2013	16.71	125.32	11/08/13
UG-MW35	Qvi	181.91	181.60	176	169	6	12.5	20	GeoEngineers	September 18, 2013	8.39	173.21	11/08/13
UG-MW36	Qvi	180.57	180.24	175	170	6	11	14	GeoEngineers	September 18, 2013	8.22	172.02	11/08/13
UG-MW37R [3]	Qvi	--	--	--	--	7	17	20	GeoEngineers	April 30, 2015	NM	NM	NM
UG-MW38D	Advance Outwash	192.91	192.47	152	142	41	51	55	GeoEngineers	September 17, 2013	26.11	166.36	11/08/13
UG-MW38S	Qvi	193.60	193.17	188	179	6	15	25	GeoEngineers	September 16, 2013	9.31	183.86	11/08/13
USC-MW1D	Advance Outwash	70.48	69.97	25.48	15.48	45	55	56	GeoEngineers	October 21, 2014	22.42	47.55	10/27/14
USC-MW1S	Qvi	70.48	70.13	64.48	45.48	6	25	25.5	GeoEngineers	October 20, 2014	21.11	49.02	10/27/14
Y-MW1D	Advance Outwash	127.10	126.41	99.10	84.10	28	43	50	GeoEngineers	September 20, 2013	8.73	117.68	11/08/13
Y-MW1S	Qvi	127.08	126.66	120.08	115.08	7	12	13	GeoEngineers	September 11, 2013	6.17	120.49	11/08/13
Y-MW2S	Qvi	126.11	125.14	116.11	106.11	10	20	20	GeoEngineers	October 24, 2013	11.12	114.02	11/08/13
Y-MW3D	Advance Outwash	126.87	126.65	91.87	76.87	35	50	50	GeoEngineers	October 16, 2013	12.73	113.92	11/08/13
Y-MW3S	Qvi	126.91	126.47	119.91	109.91	7	17	26	GeoEngineers	October 17, 2013	9.39	117.08	11/08/13
Y-MW4S	Qvi	150.76	150.20	141.76	131.76	9	19	22	GeoEngineers	October 21, 2013	13.69	136.51	11/08/13
Y-MW6S	Qvi	148.11	147.74	136.11	126.11	12	22	24	GeoEngineers	October 22, 2013	9.54	138.20	11/08/13
Y-MW7S	Qvi	142.23	141.74	133.23	128.23	9	14	20	GeoEngineers	October 20, 2013	0.58	141.16	11/08/13

Monitoring Well Identification	Lithology of Aquifer	Ground Surface Elevation (feet, AMSL [1])	Top of Casing Elevation [1]	Screen Intervals				Total Boring Depth (feet bgs)	Consultant Observing Well Installation	Date of Installation	Recent Water Level Measurements		
				Top of Well Screen Elevation (feet, AMSL) [2]	Bottom of Well Screen Elevation (feet, AMSL) [2]	Depth of Top of Well Screen (bgs)	Depth of Bottom of Well Screen (bgs)				Water Level (feet below top of casing)	Water Level Elevation (feet AMSL)	Date Water Level Measured
Decommissioned Wells													
BL-MW2	Fill/Recessional Outwash/Qvi	--	71.01	--	--	10	20	21.5	AGI	May 26, 1994	N/A	N/A	N/A
BL-MW7	Qvi/Advance Outwash	--	--	--	--	15	30	30.5	URS	January 31, 2002	N/A	N/A	N/A
CR-MW7	Fill/Recessional Outwash	--	78.25	--	--	7	17	17.5	AGI	March 31, 1994	N/A	N/A	N/A
CR-MW10	Unconfirmed	--	76.95	--	--	18	33	33	URS	September 25, 1998	N/A	N/A	N/A
CR-MW11	Qvi	--	47.39	--	--	10	25	25	URS	October 12, 1999	N/A	N/A	N/A
CR-MW13	Unconfirmed	--	64.22	--	--	13	28	31	URS	February 1, 2002	N/A	N/A	N/A
CR-MW14	Qvi/Silt/Advance Outwash	--	64.71	--	--	3	13	21	URS	February 5, 2002	N/A	N/A	N/A
JP-MW1	Qvi//Silt/Advance Outwash	97.24	95.77	82	67	15	30	30	URS	September 14, 1998	12.20	83.57	7/17/2013
UG-MW2	Qvi	--	99.50	--	--	18	33	35	URS	September 28, 1998	N/A	N/A	N/A
UG-MW29D	Advance Outwash	149.61	149.26	122	112	28	38	46.5	GeoEngineers	June 26, 2013	19.81	129.45	11/08/13
UG-MW37	Qvi	197.78	197.29	192	184	6	14	20	GeoEngineers	September 19, 2013	1.51	195.78	11/08/13
MF-MW1	Unconfirmed	--	64.46	--	--	10	20	20.5	URS	February 6, 2002	N/A	N/A	N/A
SH-MW2	Unconfirmed	--	48.55	--	--	5	20	20.5	AGI	July 23, 1993	N/A	N/A	N/A
SH-MW3	Unconfirmed	--	48.29	--	--	12.5	27.5	28	AGI	July 23, 1993	N/A	N/A	N/A
Y-MW2D	Advance Outwash	126.67	125.36	92	77	35	50	50	GeoEngineers	October 18, 2013	22.02	103.34	11/08/13
Y-MW5S	Qvi	151.63	151.29	143	133	8.5	18.5	25	GeoEngineers	October 22, 2013	0.58	150.71	11/08/13

Notes:

[1] Based on surveys completed by AHBL November 6, 2013, Horizontal datum - NAD 83/91 Washington State Plane - South Zone (City of Tacoma Horizontal control Holding City Monument Numbers 411 and 414). Vertical datum NGVD 29 (brass monument at South 19th and Fawcett Avenue, Elevation 165.15) and by URS August 20 and 28, 2008, Horizontal datum - NAD 81/96 Washington State Plane - South Zone (City of Tacoma Horizontal control Holding City Monument Numbers 2734 and 3227). Vertical datum NGVD 29.

[2] Calculated from survey ground surface elevation.

[3] Survey pending.

AMSL = Above mean sea level

BGS = Below ground surface

Qvi = Ice-contact deposits

-- = Elevation data not available for well

NM = Not measured

N/A = Not applicable

Table 9

Summary of Chemical Analytical Results for Benzene, Chlorobenzene, Lead, and cPAHs - AOC 10 - Soil

Agreed Order Remedial Investigation Work Plan - University of Washington-Tacoma

Tacoma, Washington

Boring/Test Pit/Confirmation Sample Identification	Sample Depth (feet bgs)	Investigation Reference	Sample Date	Petroleum Hydrocarbons [1] (mg/kg)	VOCs [2] (mg/kg)		Total Metals [3] (mg/kg)	cPAHs [4] (mg/kg)							
				Gasoline-Range	Benzene	Chlorobenzene	Lead	Benzo (a) anthracene (TEF 0.1)	Benzo (a) pyrene (TEF 1)	Benzo (b) fluoranthene (TEF 0.1)	Benzo (J,k) fluoranthene (TEF 0.1)	Chrysene (TEF 0.01)	Dibenz (a,h) anthracene (TEF 0.1)	Indeno (1,2,3-cd) pyrene (TEF 0.1)	TTEC of cPAHs (detect only)
TLB-B01	5 to 6.5	GeoEngineers TLB 2008 Investigation	2/21/2008	3.4 U	0.00096 U	0.00096 U	1.6 U	0.027 U	0.033 U	0.022 U	0.027 U	0.027 U	0.044 U	0.044 U	--
TLB-B02	2 to 3.5	GeoEngineers TLB 2008 Investigation	2/21/2008	4.3 U	0.00089 U	0.00089 U	**1.9**	0.028 U	0.033 U	0.022 U	0.028 U	0.028 U	0.045 U	0.045 U	--
	5 to 6.5	GeoEngineers TLB 2008 Investigation	2/21/2008	3.7 U	0.00095 U	0.00095 U	**2**	0.029 U	0.034 U	0.023 U	0.029 U	0.029 U	0.046 U	0.046 U	--
	10 to 11.5	GeoEngineers TLB 2008 Investigation	2/21/2008	3.7 U	0.0010 U	0.0010 U	**1.7**	0.028 U	0.034 U	0.023 U	0.028 U	0.028 U	0.046 U	0.046 U	--
TLB-B03	2.5 to 4	GeoEngineers TLB 2008 Investigation	2/21/2008	4.1 U	0.0011 U	0.0011 U	**3**	0.025 U	0.030 U	0.020 U	0.025 U	0.025 U	0.041 U	0.041 U	--
	27.5 to 28.5	GeoEngineers TLB 2008 Investigation	2/21/2008	4.6 U	0.00055 U	0.00055 U	**1.3**	0.025 U	0.030 U	0.020 U	0.025 U	0.025 U	0.040 U	0.040 U	--
TLB-B04	5 to 6.5	GeoEngineers TLB 2008 Investigation	2/21/2008	3.6 U	0.00091 U	0.00091 U	**40**	**0.088**	**0.3**	**0.22**	**0.054**	**0.19**	**0.047**	**0.16**	0.36
	10 to 11.5	GeoEngineers TLB 2008 Investigation	2/21/2008	--	--	--	--	0.028 U7	0.033 U7	0.022 U7	0.028 U7	0.028 U7	0.044 U7	0.044 U7	--
	15 to 16	GeoEngineers TLB 2008 Investigation	2/21/2008	4.7 U	0.0010 U	0.0010 U	**2.1**	0.030 U	0.036 U	0.024 U	0.030 U	0.030 U	0.048 U	0.048 U	--
	37.5 to 38.5	GeoEngineers TLB 2008 Investigation	2/21/2008	4.8 U	0.00068 U	0.00068 U	1.3 U	0.025 U	0.030 U	0.020 U	0.025 U	0.025 U	0.040 U	0.040 U	--
TLB-B05	2.5 to 4	GeoEngineers TLB 2008 Investigation	2/21/2008	3.6 U	0.0011 U	0.0011 U	**13**	**0.037**	**0.05**	0.021 U	0.026 U	**0.041**	0.041 U	**0.048**	--
	10 to 11	GeoEngineers TLB 2008 Investigation	2/21/2008	3.6 U	**0.0028**	**0.059**	**2.5**	0.026 U	0.031 U	0.021 U	0.026 U	0.026 U	0.041 U	0.041 U	--
	15 to 16	GeoEngineers TLB 2008 Investigation	2/21/2008	--	**1.1 J**	**0.0016**	--	--	--	--	--	--	--	--	--
	20 to 21.5	GeoEngineers TLB 2008 Investigation	2/21/2008	3.0 U	**0.069**	**0.01**	**2.2**	0.026 U	0.031 U	0.021 U	0.026 U	0.026 U	0.041 U	0.041 U	--
	25 to 25.5	GeoEngineers TLB 2008 Investigation	2/21/2008	--	**0.0033**	**0.0016**	--	--	--	--	--	--	--	--	--
TLB-B06	5 to 6.5	GeoEngineers TLB 2008 Investigation	2/21/2008	3.8 U	0.00090 U	0.00090 U	**1.9**	0.026 U	0.031 U	0.021 U	0.026 U	0.026 U	0.042 U	0.042 U	--
	10 to 10.5	GeoEngineers TLB 2008 Investigation	2/21/2008	5.0 U	**0.0015**	0.00092 U	**2**	0.026 U	0.031 U	0.021 U	0.026 U	0.026 U	0.042 U	0.042 U	--
	17.5 to 18.5	GeoEngineers TLB 2008 Investigation	2/21/2008	4.8 U	0.00099 U	0.00099 U	**1.3**	0.025 U	0.031 U	0.020 U	0.025 U	0.025 U	0.041 U	0.041 U	--
PLT-B1	0 to 10	GeoEngineers PLT 2013 Investigation	3/26/2013	22 U	--	--	**610**	**0.012**	**0.010**	**0.011**	0.0073 U	**0.014**	0.0073 U	**0.013**	**0.02**
JP-S7	9	UST Excavation Confirmation Sample	8/23/1996	**1,930**	ND	--	--	--	--	--	--	--	--	--	--
JP-TP4	0.5 to 1.5	URS 1997 Investigation	6/27/1997	**2**	ND	--	--	--	--	--	--	--	--	--	--
UG-MW-1	5	URS RI	9/28/1998	5.0 U	0.0500 U	--	--	--	--	--	--	--	--	--	--
	15	URS RI	9/28/1998	5.0 U	0.0500 U	--	--	--	--	--	--	--	--	--	--
UG-MW2	5	URS RI	9/28/1998	5.0 U	0.0500 U	--	--	--	--	--	--	--	--	--	--
UG-MW5	5	URS RI	3/26/2002	--	--	--	**2.39**	--	--	--	--	--	--	--	--
	20	URS RI	3/26/2002	5.0 U	0.0015 U	**0.1**	--	--	--	--	--	--	--	--	--
UG-MW6	5	URS RI	3/27/2002	--	--	--	**2.13**	--	--	--	--	--	--	--	--
	20	URS RI	3/27/2002	5.0 U	0.0015 U	**0.049**	--	--	--	--	--	--	--	--	--
BA-MW1	20	EPA 2005 Groundwater Investigation	1/18/2005	3.4 U	ND	ND	--	--	--	--	--	--	--	--	--
Site Specific Screening Level (mg/kg)				**30/100 [5]**	**0.001**	**0.043**	**250**	**Site Specific Screening Level for the TTEC of cPAHs is 0.14 mg/kg**							

Boring/Test Pit/Confirmation Sample Identification	Sample Depth (feet bgs)	Investigation Reference	Sample Date	Petroleum Hydrocarbons [1] (mg/kg)	VOCs [2] (mg/kg)		Total Metals [3] (mg/kg)	cPAHs [4] (mg/kg)							
				Gasoline-Range	Benzene	Chlorobenzene	Lead	Benzo (a) anthracene (TEF 0.1)	Benzo (a) pyrene (TEF 1)	Benzo (b) fluoranthene (TEF 0.1)	Benzo (J,k) fluoranthene (TEF 0.1)	Chrysene (TEF 0.01)	Dibenz (a,h) anthracene (TEF 0.1)	Indeno (1,2,3-cd) pyrene (TEF 0.1)	TTEC of cPAHs (detect only)
MS-SB04	5	URS 2007 Investigation	3/15/2007	**4.4 U**	**0.699**	**0.0129 J**	–	–	–	–	–	–	–	–	–
	25	URS 2007 Investigation	3/15/2007	–	0.00124 U	0.00165 U	–	–	–	–	–	–	–	–	–
MS-SB05	5	URS 2007 Investigation	3/15/2007	**3.75 U**	0.00109 U	0.00146 U	–	–	–	–	–	–	–	–	–
	15	URS 2007 Investigation	3/15/2007	–	0.00115 U	0.00154 U	–	–	–	–	–	–	–	–	–
MS-SB06	5	URS 2007 Investigation	3/16/2007	**479 J**	**0.00154**	**9.45**	–	–	–	–	–	–	–	–	–
	11	URS 2007 Investigation	3/16/2007	–	0.00106 U	**0.0156**	–	–	–	–	–	–	–	–	–
UG-MW10	10	URS 2007 Investigation	4/11/2007	3.63 U	0.00111 U	0.00148 U	–	–	–	–	–	–	–	–	–
	15	URS 2007 Investigation	4/11/2007	3.87 U	0.00105 U	0.00140 U	–	–	–	–	–	–	–	–	–
UG-MW11	10	URS 2007 Investigation	4/12/2007	3.45 U	0.00109 U	0.00145 U	–	–	–	–	–	–	–	–	–
UG-MW12	10	URS 2007 Investigation	5/10/2007	–	**0.00661**	**0.00341**	–	–	–	–	–	–	–	–	–
	15	URS 2007 Investigation	5/10/2007	–	**0.00652**	0.00161 U	–	–	–	–	–	–	–	–	–
101+00-9	9	URS Market Street Utilities 2013 Investigation	9/22/2012	3.6 U	**1.4**	0.00074 U	--	–	–	–	–	–	–	–	–
101+10-3	3	URS Market Street Utilities 2013 Investigation	2/29/2012	**7.3**	**0.052**	0.00077 U	--	–	–	–	–	–	–	–	–
101+75-8WL	8	URS Market Street Utilities 2013 Investigation	10/3/2012	**25**	**4.6**	**0.0015 J**	--	–	–	–	–	–	–	–	–
103+40-9.7	9.7	URS Market Street Utilities 2013 Investigation	10/2/2012	3.9 U	**0.0013**	**0.0027**	--	–	–	–	–	–	–	–	–
JS-MW5	9 to 10	GeoEngineers PDA 2013 Investigation	08/29/2013	24 U	0.001 U	0.001 U	--	–	–	–	–	–	–	–	–
	10 to 11	GeoEngineers PDA 2013 Investigation	08/29/2013	23 U	0.00078 U	0.00078 U	--	–	–	–	–	–	–	–	–
	14 to 15	GeoEngineers PDA 2013 Investigation	08/29/2013	23 U	0.00072 U	0.00072 U	--	–	–	–	–	–	–	–	–
	15.5 to 15.5	GeoEngineers PDA 2013 Investigation	08/29/2013	22 U	0.00081 U	0.00081 U	--	–	–	–	–	–	–	–	–
	16 to 17	GeoEngineers PDA 2013 Investigation	08/29/2013	22 U	0.0008 U	0.0008 U	--	–	–	–	–	–	–	–	–
	22 to 23	GeoEngineers PDA 2013 Investigation	08/29/2013	22 U	0.00087 U	0.00087 U	--	–	–	–	–	–	–	–	–
	24 to 25	GeoEngineers PDA 2013 Investigation	08/29/2013	22 U	0.00071 U	0.00071 U	--	–	–	–	–	–	–	–	–
	29 to 30	GeoEngineers PDA 2013 Investigation	08/29/2013	22 U	0.00077 U	0.00077 U	--	–	–	–	–	–	–	–	–
	34 to 35	GeoEngineers PDA 2013 Investigation	08/29/2013	23 U	0.00098 U	0.00098 U	--	–	–	–	–	–	–	–	–
	37 to 38	GeoEngineers PDA 2013 Investigation	08/29/2013	23 U	0.00068 U	**0.00082**	--	–	–	–	–	–	–	–	–
	38 to 39	GeoEngineers PDA 2013 Investigation	08/29/2013	23 U	0.0009 U	**0.001**	--	–	–	–	–	–	–	–	–
	39 to 40	GeoEngineers PDA 2013 Investigation	08/29/2013	22 U	0.0007 U	**0.001**	--	–	–	–	–	–	–	–	–
JS-MW6D	11 to 12	GeoEngineers PDA 2013 Investigation	08/30/2013	22 U	0.00084 U	0.00084 U	--	–	–	–	–	–	–	–	–
	16 to 17	GeoEngineers PDA 2013 Investigation	08/30/2013	22 U	0.00087 U	0.00087 U	--	–	–	–	–	–	–	–	–
	18 to 19	GeoEngineers PDA 2013 Investigation	08/30/2013	24 U	0.00098 U	0.00098 U	--	–	–	–	–	–	–	–	–
	20.5 to 21.5	GeoEngineers PDA 2013 Investigation	08/30/2013	21 U	0.00083 U	0.00083 U	--	–	–	–	–	–	–	–	–
	24 to 25	GeoEngineers PDA 2013 Investigation	08/30/2013	23 U	0.00071 U	0.00071 U	--	–	–	–	–	–	–	–	–
	27.5 to 28	GeoEngineers PDA 2013 Investigation	08/30/2013	21 U	0.00073 U	0.00073 U	--	–	–	–	–	–	–	–	–
	29 to 29.5	GeoEngineers PDA 2013 Investigation	08/30/2013	22 U	0.00079 U	0.00079 U	--	–	–	–	–	–	–	–	–
	33 to 34	GeoEngineers PDA 2013 Investigation	08/30/2013	23 U	0.00087 U	0.00087 U	--	–	–	–	–	–	–	–	–
	39 to 40	GeoEngineers PDA 2013 Investigation	08/30/2013	23 U	0.00087 U	0.00087 U	--	–	–	–	–	–	–	–	–
	46 to 47	GeoEngineers PDA 2013 Investigation	08/30/2013	23 U	0.00078 U	0.00078 U	--	–	–	–	–	–	–	–	–
	48 to 49	GeoEngineers PDA 2013 Investigation	08/30/2013	22 U	0.00077 U	0.00077 U	--	–	–	–	–	–	–	–	–
Site Specific Screening Level (mg/kg)				**30/100 [5]**	**0.001**	**0.043**	**250**	**Site Specific Screening Level for the TTEC of cPAHs is 0.12 mg/kg**							

Boring/Test Pit/Confirmation Sample Identification	Sample Depth (feet bgs)	Investigation Reference	Sample Date	Petroleum Hydrocarbons [1] (mg/kg)	VOCs [2] (mg/kg)		Total Metals [3] (mg/kg)	cPAHs [4] (mg/kg)							
				Gasoline-Range	Benzene	Chlorobenzene	Lead	Benzo (a) anthracene (TEF 0.1)	Benzo (a) pyrene (TEF 1)	Benzo (b) fluoranthene (TEF 0.1)	Benzo (J,k) fluoranthene (TEF 0.1)	Chrysene (TEF 0.01)	Dibenz (a,h) anthracene (TEF 0.1)	Indeno (1,2,3-cd) pyrene (TEF 0.1)	TTEC of cPAHs (detect only)
JS-MW6S	10 to 11	GeoEngineers PDA 2013 Investigation	09/03/2013	22 U	0.00093 U	0.00093 U	--	--	--	--	--	--	--	--	--
	14 to 15	GeoEngineers PDA 2013 Investigation	09/03/2013	22 U	0.00079 U	0.00079 U	--	--	--	--	--	--	--	--	--
	16 to 17	GeoEngineers PDA 2013 Investigation	09/03/2013	23 U	0.00073 U	0.00073 U	--	--	--	--	--	--	--	--	--
	17 to 17.5	GeoEngineers PDA 2013 Investigation	09/03/2013	23 U	0.0008 U	0.0008 U	--	--	--	--	--	--	--	--	--
	18 to 19	GeoEngineers PDA 2013 Investigation	09/03/2013	23 U	0.0008 U	0.0008 U	--	--	--	--	--	--	--	--	--
Site Specific Screening Level (mg/kg)				**30/100 [5]**	**0.001**	**0.043**	**250**	**Site Specific Screening Level for the TTEC of cPAHs is 0.12 mg/kg**							

Notes:

[1] Gasoline-range petroleum hydrocarbons by Washington State Department of Ecology (Ecology)-approved method NWTPH-HCID/Gx.

[2] Volatile organic compounds (VOCs) by United States Environmental Protection Agency (EPA) method 8020/8260C.

[3] Metals by EPA method 6000/7000 series.

[4] CPAHs by EPA method 8260D SIM.

[5] Site Specific Screening Level for gasoline-range petroleum hydrocarbons is 100 mg/kg or 30 mg/kg if benzene is detected.

U = Analyte was not detected at or greater than the listed reporting limit

J = Estimated result by analytical laboratory

ND = Not Detected (laboratory reporting limit not shown)

TEF = Toxicity Equivalency Factor as defined in WAC 173-340-900 Table 708-2

Total Toxic Equivalent Concentration (TTEC) is the sum of each individual cPAH concentration multiplied by its corresponding TEF.

Bold font type indicates that the analyte was detected at a concentration greater than the respective laboratory reporting limit.

Bold font type and gray shading indicates that the detected concentration is greater than the respective Site Specific Screening Level.

mg/kg = milligram per kilogram

bgs = below ground surface

-- = sample not analyzed

PDA = Priority Development Area

Table 10

Summary of Chemical Analytical Results for Gasoline-Range Petroleum Hydrocarbons, Benzene and Chlorobenzene - AOC 10 - Groundwater

Agreed Order Remedial Investigation Work Plan - University of Washington-Tacoma
Tacoma, Washington

Monitoring Well Identification	Lithology At Well Screen	Well Type	Sample Date	Petroleum Hydrocarbons [1]	VOCs[2] (µg/L)	
				Gasoline-Range	Benzene	Chlorobenzene
BA-MW1	Unconfirmed	Permanent	1/20/05	25 U	0.5 U	--
			1/20/05	--	**0.08 J**	--
			4/19/07	--	0.20 U	0.20 U
			7/11/13	100 U	0.20 U	0.20 U
BL-MW5	Recessional Outwash/Qvi/Silt	Permanent	4/7/00	**449**	**4.54**	**3.88**
			9/7/00	**623**	**4.59**	**4.47**
			7/9/13	100 U	4 U	**9.6**
CR-MW3	Qvi	Permanent	10/22/98	50 U	1 U	1 U
			1/12/99	50 U	1 U	1 U
			4/21/99	50 U	1 U	1 U
			9/8/99	50 U	1 U	1 U
			4/4/00	50 U	1 U	1 U
			9/8/00	50 U	1 U	1 U
			7/9/13	100 U	0.20 U	0.20 U
DD-MW2	Advance Outwash	Permanent	6/13/02	--	0.2 U	0.2 U
			7/9/13	100 U	0.20 U	0.20 U
JP -MW1[3]	Qvi//Silt/Advance Outwash	Permanent	10/23/98	50 U	0.2 U	0.2 U
			1/11/99	50 U	0.5 U	--
			4/19/99	50 U	0.5 U	--
			9/9/99	50 U	0.5 U	--
			4/2/13	100 U	0.2 U	0.2 U
			7/12/13	100 U	0.20 U	0.20 U
JP-MW1R	Qvi	Permanent	7/12/13	100 U	0.20 U	0.20 U
JP-MW2	Advance Outwash	Permanent	4/3/01	--	**161**	**68**
			4/11/07	--	**146**	**234**
			7/2/13	**540 J**	**57**	**170**
JS-MW5	Advance Outwash	Permanent	9/12/13	100 U	0.20 U	**0.55**
JS-MW6D	Advance Outwash	Permanent	9/13/13	100 U	0.20 U	0.20 U
JS-MW6S	Qvi	Permanent	9/12/13	100 U	**0.29**	0.20 U
PL-MW1	Qvi	Permanent	4/1/13	100 U	**1.2**	**0.82**
			7/12/13	100 U	**0.94**	**0.27**
PL-MW2	Qvi	Permanent	7/10/13	100 U	0.20 U	0.20 U
UG-MW1	Advance Outwash	Permanent	10/21/98	**694**	**488**	1 U
			4/19/99	**857**	**553**	1 U
			4/11/07	--	**212**	0.2 U
			7/2/13	100 U	**56**	0.40 U
UG-MW2[3]	Qvi	Permanent	10/21/98	50 U	1 U	1 U
			4/19/99	50 U	1 U	1 U
UG-MW2R	Qvi	Permanent	6/17/10	100 U	0.20 U	0.20 U
			7/15/13	100 U	0.20 U	0.20 U
UG-MW5	Advance Outwash/Transition Zone	Permanent	4/4/02	--	0.20 U	0.20 U
			4/12/07	--	**1.99**	**6.68**
			7/10/13	100 U	0.20 U	0.20 U
UG-MW6	Unconfirmed	Permanent	4/4/02	--	**39.9**	**231**
			4/11/02	--	**29.3**	**566**
			7/10/13	**890 J**	**18**	**310**
UG-MW10	Advance Outwash/Silt	Permanent	4/19/07	--	0.2 U	0.2 U
			7/11/13	100 U	0.20 U	0.20 U
UG-MW11	Advance Outwash	Permanent	4/12/07	--	0.20 U	0.20 U
			4/19/07	--	0.20 U	0.20 U
			7/10/13	100 U	0.20 U	0.20 U
UG-MW12	Advance Outwash/Silt	Permanent	5/17/07	--	**83.5**	0.2 U
			7/10/13	100 U	**30**	0.20 U
UG-MW15	Advance Outwash/Silt	Permanent	8/1/08	50 U	0.20 U	0.20 U
			7/10/13	100 U	0.20 U	0.20 U
JP-GW1	Qvi	Temporary	8/27/1998	--	0.5 U	--
JP-GW2	Qvi	Temporary	9/14/1999	--	1 U	1 U
JP-GW3	Unconfirmed	Temporary	3/29/2001	--	**1,740**	1 U
JP-GW5	Unconfirmed	Temporary	3/29/2001	--	**3.51**	**405**
MS-SB04	Advance Outwash	Temporary	3/15/2007	--	0.80 U	1 U
MS-SB05	Qvi	Temporary	3/15/2007	--	0.80 U	1 U
MS-SB06	Qvi	Temporary	3/16/2007	**52.9 J**	0.80 U	**3.64**
			Site Specific Screening Level (µg/L)	**800**	**2.4**	**100**

Notes:

[1] Gasoline-range petroleum hydrocarbons by Washington State Department of Ecology (Ecology)-approved method NWTPH-Gx.

[2] Volatile organic compounds (VOCs) by United States Environmental Protection Agency (EPA) method 8260B.

[3] Well decommissioned during property development

U = Analyte was not detected at or greater than the listed reporting limit

J = Estimated result by analytical laboratory

Bold font type indicates that the analyte was detected at a concentration greater than the respective laboratory reporting limit.

Bold font type and gray shading indicates that the detected concentration is greater than the respective Site Specific Screening Level.

µg/L = Microgram per liter

bgs = Below ground surface

-- = Sample not analyzed

Qvi = Ice-contact deposits

Table 11

Summary of Historical Chemical Analytical Results for PCE and Associated Breakdown Products - AOC 11 - Groundwater

Agreed Order Remedial Investigation Work Plan - University of Washington-Tacoma

Tacoma, Washington

Monitoring Well	Lithology At Well Screen	Depth of Top of Well Screen (feet bgs)	Depth of Bottom of Well Screen (feet bgs)	Well Type	Sample Date	VOCs (µg/L)[1]					
						PCE	TCE	cis-1,2-DCE	Trans-1,2-DCE	1,1-DCE	Vinyl Chloride
Westerly Plume											
BA-MW2	Advance Outwash	22	37	Permanent	08/20/2004	--	**0.42 J**	--	--	--	--
					04/11/2007	0.05 U	0.05 U	0.2 U	0.2 U	0.05 U	0.02 U
					06/17/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
DD-MW1	Advance Outwash	45	60	Permanent	5/28/2002	**1.98**	**305**	**1.43**	1 U	1 U	1 U
					04/11/2007	**1.42**	**223**	**1.01**	0.2 U	**0.45**	0.2 U
					06/19/2013	**1.2**	**130**	1 U	1 U	1 U	0.5 U
JS-GW2	Advance Outwash	40[3]	45[3]	Temporary	03/29/2001	--	**1.88**	--	--	--	--
JS-MW1	Advance Outwash	35	50	Permanent	09/08/1999	--	1 U	--	--	--	--
					06/18/2013	0.2 U	**1.4**	0.2 U	0.2 U	0.2 U	0.1 U
JS-MW2	Advance Outwash	34	49	Permanent	09/08/1999	--	**8.71**	--	--	--	--
					04/05/2000	--	**10.8**	--	--	--	--
					09/08/2000	--	**9.18**	--	--	--	--
					06/18/2013	0.2 U	**14**	0.2 U	0.2 U	0.2 U	0.1 U
JS-MW3	Advance Outwash	39	54	Permanent	04/03/2001	--	1 U	--	--	--	--
					06/25/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
					10/27/2014	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
JS-MW3S	Qvi	12	22	Permanent	09/13/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
					01/22/2014	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
					10/27/2014	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
JS-MW4D	Advance Outwash	43	53	Permanent	09/19/2013	0.2 U	**2.5**	0.2 U	0.2 U	0.2 U	0.2 U
JS-MW7A	Qvi	7	12	Permanent	01/22/2014	0.2 U	**1.8**	0.2 U	0.2 U	0.2 U	0.2 U
MS-SB01	Advance Outwash	50	60	Temporary	03/12/2007	**0.143**	**62.9**	1 U	1 U	**0.091**	0.02 U
MS-SB02	Qvi	Grab sample inside auger at 19 feet bgs		Temporary	03/13/2007	**1.42**	**163**	**1.17**	1 U	**0.135**	0.02 U
	Advance Outwash	50	60	Temporary	03/13/2007	**0.532**	**92.6**	1 U	1 U	**0.12**	0.02 U
MS-SB03	Qvi	Grab sample inside auger at 25 feet bgs		Temporary	03/14/2007	**0.205**	**27.2**	1 U	1 U	0.05 U	0.02 U
	Advance Outwash	45	55	Temporary	03/14/2007	0.05 U	**0.367**	1 U	1 U	0.05 U	0.02 U
UG-MW3	Advance Outwash	38	53	Permanent	10/26/1998	--	**2.91**	--	--	--	--
					04/19/1999	--	**7.8**	--	--	--	--
					04/05/2000	--	**11.2**	--	--	--	--
					09/08/2000	--	**13**	--	--	--	--
					06/18/2013	0.2 U	**13**	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW4	Advance Outwash	45	60	Permanent	04/04/2002	--	**1.7**	--	--	--	--
					06/19/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW7	Advance Outwash	55	70	Permanent	05/28/2002	--	1 U	--	--	--	--
					04/12/2007	0.05 U	0.05 U	0.2 U	0.2 U	0.05 U	0.02 U
					06/19/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW8	Advance Outwash	55	70	Permanent	05/28/2002	--	**204**	--	--	--	--
					04/11/2007	**0.32**	**113**	**0.59**	0.2 U	0.2 U	0.2 U
					06/19/2013	0.4 U	**56**	**0.44**	0.4 U	0.4 U	0.2 U
UG-MW9	Advance Outwash	50	65	Permanent	04/19/2007	0.05 U	**1.06**	0.2 U	0.2 U	0.05 U	0.02 U
					06/17/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW13	Qvi	24	44	Permanent	05/17/2007	**1.33**	**165**	**1.24**	0.2 U	**0.28**	0.2 U
					06/25/2013	**1.4**	**110**	1 U	1 U	1 U	0.5 U
UG-MW14	Advance Outwash	22.5	37.5	Permanent	08/01/2008	**1.71 J**	**133**	**0.68**	0.2 U	**0.42 J**	0.02 U
					05/14/2009	**1.53**	**138**	**0.91**	0.1 U	**0.29**	0.02 U
					06/17/2013	**1.2**	**110**	1 U	1 U	1 U	0.5 U
UG-MW16	Unconfirmed	7	22	Permanent	05/15/2009	**2.68**	**207**	**1.25**	0.1 U	**0.51**	0.02 U
					06/17/2013	**1.9**	**170**	**1.1**	1 U	1 U	0.5 U
UG-MW17	Unconfirmed	3	18	Permanent	05/15/2009	**2.45**	**301**	**1.11**	**0.11**	**0.86**	0.02 U
					06/17/2013	2 U	**250**	2 U	2 U	2 U	1 U
UG-MW18	Advance Outwash	34	49	Permanent	05/14/2009	**18**	**1,170**	**17.5**	**0.18**	**3.1**	**0.18**
					06/14/2013	**12**	**1,200**	10 U	10 U	10 U	5 U
UG-MW19	Advance Outwash	24	39	Permanent	05/14/2009	**9.73**	**502**	**1.21**	0.1 U	**0.77**	0.02 U
					06/14/2013	**5.6**	**300**	2 U	2 U	2 U	1 U
UG-MW20	Advance Outwash	7	22	Permanent	05/14/2009	**0.18**	**283**	**2.68**	0.1 U	**0.26**	0.02 U
					06/14/2013	1 U	**170**	**1.8**	1 U	1 U	0.5 U
UG-MW21	Advance Outwash	23	38	Permanent	05/14/2009	0.05 U	**12.8**	0.05 U	0.1 U	0.05 U	0.02 U
					06/18/2013	0.2 U	**7.7**	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW22	Advance Outwash	15	30	Permanent	05/14/2009	0.05 U	**8.21**	0.05 U	0.1 U	0.05 U	0.02 U
					06/14/2013	0.2 U	**14**	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW23	Advance Outwash	11	18	Permanent	10/03/2013	0.2 U	**5.5**	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW24	Advance Outwash	65	80	Permanent	07/15/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW25D	Advance Outwash	45	55	Permanent	09/04/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW25S	Qvi	8	18	Permanent	09/04/2013	2 U	**290**	**6**	2 U	**12**	2 U
UG-MW26	Qvi	7	17	Permanent	09/30/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW27	Advance Outwash	40	56	Permanent	07/02/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW28	Qvi	9	24	Permanent	07/02/2013	0.2 U	**0.21**	0.2 U	0.2 U	0.2 U	0.1 U
					10/29/2013	0.2 U	**0.33**	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW29D[2]	Advance Outwash	28	38	Permanent	07/01/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
					10/28/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW29S	Qvi	9	19	Permanent	07/01/2013	**0.29**	**42**	0.2 U	0.2 U	0.2 U	0.1 U
					10/30/2013	0.2 U	**47**	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW30D	Qvi	38	48	Permanent	07/12/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW30S	Qvi	9	19	Permanent	07/15/2013	**1.1**	**130**	1 U	1 U	1 U	0.5 U
UG-MW31	Qvi	8	18	Permanent	09/04/2013	1 U	**120**	**1.4**	1 U	1 U	1 U
UG-MW32	Qvi	10	15	Permanent	10/03/2013	0.2 U	**39**	0.2 U	0.2 U	0.2 U	0.2 U
Site Specific Screening Level (µg/L)						**5**	**1.6**	**16**	**100**	**3.2**	**0.29**

Monitoring Well	Lithology At Well Screen	Depth of Top of Well Screen (feet bgs)	Depth of Bottom of Well Screen (feet bgs)	Well Type	Sample Date	VOCs (µg/L)[1]					
						PCE	TCE	cis-1,2-DCE	Trans-1,2-DCE	1,1-DCE	Vinyl Chloride
Westerly Plume (Continued)											
UG-MW33	Qvi	6.5	11.5	Permanent	10/02/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW34	Qvi	9	19	Permanent	09/23/2013	1 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW35	Qvi	6	12.5	Permanent	01/22/2014	0.2 U	**0.24**	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW36	Qvi	6	11	Permanent	01/22/2014	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW37[2]	Qvi	6	14	Permanent	09/30/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
UG-MW38D	Advance Outwash	41	51	Permanent	10/02/2013	**6.7**	**160**	**1.9**	1 U	1 U	1 U
UG-MW38S	Qvi	6	15	Permanent	10/01/2013	0.2 U	**1.4**	0.2 U	0.2 U	0.2 U	0.2 U
PLT-B10	Qvi	5.5	10.5	Temporary	03/26/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
PLT-B14	Qvi	9	14	Temporary	03/27/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
PLT-B15	Qvi	10	15	Temporary	03/29/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
PLT-B29	Qvi	8	13	Temporary	03/29/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1F-B3	Qvi	7	12	Temporary	06/12/2013	**1.2**	**180**	1 U	1 U	1 U	0.5 U
1F-B5	Qvi	7	12	Temporary	06/12/2013	0.2 U	**35**	**1.4**	0.2 U	0.2 U	0.1 U
1F-B7	Qvi	12	17	Temporary	06/11/2013	0.2 U	**30**	0.2 U	0.2 U	0.2 U	0.1 U
Upton Plume											
1A-B2	Fill	25	30	Temporary	06/13/2013	**6.5**	**4.8**	**45**	**2.9**	0.4 U	**6.9**
Y-MW1D	Advance Outwash	28	43	Permanent	09/16/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
					10/29/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Y-MW1S	Qvi	7	12	Permanent	09/16/2013	0.2 U	**21**	**0.37**	0.2 U	0.2 U	0.2 U
					10/29/2013	0.2 U	**19**	**0.23**	0.2 U	0.2 U	0.2 U
Y-MW2D[2]	Advance Outwash	35	50	Permanent	10/28/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Y-MW2S	Qvi	10	20	Permanent	10/28/2013	0.2 U	**8.1**	**1**	0.2 U	0.2 U	0.2 U
Y-MW3D	Advance Outwash	35	50	Permanent	10/28/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Y-MW3S	Qvi	7	17	Permanent	10/28/2013	0.2 U	**1.2**	0.2 U	0.2 U	0.2 U	0.2 U
Y-MW4S	Qvi	9	19	Permanent	10/28/2013	0.2 U	**43**	0.2 U	0.2 U	0.2 U	0.2 U
Y-MW5S[2]	Qvi	8.5	18.5	Permanent	10/28/2013	0.21 U	**37**	0.2 U	0.2 U	0.2 U	0.2 U
Y-MW6S	Qvi	12	22	Permanent	10/29/2013	**0.24**	**42**	0.2 U	0.2 U	0.2 U	0.2 U
Y-MW7S	Qvi	9	14	Permanent	10/29/2013	0.2 U	**45**	0.2 U	0.2 U	0.2 U	0.2 U
Y-TMW1	Qvi	4	14	Temporary	10/24/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Y-TMW2	Qvi	1	5	Temporary	10/25/2013	0.2 U	**5.3**	**3.6**	0.2 U	0.2 U	0.2 U
Tacoma Paper and Stationary Plume											
USC-MW1D	Advance Outwash	45	55	Permanent	10/27/2014	**1.5**	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
USC-MW1S	Qvi	6	25	Permanent	10/27/2014	**330**	**3**	2 U	2 U	2 U	2 U
Easterly Plume											
BA-MW1	Unconfirmed	22	37	Permanent	01/20/2005	--	0.5 U	--	--	--	--
					01/20/2005	--	**0.1**	--	--		--
					04/19/2007	0.05 U	0.05 U	0.2 U	0.2 U	0.05 U	0.02 U
					07/11/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
BL-MW1[2]	Fill/Recessional Outwash/Qvi	7.5	22.5	Permanent	10/26/1998	10 U	**152**	**92.2**	10 U	10 U	10 U
					01/12/1999	1 U	**87**	**66.1**	**5.24**	1 U	1 U
					03/26/1999	--	**328**	**220**	**10.6**	1 U	1 U
					04/20/1999	1 U	**109**	**87.5**	**7.45**	1 U	1 U
					09/08/1999	1 U	**98.8**	**76.2**	**15**	1 U	1 U
					04/05/2000	1 U	**148**	**87.6**	**6.02**	1 U	1 U
					09/07/2000	1 U	**90.4**	**109**	**8.21**	1 U	1 U
					07/09/2013	1 U	**89**	**86**	**9.5**	1 U	0.5 U
BL-MW3	Fill/Recessional Outwash/Qvi	10	25	Permanent	10/23/1998	1 U	**99.9**	**88.8**	**3.67**	1 U	1 U
					01/12/1999	1 U	**146**	**120**	**5.75**	1 U	1 U
					04/20/1999	1 U	**165**	**144**	**5.97**	1 U	1 U
					09/08/1999	1 U	**98.6**	**96.9**	**12.6**	1 U	1 U
					04/05/2000	1 U	**144**	**97.1**	**4.62**	1 U	1 U
					09/05/2000	1 U	**126**	**110**	**4.65**	1 U	1 U
					09/11/2013	0.2 U	**40**	**22**	**2.1**	0.2 U	0.2 U
BL-MW4	Fill/Recessional Outwash/Qvi/Silt/ Advance Outwash	10	30	Permanent	10/25/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/03/2000	1 U	1 U	1 U	1 U	1 U	1 U
					09/06/2000	1 U	1 U	1 U	1 U	1 U	1 U
					07/08/2013	0.2 U	**0.3**	**0.79**	0.2 U	0.2 U	**0.75**
BL-MW5	Recessional/Qvi/Silt	38	43	Permanent	03/20/2000	--	**180**	**170**	**18**	10 U	10 U
					03/20/2000	--	**500**	**650**	**10**	**18**	**100**
					03/20/2000	--	**500**	**500**	10 U	10 U	10 U
					04/07/2000	1 U	**1,300**	**782**	**24.7**	**14.2**	**120**
					09/07/2000	1 U	**785**	**623**	**32.9**	**15.5**	**88.8**
					07/09/2013	4 U	**910**	**220**	**8.8**	**7.5**	**24**
BL-MW6	Qvi	33	38	Permanent	03/21/2000	--	**160**	**170**	**16**	10 U	10 U
					03/21/2000	--	**10**	**44**	10 U	10 U	10 U
					04/05/2000	1 U	**5.4**	**40**	1 U	1 U	**2.45**
					09/05/2000	1 U	**8.99**	**59.6**	1 U	1 U	**6.35**
					07/11/2013	2 U	**120**	**240**	**4.5**	**4.5**	**61**
BL-MW7[2]	Qvi/Advance Outwash	15	30	Permanent	02/11/2002	--	**54.1**	**78.2**	**1.04**	1 U	1 U
					02/12/2002	--	**52.5**	**78.2**	**1.04**	1 U	1 U
CR-B6	Unconfirmed	13	16	Temporary	09/21/2000	1 U	**268**	**245**	**23.7**	**1.9**	1 U
CR-GW1	Unconfirmed	0	15	Temporary	08/27/1998	1 U	1 U	**4.42**	1 U	1 U	1 U
CR-GW2	Unconfirmed	5	15	Temporary	08/27/1998	1 U	1 U	1 U	1 U	1 U	1 U
CR-MW3	Qvi	10	25	Permanent	10/22/1998	1 U	1 U	1 U	1 U	1 U	1 U
					01/12/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/21/1999	1 U	1 U	1 U	1 U	1 U	1 U
					09/08/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/04/2000	1 U	1 U	1 U	1 U	1 U	1 U
					09/08/2000	1 U	1 U	1 U	1 U	1 U	1 U
					07/09/2013	0.2 U	0.2 U	**1.4**	0.2 U	0.2 U	0.1 U
Site Specific Screening Level (µg/L)						**5**	**1.6**	**16**	**100**	**3.2**	**0.29**

Monitoring Well	Lithology At Well Screen	Depth of Top of Well Screen (feet bgs)	Depth of Bottom of Well Screen (feet bgs)	Well Type	Sample Date	VOCs (µg/L)[1] PCE	TCE	cis-1,2-DCE	Trans-1,2-DCE	1,1-DCE	Vinyl Chloride
Easterly Plume (Continued)											
CR-MW5	Fill/Qvi	8	18	Permanent	10/22/1998	1 U	**4.73**	**4.73**	1 U	1 U	**1.28**
					01/11/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/21/1999	1 U	1 U	1 U	1 U	1 U	1 U
					09/07/1999	1 U	**3.29**	**3.81**	1 U	1 U	**1.09**
					07/09/2013	0.2 U	**2.9**	**22**	**1.2**	**0.24**	**1.1**
CR-MW6	Fill/Recessional Outwash	8	18	Permanent	10/22/1998	1 U	**3.78**	**3.52**	1 U	1 U	1 U
					01/11/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/21/1999	1 U	1 U	1 U	1 U	1 U	1 U
					09/07/1999	1 U	**8.3**	**9.11**	1 U	1 U	1 U
					07/09/2013	0.2 U	**5.5**	**15**	**0.94**	0.2 U	**0.52**
CR-MW7[2]	Fill/Recessional Outwash/Qvi	7	17	Permanent	10/22/1998	1 U	**2.19**	**1.84**	1 U	1 U	1 U
					01/11/1999	1 U	**2.56**	**3.72**	1 U	1 U	1 U
					04/21/1999	1 U	**1.71**	**2.5**	1 U	1 U	1 U
					09/07/1999	1 U	**2.98**	**2.34**	1 U	1 U	1 U
					04/04/2000	**2.08**	**2.36**	**2**	1 U	1 U	1 U
					09/07/2000	1 U	**2.33**	**1.26**	1 U	1 U	1 U
CR-MW8	Fill/Recessional Outwash/Qvi	8	18	Permanent	10/23/1998	10 U	10 U	10 U	10 U	10 U	10 U
					01/11/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/21/1999	10 U	10 U	10 U	10 U	10 U	10 U
					09/07/1999	10 U	10 U	10 U	10 U	10 U	10 U
					04/04/2000	1 U	1 U	1 U	1 U	1 U	1 U
					09/07/2000	1 U	1 U	1 U	1 U	1 U	1 U
					07/02/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
CR-MW9	Fill/Recessional Outwash	7	20	Permanent	04/04/2000	1 U	1 U	1 U	1 U	1 U	1 U
					03/26/1999	100 U	100 U	100 U	100 U	100 U	100 U
					07/08/2013	1 U	1 U	1 U	1 U	1 U	0.5 U
					03/26/1999	1 U	1 U	1 U	1 U	1 U	1 U
CR-MW10[2]	Unconfirmed	18	33	Permanent	10/22/1998	1 U	1 U	**2.09**	1 U	1 U	1 U
					01/11/1999	1 U	1 U	**1.35**	1 U	**1.33**	1 U
					04/21/1999	1 U	1 U	**1.24**	1 U	1 U	1 U
					09/07/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/04/2000	1 U	1 U	1 U	1 U	1 U	1 U
					09/07/2000	1 U	1 U	1 U	1 U	1 U	1 U
CR-MW11[2]	Qvi	10	25	Permanent	10/25/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/04/2000	1 U	1 U	1 U	1 U	1 U	1 U
					09/06/2000	1 U	1 U	1 U	1 U	1 U	1 U
CR-MW12	Qvi/Advance Outwash	10	25	Permanent	10/25/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/03/2000	1 U	1 U	1 U	1 U	1 U	1 U
					09/06/2000	1 U	1 U	1 U	1 U	1 U	1 U
					07/08/2013	0.2 U	**4.7**	**3.8**	0.2 U	0.2 U	**0.64**
CR-MW13[2]	Unconfirmed	13	28	Permanent	02/11/2002	1 U	**164**	**184**	**5.3**	**1.26**	**5.35**
CR-MW15	Advance Outwash	15	30	Permanent	09/05/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	**1.3**
CR-MW16	Qvi	15	30	Permanent	09/05/2013	2 U	**300**	**240**	**15**	**3.9**	**17**
					10/30/2014	2 U	**340**	**270**	**15**	**3**	**19**
CR-MW17	Qvi	10	25	Permanent	09/05/2013	1 U	**93**	**120**	**6.5**	**1.7**	**12**
					10/30/2014	1 U	**65**	**86**	**4.9**	1 U	**8.7**
DD-MW2	Advance Outwash	40	55	Permanent	6/13/2002	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
					07/09/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
FW-B02	Qvi	7[3]	12[3]	Temporary	07/15/2013	0.2 U	**2.1**	0.2 U	0.2 U	0.2 U	0.1 U
FW-B08	Qvi	4[3]	9[3]	Temporary	07/15/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
JP-GW1	Qvi	16	19	Temporary	8/27/1998	--	--	--	--	--	--
JP-GW2	Qvi	18	20	Temporary	09/14/1999	--	1 U	**2.22**	1 U	1 U	1 U
JP-GW3	Unconfirmed	20[3]	25[3]	Temporary	03/29/2001	--	1 U	**23.2**	**1.21**	1 U	**68**
JP-GW5	Unconfirmed	19[3]	24[3]	Temporary	03/29/2001	--	**1,740**	**404**	**16.5**	**3.36**	**90.6**
JP-MW1[2]	Qvi/Silt/Advance Outwash	15	30	Permanent	04/02/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
					07/12/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
					09/09/1999	--	1 U	1 U	1 U	1 U	1 U
JP-MW1R	Qvi	14.5	24.5	Permanent	04/03/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
					07/12/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
JP-MW2	Unconfirmed	15	27	Permanent	04/03/2001	--	**641**	**1,200**	**87.8**	**12.9**	**287**
					04/11/2007	0.2 U	**1,460**	**1,650**	**78.9**	**18**	**338**
					07/02/2013	4 U	**500**	**600**	**38**	**10**	**120**
JS-MW5	Advance Outwash	27	37	Permanent	09/12/2013	0.2 U	**3.8**	**0.69**	0.2 U	0.2 U	0.2 U
JS-MW6D	Advance Outwash	25	40	Permanent	09/13/2013	0.2 U	**2.8**	0.2 U	0.2 U	0.2 U	0.2 U
JS-MW6S	Qvi	8.5	18.5	Permanent	09/12/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
MDS-MW1D	Advance Outwash	45	60	Permanent	10/30/2014	0.2 U	**2.3**	**4.4**	0.2 U	0.2 U	**1.2**
MER-KSB-16	Unconfirmed	Grab sample inside auger at 28 feet bgs		Temporary	12/01/2008	--	**6.8**	--	--	--	--
MER-KSB-17	Unconfirmed	Grab sample inside auger at 15 feet bgs		Temporary	12/01/2008	--	**62**	--	--	--	--
MER-KSB-22	Unconfirmed	Grab sample inside auger at 14 feet bgs		Temporary	12/01/2008	--	**83**	--	--	--	--
MER-KSB-24	Unconfirmed	Grab sample inside auger at 35 feet bgs		Temporary	12/01/2008	--	**230**	--	--	--	--
MER-KSB-25	Unconfirmed	Grab sample inside auger at 27 feet bgs		Temporary	12/01/2008	--	**37**	--	--	--	--
MS-SB04	Advance Outwash	45	55	Temporary	03/15/2007	0.05 U	0.1 U	1 U	1 U	0.05 U	0.02 U
MS-SB05	Qvi	20	30	Temporary	03/15/2007	0.05 U	0.1 U	1 U	1 U	0.05 U	**0.027**
MS-SB06	Qvi	15	25	Temporary	03/16/2007	0.05 U	**12.7**	**3.07**	1 U	**0.117**	**0.625**
PL-MW1	Qvi	13	28	Permanent	04/01/2013	0.4 U	**41**	**31**	**1.2**	**0.69**	**5.2**
					07/12/2013	0.2 U	**17**	**10**	**0.43**	**0.22**	**2.2**
PL-MW2	Qvi	6	26	Permanent	07/10/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
PS-MW6	Recessional/Qvi/Silt	11	26	Permanent	10/23/1998	--	**13.3**	**45.2**	1 U	1 U	1 U
					01/13/1999	--	**47.3**	**68.1**	**1.74**	1 U	**1.18**
					04/20/1999	--	**34.5**	**58.8**	**1.2**	1 U	1 U
					09/09/1999	--	**3.12**	**52**	**1.91**	1 U	**3.05**
					07/11/2013	0.4 U	**50**	**20**	**16**	**0.4**	**4.7**
Site Specific Screening Level (µg/L)						**5**	**1.6**	**16**	**100**	**3.2**	**0.29**

Monitoring Well	Lithology At Well Screen	Depth of Top of Well Screen (feet bgs)	Depth of Bottom of Well Screen (feet bgs)	Well Type	Sample Date	VOCs (µg/L)[1] PCE	TCE	cis-1,2-DCE	Trans-1,2-DCE	1,1-DCE	Vinyl Chloride
Easterly Plume (Continued)											
PS-MW7	Recessional/Qvi/Silt	8	23	Permanent	10/23/1998	--	**54.8**	**51.8**	1 U	1 U	1 U
					01/13/1999	--	**60.9**	**51**	**1.01**	1 U	1 U
					04/20/1999	--	**70**	**66.6**	**1.28**	1 U	1 U
					09/09/1999	--	**87.8**	**71.8**	**1.54**	1 U	1 U
					04/07/2000	--	**144**	**101**	**1.82**	**1.24**	1 U
					09/06/2000	--	**105**	**115**	**1.82**	**1.37**	1 U
					07/15/2013	1 U	**180**	**38**	**1.6**	1 U	**5.9**
PS-MW8	Recessional/Qvi/Silt	11	26	Permanent	10/23/1998	--	**10.6**	**27.4**	1 U	1 U	1 U
					01/13/1999	--	**7.83**	**6.67**	1 U	1 U	1 U
					04/20/1999	--	**14.7**	**26.7**	**1.12**	1 U	1 U
					09/09/1999	--	**7.14**	**27.7**	**2.03**	1 U	**3.46**
					04/07/2000	--	**19**	**26.8**	**2.37**	1 U	**1.57**
					09/06/2000	--	**8.78**	**29.1**	**4.07**	1 U	**2.68**
					07/11/2013	0.2 U	**12**	**13**	**3.3**	0.2 U	**0.18**
PS-MW9	Recessional/Qvi/Silt	12	27	Permanent	11/02/1999	--	1 U	1 U	1 U	1 U	1 U
					04/03/2000	--	**6.19**	**4.27**	1 U	1 U	1 U
					09/06/2000	--	**1.28**	1 U	1 U	1 U	1 U
					07/11/2013	0.2 U	**3.3**	**1.2**	0.2 U	0.2 U	0.1 U
SH-MW6	Silt/Advance Outwash	14	29	Permanent	10/26/1998	1 U	1 U	1 U	1 U	1 U	1 U
					01/12/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/19/1999	1 U	1 U	1 U	1 U	1 U	1 U
					09/08/1999	1 U	1 U	1 U	1 U	1 U	1 U
					07/08/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
SH-MW7	Silt/Advance Outwash	16	31	Permanent	10/26/1998	**11.2**	1 U	10 U	1 U	1 U	10 U
					01/12/1999	1 U	1 U	**9.09**	1 U	1 U	1 U
					04/19/1999	1 U	1 U	**9.97**	1 U	1 U	**1.01**
					09/08/1999	1 U	1 U	**8.66**	1 U	1 U	**1.78**
					04/03/2000	1 U	1 U	**12.2**	1 U	1 U	**4.99**
					09/06/2000	1 U	1 U	**12.4**	1 U	1 U	**7.44**
					07/08/2013	0.4 U	**0.47**	**1.6**	**2.1**	0.4 U	**1**
SH-MW8	Qvi	10	30	Permanent	10/26/1999	1 U	1 U	1 U	1 U	1 U	1 U
					04/04/2000	1 U	1 U	1 U	1 U	1 U	1 U
					09/07/2000	1 U	1 U	1 U	1 U	1 U	1 U
UG-MW1	Advance Outwash	23	38	Permanent	10/21/1998	–	1 U	**230**	1 U	**2.38**	**75.3**
					04/19/1999	–	1 U	**171**	1 U	**2.44**	**61.5**
					04/11/2007	0.05 U	0.05 U	0.2 U	0.2 U	0.05 U	0.02 U
					04/11/2007	0.2 U	**1.5**	**49.3**	**1.98**	**1.2**	**22.1**
					07/02/2013	0.4 U	**1.1**	**19**	**0.81**	**0.63**	**9.7**
UG-MW2[2]	Qvi	18	33	Permanent	10/21/1998	–	1 U	1 U	1 U	1 U	1 U
					04/19/1999	–	1 U	1 U	1 U	1 U	1 U
UG-MW2R	Qvi	15	36	Permanent	06/17/2010	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
					07/15/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW5	Advance Outwash/ Transition Zone	28	43	Permanent	04/04/2002	–	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
					04/12/2007	0.05 U	**15.6**	**6.8**	0.2 U	**0.21**	**0.79**
					07/10/2013	0.2 U	**5.8**	**1.4**	0.2 U	0.2 U	0.1 U
UG-MW6	Unconfirmed	20	35	Permanent	04/04/2002	–	**1,590**	**569**	50 U	50 U	**131**
					04/11/2007	0.2 U	**1,290**	**374**	**16.3**	**8.06**	**79**
					07/10/2013	4 U	**700**	**180**	**9.4**	**5.2**	**33**
UG-MW10	Advance Outwash/Silt	20	35	Permanent	04/19/2007	0.05 U	0.05 U	0.2 U	0.2 U	0.05 U	0.02 U
					07/11/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW11	Qvi	Grab sample inside auger at 15 feet bgs		Temporary	04/12/2007	**0.154**	**0.087**	0.2 U	0.2 U	0.05 U	0.02 U
	Advance Outwash/Silt	20	35	Permanent	04/19/2007	0.05 U	0.05 U	0.2 U	0.2 U	0.05 U	0.02 U
					07/10/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
UG-MW12	Advance Outwash/Silt	20	35	Permanent	05/17/2007	0.05 U	0.05 U	**20.3**	**0.22**	**0.601**	**5.15**
					07/10/2013	0.2 U	**0.4**	**5.8**	0.2 U	**0.21**	**0.93**
UG-MW15	Advance Outwash/Silt	25	40	Permanent	08/01/2008	0.05 U	**0.25 J**	0.2 U	0.2 U	0.05 U	0.02 U
					07/10/2013	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U
Howe Plume											
H-MW1	Advance Outwash	12	27	Permanent	3/24/2016	0.5 U	**0.52**	**1.3**	0.2 U	0.1 U	**0.41**
H-MW2	Advance Outwash	15	30	Permanent	3/24/2016	**16**	**3.7**	**1.5**	0.2 U	0.1 U	**0.046**
H-MW3	Advance Outwash	25	40	Permanent	3/24/2016	0.5 U	**0.38**	**0.61**	0.2 U	0.1 U	0.02 U
H-MW4	Advance Outwash	20	40	Permanent	3/25/2016	**4.9**	**20**	**36**	0.2 U	0.1 U	**0.31**
H-MW5	Advance Outwash	26	41	Permanent	3/24/2016	0.5 U	0.2 U	0.2 U	0.2 U	0.1 U	0.02 U
H-MW11	Advance Outwash	15	25	Permanent	3/25/2016	0.5 U	0.2 U	0.2 U	0.2 U	0.1 U	0.02 U
H-MW12	Advance Outwash	5	15	Permanent	3/25/2016	0.5 U	0.2 U	0.2 U	0.2 U	0.1 U	0.02 U
H-MW13	Advance Outwash	5	15	Permanent	3/25/2016	**1.2**	0.2 U	0.2 U	0.2 U	0.1 U	0.02 U
H-MW14	Advance Outwash	15	25	Permanent	3/25/2016	0.5 U	0.2 U	0.2 U	0.2 U	0.1 U	0.02 U
H-MW15	Advance Outwash	5	15	Permanent	3/25/2016	0.5 U	0.2 U	0.2 U	0.2 U	0.1 U	0.02 U
H-MW16	Advance Outwash	25	40	Permanent	3/24/2016	**0.89**	**6**	**17**	0.2 U	0.1 U	**0.15**
H-MW17	Advance Outwash	23	39	Permanent	3/24/2016	**89**	**8.5**	**11**	0.2 U	**0.11**	**3.9**
H-MW18	Advance Outwash	20	35	Permanent	3/24/2016	**7.9**	**0.77**	**0.32**	0.2 U	0.1 U	0.02 U
H-MW19	Advance Outwash	28	43	Permanent	3/24/2016	**7.3**	**1.6**	**4.4**	0.2 U	0.1 U	0.02 U
H-MW20	Advance Outwash	26	41	Permanent	3/25/2016	**18**	**1**	**0.75**	0.2 U	0.1 U	0.02 U
H-MW21	Advance Outwash	2	7	Permanent	3/25/2016	0.5 U	0.2 U	0.2 U	0.2 U	0.1 U	0.02 U
H-MW22	Advance Outwash	4	9	Permanent	3/25/2016	**4**	**0.27**	**0.21**	0.2 U	0.1 U	0.02 U
					Site Specific Screening Level (µg/L)	**5**	**1.6**	**16**	**100**	**3.2**	**0.29**

Notes:

[1] Volatile organic compounds (VOCs) by United States Environmental Protection Agency (EPA) method 8260B.

[2] Well decommissioned during property redevelopment.

[3] Well screen is not shown on the boring log. Well screen is estimated to be 5 feet long and end at the base of the boring.

U = Analyte was not detected at or greater than the listed reporting limit

J = Estimated result by analytical laboratory

Bold font type indicates that the analyte was detected at a concentration greater than the respective laboratory reporting limit

Bold font type and gray shading indicates that the detected concentration is greater than the respective Site Specific Screening Level.

-- = Sample not analyzed

Qvi= Ice-contact deposits

trans-1,2-DCE = Trans-1,2-Dichloroethene

µg/L = microgram per liter

bgs = below ground surface

TCE = Trichloroethene

PCE = Tetrachloroethene

cis-1,2-DCE = cis-1,2-Dichloroethene

1,1-DCE = 1,1-dichloroethylene

SECTION 2. SOUTH 17TH STREET AND PACIFIC AVENUE (CUT AND COVER AND TRENCHLESS)

Geotechnical

GeoEngineers, Inc. 2013. Report Addendum: Geotechnical Engineering Services, Tacoma Art Museum (TAM) Expansion, Tacoma, Washington, for Tacoma Art Museum. July 31, 2013.

Environmental

Tacoma/Pierce County Health Department. 2007. Site Hazard Assessment Completion, Tacoma City Convention Center Garage, 1500 Broadway, Tacoma, Washington. June 18, 2007.

Washington State Department of Ecology. 2010. Site Hazard Assessment Worksheet 1, Summary Score Sheet, Sound Transit Depot Partnership Property, 1548 Pacific Avenue, Tacoma, Washington. August 2010.

Geotechnical Reference Material

TACO:CAJ : SCY

PACIFIC AVENUE

CONCRETE RETAINING WALL SUPPORTING STREET LEVEL SIDEWALK

FACE OF BUILDING IS 0.2' OVER PROPERTY LINE TO WEST

B-7

SEE SHEET 3 FOR DETAIL OF THE TOPOGRAPHY OF THE CANTILEVERED SIDEWALK AND PACIFIC AVE. ENTRANCE TO ART MUSEUM

LARGE VERTICAL SIGN POLES

"ART MUSEUM PARKING"

"STOP"

TRAFFIC DETECTION LOOPS (TYP.)

METAL GUARDRAIL BEHIND CURB

GABION BASKET RETAINING WALL

"NO PARKING"

60'

52.60'

TALL METAL RAIL FENCE WITH CONCRETE POSTS

33.15'

28.05'

PROPOSED MUSEUM ADDITION

B-1

B-6

B-5

"PARKING TO RIGHT"

3" ROOF DRAIN PIPE IE=25.60'

2ND LANDING OF METAL STAIRS 39.60'

3RD LANDING OF METAL STAIRS

BUILDING FOOTPRINT AT GROUND LEVEL

1' WIDE CONCRETE WALL AT GROUND LEVEL

HOOD STREET

"PARKING TO RIGHT"

CONCRETE RETAINING WALL AT CORNER OF PARKING LOT

6' TALL CHAIN LINK FENCE

22.55'

25.10'

28.60'

32.04'

36.58'

GABION BASKET RETAINING WALL

4' TALL CHAIN LINK FENCE

25.18'

EXISTING ART MUSEUM

3" ROOF DRAIN PIPE IE=27.80'

VEHICLE SCALES

B-2

CONC. LANDING 26.90' (SEE STAIR DETAIL)

1ST LANDING OF METAL STAIRS 33.28'

PROPERTY LINE

FACE OF BUILDING IS ON PRPOERTY LINE

B-4

"NO PARKING"

STA: 21+

FEDERAL COURTHOUSE FOOTPRINT AT GROUND LEVEL

FEDERAL COURTHOUSE

24.5'

25.5'

CONCRETE CHANNEL DRAIN ELEVATED 1' ABOVE LOWER PARKING LOT

CONCRETE CHANNEL

BUILDING COLUMN (TYP.)

LAND SCAPING

"PARKING TO RIGHT"

B-3

PARKING PAY STATION

6' TALL METAL RAIL FENCE

STA. 21+34.54

"UNION STATION"

EXCESS RIGHT OF WAY AS PER R1

OUTLINE OF UPPER CANTILEVERED BUILDING SUPPORTED BY COLUMNS (HATCHED W/ DOTS)

STATE ROUTE 705

S-CBD LINE

19+76.57

18+72.1

6' TALL METAL RAIL FENCE

EXCESS RIGHT OF WAY AREA AS PER R1

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

Reference: Drawing provided by Apex Engineering.

Legend

B-6 Boring number and approximate location completed for this study May 6, 2013

B-1 Boring number and approximate location completed February 8, 2000

W N S E

50 0 50

Feet

Site Plan

Tacoma Art Museum - Expansion Project
Tacoma, Washington

GeoEngineers

Figure 2

W:\Tacoma\Projects\7\782200104\CAD\782200104_F2.dwg|TAB:F2 modified on May 17, 2013 - 10:07am

Drilled	Start 5/6/2013	End 5/6/2013	Total Depth (ft) 26	Logged By EKV / Checked By CAJ	Driller Holocene Drilling	Drilling Method Hollow Stem Auger
Surface Elevation (ft) Vertical Datum	52 City of Tacoma-NAD83/91		Hammer Data	140 (lbs) / 30 (in) Drop	Drilling Equipment	BK 81 Truck Mount
Easting (X) Northing (Y)			System Datum	--	Groundwater Date Measured	Depth to Water (ft) / Elevation (ft)

Notes: 4¼ I.D. CFA

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content, %	Dry Density, (pcf)	REMARKS
	0						CC	8 inch concrete slab			
							SP	Brown fine sand (loose, moist) (fill)			
50							GP	Gray fine to coarse gravel with sand (loose, moist) (fill)			
	5	17	11	1 MC			SM	Brown silty fine to coarse sand with gravel (medium dense, moist) (fill)	15		
45							SM	Brown silty fine to coarse sand with occasional gravel (very dense, moist)			
	10	8	59	2							
40											
	15	12	43	3 MC					8		
35											
	20	18	40	4							
30							GP	Brown/gray fine to coarse gravel with sand (very dense, moist)			
	25	6	50/5.5"	5/6*							*3-inch diameter sample taken at 25 feet; inches driven = 10 inches recovered = 6 blow/ft. = 50/4"

Note: See Figure A-1 for explanation of symbols.

Log of Boring B-7

GeoEngineers

Project: Tacoma Art Museum - Expansion Project
Project Location: Tacoma, Washington
Project Number: 7822-001-04

Figure A-3
Sheet 1 of 1

Tacoma: Date:5/23/13 Path:P:\7\782200104\GINT\782200104.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_STANDARD

Site 2A

RECEIVED
JUL 06 2010
WA State Department of Ecology (SWRO)

Site Hazard Assessment
Worksheet 1
Summary Score Sheet

SITE INFORMATION

Name: Sound Transit Depot Partnership Property
Address: 1548 Pacific Ave
City: Tacoma **County:** Pierce **State:** WA **Zip:** 98402
Section/Township/Range: 01 / 20N / 03E
Latitude: 47.24778 **Longitude:** -122.4375
Facility Site ID Number: 74455879

Site assessed/ranked for the August update

Site Description (Include management areas, substances of concern, and quantities):

General Site Description

The subject site consists of one-third acre, irregular five-sided polygon shaped parcel zoned for "commercial use," in the City of Tacoma. *Pacific Avenue* is the property's east border and *South 17th Street* provides the southern border, beyond these borders are properties zoned for "mixed use". *Jefferson Avenue* serves as the subject parcels north border, and *Commerce Street* serves as its west border. Beyond these borders are commercial use zoned properties. The entire surface of the site is covered by an impervious surface (concrete). The property's current primary use is as a "right-of-way" for the City of Tacoma's Linked Light Rail System.

Subsurface conditions at the property consist of clayey, gravelly sand and silty clay. Groundwater was encountered at approximately eleven to twelve feet below ground surface (11-12ft bgs).

Groundwater is assumed to flow down gradient and easterly, towards the Thea Foss Waterway of Commencement Bay, Puget Sound. The Thea Foss Waterway lies approximately one thousand (1000) feet to the east.

Site History

The subject site has been used to dispense fuel and as a service station since 1940. Prior to 1940 the site was used for a variety of commercial purposes. Seven underground storage tanks (USTs) were removed in 1990. Approximately eight hundred cubic yards of petroleum contaminated soil (~800yd^3 of PCS) were removed at this time and three new ten thousand gallon USTs were placed to the north of the former UST excavation area.

In 1994 a three hundred and fifty (350) gallon waste oil UST was discovered and removed with approximately one hundred (100) cubic yards of PCS from the south side of the former store building.

During the 1990 and 1994 UST removal projects excavation bottom and sidewall samples were collected. Additional soil and initial groundwater samples were collected in 1999 on behalf of Sound Transit. Thirteen (13) soil borings were advanced and at least two samples were taken from each, from depths ranging between two and twelve feet, to investigate contaminant mobility. Twelve (12) groundwater samples were collected from the borings. Laboratory analysis included; TPH-gas (TPH-Gx), diesel (TPH-Dx) and oil (TPH-Oil) range hydrocarbons; benzene, toluene, ethylbenzene, xylenes (BTEX Compounds); ethylene dibromide (EDB); Methyl Tertiary Butyl Ether (MTBE), and/or lead (Pb). The data was used to estimate the extent and location of residual petroleum contamination to guide the Cleanup Action Plan (CAP).

The laboratory analysis of the 1999 soil and groundwater samples indicated that gasoline range hydrocarbons (TPH-Gx), BTEX Compounds and MTBE were present in one or more soil or groundwater samples above Model Toxics Control Act Method A Cleanup Levels for Unrestricted Land Use (MTCA-soil or MTCA-groundwater). Significant results are presented below in Table 1 and Table 2. The site layout and location of borings in depicted in Figure 1.

Table 1[1]

URS Soil Samples, 1999 (mg/kg)								
Sample ID	Depth (ft bgs)	TPH-Gx	MTBE	EDB	Benzene	Toluene	Ethylbenzene	Xylenes (total)
DPSB-3-5	5	**1300**	**1.8**	**<0.12**	**5.7**	**<**	**20**	**24.1**
DPSB-6-2	2	**260**	NA	NA	**2.3**	<	**8.3**	<
DPSB-7-2	2	**690**	**0.87**	**<0.15**	**15**	<	**15**	**88.9**
DPSB-7-7	7	**4400**	NA	NA	**16**	**300**	**85**	**460**
DPSB-8-2	2	**490**	**<0.29**	**<0.058**	**<0.29**	<	<	<
DPSB-8-7	7	**380**	NA	NA	**<0.28**	<	<	<
DPSB-10-7	7	**160**	NA	NA	**<0.28**	<	<	<
DPSB-11-2	2	**8400**	NA	NA	**3**	**13**	**100**	**400**
DPSB-11-7	7	**970**	NA	NA	**0.91**	**23**	**17**	**116**
DPSB-13-7	7	**2700**	NA	NA	**1.1**	**100**	**60**	**311**
MTCA METHOD A		**100(30)**	**0.1**	**0.005**	**0.03**	**7**	**6**	**9**

[1] Data obtained from "URS Phase I Environmental Site Assessment and Phase II Sampling Results, 1548 Pacific Avenue, Tacoma, Washington", dated September 13, 1999

Table 2[2]

URS Groundwater Samples, 1999 (ug/l)							
Sample ID	TPH-Gx	EDB	MTBE	Benzene	Toluene	Ethylbenzene	Xylenes (total)
DPGW-3	18000	<1.0	<	1800	<	780	1390
DPGW-6	13000	NA	<100	4000	<	890	1590
DPGW-7	290,000	NA	NA	39,000	47,000	5900	28,600
DPGW-8	59,000	<1.0	<	<	<	<	<
DPGW-10	61,000	NA	NA	920	<	<	2480
DPGW-11	6,900,000	NA	33,000	66,000	320,000	110,000	600,000
DPGW-12	820	NA	140	450	<	<	<
MTCA METHOD A	1000(800)	0.01	20	5	1000	700	1000

The CAP was developed to remediate TPH and BTEX Compounds in soil by decommissioning the three active USTs, excavation of PCS and offsite treatment/disposal, placement of oxygen releasing compound (ORC®) to address any residual impacts, and backfilling the excavation with clean fill. In addition to the above specified site remediation actions, the abatement of asbestos containing materials (ACM), demolition of structures and pavement also occurred to prepare the site for inclusion in the City of Tacoma's Linked Light Rail System. The above activities were completed in October 2001.

URS worked with the Tacoma-Pierce County Health Department to investigate any impact that the USTs may have caused. Several exploratory trenches were dug in the areas noted in the 1999 analytical results. Contaminated soil was discovered and the extent of the excavation was increased. During this process a five hundred gallon waste-oil UST was discovered. In total three different areas were excavated at the subject site. The main area of excavation was the area where the three known 10,000 gallon USTs were located and decommissioned. An area referred to as the "trench-box excavation" ran along the Pacific Avenue border. Lastly, the "waste-oil UST excavation" was located at the approximate center of the site.

A total of 2,100 cubic yards of soil was excavated, 1,450 cubic yards were considered contaminated. Analytical soil samples were collected from the sidewalls and bottoms of the various excavations. Groundwater seepage into the excavations was pumped and contained. With approval from the City of Tacoma, the water was discharged to the sanitary sewer. Approximately 19,500 gallons of groundwater was discharged to the city sanitary sewer.

ORC® was applied to areas of the excavation that did not meet the substantive requirements of MTCA Method A CULs, and the excavation were then backfilled with clean imported fill and

[2] Data obtained from "URS Supplemental Phase II Soil and Groundwater Sampling, 1548 Pacific Avenue, Tacoma, Washington", dated January, 2000

crushed rock. Compaction and surface grading was performed to minimize pooling and facilitate run-off.

Thirteen confirmation samples were collected from the main area of excavation, seven from the sidewalls (NSW-5, NSW-8, NWSW-4, MWSW-5, MSSW-7, MESW-6, and SESW-6) three from the pit bottom (NTB-11, MTB-11, and STB-11), and three from the product piping bed (PP-1-1.5, PP2-2.5, and PP3-2.0). Four confirmation samples were collected from the trench-box excavation (NMESW-6, MMESW-7, SMESW-7, and SSESW-7). Four confirmation samples were collected from the waste-oil UST excavation area (NNSW3-5, WSW3-5, SSW3-5, and B3-8). Five confirmation samples were collected from the soil excavation to the east and southeast of the waste-oil UST excavation area (NSW2-5, WSW2-6, SSW2-5, ESW2-7, and B2-8). The confirmation soil samples were analyzed for TPH-Gx, TPH-Dx, TPH-Oil, MTBE, Pb, and BTEX compounds. Significant results from the confirmation soil samples collected by URS are presented below in Table 3.

Table 3[3]

URS Excavation Confirmation Soil Samples, 2001 (mg/kg)								
Sample ID	Depth (ft bgs)	TPH-Gx	MTBE	HVOCS	Benzene	Toluene	Ethylbenzene	Xylenes (total)
NSW-5	5	<	<	NA	**0.25**	<	<	<
MESW-6	6	**1300**	<	NA	**1**	<	**6.9**	<
NWSW-4	4	**2000**	**1.5**	NA	**0.95**	<	<	<
PP-1-1.5	1.5	<	**0.27**	NA	<	<	<	<
PP2-2.5	2.5	**320**	<	NA	**0.67**	<	<	<
PP3-2	2	<	**0.27**	NA	<	<	<	<
NMESW-6	6	**820**	**0.3**	NA	**2.3**	<	<	<
MMESW-8	8	**300**	<	NA	**0.31**	<	<	<
SMESW-7	7	**770**	<	NA	**0.69**	**8.3**	**9.2**	**47**
MTCA METHOD A		**100(30)**	**0.1**	**0.005**	**0.03**	**7**	**6**	**9**

[3] Data obtained from "URS Link Light Rail Project Environmental Remediation, Depot Partnership Property, 1548 Pacific Avenue, Tacoma, Washington", dated July 2002

In January 2001, the Central Puget Sound Regional Transit Authority applied for enrollment in Ecology's Voluntary Cleanup Program (VCP). On January 4, 2001 the subject site was also included in Ecology's Confirmed or Suspected Contaminated Sites List (CSCSL) database with a status of "awaiting SHA".

In July 2002, Puget Sound Transit Authority submitted a report titled "Link Light Rail Project Environmental Remediation, Deport Partnership Property, 1548 Pacific Ave, Tacoma, Washington".

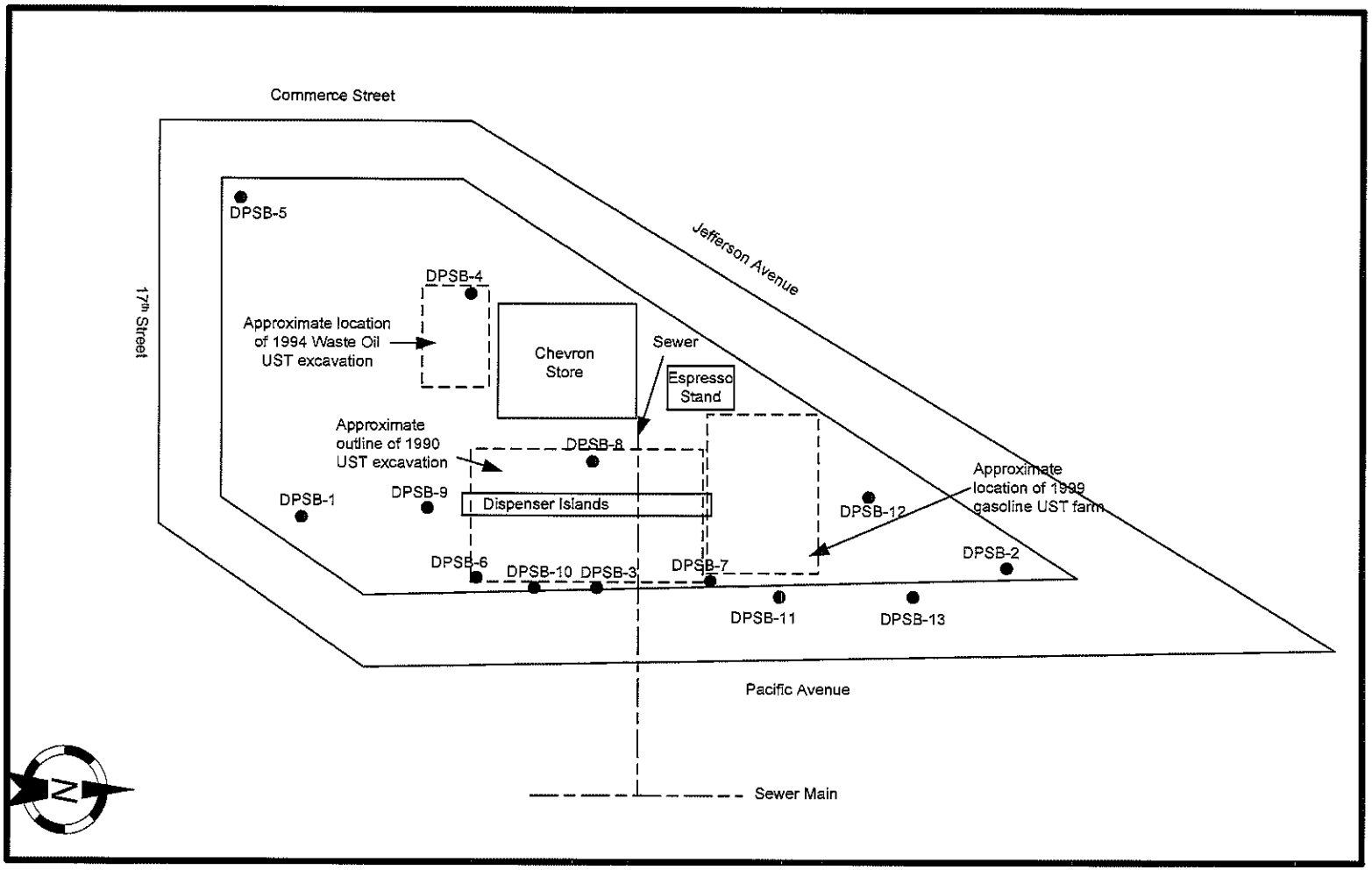
The report summarized the remaining contamination and did not recommend further remediation due to the minimal amount remaining and the location of the identified PCS.

On August 17 2005, Ecology issued an opinion letter stating that a "No Further Action" (NFA) could not be granted at this time. The letter summarizes these reasons for their opinion:

1. TPH-Gx, MTBE, and BTEX Compounds remain in the subsurface soils and shallow groundwater at the subject site.
2. The site is located above an aquifer that must be considered by Ecology as a drinking water aquifer. Groundwater data and continued monitoring would need to be performed to demonstrate that shallow and deep aquifers were not impacted and to determine the path of groundwater flow.

On August 27, 2007 Ecology issued a letter indicating that the subject site had been removed from the VCP due to inactivity.

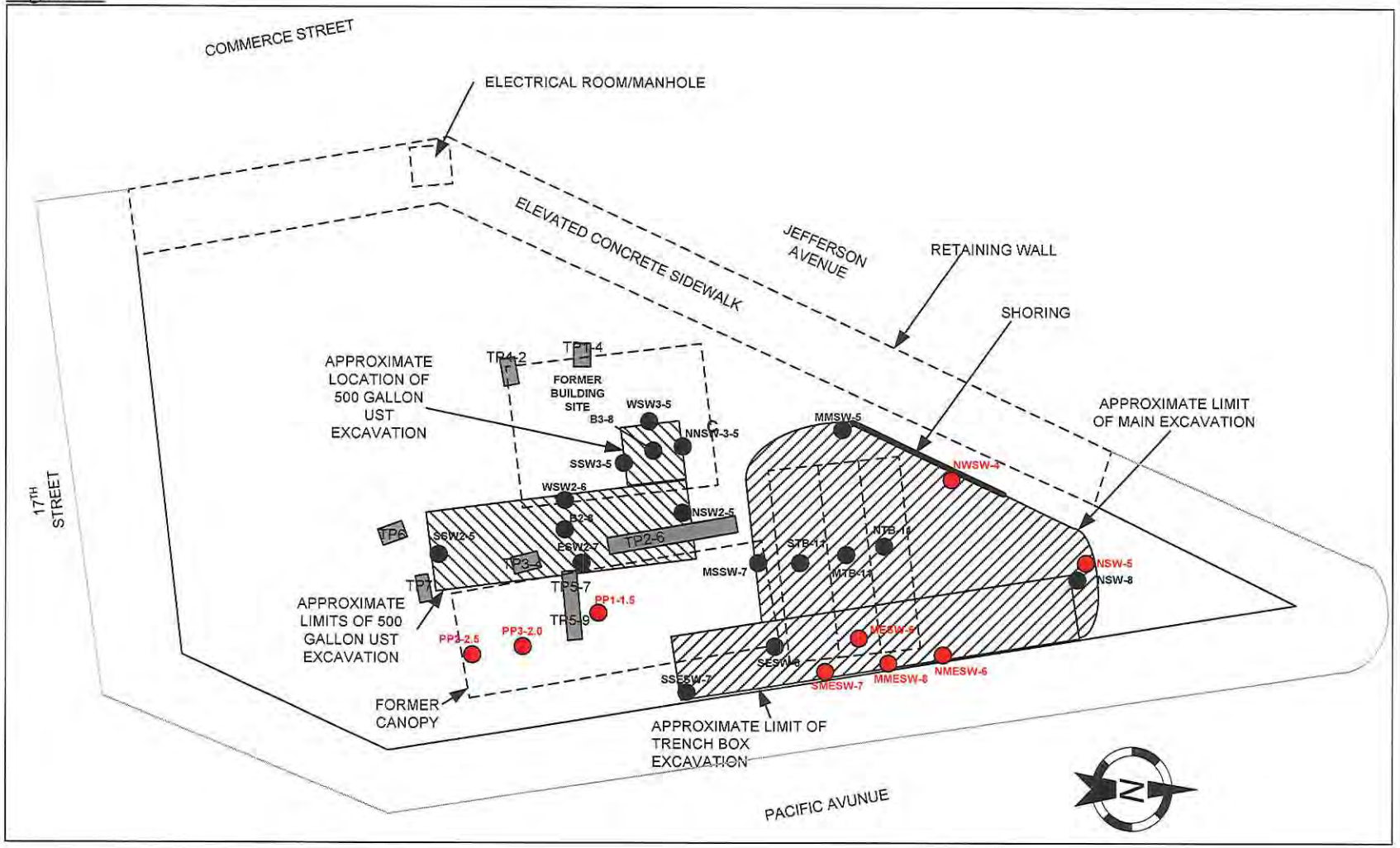
Figure 1[4]



[4] Site Diagram re-created from "URS Supplemental Phase II Soil and Groundwater Sampling, 1548 Pacific Ave, Tacoma, Washington", dated January2000.

Site 2A

Figure 2[5]



[5] Site Diagram re-created with edits from "URS Link Light Rail Project Environmental Remediation, Depot Partnership Property, 1548 Pacific Ave, Tacoma, Washington" dated July 2002.

Site 2A

Site 2A

Special Considerations (Include limitations in site file data or data which cannot be accommodated in the model, but which are important in evaluating the risk associated with the site, or any other factor(s) over-riding a decision of no further action for the site):

The scope of this Site Hazard Assessment did not include a hydrogeologic survey of the subject site and surrounding area. The groundwater contamination documented or inferred at the subject site is therefore considered to have the potential to impact any well located within the prescribed 2-mile radius and all such wells were used in the scoring process.

ROUTE SCORES:

Surface Water/Human Health:	**NS**	Surface Water/Environ.	**NS**
Air/Human Health:	**NS**	Air/ Environmental:	**NS**
Ground Water/Human Health:	**79.4**		

OVERALL RANK: 2

Site 2C

Tacoma | Pierce County
Health Department
Healthier. Safer. Smarter.
tpchd.org

Governed by a Local Board of Health

RECEIVED
JUN 20 2007
Washington State
Department of Ecology

June 18, 2007

Rick Fuller
City of Tacoma Public Works
Environmental Services
2201 Portland Ave.
Tacoma, WA 98421

RE: Site Hazard Assessment Completion

Dear Mr. Fuller:

The Tacoma-Pierce County Health Department has completed the Site Hazard Assessment (SHA) of the Tacoma City Convention Center Garage located at 1500 Broadway, Tacoma, WA 98402, as required under the Model Toxics Control Act. This site's hazard ranking, an estimation of the potential threat to human health and/or the environment, relative to all other Washington state sites assessed at this time, has been determined to be a ***5***. The ranking scale is 1 to 5, 1 representing the highest relative risk and 5 the lowest relative risk.

For your information, Ecology will be publishing the ranking of this and other recently assessed sites in the ***August 22, 2007*** Special Issue of the Site Register. The site hazard ranking will be used in conjunction with other site-specific considerations in determining Ecology's priority for future actions.

Please contact me at (253) 798-6566 if you have any questions relating to the SHA of your site. If you have inquiries/comments about the site scoring/ranking process, please call Michael Spencer, Ecology at (360) 407-7195. For inquiries regarding any further activities at your site now that it is on Ecology's Hazardous Sites List, please call Cris Matthews, Ecology at (360) 407-6388.

Sincerely,

Tony Ohrazda, RS
Environmental Health Specialist
Environmental Health Program

cc: Michael Spencer, Ecology
Cris Matthews, Ecology

Site Hazard Assessment
Worksheet 1
Summary Score Sheet

SITE INFORMATION

Name: **Tacoma City Convention Center Garage**
Address: 1500 Broadway
City: Tacoma, **County:** Pierce, **State:** WA **Zip:** 98402
Section/Township/Range: 04 / 20N / 03E
Latitude: 47° 14' 51.1"N **Longitude:** 122° 26' 23.5"W
Facility Site ID Number: 8168704

Site assessed/ranked for the August 22, 2007 update

Site Description (Include management areas, substances of concern, and quantities):

General Information

The subject site lies on a five acre parcel (APN: 2015060011), and serves as a multi-level parking garage for the Greater Tacoma Convention Center, and is known as the Tacoma Convention Center Garage (TCCG). Both the convention center and parking garage occupy the same parcel. The parcel is covered in impervious surfaces such as buildings and pavement. This Site Hazard Assessment will focus on tetrachloroethene (PCE) and petroleum hydrocarbon (TPH-Oil) groundwater contamination in the area of the parking garage footing drains.

The TCCG lies in a primarily commercial area of Tacoma at approximately one hundred feet (100') above sea level. The subject site is bordered on the north by a multiuse office building. Across "Court C", to the east, lies the Greater Tacoma Convention Center. To the south, across South 17th Street, are several University of Washington Buildings which includes: parking, housing and the University of Washington Pinkerton Building. Across Market Street to the west are a variety of structures including: Help A Vet offices, vacant land, parking, a single family dwelling, Tahoma Indian Center and law offices.

Subsurface Soil Conditions

The TCCG rests on Alderwood – Everett series soil. The Alderwood soil series can be described as moderately deep, moderately well drained soils formed in glacial till. The Everett soil series can be described as deep, somewhat excessively drained soils formed in glacial outwash or alluvium with an admixture of volcanic ash on terraces, moraines, and terrace escarpments.

Subsurface investigations performed by Environmental Science & Engineering, Inc. (ESE) in 1992 at another location (Pax Associates) approximately one hundred twenty five feet (125') to the northwest and resting at approximately one hundred sixty feet (160') above sea level describes the subsurface conditions as, "Sediments beneath the site from the surface to approximately eighteen feet (18') below ground surface (bgs) consist of unconsolidated sand and

gravel to silty sand and gravel. Sediments from approximately eighteen feet (18') bgs to twenty five feet (25') bgs consist of unconsolidated sand. A silt layer was identified at approximately twenty five feet (25') bgs which is the maximum depth drilled at this site. Saturated conditions were encountered in sediments from eight (8) to eighteen (18) feet bgs".

Site History

In September 2001, the construction of the Greater Tacoma Convention Center and TCCG began. Prior to 2001 the subject site was uncovered, paved auto parking.

In January 2005, the City of Tacoma reported to Ecology that sampling revealed contaminated groundwater coming from the footing drains of the TCCG. Reported analytical results indicated the presence of gasoline, oil and PCE.

Specifically, analytical results revealed PCE in the catch basin ranging in concentration from thirty one (31) to thirty five (35) ug/l and TPH-oil was discovered at 0.6 mg/l. A grab sample obtained from the catch basin was also analyzed for Free Product ID. Analytical results indicated that it was "a very good match to CRC Sta-Lube Extreme Pressure Anti-Seize Engine Assembly Lube with Moly-graphite Part #SL3331".

A sample was collected from the location where the connected storm-sewer line releases to the Thea Foss Waterway, Outfall 230. This sample was analyzed for petroleum hydrocarbons and results indicated concentrations of TPH-oil at 6.6 mg/l. Sample results are displayed in Table 1. Several other connections merge with the storm sewer line prior to its outfall, so it is impossible to determine based on the sample data what portion of the detected contamination is due to the subject site.

In February 2005, Tacoma-Pierce County Health Department (TPCHD) staff met with City of Tacoma staff to perform an Initial Investigation (II). Discussions revealed that when the garage was built, it was constructed so that the footing drains would channel groundwater away from the back wall which is sub-grade to Market Street.

The footing drains are connected to the storm-water catch basin at South 17th Street and Court C, via a smaller basin exclusively utilized by the TCCG footing drains.

Water was observed to be entering into the catch basin and was determined to be groundwater due to the lack of rainfall in several days.

All samples collected (except Outfall 230) were obtained from the smaller, exclusive to TCCG, basin. From this smaller basin the footing drain collected groundwater flows into the storm-water catch basin at South 17th Street and Court C.

In November 2005, the subject site was listed on Ecology's Confirmed and Suspected Contaminated Sites (CSCS) database with a site status of awaiting a site hazard assessment (SHA).

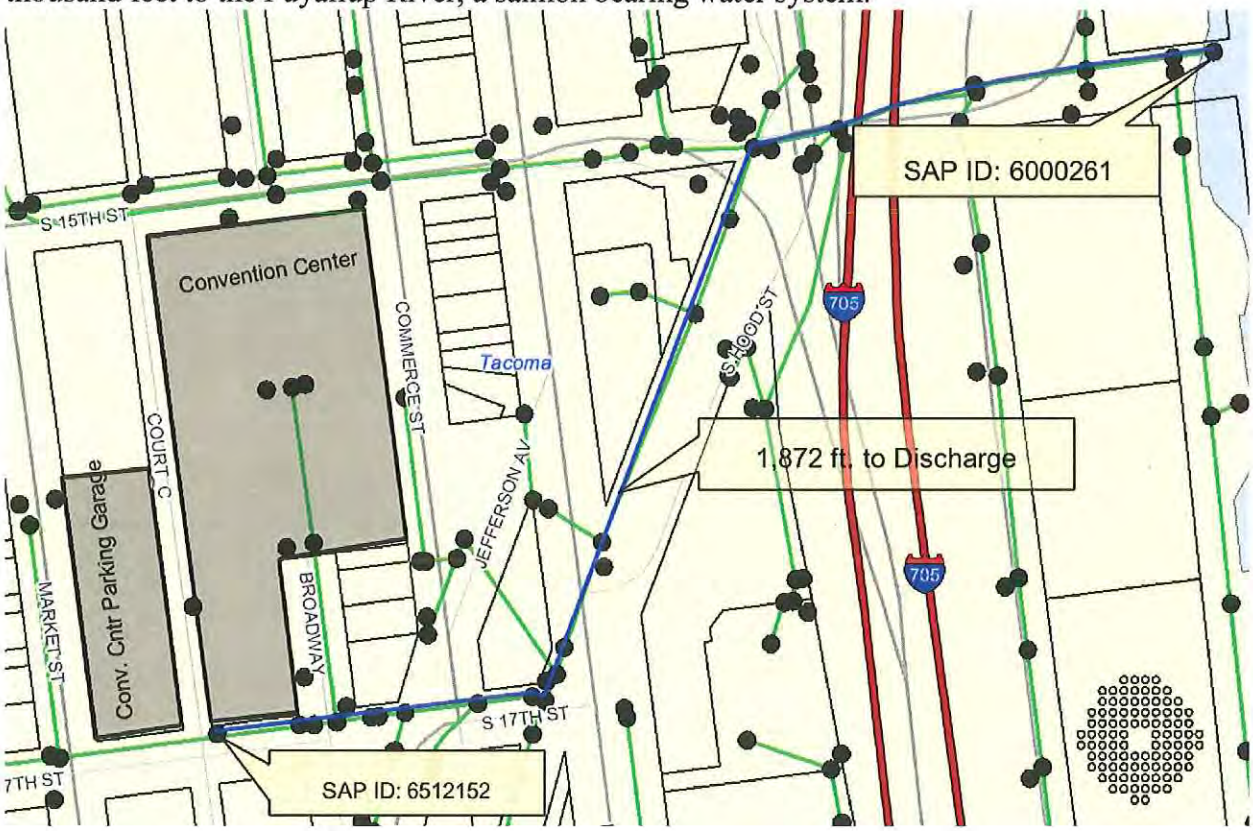
Site 2C

Table 1

Tacoma Convention Center Garage - Grab Samples							
Sample ID	**Date**	**Matrix**	**NWTPH-Gas (mg/l)**	**NWTPH - Diesel (mg/l)**	**NWTPH-Oil (mg/l)**	**PCE (ug/l)**	**Free Product ID**
17th & Court C	1.3.2005	Water	ND	ND	**0.6**	NA	NA
17th & Court C	1.5.2005	Water	ND	NA	NA	**31**	NA
17th & Court C Top of CB	1.6.2005	Water	ND	NA	NA	**34**	NA
17th & Court C Bottom of CB	1.6.2005	Water	ND	NA	NA	**35**	NA
Outfall 230	1.11.2005	Water	ND	ND	**6.6**	NA	NA
6-day Oil Pig	1.12.2005	Solid	ND	ND	ND	NA	NA
CB AT 17TH & Court C	1.14.05	Water	NA	NA	NA	NA	Engine Lube
MTCA Method A Cleanup Levels			**1**	**0.5**	**0.5**	**5**	**N/A**

Special Considerations (Include limitations in site file data or data which cannot be accommodated in the model, but which are important in evaluating the risk associated with the site, or any other factor(s) over-riding a decision of no further action for the site):

Contaminated groundwater detected on this site is collected in the City of Tacoma's storm sewer and travels approximately one thousand eight hundred and seventy two feet (1,872') to an outfall into the Thea Foss waterway of Commencement Bay. From the outfall it is approximately eight thousand feet to the Puyallup River, a salmon bearing water system.



Due to the significant contamination documented on-site being primarily subsurface, the surface water and air routes are not applicable for WARM scoring for this site. Thus, only the groundwater route will be scored.

ROUTE SCORES:

Surface Water/Human Health: **NS**

Surface Water/Environ. **NS**

Air/Human Health: **NS**

Air/ Environmental: **NS**

Ground Water/Human Health: **19**

OVERALL RANK: 5

SECTION 3. PRAIRIE LINE TRAIL/HOOD STREET/I-705 CORRIDOR (CUT AND COVER)

Geotechnical

GeoEngineers, Inc. 2014. Geotechnical Engineering Services, City of Tacoma Prairie Line Trail project, Phase 1A, South Hood Street, Tacoma, Washington. Prepared for BCRA, Inc. August 15, 2014.

Hart Crowser & Associates, Inc. 1983. Phase I Subsurface Explorations, Preliminary Seismic and Geotechnical Engineering Evaluation, Bridge Structures and Roadway: South 11th to South 15th Street, SR-705 Tacoma Spur. March 22, 1983.

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Zipper Zeman Associates, Inc. 2002. Draft Geotechnical Report, Proposed Hood Street Storm Sewer Replacement, Tacoma, Washington. Prepared for Cosmopolitan Engineering Group. April 23, 2002.

Environmental

Aspect Consulting, 2008. Site Map, Groundwater Elevations and Groundwater Chemistry, 1201 A Street, Tacoma, Washington. April 2008.

Aspect Consulting. 2005,2008. Appendix A Site Exploration Plan with Significant Historical Features, Cock Street North ROW (Hart Crowser, 2005; annotated Aspect Consulting, 2008).

Aspect Consulting. 2009. Table 1 – Groundwater Elevation Data, A Street Remediation, Tacoma, Washington. October 15, 2009.

Aspect Consulting. 2009. Table 2 – Analytical Results for Soil, A Street Remediation, Tacoma, Washington. October 15, 2009.

Aspect Consulting. 2009. Table 3 – Analytical Results for Groundwater – TPH-G/BTEX, A Street Remediation, Tacoma, Washington. October 15, 2009.

Aspect Consulting. 2009. Table 4 – Analytical Results for Groundwater – Other Analytes, A Street Remediation, Tacoma, Washington. October 15, 2009.

Aspect Consulting. 2009. Table 5 – Product Thickness and Recovery Data, A Street Remediation, Tacoma, Washington. October 15, 2009

GeoEngineers, Inc. 2014. Table 1 – May 2014 Soil Chemical Analytical Data, City of Tacoma – Prairie Line Trail, Tacoma, Washington. December 23, 2014.

GeoEngineers, Inc. 2014. Table 2 – November 2014 Soil Chemical Analytical Data, City of Tacoma – Prairie Line Trail, Tacoma, Washington. December 23, 2014.

GeoEngineers, Inc. 2014. Vicinity Map, City of Tacoma – Prairie Line Trail Phase 1A, Tacoma, Washington. December 23, 2014.

GeoEngineers, Inc. 2014. Site Plan – Subsurface Locations and Vertical Extent of Contaminated and Impacted Soil, City of Tacoma – Prairie Line Trail Phase 1A, Tacoma, Washington. December 23, 2014.

Landau Associates. 2014. Surface Topography and Geologic Cross Section Area, Sauro's Property RI/FS, Tacoma, Washington. August 26, 2014.

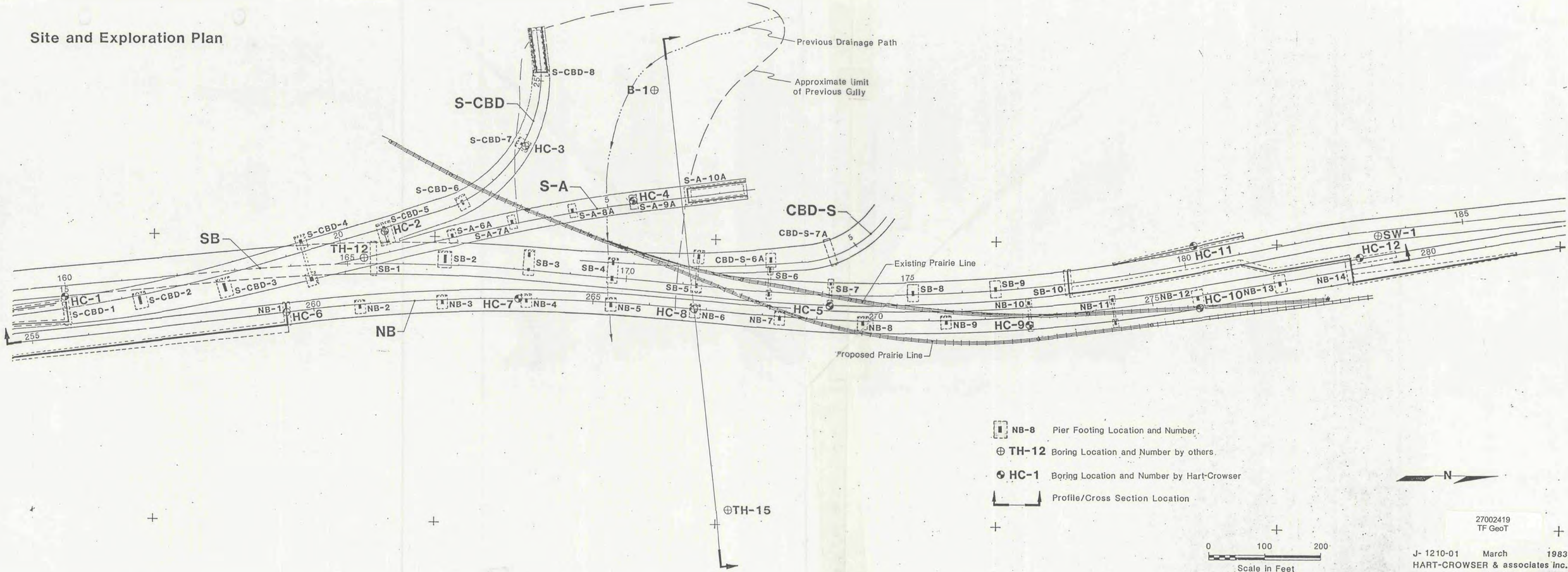
Landau Associates, 2017. Draft Technical Memorandum, Long-Term Groundwater Monitoring Status Report No. 3 for January 2017, Former Sauro's Cleanerama Site, Tacoma, Washington. March 9, 2017.

Robinson and Noble. 2005. 4th Quarter Groundwater Monitoring Report, 1501 Pacific Avenue, Tacoma, Washington. January 27, 2005

Washington State Department of Ecology. 2005. Washington State Department of Ecology's Review letter, United Way of Pierce County site, 1501 Pacific Avenue, Tacoma, Washington. March 7, 2005.

Geotechnical Reference Material

Site and Exploration Plan



NB-8 Pier Footing Location and Number

TH-12 Boring Location and Number by others

HC-1 Boring Location and Number by Hart-Crowser

Profile/Cross Section Location

N

0 100 200

Scale in Feet

27002419
TF GeoT

J- 1210-01 March 1983

HART-CROWSER & associates inc.

Figure

80000206

Boring Log HC-5 (Pier SB-7)

SOIL INTERPRETATION

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY TESTS

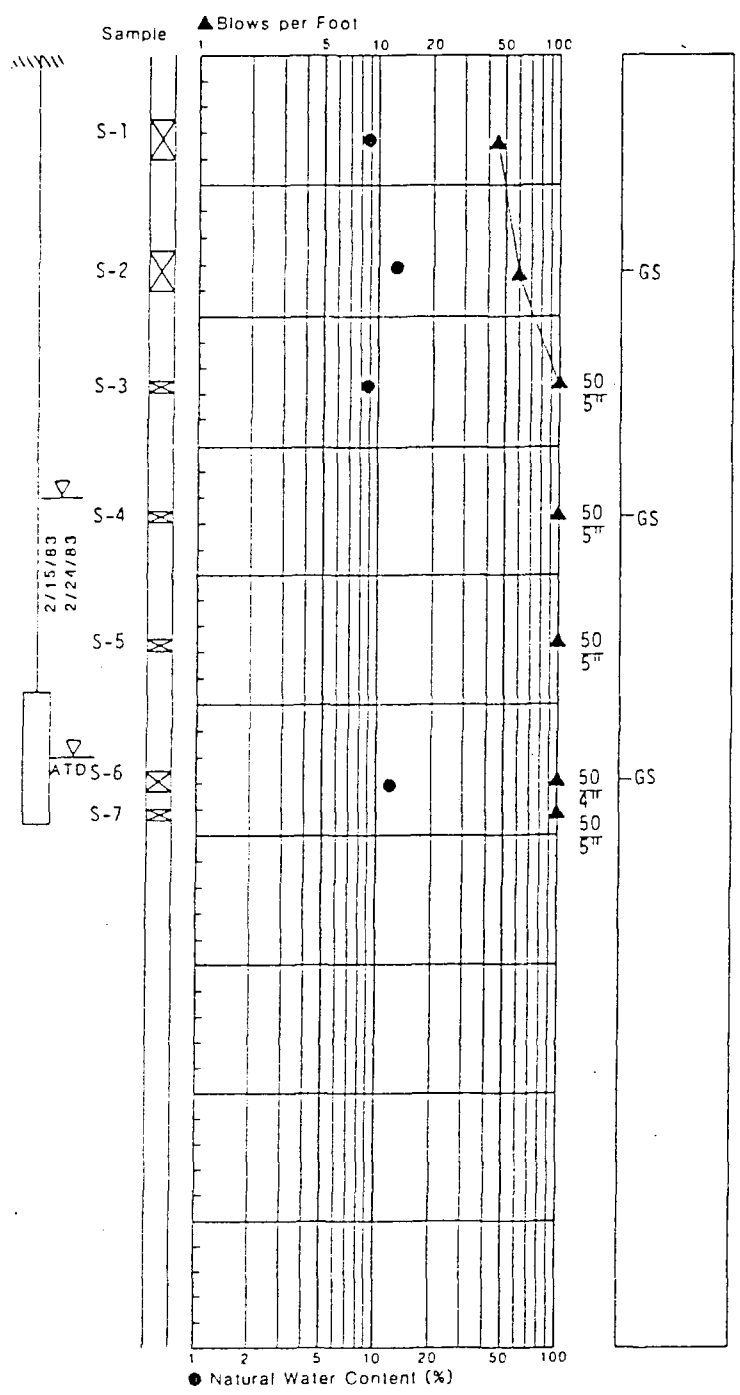
Approximate Ground Surface Elevation in Feet 27.4

Black, silty, gravelly SAND (FILL).

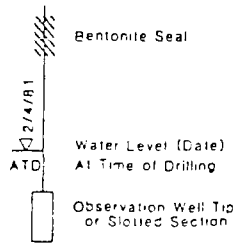
Dense to very dense, moist to wet, brown, silty, gravelly to very gravelly, fine to medium SAND with occasional coarse sand. Few clay nodules.

Very dense, wet and moist, oxidized brown and brown, slighty clayey, silty, very sandy GRAVEL.

Bottom of Boring at 29.5 Feet.
Completed 2/10/83.



Groundwater Level



Sampling

- 2" O.D. Split Spoon Sample
- 3" O.D. Shelby Tube Sample
- Cutting Sample
- ★ No Sample Recovery

Laboratory Tests

GS	Grain Size Analysis
CN	Consolidation Test
K	Permeability Test
DS	Direct Shear
QU	Unconfined Compression, tsf
TV	Torvane, tsf
PP	Pocket Penetrometer, tsf
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained

Water Content (%)

Plastic Limit — Natural Water Content — Liquid Limit

Notes

1. Soil descriptions are interpretive and *actual changes may be gradual.*
2. Water Level, if indicated, is for the date specified and may vary with the time of year.

27002430
TF GeoT

J-1210-01 March 1983

8000217

HART-CROWSER & associates inc.

Figure A-5

Boring Log HC-8 (Pier NB-6)

SOIL INTERPRETATION

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY TESTS

Approximate Ground Surface Elevation in Feet 13.0

Depth Feet

Sample

▲ Blows per Foot
1 5 10 20 50 100

- Washed GRAVEL (FILL).
- FILL
- Very dense, moist, brown and slightly oxidized, silty, very gravelly SAND.
- Very dense, moist, brown, slightly clayey, gravelly, very silty SAND.
- Very dense, wet, brown and black, slightly silty, very sandy GRAVEL to gravelly SAND. Gasoline odor in sample S-3.
- Slightly clayey.
- Very dense, wet, red brown and brown, sandy, clayey, very silty GRAVEL.
- Very dense, saturated, brown, trace to slightly clayey, slightly silty, very sandy GRAVEL and very gravelly SAND.

2/15/83 2/24/83 ATD

Sample	Blows per Foot	Lab
S-1		
S-2	50 / 6"	GS
S-3	50 / 5"	GS
S-4	50 / 6"	
S-5	50 / 3"	GS
S-6	50 / 5"	GS
S-7	50 / 4"	
S-8	50 / 5"	
S-9	50 / 5"	
S-10	50 / 6"	GS

0 5 10 15 20 25 30 35 40 45 50

1 2 5 10 20 50 100
● Natural Water Content (%)

SOIL INTERPRETATION

Depth Feet

Bottom of Boring at 52.7 Feet.
Completed 2/14/83.

50 55 60 65 70 75 80 85 90 95 100

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY TESTS

Sample

▲ Blows per Foot
1 5 10 20 50 100

Sample	Blows per Foot
S-11	50 / 2"

1 2 5 10 20 50 100
● Natural Water Content (%)

Groundwater Level

Bentonite Seal

2/14/83 ATD

Water Level (Date) At Time of Drilling

Observation Well Tip or Slotted Section

Sampling

- 2" O.D. Split Spoon Sample
- 3" O.D. Shelby Tube Sample
- Cutting Sample
- ★ No Sample Recovery

Laboratory Tests

GS	Grain Size Analysis	TUU	Triaxial Unconsolidated Undrained
CN	Consolidation Test	TCU	Triaxial Consolidated Undrained
K	Permeability Test	TCD	Triaxial Consolidated Drained
DS	Direct Shear		
OU	Unconfined Compression, tsf		
TV	Torvane, tsf		
PP	Pocket Penetrometer, tsf		

Water Content (%)

Plastic Limit — Natural Water Content — Liquid Limit

Notes

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level, if indicated, is for the date specified and may vary with the time of year.

27002433
TF GeoT

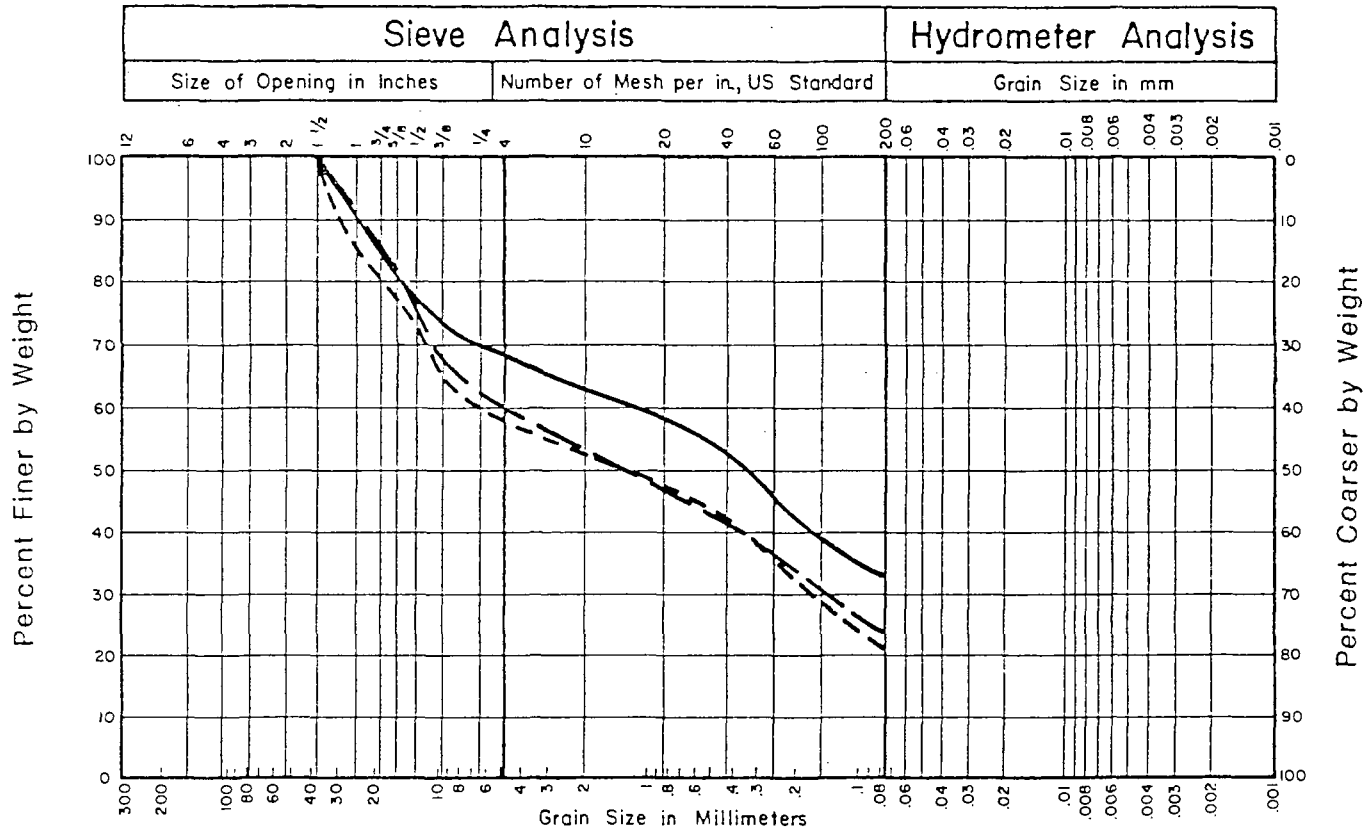
80000320

J-12-80 1983

HART-CROWSER & associates inc.

Figure A-8

Grain Size Classification



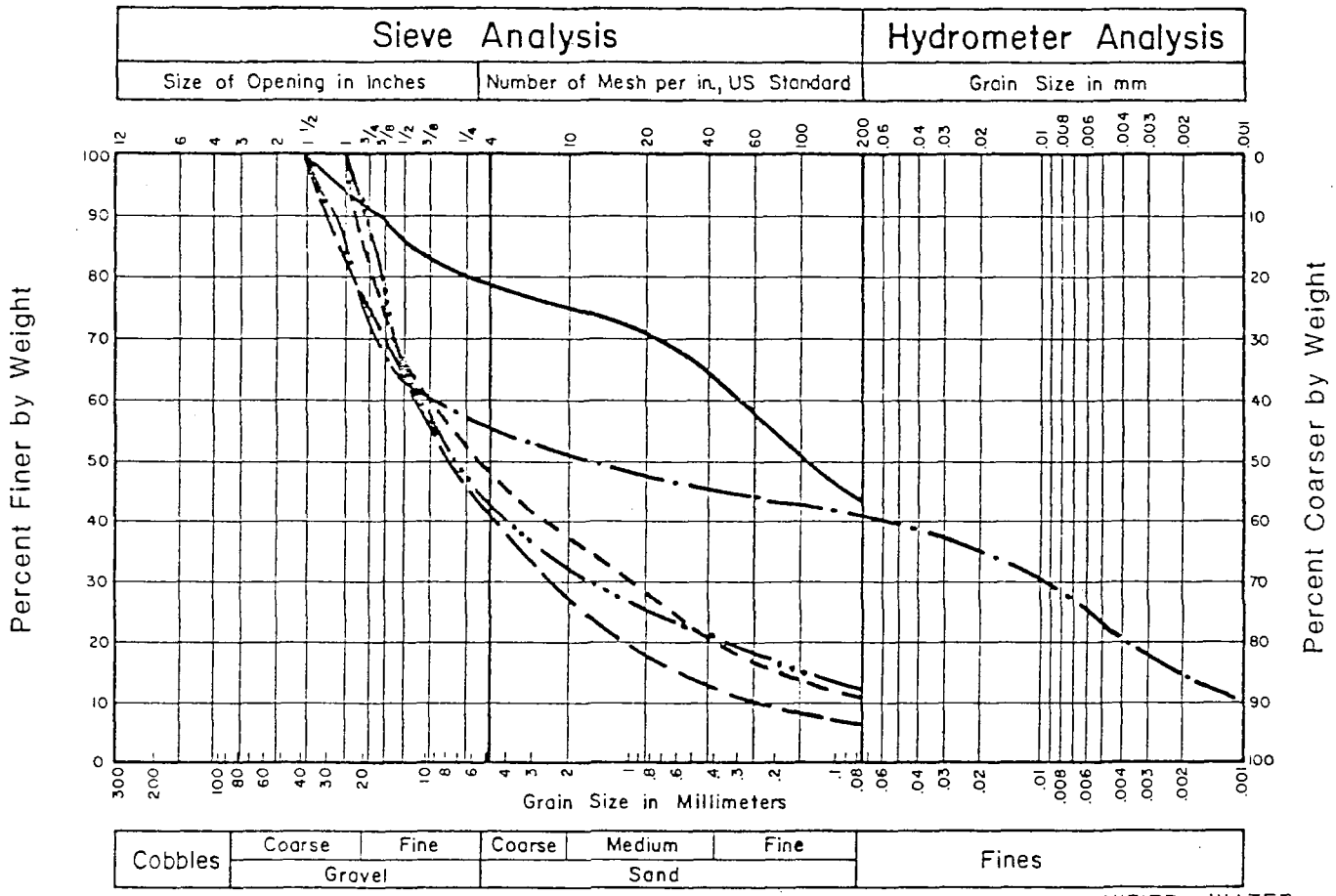
LINE SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH IN FEET	CLASSIFICATION	UNIFIED SOIL CLASS.	WATER CONTENT PERCENT
———	HC-5	S-2	7.5 - 9.0	Very gravelly, very silty SAND	SM	9
— — —	HC-5	S-4	17.5 - 18.0	Silty, very sandy GRAVEL	GM	9
— — — —	HC-5	S-6	27.5 - 28.5	Silty, very sandy GRAVEL	GM	10

27002447
TF GeoT

J-1210-01 March 1983
HART-CROWSER & associates, inc.
Figure B-7

80000231

Grain Size Classification

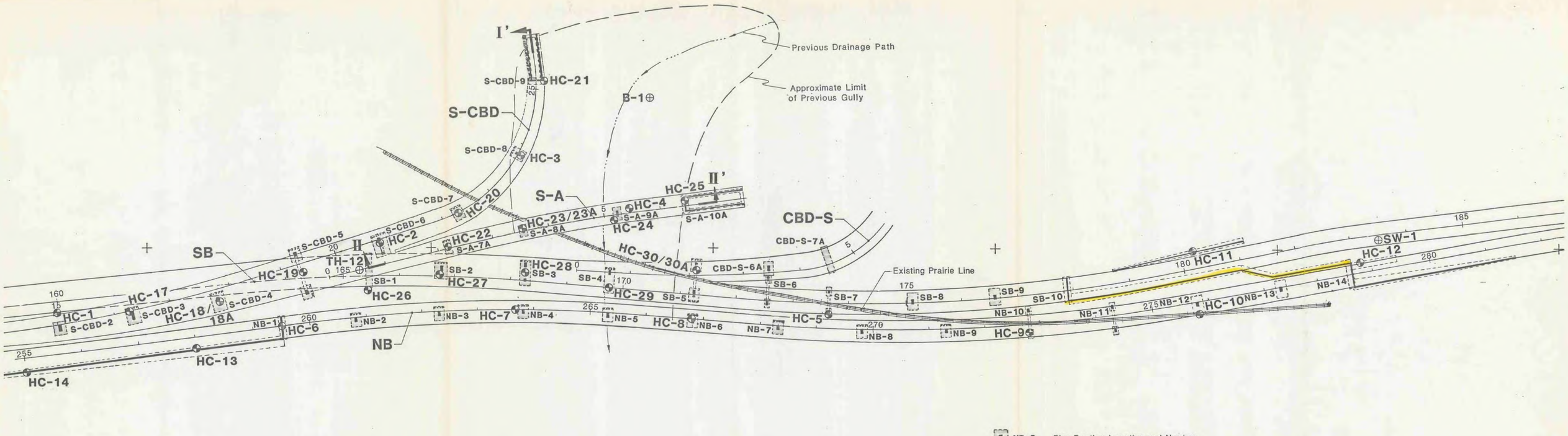


LINE SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH IN FEET	CLASSIFICATION	UNIFIED SOIL CLASS.	WATER CONTENT PERCENT
———	HC-8	S-2	7.5 - 8.5	Gravelly, very silty SAND	SM	16
— — —	HC-8	S-3	12.5 - 13.5	Slightly silty, very sandy GRAVEL	GM - GW	10
— — — —	HC-8	S-5	22.5 - 23.0	Slightly silty, very sandy GRAVEL	GM - GW	10
—·—	HC-8	S-6	27.5 - 28.5	Sandy, clayey, very silty GRAVEL	GM	29
—···—	HC-8	S-10	47.5 - 48.0	Slightly silty, very sandy GRAVEL	GM - GP	9

27002450
TF GeoT

J-1210-01 March 1983
HART-CROWSER & associates, inc.
Figure B-10

80000237



27009941
TF GeoT

J-1210-02 May 1983
HART-CROWSER & associates inc.
Figure 1

40003915

Boring Log HC-20 (Pier S-CBD-7)

SOIL INTERPRETATION

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY TESTS

Approximate Ground Surface Elevation in Feet **41**

Depth Feet

Sample

▲ Blows per Foot

0	Loose, moist, black, slightly gravelly, silty SAND with scattered massive, tan, clayey silt lenses. (FILL).
5	Very dense, moist, brown, slightly gravelly, fine to coarse SAND with scattered mottled dark brown to tan silt lenses.
10	*Very dense, moist, tan to brown, massive to laminated, fine sandy SILT.*
15	Very dense, moist, tan, fine to medium SAND with scattered dark brown silt lenses.
20	Very dense, moist to wet, brown, thinly interbedded, fine sandy SILT and slightly silty, fine to medium SAND.
25	Very dense, wet, gray, massive, fine to medium SAND with a trace of gravel.
30	Very dense, wet, thinly interbedded, gray, silty, fine to medium SAND and tan to brown, laminated, fine sandy SILT.
35	Bottom of Boring at 38.4 Feet. Completed 4/19/83.
40	
45	
50	

ATD

S-1 S-2 S-3 S-4 S-5 S-6 S-7 S-8

GS GS

50/6"

85/11"

1 2 5 10 20 50 100

● Natural Water Content (%)

Groundwater Level

Bentonite Seal

2/4/81 ATD

Water Level (Date) At Time of Drilling

Observation Well Tip or Slotted Section

Sampling

- 2" O.D. Split Spoon Sample
- 3" O.D. Shelby Tube Sample
- Cutting Sample
- ★ No Sample Recovery

Laboratory Tests

GS	Grain Size Analysis
CN	Consolidation Test
K	Permeability Test
DS	Direct Shear
QU	Unconfined Compression, tsf
TV	Torvane, tsf
PP	Pocket Penetrometer, tsf
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained

Water Content (%)

Plastic Limit — Natural Water Content — Liquid Limit

Notes

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level, if indicated, is for the date specified and may vary with the time of year.
3. Water contents not determined for gravelly or very small samples.

J-1210-02 May 1983

HART-CROWSER & associates inc.

Figure A-11

27009962
TF GeoT
40002935

Boring Log HC-23/23A (Pier S-A-8A)

SOIL INTERPRETATION

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY TESTS

Approximate Ground Surface Elevation in Feet 38.5

Depth Feet

Medium dense, moist, mottled black, gravelly, silty SAND (FILL).

Loose, wet, mottled tan to brown, gravelly, silty SAND with scattered organics (FILL).

Very dense, moist, brown, slightly gravelly, silty, fine SAND.

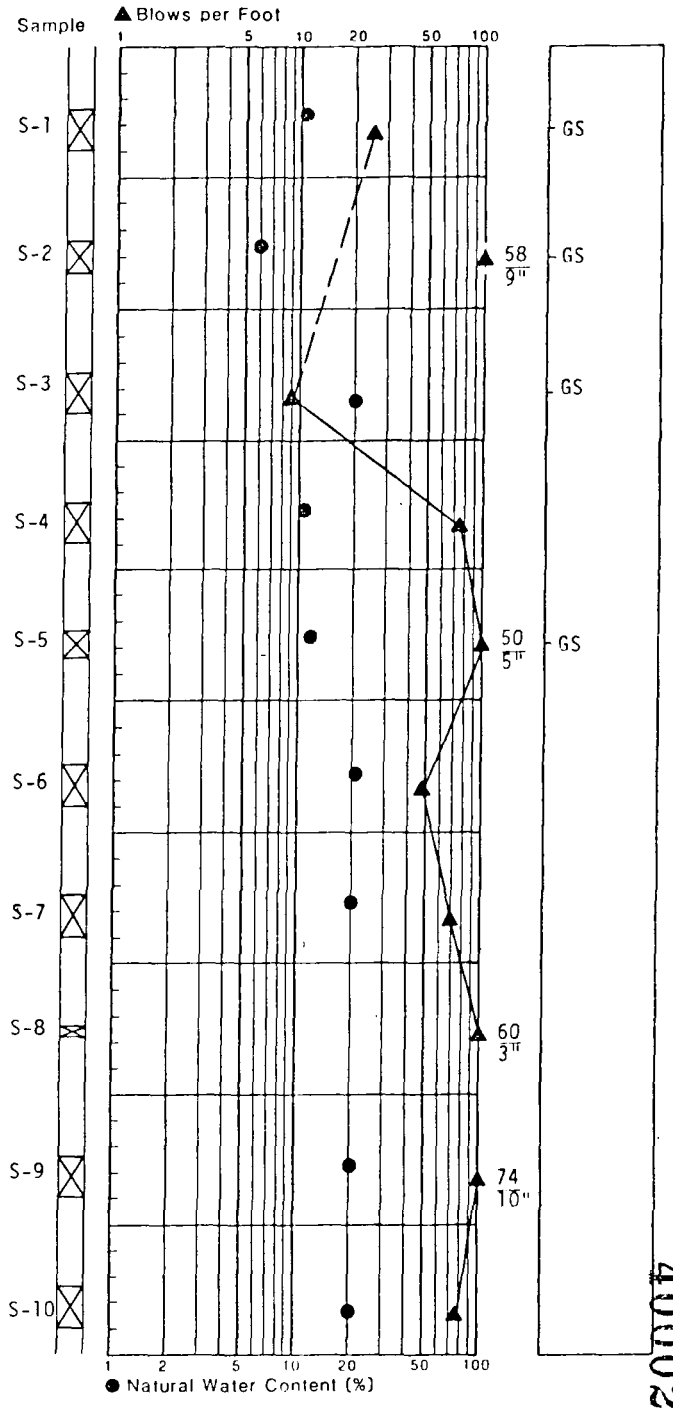
Very dense, wet to saturated, gray to brown, slightly silty, fine to medium SAND with scattered GRAVEL.

Very dense, saturated, brown to gray, very gravelly, fine to coarse SAND to very sandy, fine GRAVEL.

Very dense, wet to saturated, tan to brown, fine sandy SILT.

grades coarser with fine to medium SAND interbeds

Bottom of Boring at 49.0 Feet.
Completed 4/20/83.
Note: Auger refusal at 9 feet in HC-23. Moved drill rig 10 feet south and completed Boring HC-23A.



Groundwater Level

Bentonite Seal

2/4/81 ATD — Water Level (Date) At Time of Drilling

Observation Well Tip or Slotted Section

Sampling

- 2" O.D. Split Spoon Sample
- 3" O.D. Shelby Tube Sample
- Cutting Sample
- * No Sample Recovery

☐ High blow count may be due to drilling obstruction, not considered to reflect actual density conditions.

Laboratory Tests

GS	Grain Size Analysis
CN	Consolidation Test
K	Permeability Test
DS	Direct Shear
OU	Unconfined Compression, tsf
TV	Torvane, tsf
PP	Pocket Penetrometer, tsf
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained

Water Content (%)

Plastic Limit — Natural Water Content — Liquid Limit

Notes

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level, if indicated, is for the date specified and may vary with the time of year.
3. Water contents not determined for gravelly or very small samples.

J-1210-02 May 1983

HART-CROWSER & associates inc.

Figure A-14

27009965
TF GeoT

40002938

Boring Log HC-30/30A (Pier SB-5)

SOIL INTERPRETATION

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY TESTS

Approximate Ground Surface Elevation in Feet 33

Depth Feet

FILL

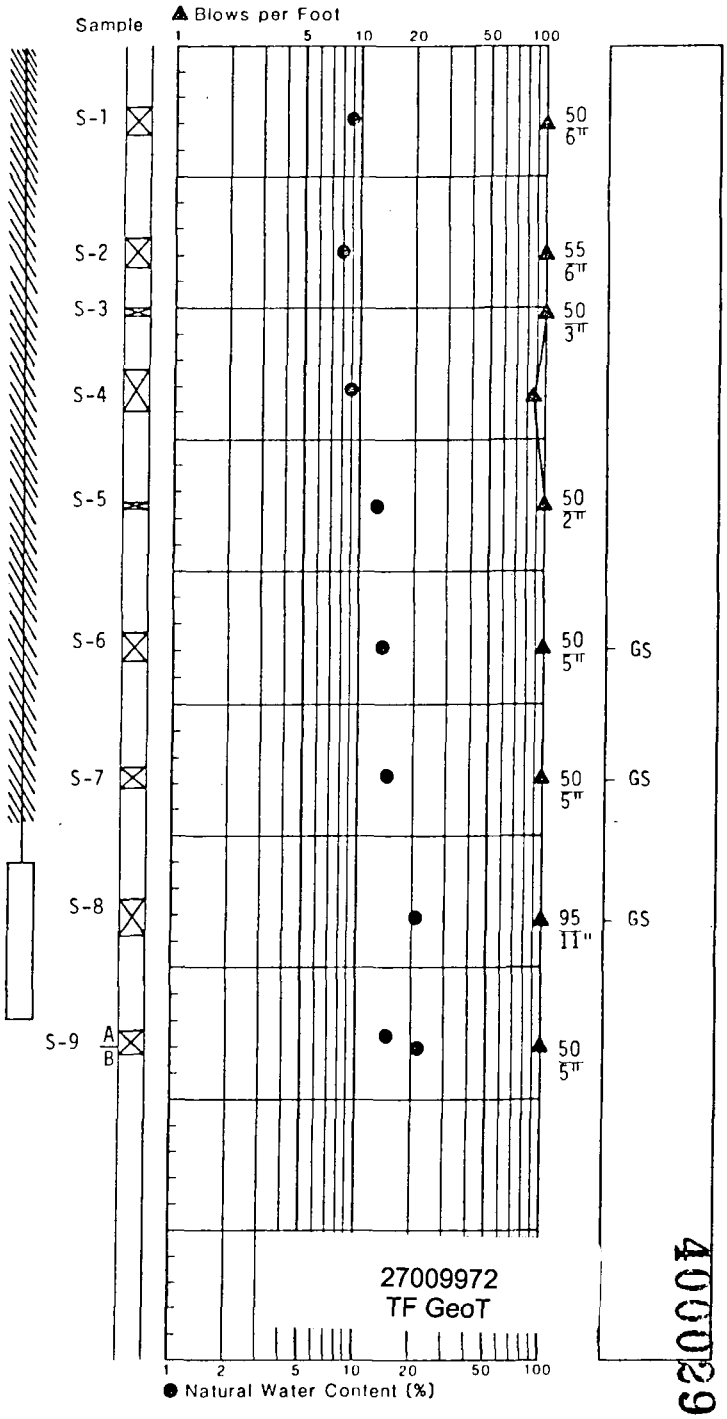
Very dense, moist, brown, silty, gravelly to very gravelly, fine to medium SAND.

slightly gravelly

Very dense, wet, brown, trace gravelly to gravelly fine sandy SILT.

Bottom of Boring at 38.4 Feet.
Completed 4/29/83.

Note: Auger refusal at 10.0 feet in HC-30. Moved drill rig six feet south and completed HC-30A.



40002945

Groundwater Level

Bentonite Seal

2/4/81 ATD — Water Level (Date) At Time of Drilling

Observation Well Tip or Slotted Section

Sampling

- 2" O.D. Split Spoon Sample
- 3" O.D. Shelby Tube Sample
- Cutting Sample
- * No Sample Recovery

Laboratory Tests

GS	Grain Size Analysis
CN	Consolidation Test
K	Permeability Test
DS	Direct Shear
QU	Unconfined Compression, tsf
TV	Torvane, tsf
PP	Pocket Penetrometer, tsf
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained

Water Content (%)

Plastic Limit — Natural Water Content — Liquid Limit

Notes

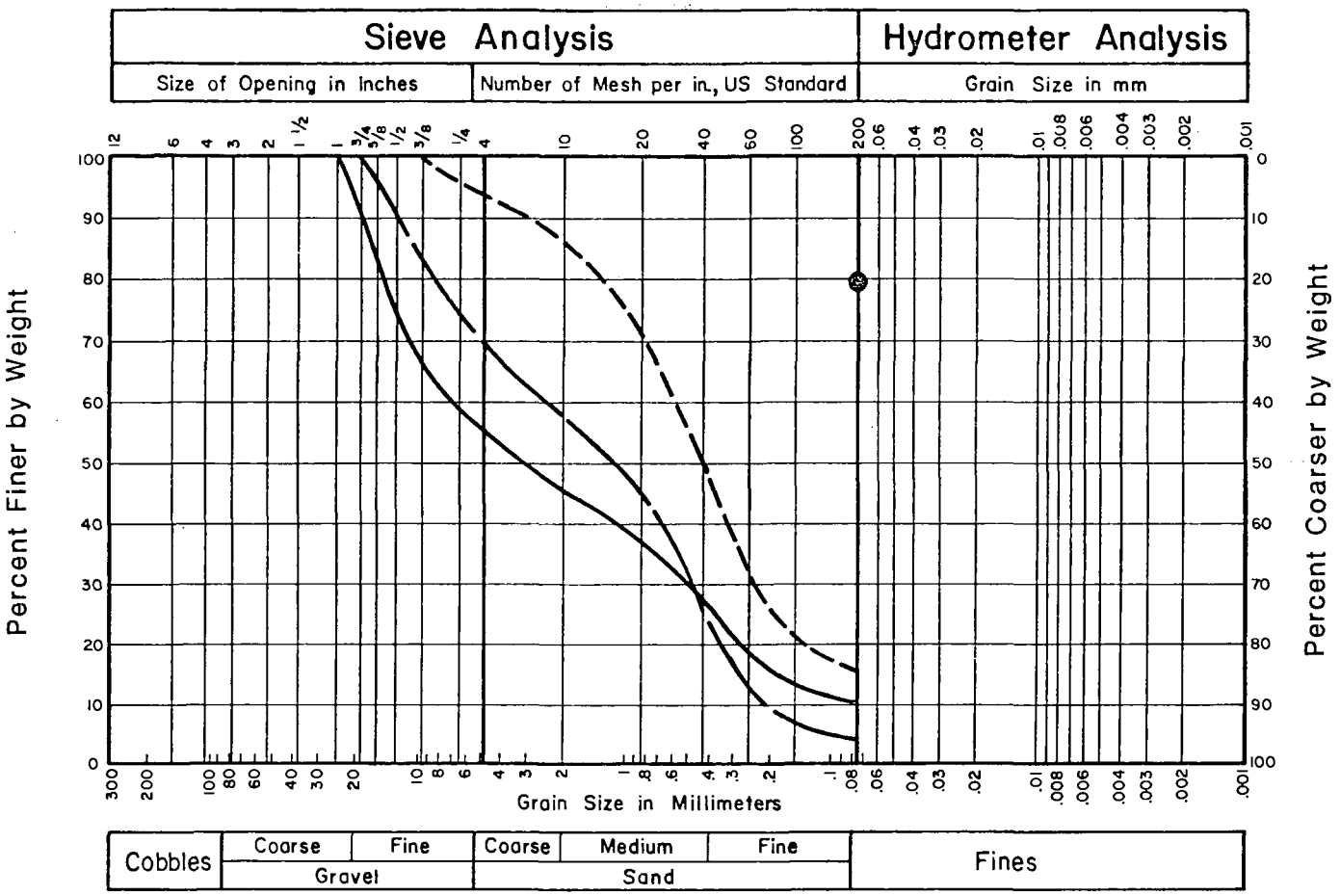
1. *Soil descriptions are interpretive and actual changes may be gradual.*
2. Water Level, if indicated, is for the date specified and may vary with the time of year.
3. **Water contents not determined for gravelly or very small samples.**

J-1210-02 May 1983

HART-CROWSER & associates inc.

Figure A-21

Grain Size Classification



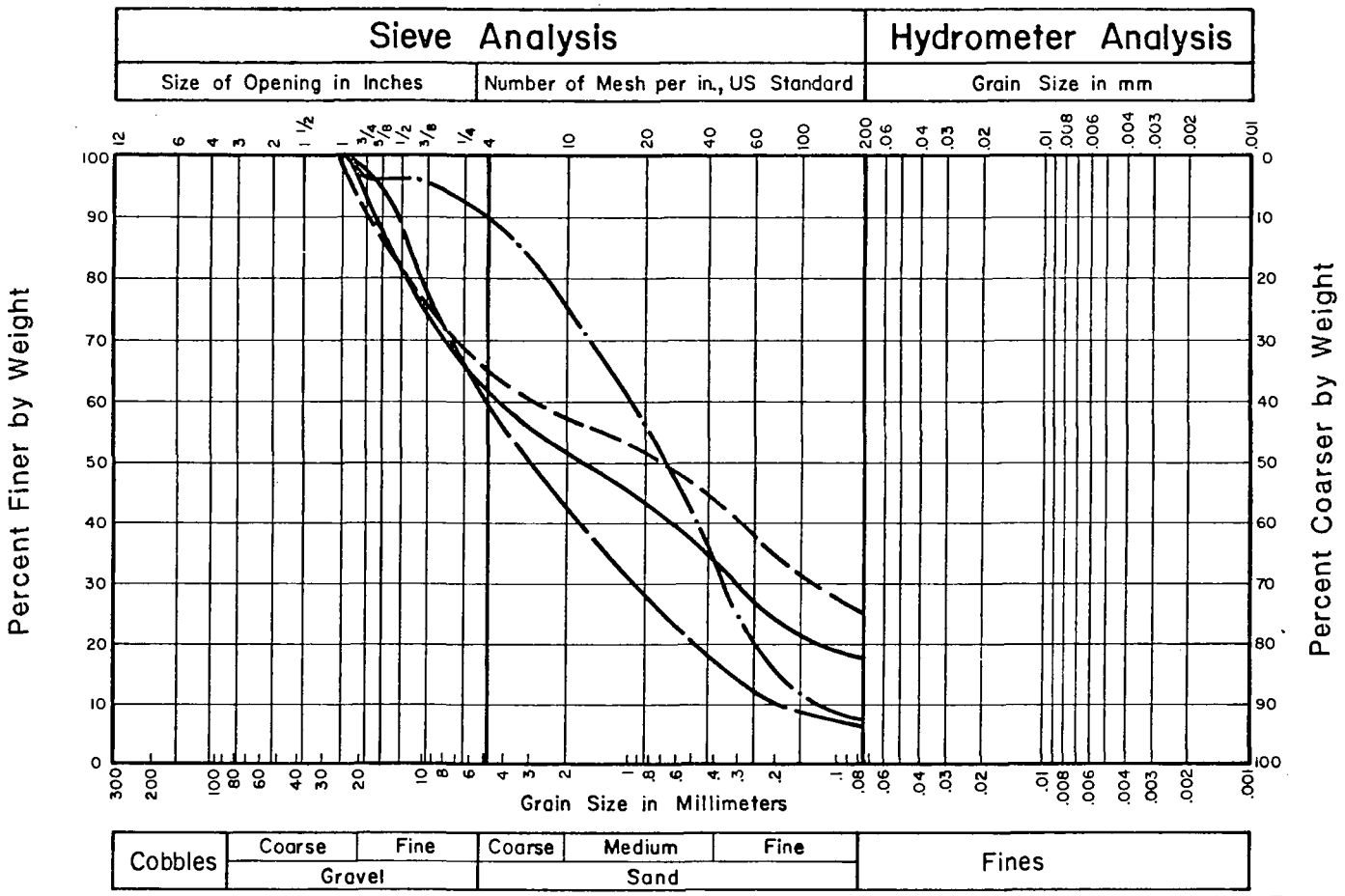
LINE SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH IN FEET	CLASSIFICATION	UNIFIED SOIL CLASS.	WATER CONTENT PERCENT
———	HC-19	S-2	7.5 - 9.0	Slightly silty, gravelly SAND	SM-SP	14
— —	HC-19	S-3	12.5 - 13.5	Slightly silty, gravelly SAND	SM - SP	11
— — — —	HC-20	S-2	7.5 - 9.0	Slightly gravelly, silty SAND	SM	12
●	HC-20	S-3	12.5 - 14.0	Fine sandy SILT	ML	22

27009979
TF GeoT

J-1210-02 May 1983
HART-CROWSER & associates, inc.
Figure B-4

4000299

Grain Size Classification



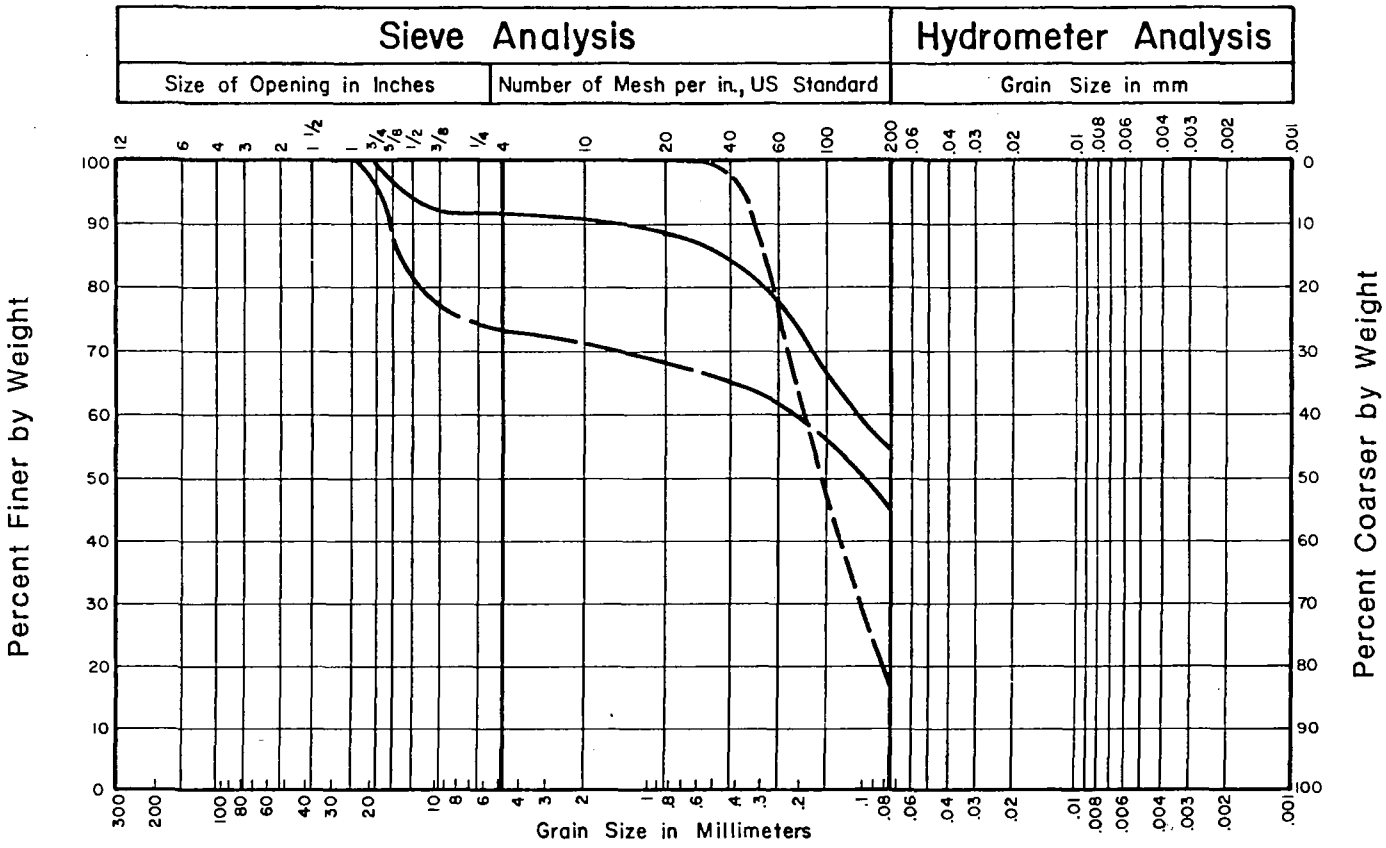
LINE SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH IN FEET	CLASSIFICATION	UNIFIED SOIL CLASS.	WATER CONTENT PERCENT
———	HC-23	S-1	2.5 - 4.0	Silty, gravelly SAND	SM	9
—— ——	HC-23	S-2	7.5 - 8.7	Slightly silty, gravelly SAND	SM - SP	6
– – – – –	HC-23	S-3	12.5 - 14.0	Silty, gravelly SAND	SM	15
——·——	HC-23	S-5	22.5 - 23.4	Slightly silty, slightly gravelly SAND	SP - SM	13

27009981
TF GeoT

J-1210-02 May 1983
HART-CROWSER & associates, inc.
Figure B-6

4000954

Grain Size Classification

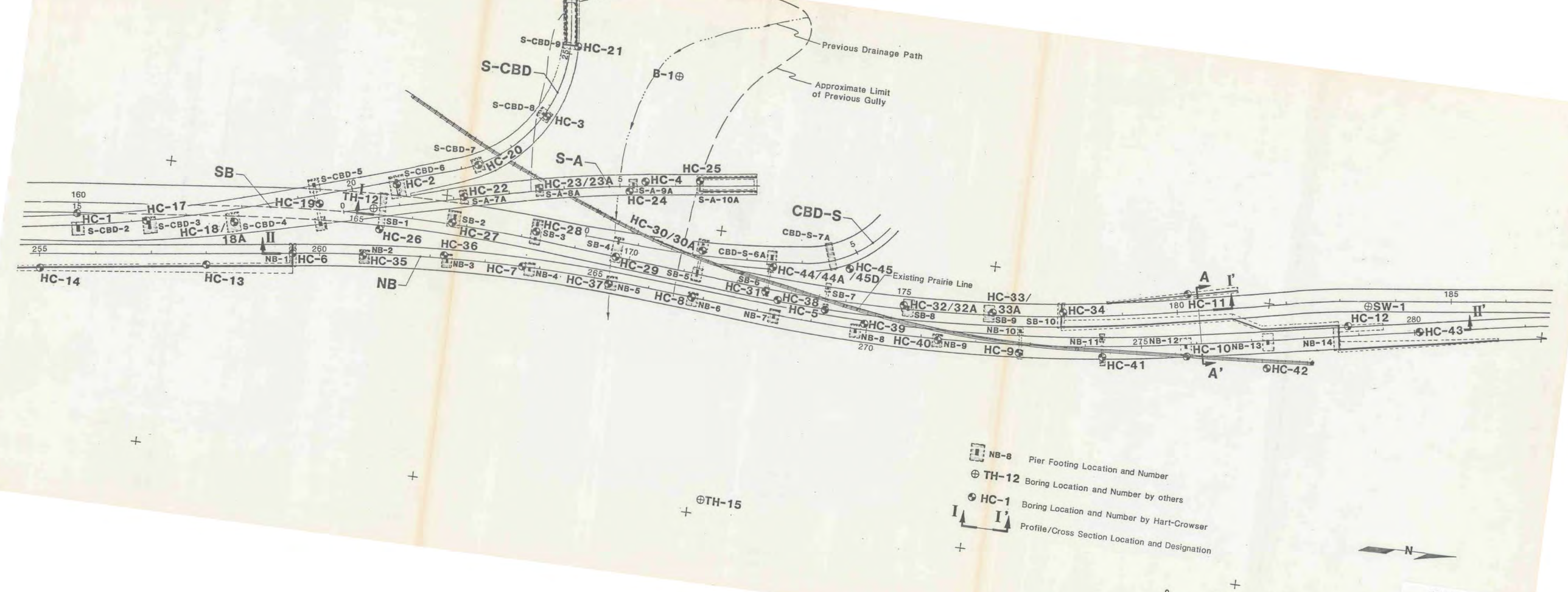


LINE SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH IN FEET	CLASSIFICATION	UNIFIED SOIL CLASS.	WATER CONTENT PERCENT
———	HC-30	S-6	22.5 - 23.4	Slightly gravelly, sandy SILT	ML	19
— — —	HC-30	S-7	27.5 - 28.4	Gravelly, silty, medium to fine SAND	SM	16
— — — —	HC-30	S-8	32.5 - 33.9	Silty, fine SAND	SM	21

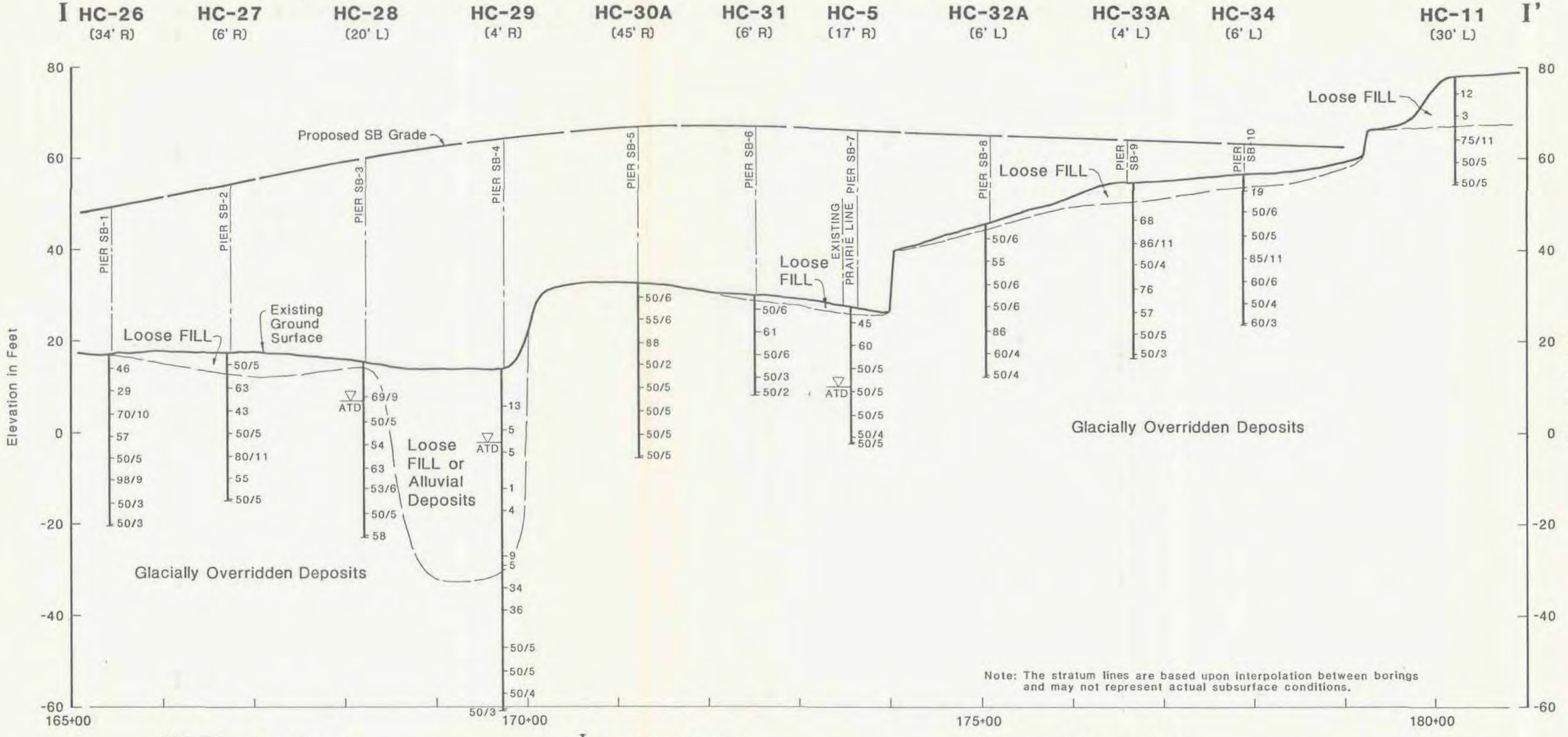
27009987
TF GeoT

J-1210-02 May 1983
HART-CROWSER & associates, inc.
Figure B-12

4000296


S-CBD-9
HC-21
S-CBD
S-CBD-8
HC-3
S-CBD-7
HC-20
S-A
HC-25
SB
S-CBD-5
S-CBD-6
HC-2
HC-22
S-A-7A
HC-23/23A
S-A-8A
HC-4
S-A-9A
HC-24
S-A-10A
HC-17
HC-19
TH-12
HC-1
S-CBD-2
S-CBD-3
HC-18/18A
S-CBD-4
SB-1
SB-2
HC-26
HC-27
HC-28
SB-3
SB-4
HC-30/30A
CBD-S
CBD-S-7A
CBD-S-6A
HC-44/44A
HC-45/45D
Existing Prairie Line
HC-14
HC-13
NB-1
HC-6
NB-2
HC-35
HC-36
NB-3
HC-7
NB-4
HC-37
NB-5
HC-8
HC-29
SB-5
SB-6
HC-31
HC-38
HC-5
NB-6
NB-7
SB-7
HC-32/32A
SB-8
HC-33/33A
SB-9
SB-10
HC-34
HC-39
NB-8
HC-40
NB-9
HC-9
NB-10
NB-11
NB-12
HC-10
NB-13
NB-14
HC-11
HC-12
SW-1
HC-43
HC-41
HC-42
NB
A
A'
I
I'
II
II'
B-1
Previous Drainage Path
Approximate Limit of Previous Gully
TH-15
NB-8 Pier Footing Location and Number
TH-12 Boring Location and Number by others
HC-1 Boring Location and Number by Hart-Crowser
Profile/Cross Section Location and Designation
N

Generalized Subsurface Profile I-I' (SB Alignment)



Note: The stratum lines are based upon interpolation between borings and may not represent actual subsurface conditions.

HC-26 Boring Number

(34' R) Offset Distance and Direction Looking Up-Station

46 Standard Penetration Resistance *N*-Value in Blows per Foot

ATD Water Level at Time of Drilling

Boring Location

0 100 200
Horizontal Scale in Feet

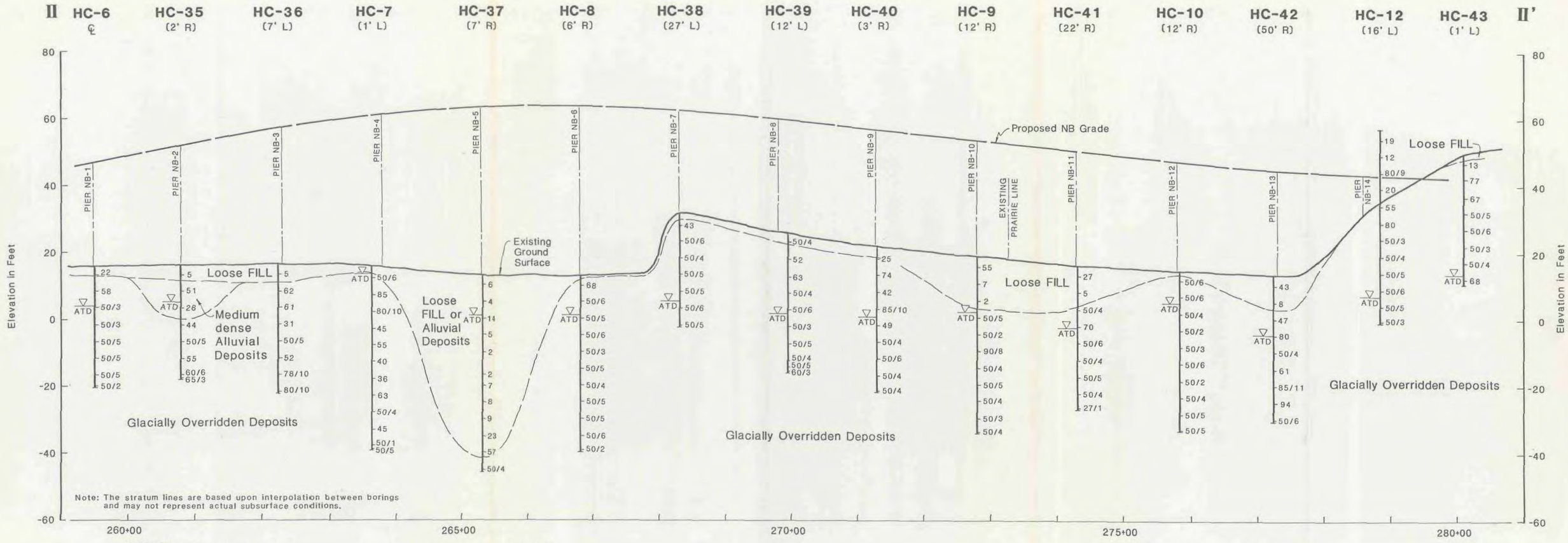
0 20 40
Vertical Scale in Feet

Vertical Exaggeration x 5

27009842
TF GeoT

J-1210-02 June 1983
HART-CROWSER & associates inc.
Figure 2

Generalized Subsurface Profile II-II' (NB Alignment)



Note: The stratum lines are based upon interpolation between borings and may not represent actual subsurface conditions.

HC-35 Boring Number

(2' R) Offset Distance and Direction Looking Up-Station

51 Standard Penetration Resistance N-Value in Blows per Foot

ATD Water Level at Time of Drilling

Boring Location

0 100 200
Horizontal Scale in Feet

0 20 40
Vertical Scale in Feet

Vertical Exaggeration x 5

27009843
TF GeoT

J-1210-02 June 1983
HART-CROWSER & associates inc.
Figure 3

J-1210-02

TABLE A-1 Piezometer Installation Summary (Phase II-A)

Boring/ Piezometer Installation Number	Ground Surface Elevation in Feet	Screen Section Elevation in Feet		Surface Seal Elevation in Feet		Downhole Seal Elevation In Feet		Water Elevation in Feet At Time of Drilling	Date of Installation	Remarks
		Top	Bottom	Top	Bottom	Top	Bottom			
HC-13	16.0	10	0	16	12			5.0	4/26/83	
HC-14	16.5	-10.5	-20.5	16.5	13				4/26/83	
HC-15	20.0	- 3	-13	20	15				4/26/83	Artesian
HC-16	20.0	- 9	-14	20	17			8.0	4/23/83	Artesian
HC-17	23.0	7	- 1	23	20				4/20/83	
HC-18A	26.0	- 1	-11	26	21				4/19/83	
HC-19	20.0	-11	-16	20	17			9.0	4/20/83	Artesian
HC-20	41.0	16	6	41	38			15.0	4/19/83	
HC-21	49.0	17	7	49	46			22.0	4/22/83	
HC-22	18.0	-27	-37	18	12			9.5	4/27/83	Artesian
HC-23A	38.5	- 3.5	- 8.5	38.5	35.5			12.5	4/20/83	
HC-24	38.0	-45	-50	38	34				4/21/83	
HC-25	46.0	29	19	46	43				4/22/83	
HC-26	17.5	-11.5	-17.5	17.5	14.5				4/23/83	Artesian
HC-27	18.0	- 9	-14	18	14				4/23/83	Artesian
HC-28	15.5	-11.5	-21.5	15.5	11.5			7.0	5/ 4/83	Artesian
HC-29	14.0	-43	-53	14	10	- 1	- 6	- 2.0	5/ 4/83	Artesian
HC-30A	33.0	2	- 4	33	30	30	3.5		4/29/83	

NOTES: 1. Details of observation well installation also shown graphically on boring logs.

2. Artesian levels indicate static groundwater levels above ground surface.

J-1210-02

TABLE A-1 Piezometer Installation Summary (Phase II-B)

Boring/ Piezometer Installation Number	Ground Surface Elevation in Feet	Screen Section Elevation in Feet		Surface Seal Elevation in Feet		Downhole Seal Elevation in Feet		Water Elevation in Feet At Time of Drilling	Date of Installation	Remarks
		Top	Bottom	Top	Bottom	Top	Bottom			
HC-31	30.0	13.5	8.5	30.0	26.0				4/29/83	
HC-32A	45.0	16.5	12.5	45.0	39.0				5/ 6/83	
HC-33A	54.0	22.5	18.5	54.0	49.0				5/ 6/83	
HC-34	56.5	29.5	24.5	56.5	51.5	35.5	32.0		5/ 6/83	
HC-35	16.5	- 6.0	-16.0	16.5	11.5			5.0	4/28/83	Artesian
HC-36	16.5	- 6.5	-16.5	16.5	11.5				4/28/83	Artesian
HC-37	13.0	-35.0	-40.0	13.0	8.0			0.5	5/ 5/83	
HC-38	31.0	3.0	0.0	31.0	28.0	28.0	10.0	5.0	5/ 2/83	
HC-39	26.0	-15.0	-17.0	26.0	21.0	21.0	- 8.0	1.5	5/ 3/83	
HC-40	21.5	-11.0	-16.0	21.5	16.5	16.5	- 5.5	0.5	5/ 4/83	
HC-41	16.0	-22.0	-27.0	16.0	12.0	12.0	-16.0	- 2.5	5/ 4/83	
HC-42	13.5	-25.0	-29.0	13.5	8.5	8.5	-18.5	- 4.5	5/ 3/83	
HC-43	49.5	18.0	13.0	49.5	44.5	34.5	27.5	13.5	5/ 5/83	
HC-44A	37.0	15.5	11.5	37.0	33.0	28.0	22.0		5/ 9/83	
HC-45D	63.0	19.0	16.0	63.0	60.0				5/22/83	

NOTES: 1. Details of observation well installation also shown graphically on boring logs.

2. Artesian levels indicate static groundwater levels above ground surface.

J-1210-02

TABLE A-2 Groundwater Level Observations (Phase II-A)

Boring/ Piezometer Installation Number	Ground Surface Elevation in Feet	Groundwater Elevation in Feet on Date Indicated													
		At Time of Drilling	4/23/83	4/26/83	4/27/83	4/28/83	4/29/83	5/2/83	5/3/83	5/4/83	5/6/83	5/9/83	5/16/83	6/6/83	
HC-13	16.0	5.0			12.5				12.2				12.4	12.0	
HC-14	16.5				8.6				8.6				7.6	8.0	
HC-15	20.0				25.2	25.5	25.5		25.2		25.3	25.4			
HC-16	20.0	8.0		21.7	23.1	24.3	25.3		27.7		28.4		28.4	28.4	
HC-17	23.0		15.1		15.2				15.0					14.9	
HC-18A	26.0		22.9		22.5				22.5					21.9	
HC-19	20.0	9.0	20.3		20.5				20.5					20.1	
HC-20	41.0	15.0	18.7						18.7				18.7		
HC-21	49.0	22.0	24.0							23.9			23.8	23.7	
HC-22	18.0	9.5						25.0	25.3				10.8	10.8	
HC-23A	38.5	12.5	18.2						18.1				17.9	18.1	
HC-24	38.0		32.5						32.1				31.1	30.8	
HC-25	46.0		Dry							Dry			21.6	Dry	
HC-26	17.5			22.0	22.0				21.8				21.6	21.4	
HC-27	18.0			21.5	21.5				21.4				21.4	21.2	
HC-28	15.5	7.0									17.5	20.8	20.4	20.6	
HC-29	14.0	-2.0									19.0	22.0	22.0		
HC-30A	33.0							8.5	8.4				8.0	7.9	

NOTES: 1. Groundwater level measurements reflect conditions at the time measurements were taken and they may vary with time.

2. Groundwater measurements with time also shown graphically on boring logs HC-1, HC-2 and HC-3.

27009856
TF GeoT

J-1210-02

TABLE A-2 Groundwater Level Observations (Phase II-B)

Boring/ Piezometer Installation Number	Ground Surface Elevation in Feet	Groundwater Elevation in Feet on Date Indicated											
		At Time of Drilling	5/2/83	5/3/83	5/4/83	5/5/83	5/6/83	5/9/83	5/16/83	6/6/83			
HC-31	30.0		Dry	Dry					Dry	Dry			
HC-32A	45.0							Dry	Dry	Dry			
HC-33A	54.0							Dry	18.8	18.3			
HC-34	56.5							Dry	Dry	Dry			
HC-35	16.5	5.0		20.2					20.1	19.4			
HC-36	16.5			22.2					22.2	22.2			
HC-37	13.0	0.5					- 9.4	- 7.5	- 4.7	0.5			
HC-38	31.0	5.0		7.0					6.1	6.0			
HC-39	26.0	1.5			6.0				5.4	5.1			
HC-40	21.5	0.5				6.5			5.9	6.0			
HC-41	16.0	- 2.5				6.4			6.0	6.1			
HC-42	13.5	- 4.5			8.5				8.3	8.1			
HC-43	49.5	13.5					15.0		14.4	14.1			
HC-44A	37.0								Dry	Dry			
HC-45D	63.0												

NOTES: 1. Groundwater level measurements reflect conditions at the time measurements were taken and they may vary with time.

2. Groundwater measurements with time also shown graphically on boring logs HC-5 through HC-10 and HC-12.

Boring Log HC-31 (Pier SB-6)

SOIL INTERPRETATION

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY TESTS

Approximate Ground Surface Elevation in Feet 29.7

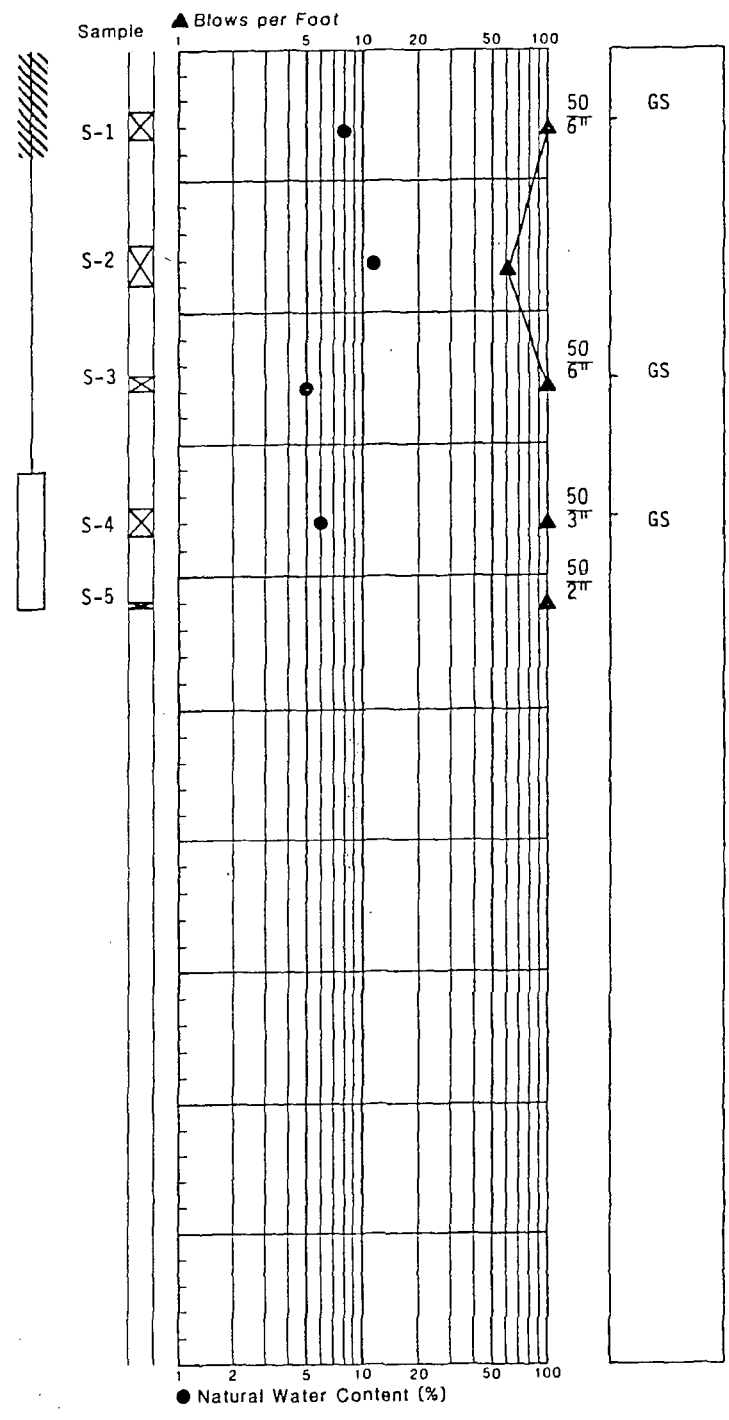
Loose, moist, black, gravelly, silty SAND (FILL).

Very dense, moist, brown, silty, gravelly SAND.

On rock.

Bottom of Boring at 21.2 Feet.
Completed 4/28/83.

Note: Auger refusal at 21.2 feet.



Groundwater Level

Bentonite Seal

2/4/81 ATD — Water Level (Date) At Time of Drilling

Observation Well Tip or Slotted Section

Sampling

- 2" O.D. Split Spoon Sample
- 3" O.D. Shelby Tube Sample
- Cutting Sample
- ★ No Sample Recovery

Laboratory Tests

GS	Grain Size Analysis
CN	Consolidation Test
K	Permeability Test
DS	Direct Shear
QU	Unconfined Compression, tsf
TV	Torvane, tsf
PP	Pocket Penetrometer, tsf
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained

Water Content (%)

Plastic Limit — Natural Water Content — Liquid Limit

Notes

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level, if indicated, is for the date specified and may vary with the time of year.
3. Water contents not determined for gravelly or very small samples.

J-1210-02 June 1983

HART-CROWSER & associates inc.

Figure A-14

27009876
TF GeoT

Boring Log HC-32/32A (Pier SB-8)

SOIL INTERPRETATION

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY TESTS

Approximate Ground Surface Elevation in Feet 45.0

Depth Feet

Loose, moist, black, gravelly, silty SAND with brick fragments (FILL).

Very dense, moist, brown, slightly silty, sandy GRAVEL.

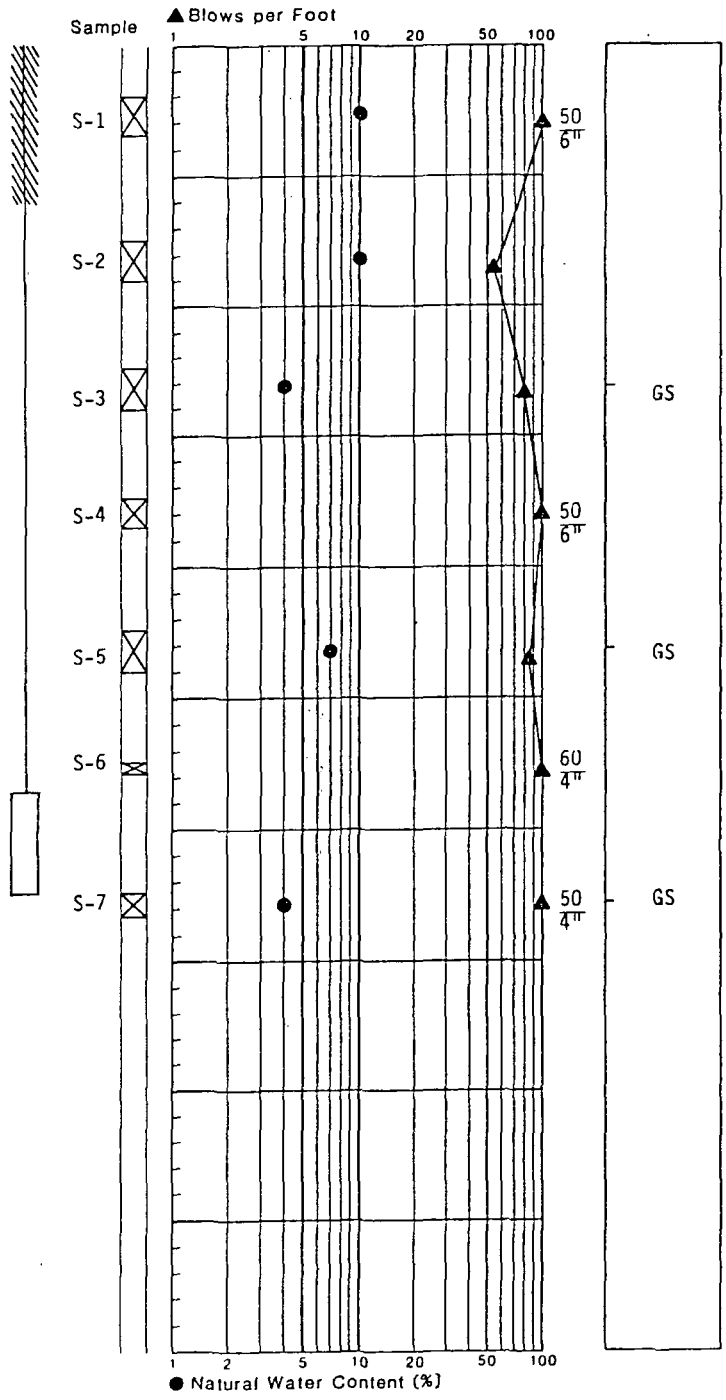
Silt interbeds.

Very dense, moist, brown, silty, gravelly SAND.

Slightly silty.

Bottom of Boring at 33.3 Feet.
Completed 5/6/83.

Note: Auger refusal at 5 feet, moved rig 5 feet south and completed boring HC-32A.



Depth Feet: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

Groundwater Level

Bentonite Seal

2/4/81 ATD — Water Level (Date) At Time of Drilling

Observation Well Tip or Slotted Section

Sampling

- 2" O.D. Split Spoon Sample
- 3" O.D. Shelby Tube Sample
- Cutting Sample
- ★ No Sample Recovery

Laboratory Tests

GS	Grain Size Analysis
CN	Consolidation Test
K	Permeability Test
DS	Direct Shear
QU	Unconfined Compression, tsf
TV	Torvane, tsf
PP	Pocket Penetrometer, tsf
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained

Water Content (%)

Plastic Limit — Natural Water Content — Liquid Limit

Notes

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level, if indicated, is for the date specified and may vary with the time of year.
3. Water contents not determined for gravelly or very small samples.

J-1210-02 June 1983

HART-CROWSER & associates inc.

Figure A-15

27009877
TF GeoT

Boring Log HC-38 (Pier NB-7)

SOIL INTERPRETATION

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY TESTS

Approximate Ground Surface Elevation in Feet 31.2

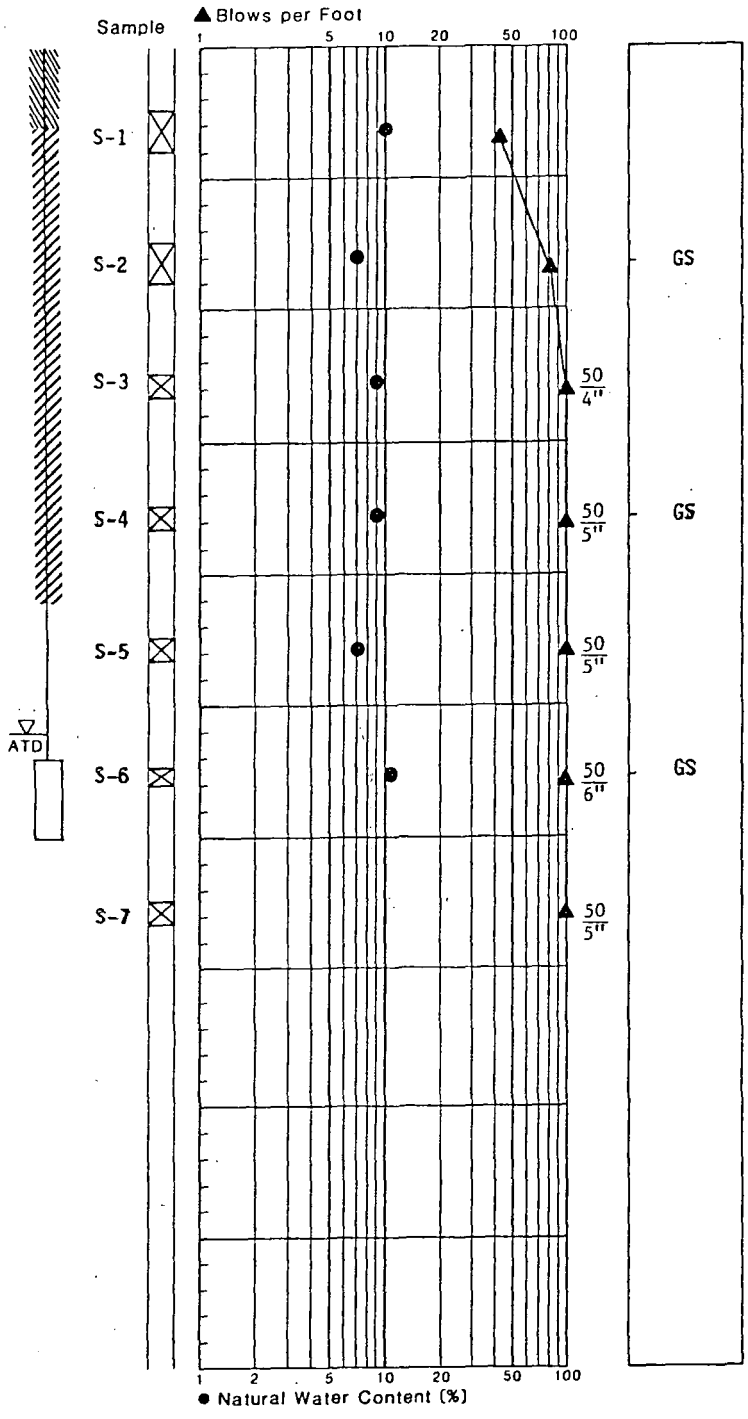
Depth Feet

Loose, moist, black-brown, gravelly, silty SAND (FILL).

Very dense, moist, brown, silty, gravelly SAND to sandy GRAVEL.

Very dense, saturated, borwn, slightly silty, sandy GRAVEL

Bottom of Boring at 33.4 Feet.
Completed 5/2/83.



Groundwater Level

Bentonite Seal
Downhole Seal
2/4/83 ATD Water Level (Date) At Time of Drilling
Observation Well Tip or Slotted Section

Sampling

2" O.D. Split Spoon Sample
3" O.D. Shelby Tube Sample
Cutting Sample
★ No Sample Recovery

Laboratory Tests

GS	Grain Size Analysis
CN	Consolidation Test
K	Permeability Test
DS	Direct Shear
QU	Unconfined Compression, tsf
TV	Torvane, tsf
PP	Pocket Penetrometer, tsf
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained

Water Content (%)

Plastic Limit — Natural Water Content — Liquid Limit

Notes

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level, if indicated, is for the date specified and may vary with the time of year.
3. Water contents not determined for gravelly or very small samples.

J-1210-02 June 1983
HART-CROWSER & associates inc.
Figure A-21

27009884
TF GeoT

Boring Log HC-39 (Pier NB-8)

SOIL INTERPRETATION

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY TESTS

Approximate Ground Surface Elevation in Feet 25.8

Depth Feet

FILL

Very dense, moist, brown, silty, gravelly to very gravelly SAND.

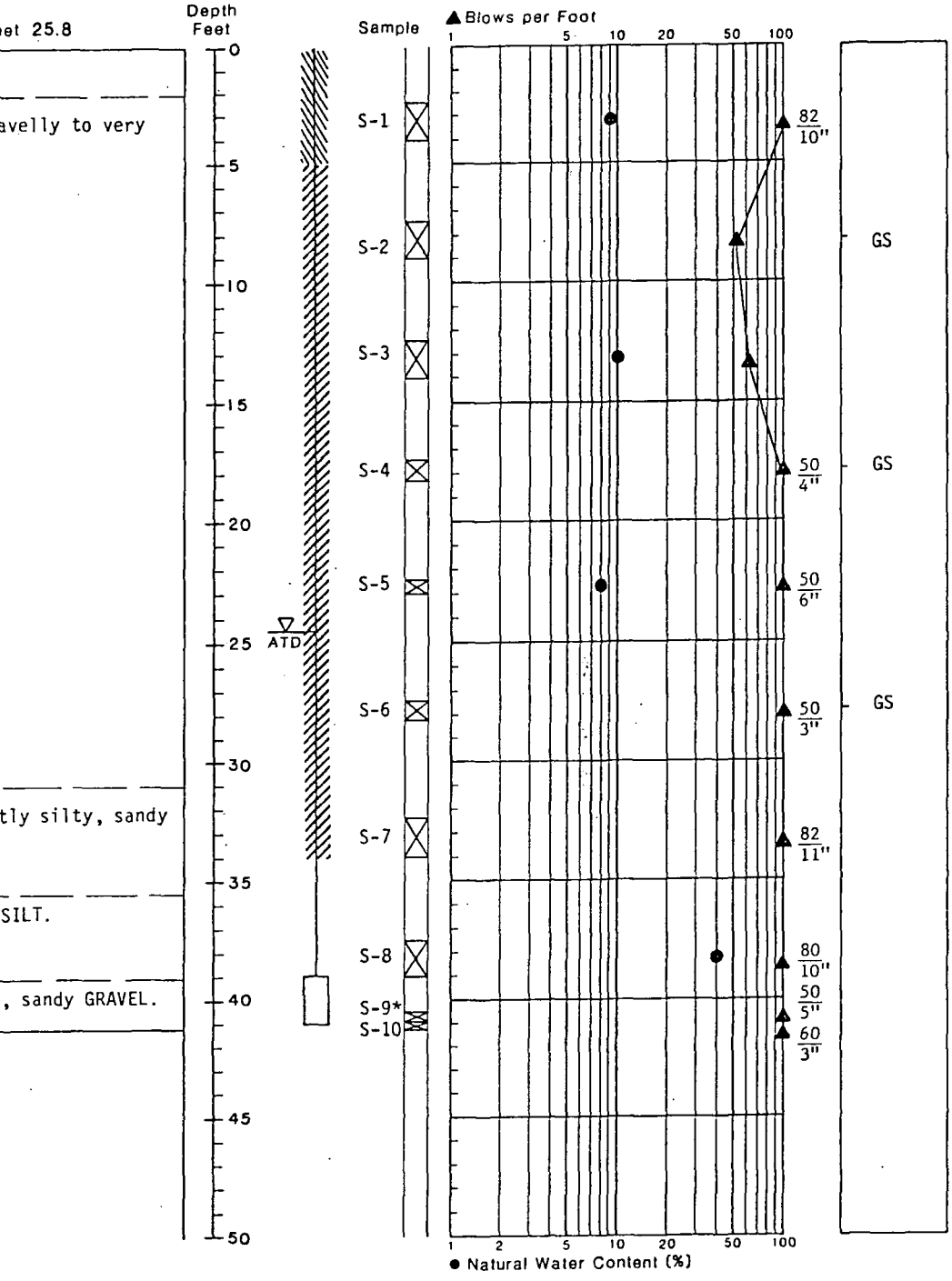
Very dense, saturated, brown, slightly silty, sandy GRAVEL.

Hard, moist, tan to brown, massive SILT.

Very dense, saturated, brown, silty, sandy GRAVEL.

Bottom of Boring at 41.2 Feet.
Completed 5/2/83.

Note: Auger refusal at 40.5 feet.



Groundwater Level

Bentonite Seal
Downhole Seal
2/4/83 ATD
Water Level (Date) At Time of Drilling
Observation Well Tip or Slotted Section

Sampling

2" O.D. Split Spoon Sample
3" O.D. Shelby Tube Sample
Cutting Sample
★ No Sample Recovery

Laboratory Tests

GS	Grain Size Analysis
CN	Consolidation Test
K	Permeability Test
DS	Direct Shear
QU	Unconfined Compression, tsf
TV	Torvane, tsf
PP	Pocket Penetrometer, tsf
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained

Water Content (%)

Plastic Limit — Natural Water Content — Liquid Limit

Notes

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level, if indicated, is for the date specified and may vary with the time of year.
3. Water contents not determined for gravelly or very small samples.

J-1210-02 June 1983
HART-CROWSER & associates inc.
Figure A-22

27009885
TF GeoT

Boring Log HC-44/44A (Pier CBD-S-6A)

SOIL INTERPRETATION

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY TESTS

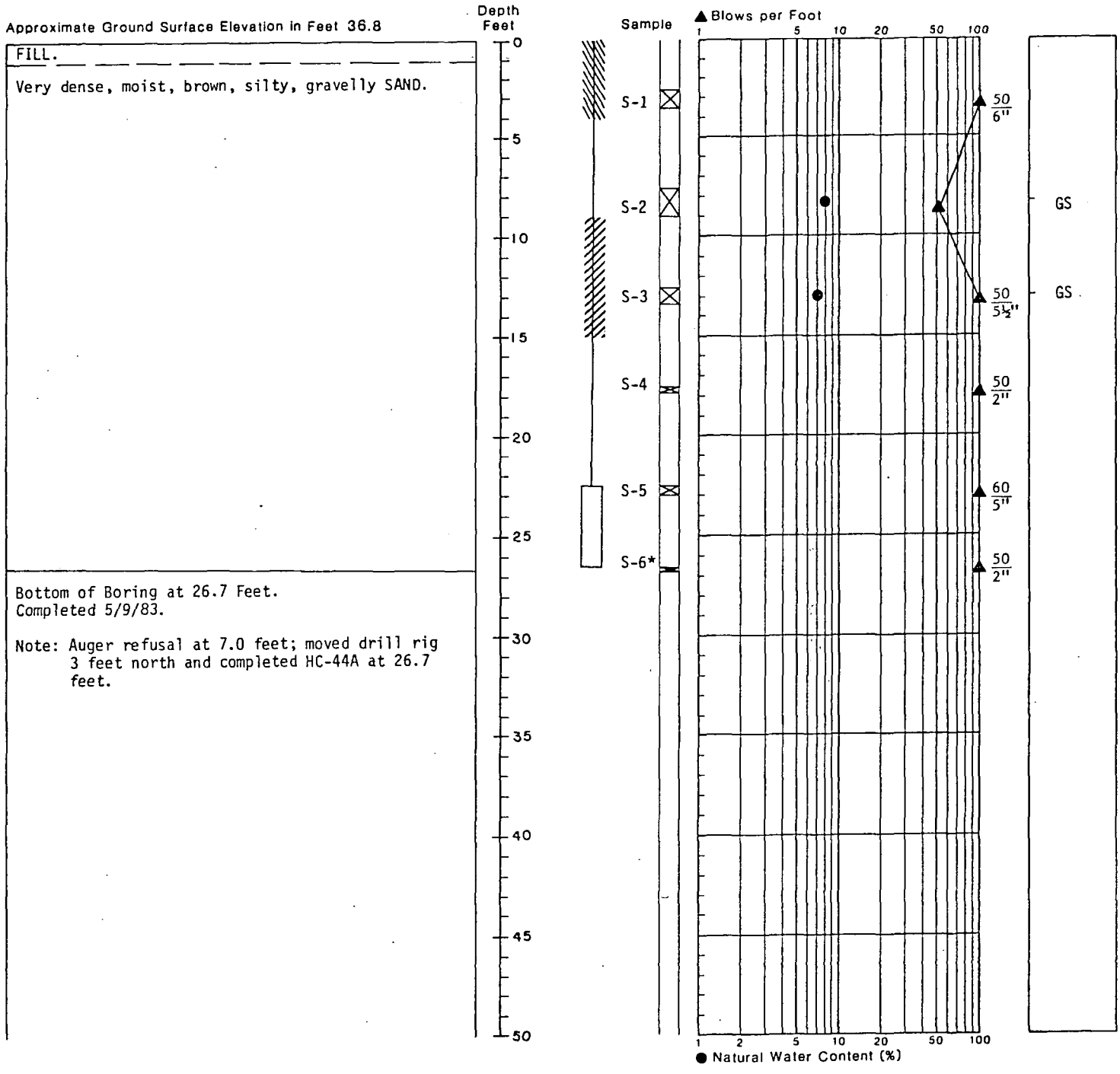
Approximate Ground Surface Elevation in Feet 36.8

FILL.

Very dense, moist, brown, silty, gravelly SAND.

Bottom of Boring at 26.7 Feet.
Completed 5/9/83.

Note: Auger refusal at 7.0 feet; moved drill rig 3 feet north and completed HC-44A at 26.7 feet.



Groundwater Level

Bentonite Seal
Downhole Seal
2/4/83
ATD
Water Level (Date) At Time of Drilling
Observation Well Tip or Slotted Section

Sampling

- 2" O.D. Split Spoon Sample
- 3" O.D. *Shelby Tube* Sample
- Cutting Sample
- ★ No Sample Recovery

Laboratory Tests

GS	Grain Size Analysis
CN	Consolidation Test
K	Permeability Test
DS	Direct Shear
QU	Unconfined Compression, tsf
TV	Torvane, tsf
PP	Pocket Penetrometer, tsf
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained

Water Content (%)

Plastic Limit — Natural Water Content — Liquid Limit

Notes

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level, if indicated, is for the date specified and may vary with the time of year.
3. Water contents not determined for gravelly or very small samples.

J-1210-02 June 1983
HART-CROWSER & associates inc.
Figure A-27

27009890
TF GeoT

Boring Log HC-45/45A/45B/45C/45D

SOIL INTERPRETATION

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY TESTS

Approximate Ground Surface Elevation in Feet 63.0

Medium dense, brown, moist, gravelly SAND (FILL).

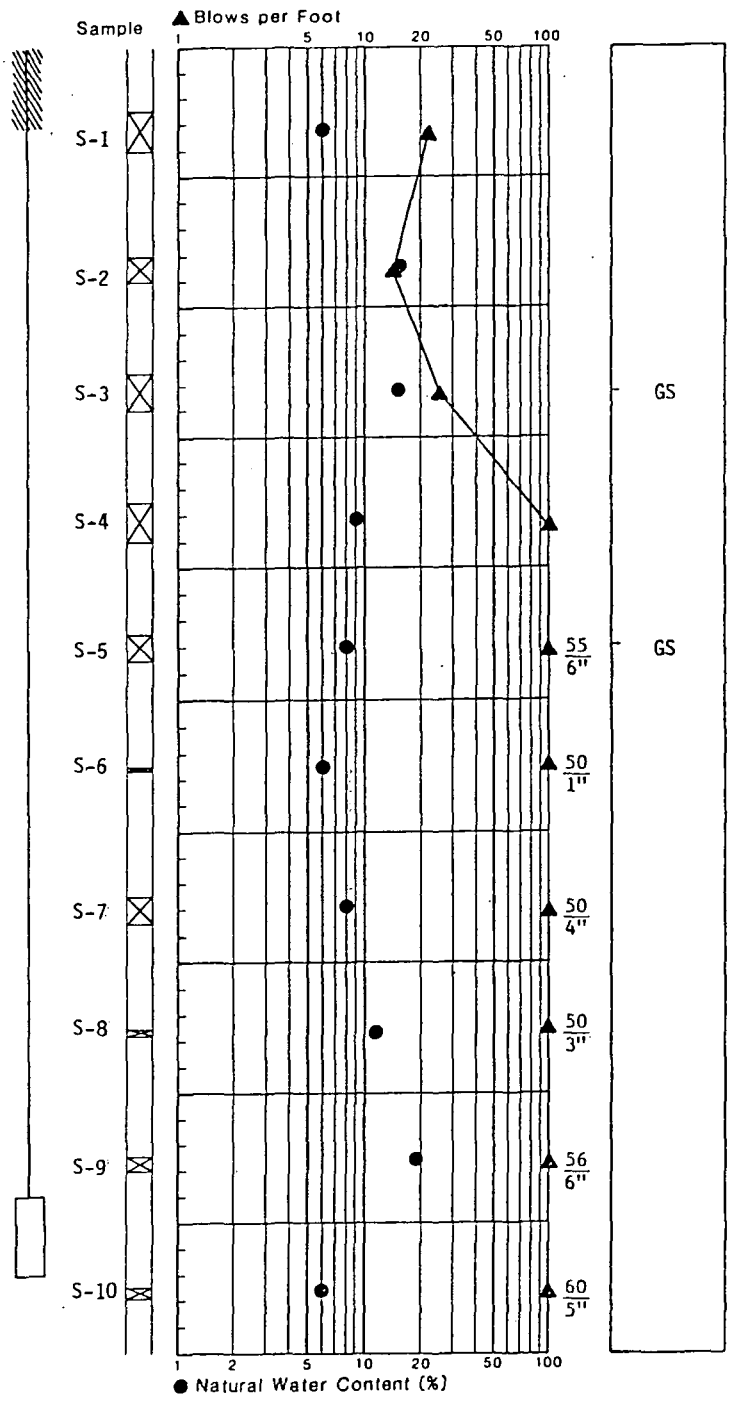
Medium dense, brown to red, moist, sandy GRAVEL with heavy concentrations of brick fragments (FILL).

Very stiff, moist, brown, slightly clayey, sandy SILT.

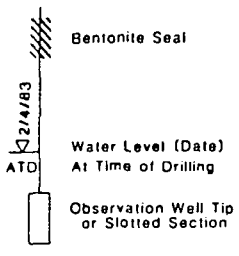
Very dense, moist, brown, silty, gravelly SAND.

Note: Auger refusal in Borings HC-45, 45A, 45B and 45C at 2.7, 2.5, 7.5 and 6.5 feet respectively. Moved drill rig 32 feet north and completed HC-45D.

Bottom of Boring at 47.9 Feet.
Completed 5/22/83.



Groundwater Level



Sampling

- 2" O.D. Split Spoon Sample
- 3" O.D. Shelby Tube Sample
- Cutting Sample
- No Sample Recovery

Laboratory Tests

GS	Grain Size Analysis
CN	Consolidation Test
K	Permeability Test
DS	Direct Shear
QU	Unconfined Compression, tsf
TV	Torvane, tsf
PP	Pocket Penetrometer, tsf
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained

Water Content (%)

Plastic Limit — Natural Water Content — Liquid Limit

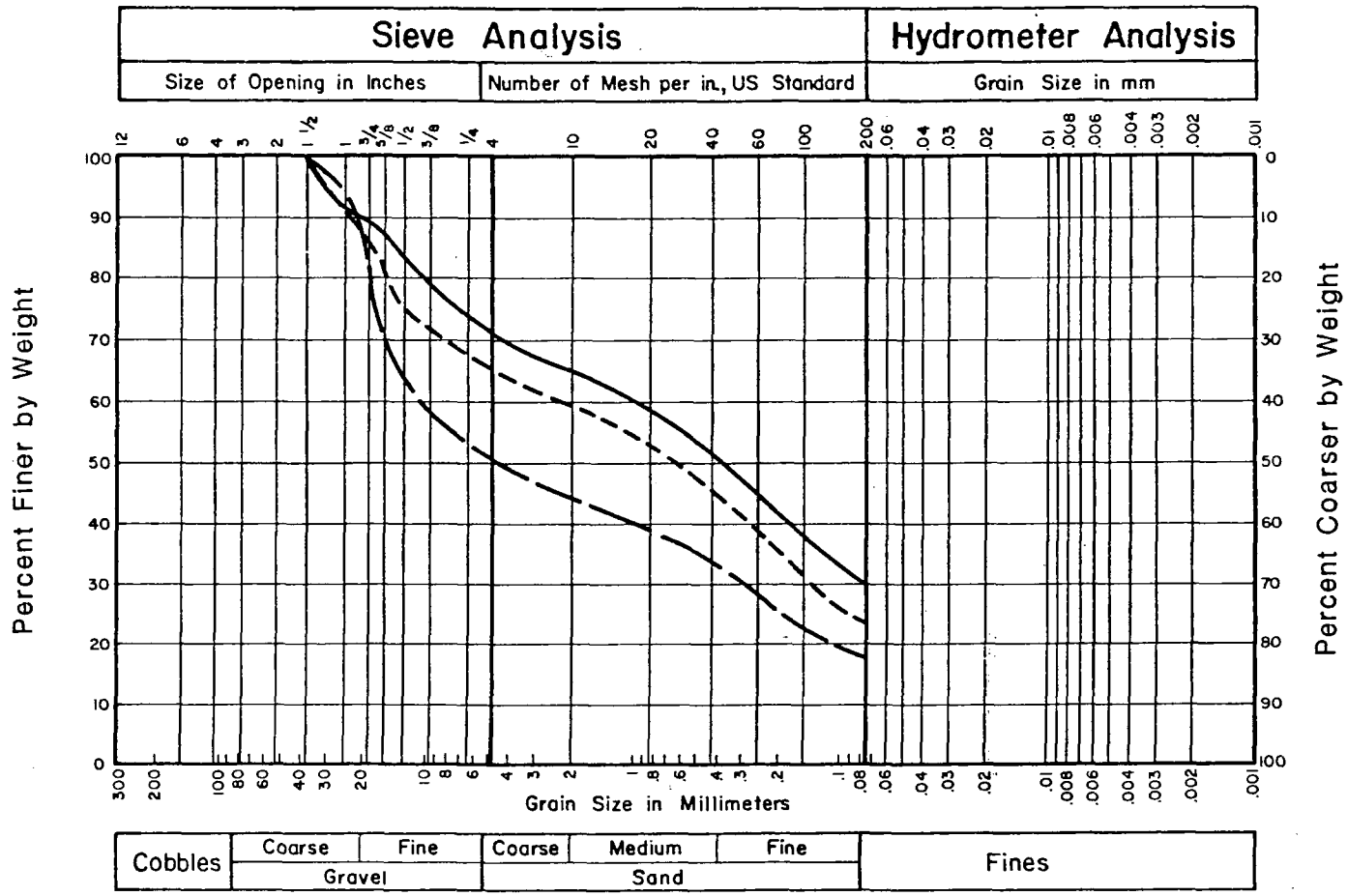
Notes

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level, if indicated, is for the date specified and may vary with the time of year.
3. Water contents not determined for gravelly or very small samples.

J-1210-02 June 1983
HART-CROWSER & associates inc.
Figure A-28

27009891
TF GeoT

Grain Size Classification

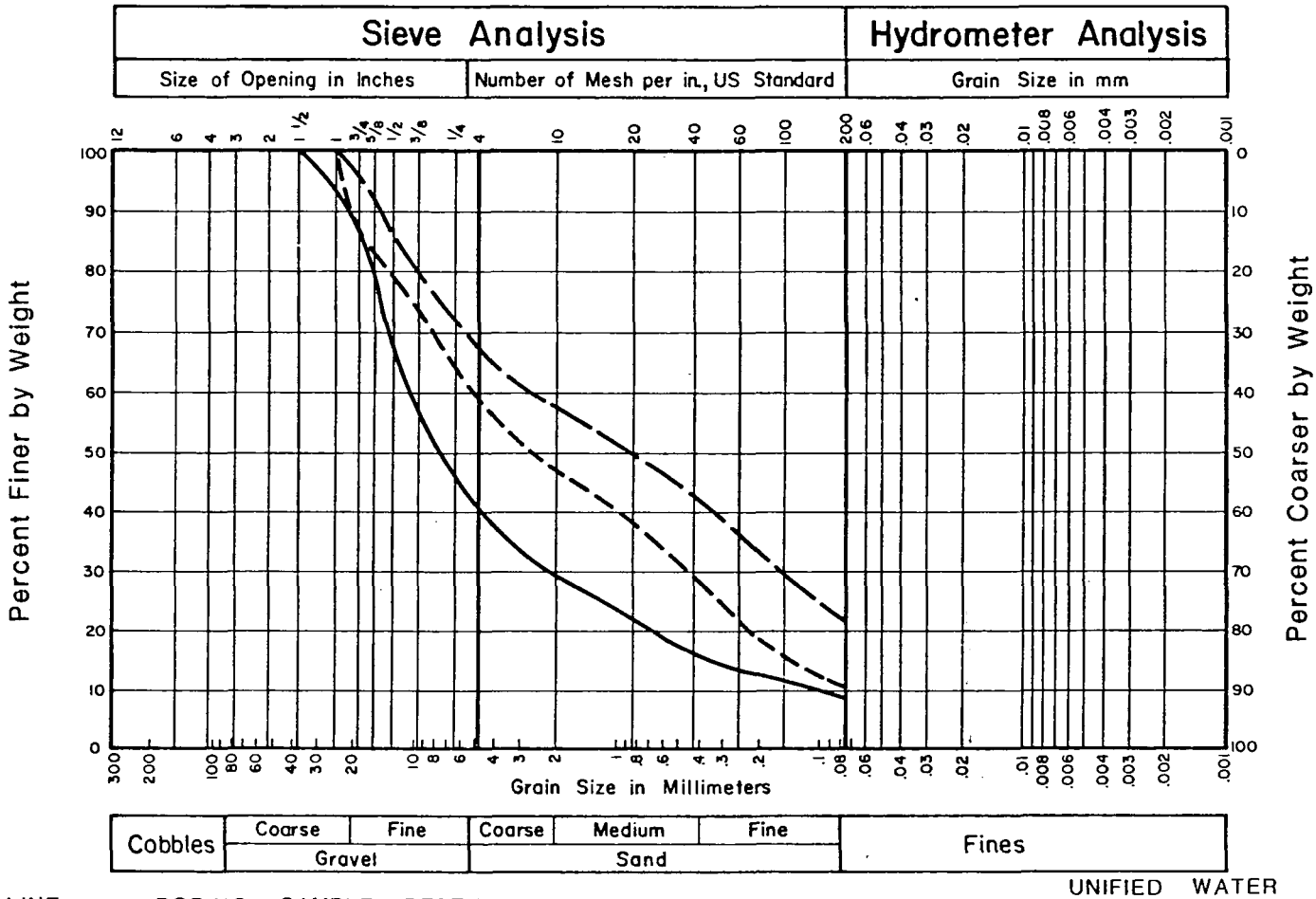


LINE SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH IN FEET	CLASSIFICATION	UNIFIED SOIL CLASS.	WATER CONTENT PERCENT
———	HC-31	S-1	2.5-3.5	Gravelly, silty SAND	SM	8.
— —	HC-31	S-3	12.5-13.6	Silty, sandy GRAVEL	GM	5.
– – – –	HC-31	S-4	17.5-18.3	Silty, gravelly SAND	SM	6.

27009895
TF GeoT

J-1210-02 June 1983
HART-CROWSER & associates, inc.
Figure B-1

Grain Size Classification

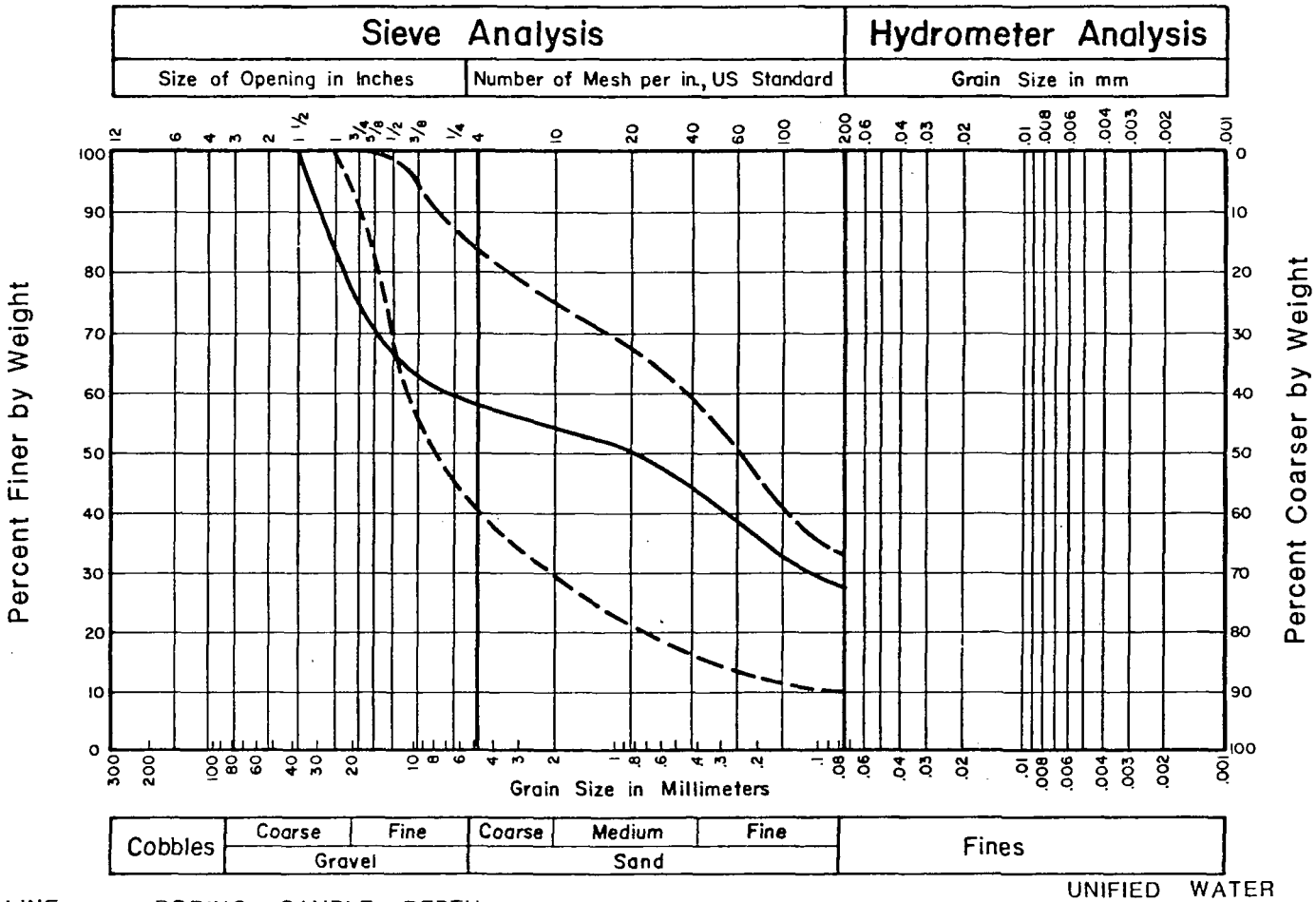


LINE SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH IN FEET	CLASSIFICATION	UNIFIED SOIL CLASS.	WATER CONTENT PERCENT
———	HC-32A	S-3	12.5-14.0	Slightly silty, sandy GRAVEL	GM-GP	4.
— —	HC-32A	S-5	22.5-24.0	Silty, gravelly SAND	SM	7.
— — — —	HC-32A	S-7	32.5-33.3	Slightly silty, gravelly SAND	SM-SP	4.

27009896
TF GeoT

J-1210-02 June 1983
HART-CROWSER & associates, inc.
Figure B-2

Grain Size Classification

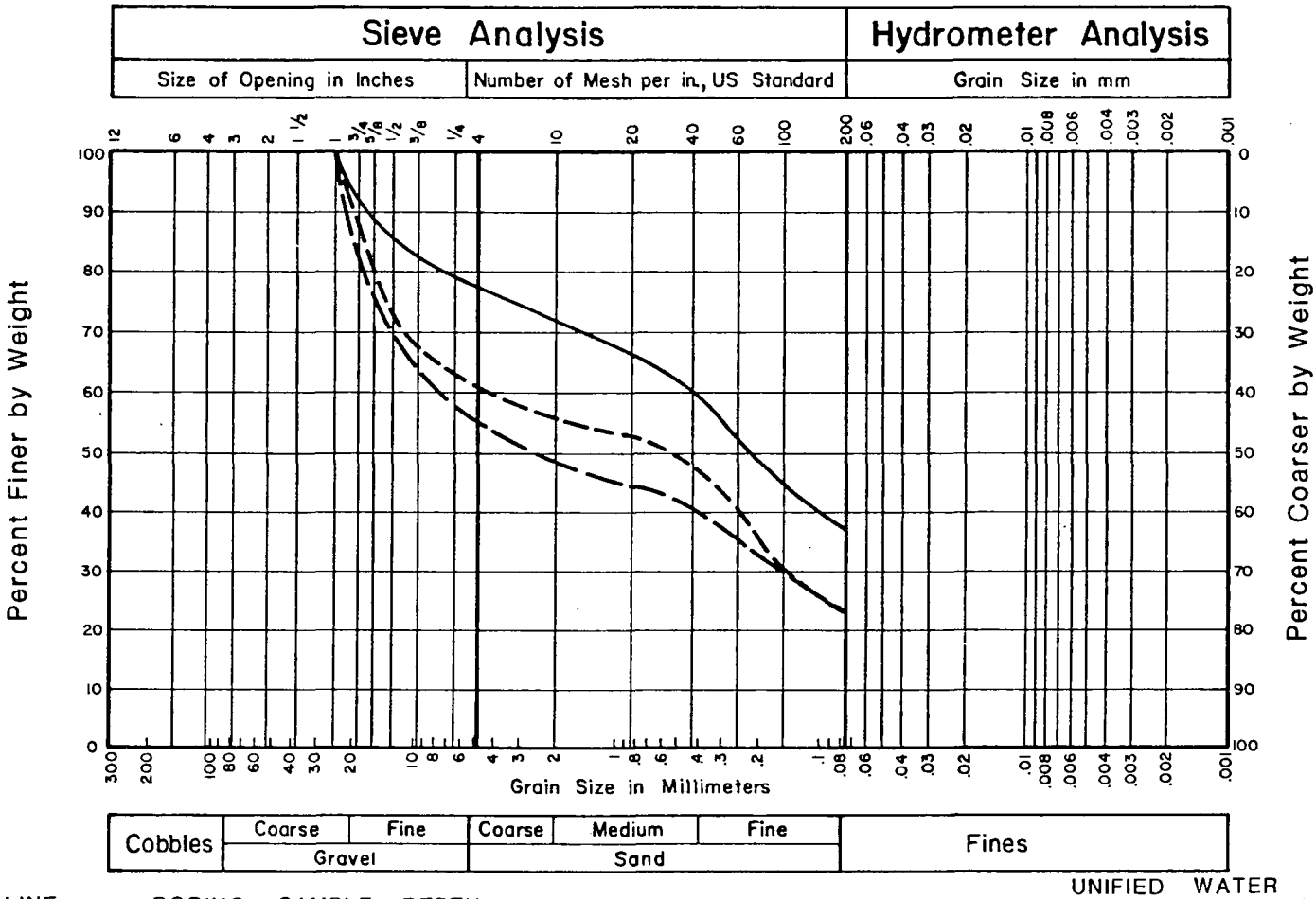


LINE SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH IN FEET	CLASSIFICATION	UNIFIED SOIL CLASS.	WATER CONTENT PERCENT
———	HC-38	S-2	7.5-9.0	Silty, sandy GRAVEL	GM	7.
— — —	HC-38	S-4	17.5-18.4	Gravelly, silty SAND	SM	9.
– – – –	HC-38	S-6	27.5-28.0	Slightly silty, sandy GRAVEL	GM-GP	7.

27009903
TF GeoT

J-1210-02 June 1983
HART-CROWSER & associates, inc.
Figure B-9

Grain Size Classification

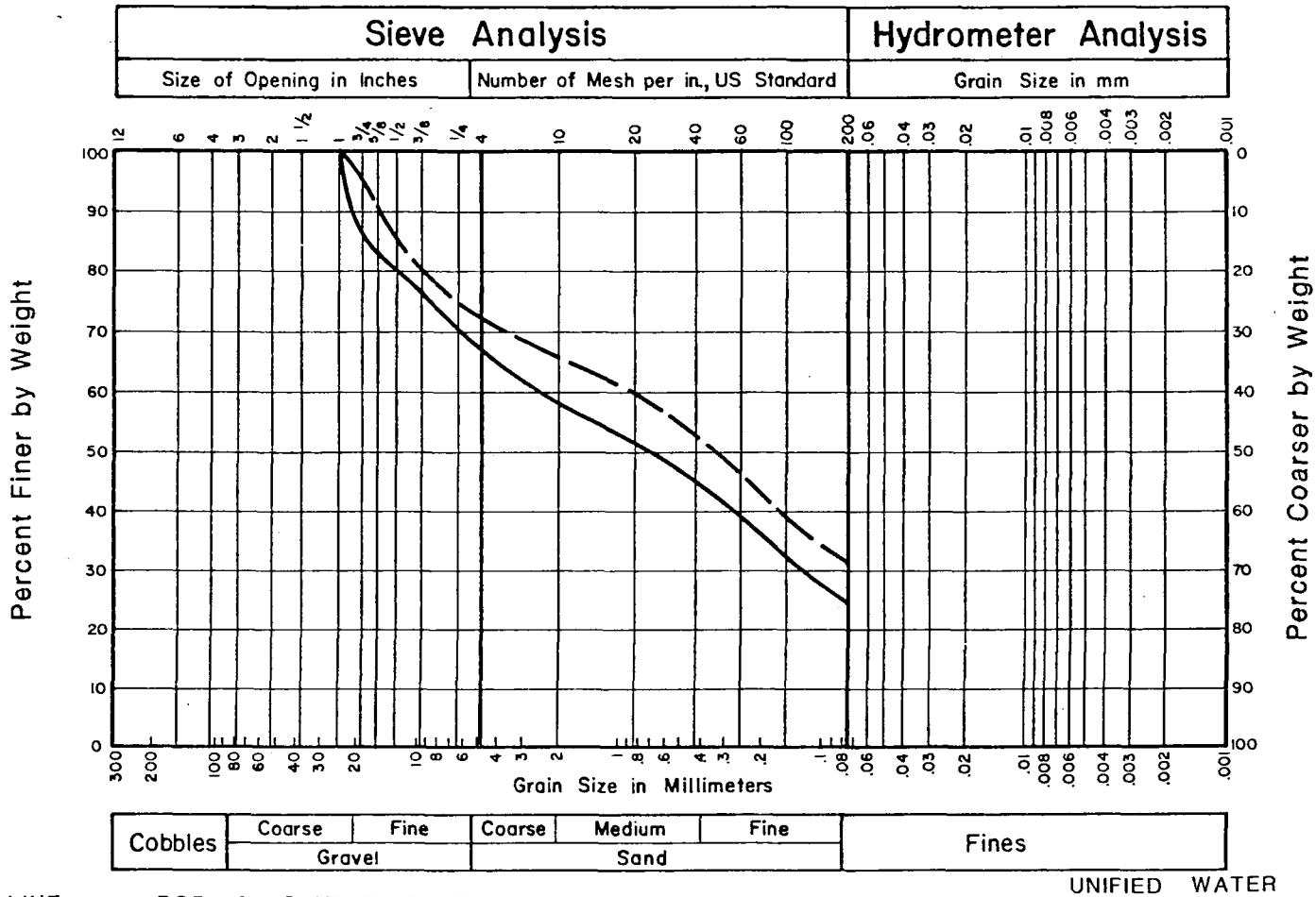


LINE SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH IN FEET	CLASSIFICATION	UNIFIED SOIL CLASS.	WATER CONTENT PERCENT
———	HC-39	S-2	7.5-9.0	Gravelly, silty SAND	SM	10.
— —	HC-39	S-4	17.5-18.3	Silty, sandy GRAVEL	GM	6.
— — — —	HC-39	S-6	27.5-28.3	Silty, gravelly SAND	SM	10.

27009904
T- GeoT

J-1210-02 June 1983
HART-CROWSER & associates, inc.
Figure B-10

Grain Size Classification

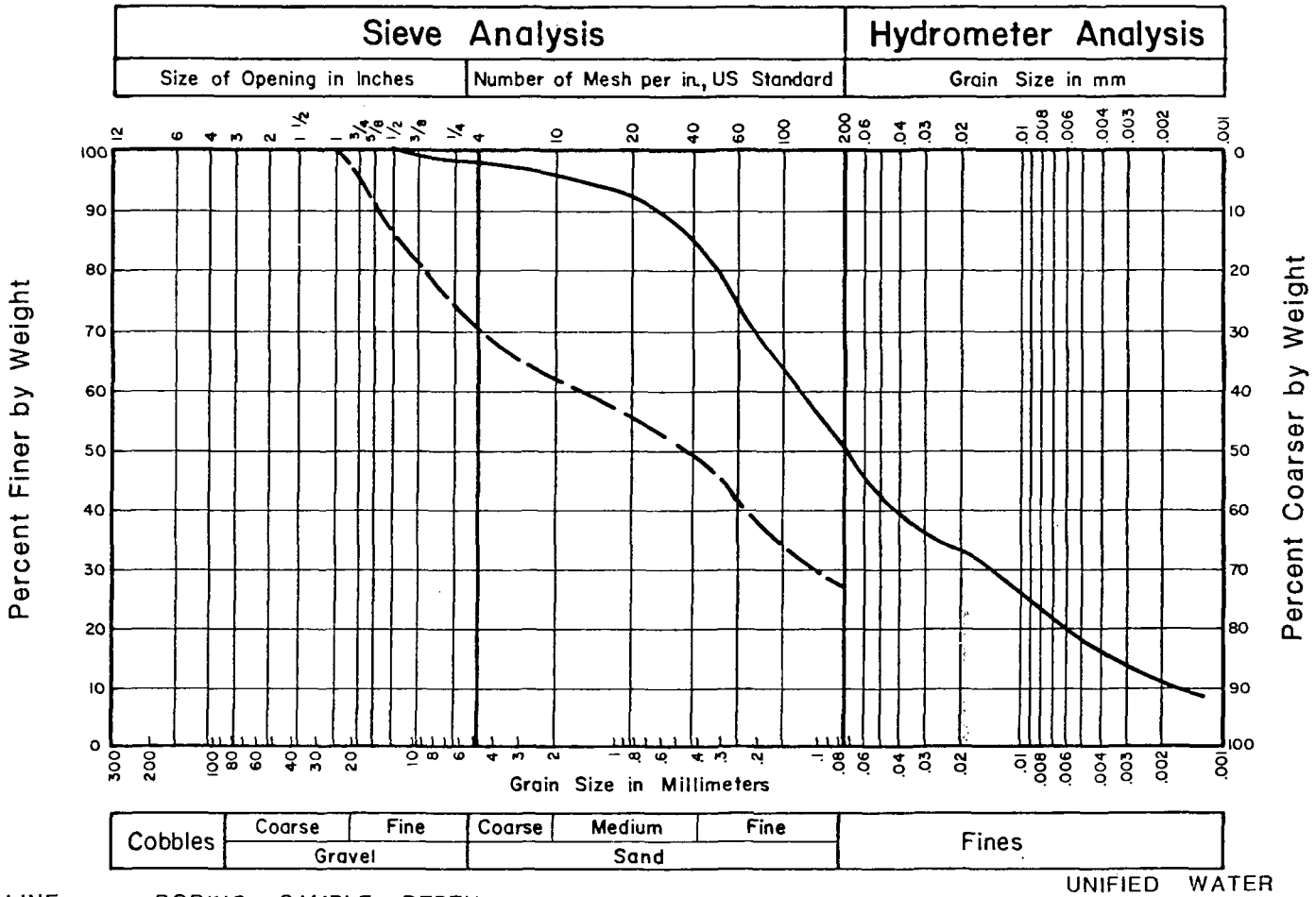


LINE SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH IN FEET	CLASSIFICATION	UNIFIED SOIL CLASS.	WATER CONTENT PERCENT
———	HC-44A	S-2	7.5-9.0	Silty, gravelly SAND	SM	8.
— —	HC-44A	S-3	12.5-13.5	Gravelly, silty SAND	SM	7.

27009909
TF GeoT

J-1210-02 June 1983
HART-CROWSER & associates, inc.
Figure B-15

Grain Size Classification

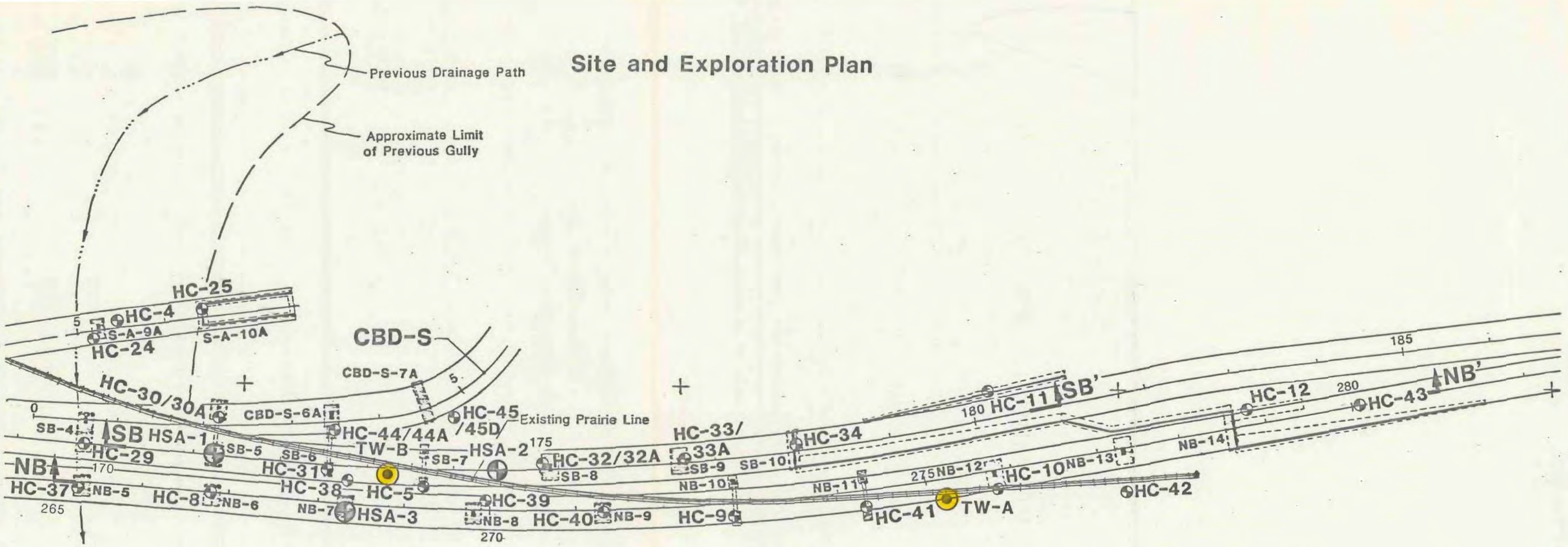


LINE SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH IN FEET	CLASSIFICATION	UNIFIED SOIL CLASS.	WATER CONTENT PERCENT
———	HC-45D	S-3	12.5-14.0	Slightly clayey, sandy SILT	ML	15.
— —	HC-45D	S-5	22.5-23.5	Silty, gravelly SAND	SM	8.

27009910
TF GeoT

J-1210-02 June 1983
HART-CROWSER & associates, inc.
Figure B-16

Site and Exploration Plan



TW-A	Test Well Location and Designation
NB-8	Pier Footing Location and Number
HSA-1	Boring Location and Number by Hart-Crowser Current Phase of SR-705 Project
HC-5	Boring Location and Number by Hart-Crowser Previous Phases of SR-705 Project
NB NB'	Subsurface Profile Location and Designation

0 100 200

Scale in Feet

27009797
TF GeoT

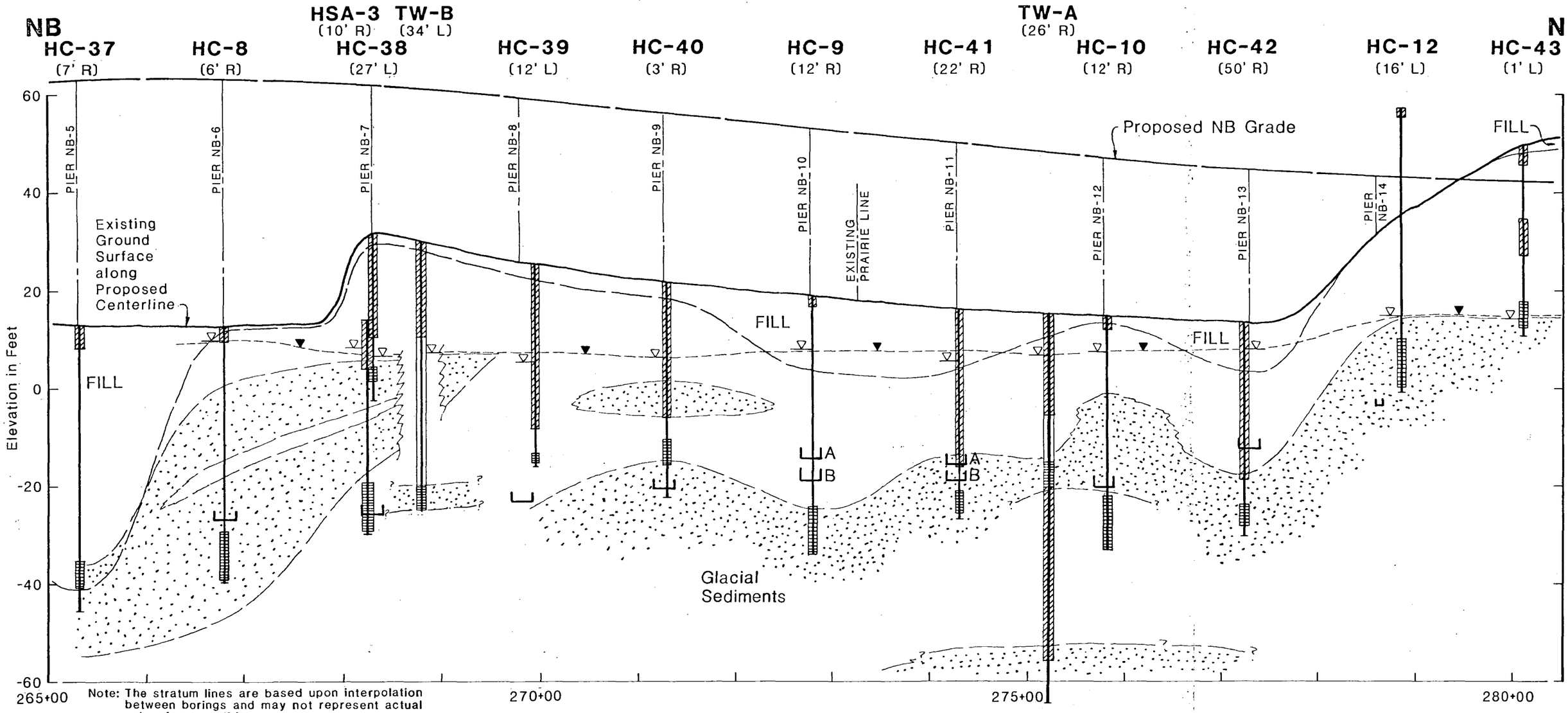
J-1210-07 May 1984

HART-CROWSER & associates inc.

Figure 3

40003176

Generalized Subsurface Profile NB-NB'



Note: The stratum lines are based upon interpolation between borings and may not represent actual subsurface conditions.

HSA-3
(10' R)
Boring Number, See Figure 3 for Explanation
Offset Distance and Direction Looking Up-Station

Seal

Boring Location

Measured Water Level in Well

Screen

Anticipated Piezometric Surface at Foundation Inverts

Anticipated Saturated Materials with Relatively High Permeability and Less than 12 Percent Fines

Drilled Pier Foundation Invert

Soldier Pile Foundation Invert (Lowest Pile)

Horizontal Scale in Feet
0 100 200
0 20 40
Vertical Scale in Feet

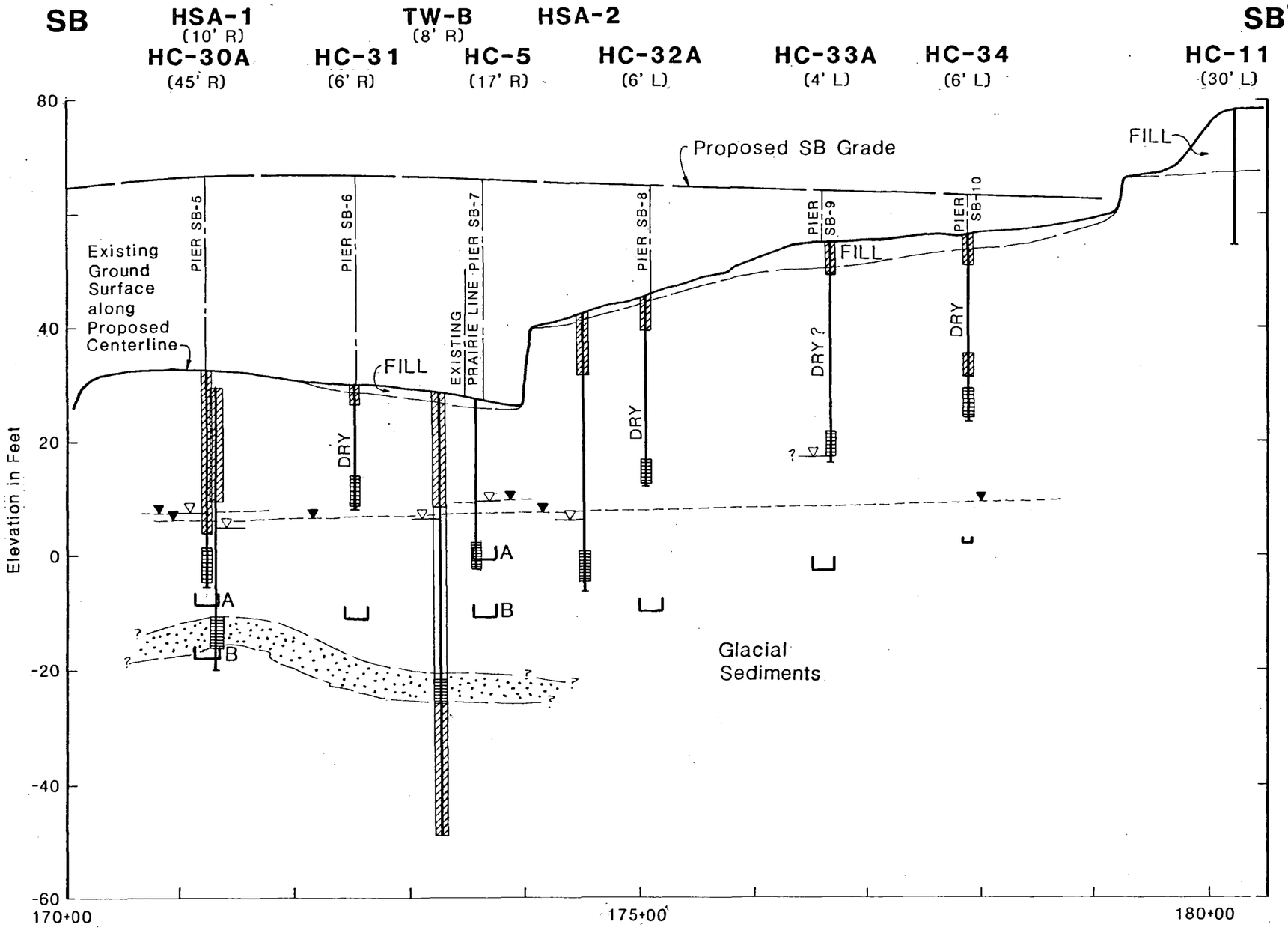
Vertical Exaggeration x 5

J-1210-07 May 1984
HART-CROWSER & associates inc.
Figure 4

27009798
TF GeoT

40003177

Generalized Subsurface Profile SB-SB'



Note: The stratum lines are based upon interpolation between borings and may not represent actual subsurface conditions.

HC-30A (45' R) — Boring Number; See Figure 3 for Explanation; Offset Distance and Direction Looking Up-Station

Seal

Boring Location

Measured Water Level in Well

Screen

Anticipated Piezometric Surface at Foundation Inverts

Anticipated Saturated Materials with Relatively High Permeability and Less than 12 Percent Fines

Drilled Pier Foundation Invert

Soldier Pile Foundation Invert (Lowest Pile)

Horizontal Scale in Feet
0 100 200
0 20 40
Vertical Scale in Feet
Vertical Exaggeration x 5

J-1210-07 May 1984
HART-CROWSER & associates inc.
Figure 5

27009799
TF GeoT

40003178

APPENDIX A
WELL INSTALLATIONS AND LOG INTERPRETATION

Three hollow stem auger borings and two cable tool test wells were installed for this project. Below are the details of each exploration method.

Cable Tool Test Wells

The two test wells shown in plan on Figure 3 and in profile in Figures 4 and 5 were installed by Holkkaido Drilling and Development Company using a Speed Star 72 cable tool drill rig. The holes were logged by Russ Prior throughout the potential water producing portions by collection and description of bailed samples. Upon entering the zones adjacent to the screened sections of the wells (Figures A-1 and A-2), the formation heaved into the 8-inch casing and undrilled samples were bailed from the heaved material and the material below the heave. These samples were transported to the Hart-Crowser soils laboratory for grain size analyses which are presented on Figures A-3 and A-4. The well screens were designed based upon the results of the grain size analyses and boring logs.

The test wells were drilled to their total proposed depths before deciding to screen only the upper aquifers. The wells were briefly developed using a surge block and bailer.

The geologic logs and indications of water production vary between the cable tool wells and the auger borings (described below) as a result of the drilling methods and sample volumes available with the two methods. The cable tool drilling method gives a relatively direct measure of the water producing potential of a zone whereas the auger method gives a less quantitative indication which often must be based on grain size analyses of collected samples. At the project site the cable tool wells drilled for this dewatering study indicated thin zones of relatively high permeability (Figures 4 and 5). The auger borings indicated relatively thicker zones of material with less than 12 percent fines (slightly silty or less). For the purpose of this evaluation the zones containing material with less than 12 percent fines were assumed to contain the site aquifers; it is likely that the aquifer are thinner than the zones presented on Figures 4 and 5 at the auger boring locations.

The grain size analyses performed for this project were conducted in general accordance with test procedures described in ASTM D 4322. The results of the analyses are presented in Figures A-3 and A-4.

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TF GeoT

Auger Borings

Borings HSA-1, HSA-2, and HSA-3 (Figures A-5, A-6, and A-7) were installed using a hollow stem auger drill rig under subcontract to Hart-Crowser. The locations of the borings are shown on Figure 3. The borings were logged and sampled only through the depths below where previous borings had penetrated. In the logged zones, samples were collected using a 2-inch OD split spoon sampler driven ahead of the auger bit. The sampler was driven with a 140-pouund hammer free falling 30 inches. The resistance to sampler penetration is recorded in three six-inch intervals. The number of blows required to drive the sampler the final 12 inches is referred to as the "N" value. This N value is used to classify the samples into relative density categories. The Standard Penetration Resistance for each sample has been recorded on the boring logs at their respective sample elevations.

Each boring was turned into an observation well by installation of a 1-1/2-inch well point at the depths indicated on the logs. Access to the well points was through 3/4-inch PVC pipe extending from the well point to the ground surface.

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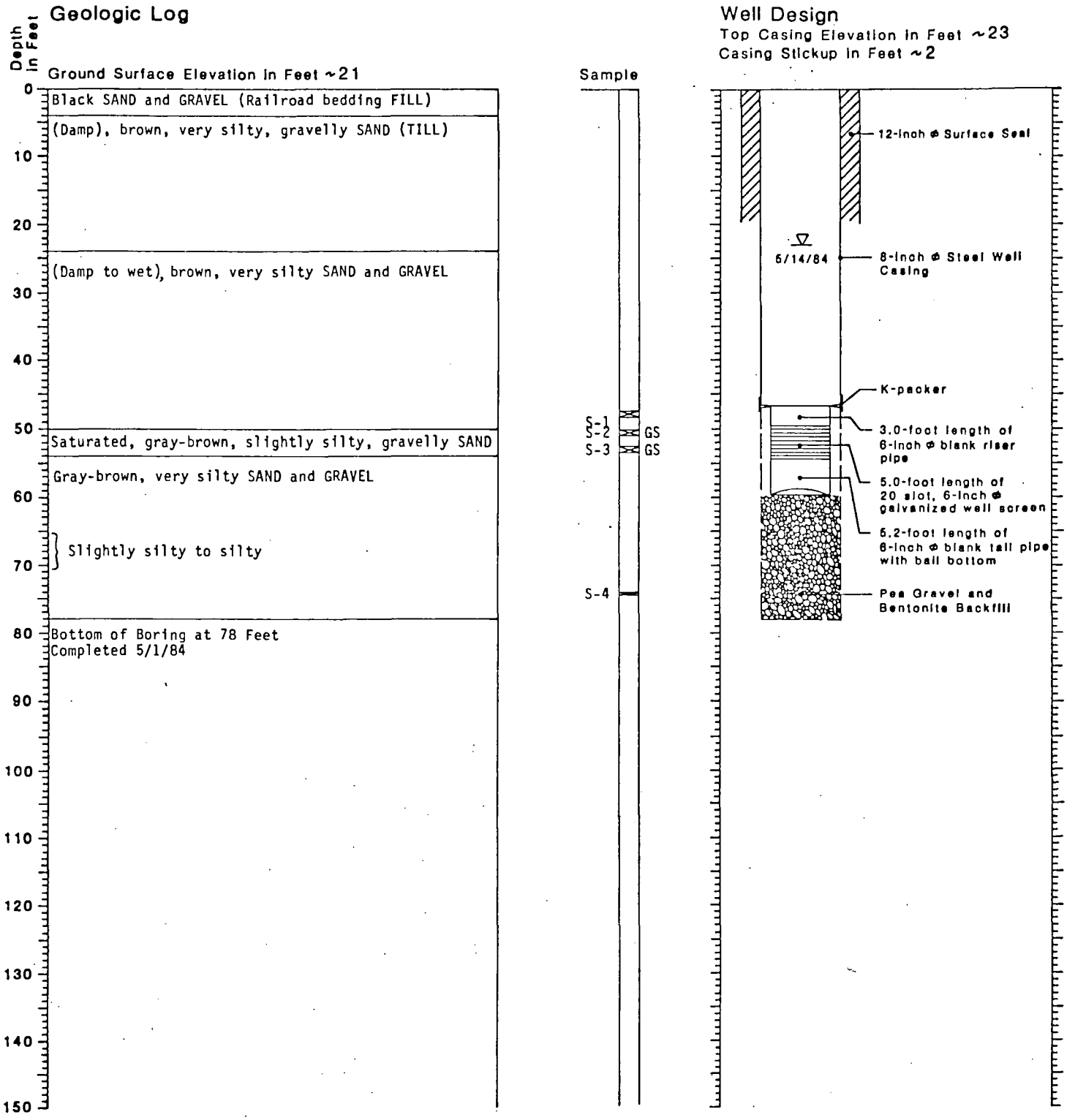
TF GeoT

400031180

Boring Log and Construction Data for Well TW-B



S-1 ☒ Bail Sample

GS Grain Size Classification

NOTES: 1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level ▽ is for date indicated and may vary with time of year. ATD: At Time of Drilling

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TF GeoT

J-1210-07 May 1984

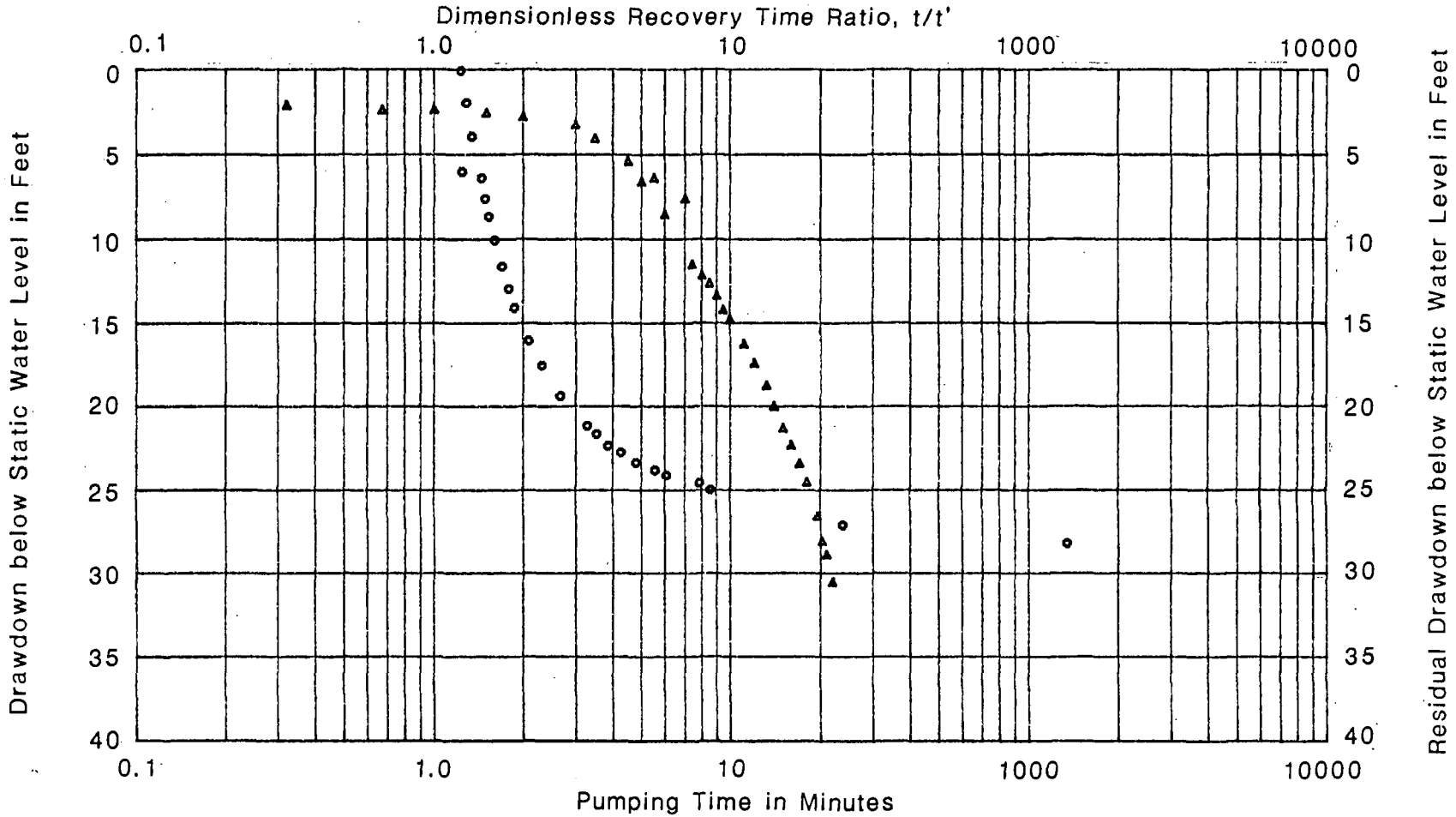
HART-CROWSER & associates, inc.

Figure A-2

40003182

TW-B Constant Rate Test

Drawdown and Recovery Data measured in Well TW-B



△ Drawdown Data

○ Recovery Data

Average pumping rate 5 gpm

Static Water Level 23.1 Feet Below Top of Casing

t = Total Time since Pump Start

t' = Time since Pump Shut Off

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TF GeoT

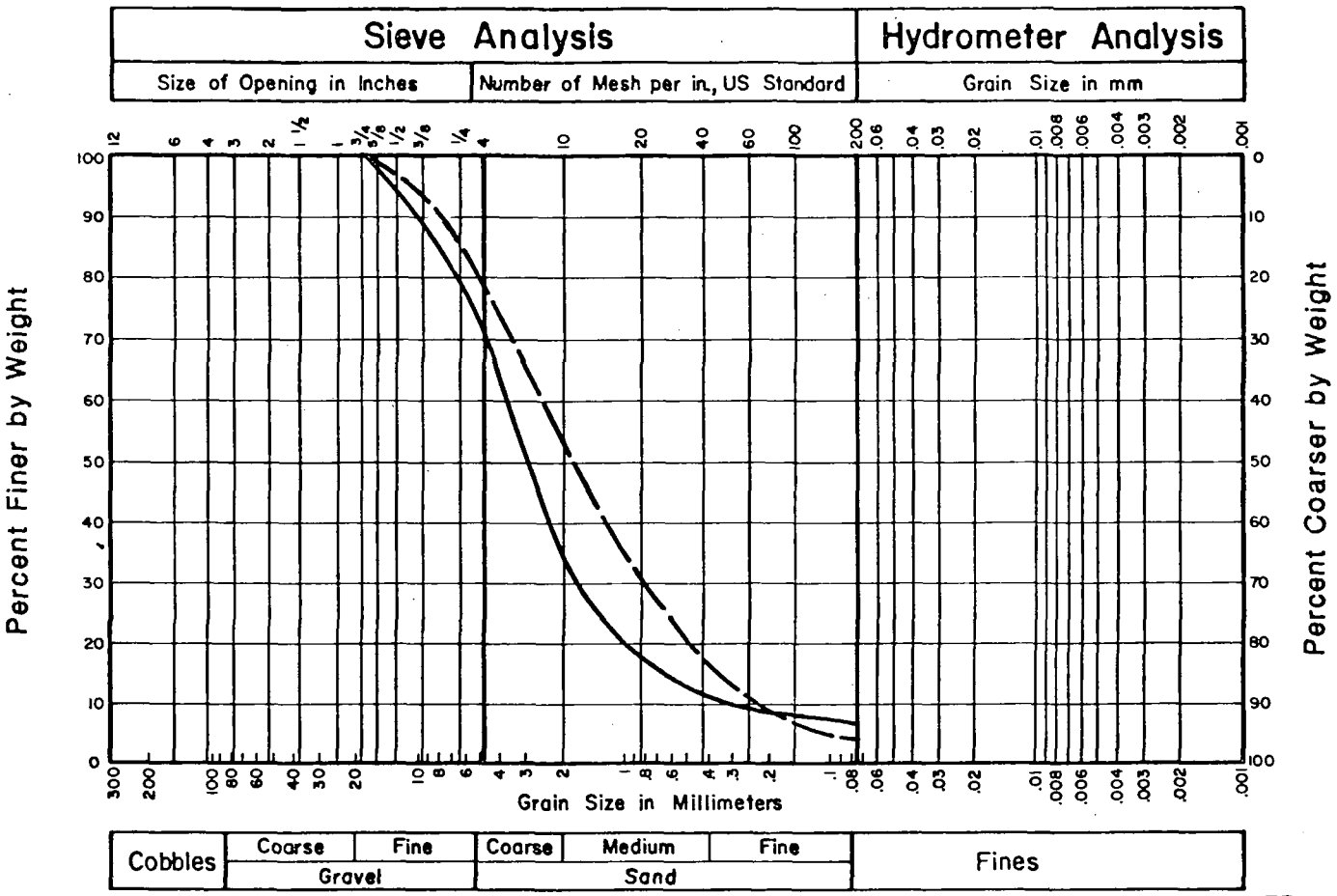
J-1210-07 May 1984

HART-CROWSER & associates inc.

Figure B-3

40003192

Grain Size Classification
Well TW-B

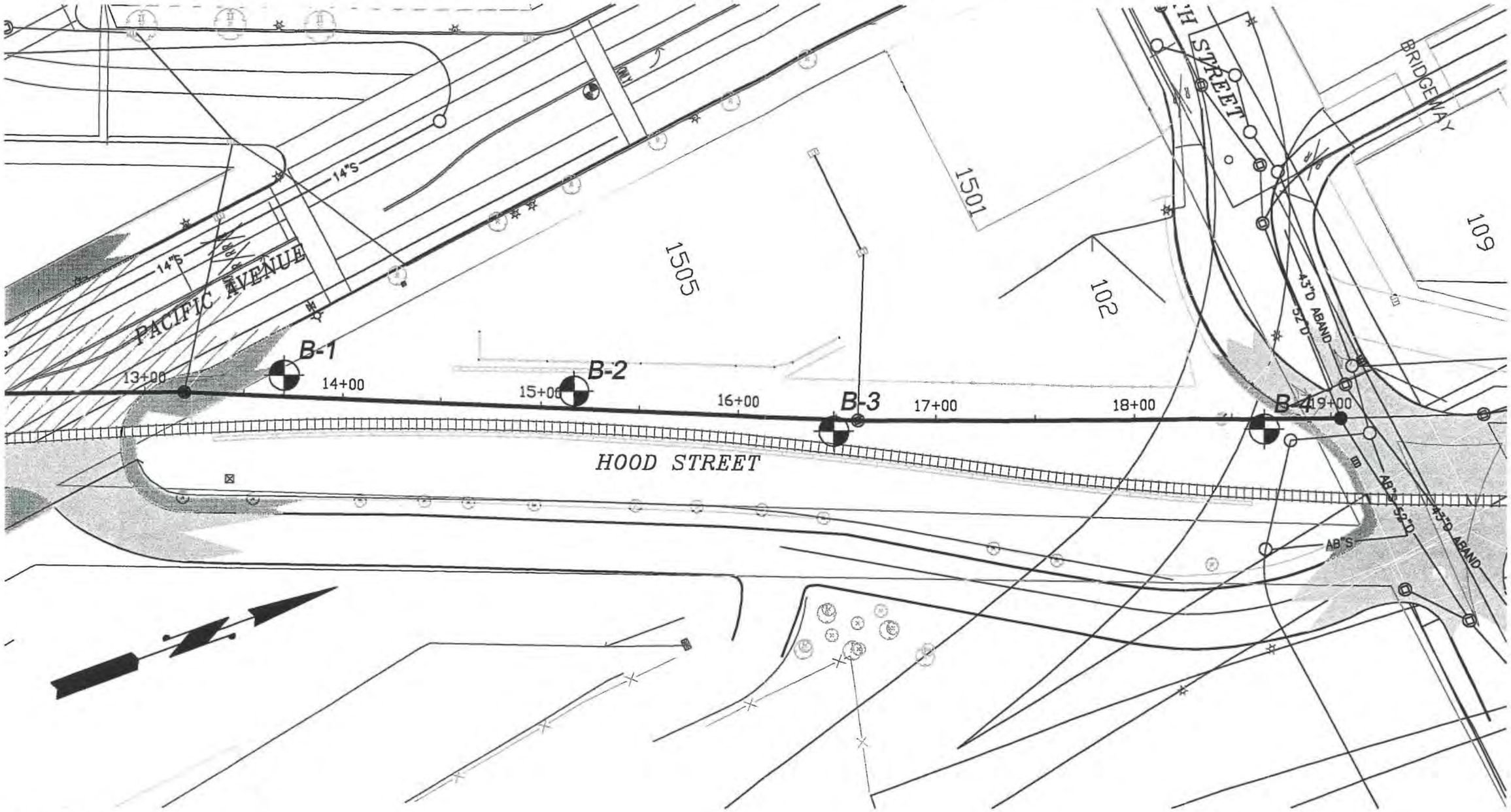


LINE SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH IN FEET	CLASSIFICATION	UNIFIED SOIL CLASS.	WATER CONTENT PERCENT
———	TW-B	S-2	50.0 - 51.0	Slightly silty, gravelly SAND	SW	-
— —	TW-B	S-3	52.5 - 53.5	Gravelly SAND	SW	-

27009805
TF GeoT

J-1210-07 May 1984
HART-CROWSER & associates, inc.
Figure A-4

40003184



EXPLANATION:

B-1 *BORING NUMBER AND APPROXIMATE LOCATION*

0 50 100
SCALE IN FEET

Zipper Zeman Associates, Inc.
Geotechnical and Environmental Consulting

18905 33rd Avenue West, Suite 117
Lynnwood, Washington 98036
Tele: (425) 771-3304 Fax: (425) 771-3549

Project No: J-1358

Drawn by: R. A. Ross

Date: April 2002

HOOD STREET SEWER REPLACEMENT
TACOMA, WASHINGTON

FIGURE 1 - SITE AND EXPLORATION PLAN

Basemap DWG File Provided by David Evans Associates, Inc.

APPENDIX A
FIELD EXPLORATION PROCEDURES AND LOGS
LABORATORY TESTING PROCEDURES AND RESULTS

Our field exploration for this project included four borings advanced on March 26, 2002. Approximate exploration locations are shown on Figure 1, Site and Exploration Plan. Exploration locations were determined by measuring distances from existing site features with a fiberglass tape relative to a site plan provided by Cosmopolitan, which showed proposed locations of improvements. Elevations of borings shown on boring logs are based on the site plan provided by Cosmopolitan. As such, the exploration locations and elevations should be considered accurate to the degree implied by the measurement method. The following sections describe our procedures associated with the exploration. Descriptive logs of the explorations are enclosed in this appendix.

Soil Boring Procedures

Exploratory borings were advanced with a hollow stem auger, using a truck-mounted drill rig operated by an independent drilling firm working under subcontract to our firm. An experienced geotechnical engineer from our firm continuously observed the borings, logged the subsurface conditions encountered, and obtained representative soil samples. All samples were stored in moisture-tight containers and transported to our laboratory for further visual classification and testing. After each boring was completed, the borehole was backfilled with soil cuttings.

Throughout the drilling operation, soil samples were obtained at 2.5- to 5-foot depth intervals by means of the Standard Penetration Test (ASTM: D-1586). This testing and sampling procedure consists of driving a standard 2-inch outside diameter steel split spoon sampler 18 inches into the soil with a 140-pound hammer free falling 30 inches. The number of blows required to drive the sampler through each 6-inch interval is recorded, and the total number of blows struck during the final 12 inches is recorded as the Standard Penetration Resistance, or "blow count" (N value). If a total of 50 blows is struck within any 6-inch interval, the driving is stopped and the blow count is recorded as 50 blows for the actual penetration distance. The resulting Standard Penetration Resistance values indicate the relative density of granular soils and the relative consistency of cohesive soils.

A photoionization detector (PID) was utilized to measure total organic vapors present in samples collected from Boring B-1 and B-4 to a depth of 10 feet below the ground surface. Field "headspace" analyses utilized a Rae Systems, Inc. MiniRae 2000 PID. The highest digital readout value displayed by the instrument was recorded for each sample. This value indicates the total vapor concentration of volatilized organic compounds with ionization potentials less than the energy produced by the ionizing radiation source (ultraviolet lamp) of the PID. These compounds include numerous constituents of petroleum hydrocarbons. However, the PID is not capable of determining the species of these compounds or their concentrations in the soil samples. Consequently, headspace measurements are a screening tool that aids in detecting the presence of volatile soil contaminants. PID readings taken for specific samples are indicated on the logs in this appendix.

The enclosed boring logs describe the vertical sequence of soils and materials encountered in each boring, based primarily upon our field classifications and supported by our subsequent laboratory examination and testing. Where a soil contact was observed to be gradational, our logs indicate the average contact depth. Where a soil type changed between sample intervals, we inferred the contact depth. Our logs also graphically indicate the blow count, sample type, sample number, and approximate depth of each soil sample obtained from the boring, as well as any laboratory tests performed on these soil samples. If any groundwater was encountered in a borehole, the approximate groundwater depth, and

date of observation, is depicted on the log. Groundwater depth estimates are typically based on the moisture content of soil samples, the wetted portion of the drilling rods, the water level measured in the borehole after the auger has been extracted, or through the use of an observation well.

The boring logs presented in this appendix are based upon the drilling action, observation of the samples secured, laboratory test results, and field logs. The various types of soils are indicated as well as the depth where the soils or characteristics of the soils changed. It should be noted that these changes may have been gradual, and if the changes occurred between sample intervals, they were inferred.

LABORATORY TESTING PROCEDURES

A series of laboratory tests were performed during the course of this study to evaluate the index and geotechnical engineering properties of the subsurface soils. Descriptions of the types of tests performed are given below.

Visual Classification

Samples recovered from the exploration locations were visually classified in the field during the exploration program. Representative portions of the samples were carefully packaged in moisture tight containers and transported to our laboratory where the field classifications were verified or modified as required. Visual classification was generally done in accordance with the Unified Soil Classification system. Visual soil classification includes evaluation of color, relative moisture content, soil type based upon grain size, and accessory soil types included in the sample. Soil classifications are presented on the exploration logs in Appendix A.

Moisture Content Determinations

Moisture content determinations were performed on representative samples obtained from the exploration in order to aid in identification and correlation of soil types. The determinations were made in general accordance with the test procedures described in ASTM: D-2216. The results are shown on the exploration logs in Appendix A.

Grain Size Analysis

A grain size analysis indicates the range in diameter of soil particles included in a particular sample. Grain size analyses were performed on representative samples in general accordance with ASTM: D-422. The results of the grain size determinations for the samples were used in classification of the soils, and are presented in this appendix.

PROJECT: Hood Street Sewer Replacement | **JOB NO.** J-1358 | **BORING** B-1 | **PAGE 1 OF 2**

Location: Tacoma, Washington | **Approximate Elevation:** 52 Feet

Depth (ft)	Soil Description	Sample Type	Sample Number	Ground Water	N-values	Testing
	2 inches sod over loose, wet, brown, silty, fine SAND with gravel (Fill).					
	Loose, wet to saturated, black, silty, fine SAND with trace gravel and abundant fine roots. (Fill)		S-1		5	
5	Very loose, wet, black, gravelly, silty, medium SAND with vesicular textured particles. (Fill)		S-2		3	GS
	Loose, saturated, gray-brown, silty, fine SAND to sandy SILT with trace organics (Buried Topsoil)		S-3	ATD	6	
10	Medium dense, wet to saturated, gray-brown, silty, fine SAND.		S-4		27	
	Dense, wet to saturated, gray-brown, silty, sandy GRAVEL.		S-5		44	GS
15	grades to very dense		S-6		77	
20	Dense, moist, brown, fine SAND with trace silt and gravel.		S-7		37	
25						

Penetration Resistance

▲ Standard △ Other

Blows per foot: 0 10 20 30 40

Moisture Content

0 10 20 30 40 50

Plastic Limit — Natural — Liquid Limit

Explanation

- 2-inch O.D. split spoon sample
- 3-inch I.D Shelby tube sample
- ⊗ No Recovery
- ▼ ATD — Groundwater level at time of drilling or date of measurement

Monitoring Well Key

- Clean Sand
- Cuttings
- Bentonite
- Grout
- Screened Casing

Zipper Zeman Associates, Inc. Geotechnical & Environmental Consultants	BORING LOG	Figure A-1
	Date Drilled: 3/26/02	Logged By: RAR

PROJECT: Hood Street Sewer Replacement | **JOB NO.** J-1358 | **BORING** B-1 | **PAGE 2 OF 2**

Location: Tacoma, Washington

Depth (ft)	Soil Description	Sample Type	Sample Number	Ground Water	Penetration Resistance (▲ Standard, △ Other; Blows per foot)	N-values	Testing
	Dense, moist, brown, fine SAND with trace silt and gravel.		S-8		▲ 49	49	
	Very stiff, saturated, brown, sandy SILT.		S-9	▼ ATD	▲ 29	29	
30	Boring completed at 29 feet on 3/26/02. Groundwater observed at approximately 7.5 and 27.5 feet at the time of drilling.						
35							
40							
45							
50							

Penetration Resistance scale: 0 10 20 30 40

Explanation

- I — 2-inch O.D. split spoon sample
- II — 3-inch I.D Shelby tube sample
- ⊗ — No Recovery
- ▼ ATD — Groundwater level at time of drilling or date of measurement

Monitoring Well Key

- Clean Sand
- Cuttings
- Bentonite
- Grout
- Screened Casing

0 10 20 30 40 50

Moisture Content

Plastic Limit — Natural — Liquid Limit

Zipper Zeman Associates, Inc. Geotechnical & Environmental Consultants	BORING LOG	Figure A-1
	Date Drilled: 3/26/02	Logged By: RAR

PROJECT: Hood Street Sewer Replacement | **JOB NO.** J-1358 | **BORING** B-2 | **PAGE 1 OF 1**

Location: Tacoma, Washington | **Approximate Elevation:** 47 Feet

Depth (ft)	Soil Description	Sample Type	Sample Number	Ground Water	Penetration Resistance (▲ Standard, △ Other; Blows per foot)	N-values	Testing
	2" Sod over loose, wet, brown, silty, fine SAND.						
	Medium dense, wet, black, silty, fine SAND with vesicular textured particles. (Fill)		S-1		▲ ●	15	
5	Very stiff, wet, orange-brown mottled, sandy SILT.		S-2		▲ ●	17	
	Medium dense to dense, wet, gray-brown, gravelly, silty, fine SAND.		S-3		● ▲	28	GS
10			S-4		● ▲	36	
	Boring completed at 11.5 feet on 3/26/02. No groundwater observed at the time of drilling.						
15							
20							
25							

Penetration Resistance scale: 0 10 20 30 40

Explanation

- 2-inch O.D. split spoon sample
- 3-inch I.D Shelby tube sample
- ⊗ No Recovery
- ▼ ATD — Groundwater level at time of drilling or date of measurement

Monitoring Well Key

- Clean Sand
- Cuttings
- Bentonite
- Grout
- Screened Casing

0 10 20 30 40 50

Moisture Content

Plastic Limit — Natural — Liquid Limit

Zipper Zeman Associates, Inc. Geotechnical & Environmental Consultants	BORING LOG	Figure A-2
	Date Drilled: 3/26/02	Logged By: RAR

PROJECT: Hood Street Sewer Replacement | **JOB NO.** J-1358 | **BORING** B-3 | **PAGE 1 OF 2**

Location: Tacoma, Washington | **Approximate Elevation:** 44 Feet

Depth (ft)	Soil Description	Sample Type	Sample Number	Ground Water	Penetration Resistance (▲ Standard, △ Other; Blows per foot: 0, 10, 20, 30, 40)	N-values	Testing
	Loose, moist, dark brown, silty, fine SAND.						
	Medium dense, wet, brown, gravelly, silty, fine SAND.		S-1		● 14, ▲ 18	22	
5			S-2		● 16, ▲ 19	23	GS
	Dense, wet, brown, silty, sandy, GRAVEL.		S-3		● 8, ▲ 27	35	GS
10	grades to very dense		S-4		● 8, ▲ 50/5"	63	
			S-5		● 7, ▲ 50/5"	73	
15				▼ ATD			
	grades to saturated		S-6		▲ 50/5"	73	
20							
			S-7		▲ 50/5"	66	
25							

Explanation

- 2-inch O.D. split spoon sample
- 3-inch I.D Shelby tube sample
- ⊗ No Recovery
- ▼ ATD — Groundwater level at time of drilling or date of measurement

Monitoring Well Key

- Clean Sand
- Cuttings
- Bentonite
- Grout
- Screened Casing

Moisture Content (0, 10, 20, 30, 40, 50)

Plastic Limit — Natural — Liquid Limit

Zipper Zeman Associates, Inc. Geotechnical & Environmental Consultants	BORING LOG	Figure A-3
	Date Drilled: 3/26/02	Logged By: RAR

PROJECT: Hood Street Sewer Replacement | JOB NO. J-1358 | BORING B-3 | PAGE 2 OF 2

Location: Tacoma, Washington

Depth (ft)	Soil Description	Sample Type	Sample Number	Ground Water	Penetration Resistance (▲ Standard, △ Other; Blows per foot: 0, 10, 20, 30, 40)	N-values	Testing
	Very dense, wet, brown, silty, sandy, GRAVEL.						
	Very stiff, saturated, brown, SILT with some sand.	I	S-8		▲	18	
30	Boring completed at 29 feet on 3/26/02. Groundwater observed at approximately 17.5 feet at the time of drilling.						
35							
40							
45							
50							

Explanation

- I — 2-inch O.D. split spoon sample
- II — 3-inch I.D Shelby tube sample
- ⊗ — No Recovery
- ▼ ATD — Groundwater level at time of drilling or date of measurement

Monitoring Well Key

- Clean Sand
- Cuttings
- Bentonite
- Grout
- Screened Casing

0 10 20 30 40 50

Moisture Content

Plastic Limit — Natural — Liquid Limit

Zipper Zeman Associates, Inc. Geotechnical & Environmental Consultants	BORING LOG	Figure A-3
	Date Drilled: 3/26/02	Logged By: RAR

PROJECT: Hood Street Sewer Replacement | **JOB NO.** J-1358 | **BORING** B-4 | **PAGE 1 OF 2**

Location: Tacoma, Washington | **Approximate Elevation:** 42 Feet

Depth (ft)	Soil Description	Sample Type	Sample Number	Ground Water	N-values
	2 inches sod over moist, black, gravelly SAND with some silt.				
	Dense, moist, brown, coarse GRAVEL with sand and trace silt.		S-1		36
5			S-2		34
	Dense, moist, brown, coarse SAND with some gravel and silt.		S-3		43
10	Dense, moist, brown, fine to coarse GRAVEL with sand and trace silt.		S-4		49
			S-5		48
15	grades to very dense		S-6		53
20			S-7		66
	Hard, moist, brown, sandy SILT.				
25				ATD	

Penetration Resistance

▲ Standard △ Other

Blows per foot: 0 10 20 30 40

Testing

0 10 20 30 40 50

Moisture Content

Plastic Limit — Natural — Liquid Limit

Explanation

- 2-inch O.D. split spoon sample
- 3-inch I.D Shelby tube sample
- ⊗ No Recovery
- ▼ ATD — Groundwater level at time of drilling or date of measurement

Monitoring Well Key

- Clean Sand
- Cuttings
- Bentonite
- Grout
- Screened Casing

Zipper Zeman Associates, Inc. Geotechnical & Environmental Consultants	BORING LOG	Figure A-4
	Date Drilled: 3/26/02	Logged By: RAR

PROJECT: Hood Street Sewer Replacement | **JOB NO.** J-1358 | **BORING** B-4 | **PAGE 2 OF 2**

Location: Tacoma, Washington

Depth (ft)	Soil Description	Sample Type	Sample Number	Ground Water	Penetration Resistance (▲ Standard, △ Other; Blows per foot)	N-values	Testing
	Very dense, saturated, brown, fine to coarse, gravelly SAND with trace to some SILT.	I	S-8		▲ at 88	88	
	Boring completed at 26.5 feet on 3/26/02. Groundwater observed at approximately 25 feet at the time of drilling.						

Penetration Resistance scale: 0 10 20 30 40

30 35 40 45 50

Explanation

- I — 2-inch O.D. split spoon sample
- II — 3-inch I.D Shelby tube sample
- ⊗ — No Recovery
- ▼ ATD — Groundwater level at time of drilling or date of measurement

Monitoring Well Key

- Clean Sand
- Cuttings
- Bentonite
- Grout
- Screened Casing

0 10 20 30 40 50

Moisture Content

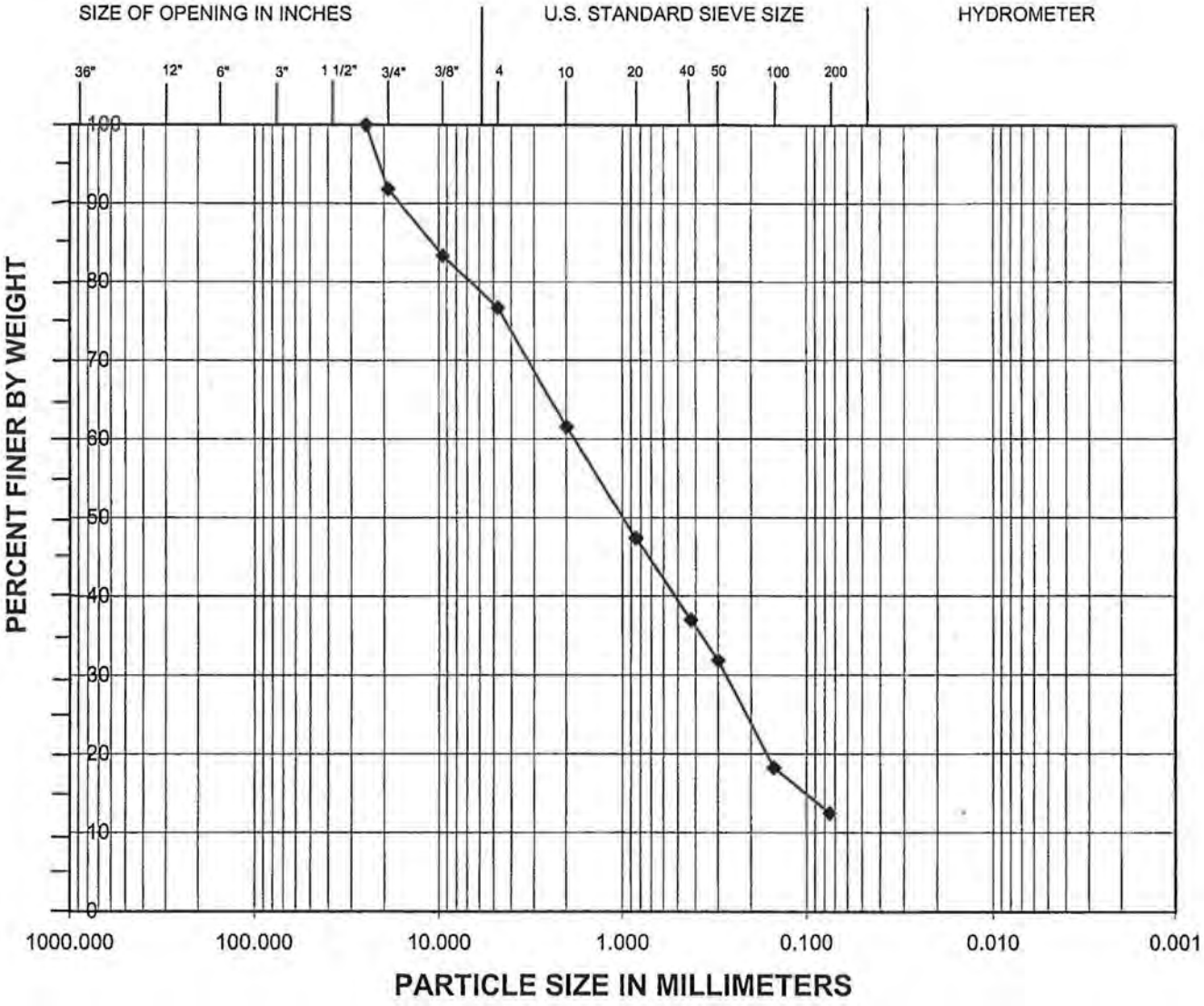
Plastic Limit — Natural — Liquid Limit

Zipper Zeman Associates, Inc. Geotechnical & Environmental Consultants	BORING LOG	Figure A-4
	Date Drilled: 3/26/02	Logged By: RAR

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D1140,D422



		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	

Comments:

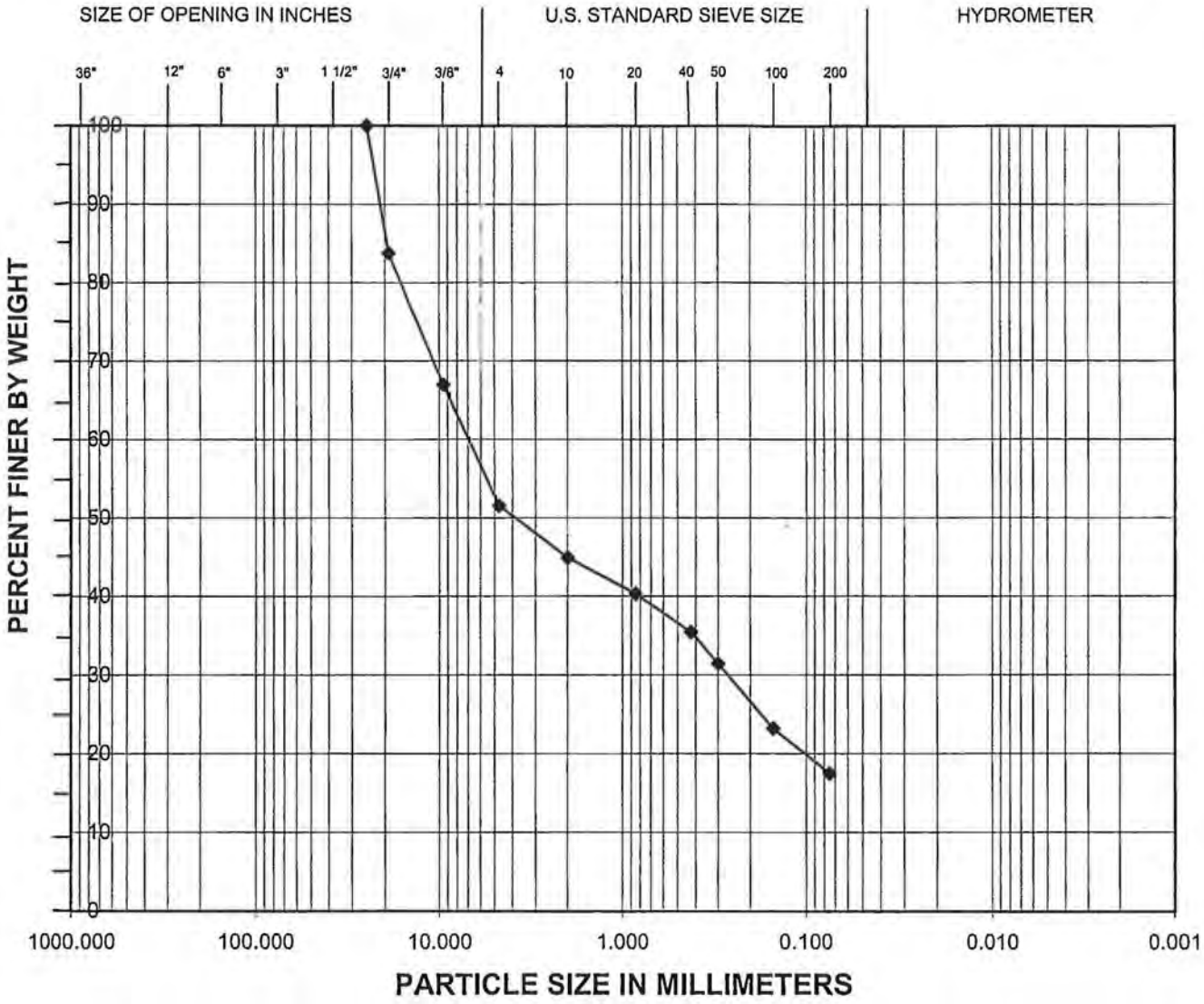
Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-1	S-2	5'	30	12.4	gravelly, silty, SAND

Zipper Zeman Associates, Inc. Geotechnical and Environmental Consulting	PROJECT NO: J-1358 DATE OF TESTING: 4/4/2002	PROJECT NAME: Hood St. Sewer Replacement

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D1140, D422



		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	

Comments:

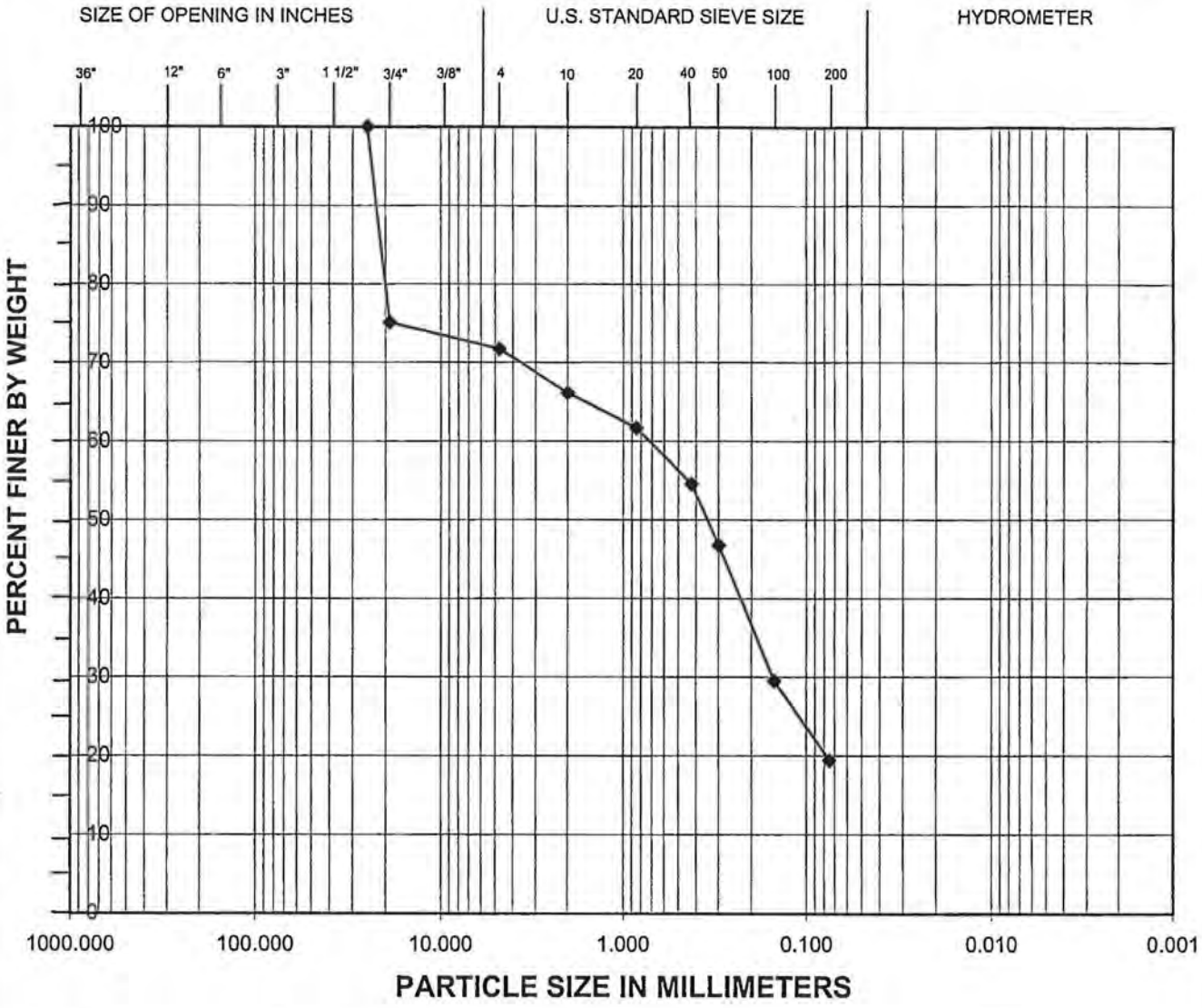
Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-1	S-5	12.5'	6	17.5	silty, sandy, GRAVEL

Zipper Zeman Associates, Inc. Geotechnical and Environmental Consulting	PROJECT NO: J-1358 DATE OF TESTING: 4/4/2002	PROJECT NAME: Hood St. Sewer Replacement

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D1140, D422



		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	

Comments:

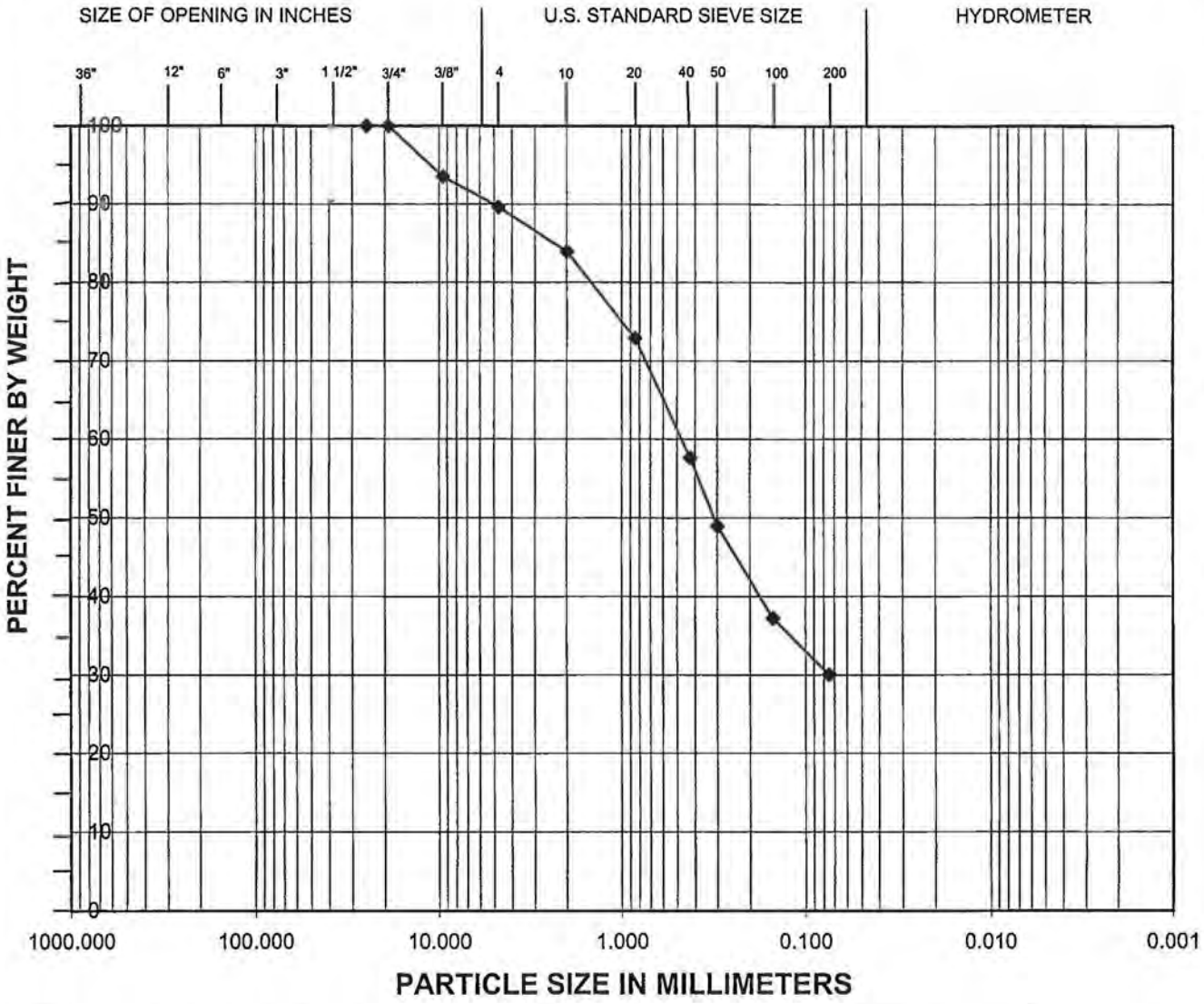
Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-2	S-3	7.5'	8	19.4	gravelly, silty SAND

Zipper Zeman Associates, Inc. Geotechnical and Environmental Consulting	PROJECT NO: J-1358 DATE OF TESTING: 4/4/2002	PROJECT NAME: Hood St. Sewer Replacement

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D1140,D422



		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	

Comments:

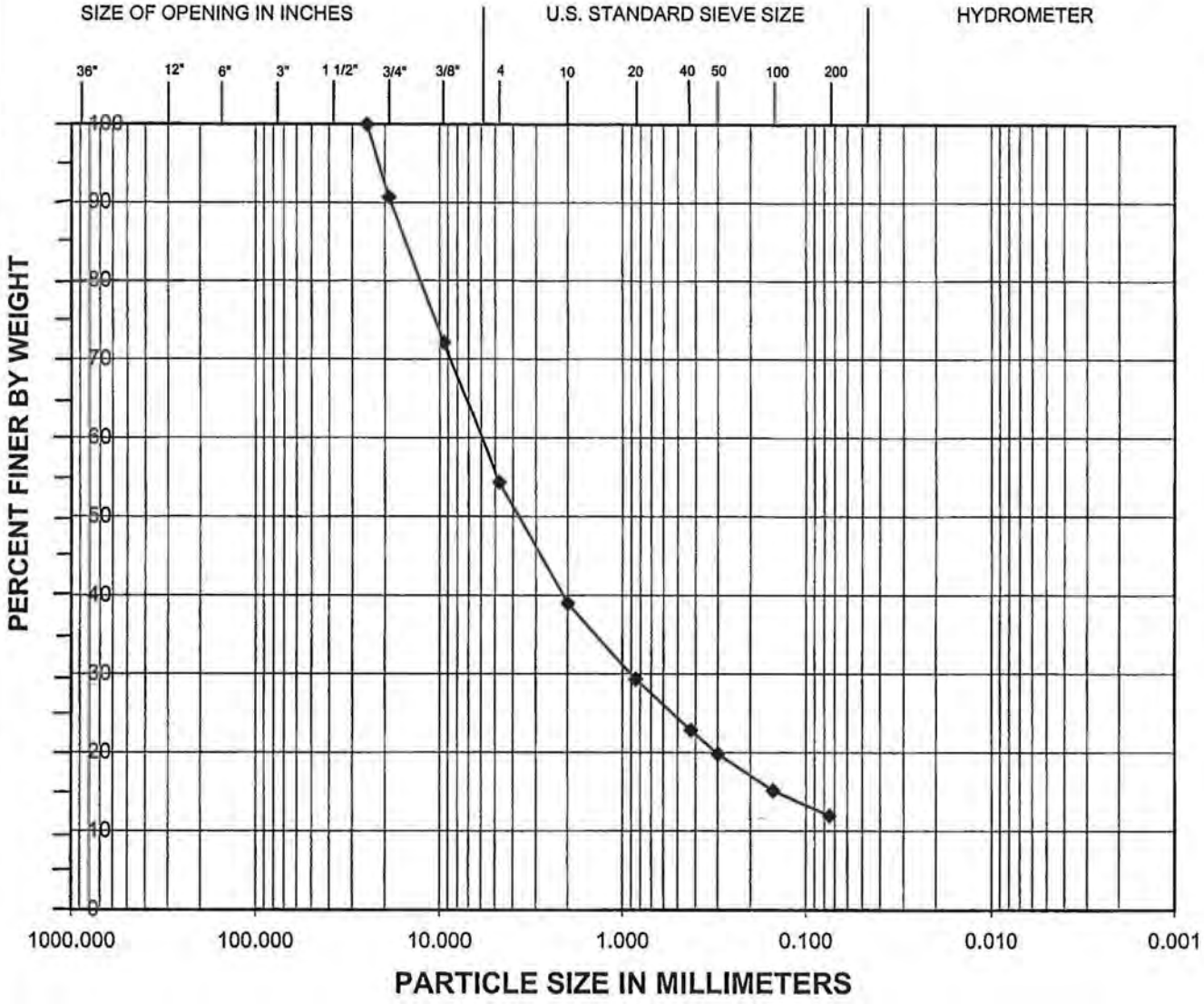
Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-3	S-2	5'	16	30.0	gravelly, silty SAND

Zipper Zeman Associates, Inc. Geotechnical and Environmental Consulting	PROJECT NO: J-1358 DATE OF TESTING: 4/4/2002	PROJECT NAME: Hood St. Sewer Replacement

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D1140, D422

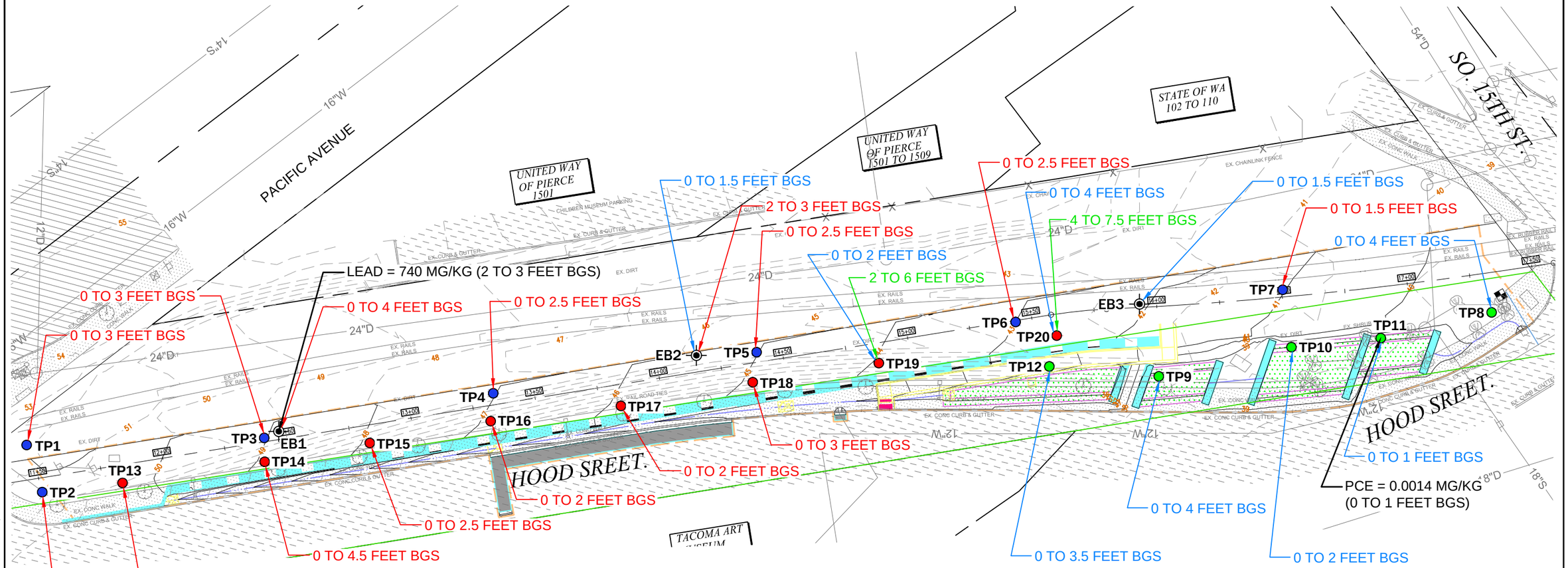


		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	

Comments:

Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-3	S-3	7.5'	8	12.0	silty, sandy, GRAVEL

Zipper Zeman Associates, Inc. Geotechnical and Environmental Consulting	PROJECT NO: J-1358 DATE OF TESTING: 4/4/2002	PROJECT NAME: Hood St. Sewer Replacement



Legend

- Existing Topographic Contours
- Proposed Topographic Contours
- EB-1 — Environmental Boring Location and Identification

Test Pit Location and Identification Related to Proposed Construction

- TP13 — Retaining Wall
- TP1 — Path
- TP9 — Stormwater Treatment Facility

Soil with cPAH Detections:

- 0 TO 3 FEET BGS — Vertical Extent of cPAHs Detected at a Concentration Greater Than the MTCA Method A ULU Cleanup Level (TTEC = 0.1 mg/kg)
- 0 TO 2 FEET BGS — Vertical Extent of cPAHs Detected at a Concentration Less Than MTCA Method A ULU Cleanup Level (TTEC = 0.1 mg/kg) But Observed to Be Visually Impacted
- 0 TO 6 FEET BGS — Vertical Extent of cPAHs Detected at a Concentration Less Than MTCA Method A ULU Cleanup (TTEC = 0.1 mg/kg) And Not Observed to be Visually Impacted

40 0 40
FEET

Notes:

TTEC = total toxicity equivalency concentration
PCE = tetrachloroethylene
MTCA = Model Toxics Control Act
bgs = below ground surface
ULU = Unrestricted Land Use
mg/kg = milligram per kilogram

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

Data Source: CAD file provided by BCRA Architects locations based on GeoEngineers.

Site Plan - Subsurface Locations and Vertical Extent of Contaminated and Impacted Soil

City of Tacoma - Prairie Line Trail Phase 1A
Tacoma, Washington

GeoEngineers

Figure 2

Office: TAC \\TAC\projects\0\0570133\01\CAD\0570133301_SitePlan_F2.dwg TAB:F1 hmara December 23, 2014

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	TS	Topsoil/ Forest Duff/Sod

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Material Description Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

A "P" indicates sampler pushed using the weight of the drill rig.

Laboratory / Field Tests

%F	Percent fines
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PP	Pocket penetrometer
PPM	Parts per million
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen
NT	Not Tested

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

KEY TO EXPLORATION LOGS

GeoEngineers

FIGURE A-1

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
5/21/2014	5/21/2014	5	LML / TSD	Holocene Drilling Inc.	Hollow-Stem Auger

Surface Elevation (ft) Vertical Datum	Hammer Data	Drilling Equipment
Undetermined	140 (lbs) / 30 (in) Drop	Diedrich D50 Turbo

Easting (X) Northing (Y)	System Datum	Groundwater: Date Measured	Depth to Water (ft)	Elevation (ft)

Notes: Samples collected with 3-inch modified California sampler

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample / Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		16	27	P1A-EB1-0-1.5 CA			GM	Dark brown silty fine to coarse sand with gravel, occasional organics (roots) and brown silt lenses (medium dense, moist) (fill)	NS	0.8	
			14	41	P1A-EB1-2-3 CA			ML	Black silt with fine to coarse sand and fine gravel (very stiff, moist) (fill)	MS	0.9	
									Grades to black/brown with roots			
			12	13	P1A-EB1-4-5 CA			SM	Grades to mottled gray/orange with roots	NS SS	0.9	
	5								Orange/brown sand, fine to medium with silt and roots (woody) (loose, moist) (fill)			

Note: See Figure A-1 for explanation of symbols.

Log of Boring EB1

GeoEngineers

Project: Prairie Line Trail Phase 1A
Project Location: Tacoma, Washington
Project Number: 0570-133-01

Figure A-2
Sheet 1 of 1

Tacoma: Date:10/15/14 Path:P:\0\0570133\01\GINT\0570133301.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
5/21/2014	5/21/2014	5	LML / TSD	Holocene Drilling Inc.	Hollow-Stem Auger

Surface Elevation (ft) Vertical Datum	Hammer Data	Drilling Equipment
Undetermined	140 (lbs) / 30 (in) Drop	Diedrich D50 Turbo

Easting (X) Northing (Y)	System Datum	Groundwater: Date Measured	Depth to Water (ft)	Elevation (ft)

Notes: Samples collected with 3-inch modified California sampler

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample / Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		18	35	P1A-EB2-0-1.5 CA			SM	Brown to black silty fine to coarse sand with gravel and occasional organics (medium dense, mosit) (fill)	NS	0.5	
										SS		
			16	48	P1A-EB2-2-3 CA				Black fine to coarse silty sand with occasional coarse gravel (medium dense, moist)	MS	1.2	
			16	37				SM	Brown silty fine to coarse sand with gravel (medium dense, moist) (ice-contact deposits)	NS	0.7	
	5											

Note: See Figure A-1 for explanation of symbols.

Log of Boring EB2

GeoEngineers

Project: Prairie Line Trail Phase 1A
Project Location: Tacoma, Washington
Project Number: 0570-133-01

Figure A-3
Sheet 1 of 1

Tacoma: Date:10/15/14 Path:P:\0\05701330\1\GINT\0570133301.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
5/21/2014	5/21/2014	5	LML / TSD	Holocene Drilling Inc.	Hollow-Stem Auger

Surface Elevation (ft) Vertical Datum	Hammer Data	Drilling Equipment
Undetermined	140 (lbs) / 30 (in) Drop	Diedrich D50 Turbo

Easting (X) Northing (Y)	System Datum	Groundwater: Date Measured	Depth to Water (ft)	Elevation (ft)

Notes: Samples collected with 3-inch modified California sampler

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample / Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Sheen	Headspace Vapor (ppm)	REMARKS
	0		18	53	P1A-EB3-0-1.5 CA			GM	Brown gravel, sand with silt and fine to coarse sand, ballast, dark brown at 1 foot (medium dense, dry) (fill)	NS	0.2	
			16	79	P1A-EB3-2-3 CA				Grades to increased gravel (dense, moist)	MS	0.4	
			16	71				GM	Light brown gravel with silt, mostly coarse sand with fines and some clay. Well graded, small gravel (medium dense, moist to dry)	NS	0.6	
	5											

Note: See Figure A-1 for explanation of symbols.

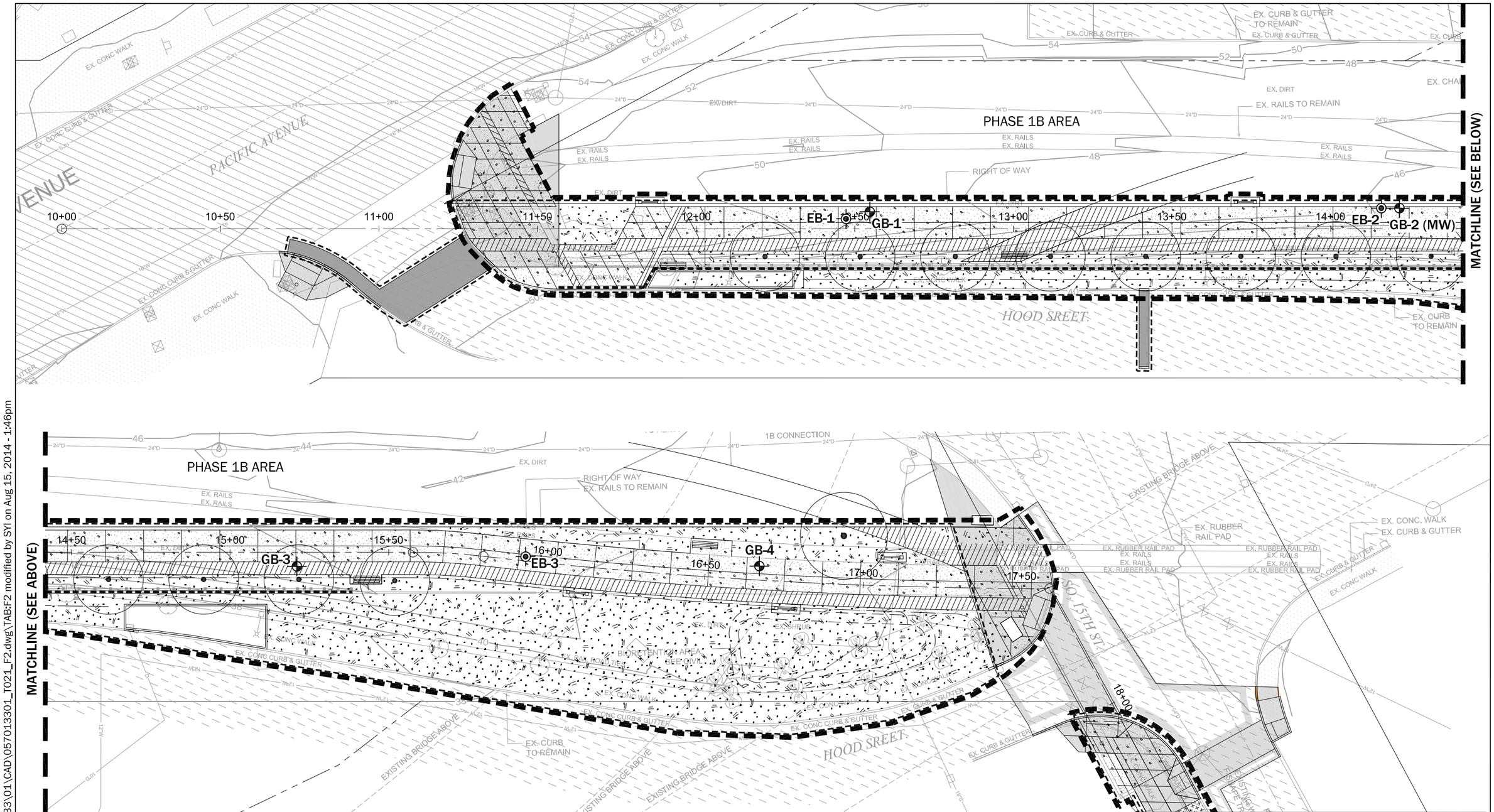
Log of Boring EB3

GeoEngineers

Project: Prairie Line Trail Phase 1A
Project Location: Tacoma, Washington
Project Number: 0570-133-01

Figure A-4
Sheet 1 of 1

Tacoma: Date:10/15/14 Path:P:\0\0570133\01\GINT\0570133301.GPJ DBTemplate/LibTemplate:GEOENGINEERS8.GDT/GEI8_ENVIRONMENTAL_STANDARD



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

Reference: Drawing provided by City of Tacoma.

Legend

- GB-1 — Geotechnical boring number and approximate location
- EB-1 — Environmental boring number and approximate location (See Environmental report)
- Phase 1A limits with conceptual design shown

30 0 30
Feet

Site Plan

City of Tacoma - Prairie Line Trail Phase 1A
Tacoma, Washington

GeoEngineers

Figure 2

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SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	TS	Topsoil/ Forest Duff/Sod

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Material Description Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

A "P" indicates sampler pushed using the weight of the drill rig.

Laboratory / Field Tests

%F	Percent fines
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PP	Pocket penetrometer
PPM	Parts per million
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen
NT	Not Tested

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

KEY TO EXPLORATION LOGS

GeoEngineers

FIGURE A-1

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
5/21/2014	5/21/2014	11.5	EKV / MM	Holocene Drilling Inc.	Hollow-Stem Auger

Surface Elevation (ft) / Vertical Datum	Hammer Data	Drilling Equipment
49 NGVD29	140 (lbs) / 30 (in) Drop	Diedrich D50 Turbo

Easting (X) / Northing (Y)	System Datum	Groundwater: Date Measured	Depth to Water (ft)	Elevation (ft)
47.247995 / -122.43696	WGS84 (feet)			

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample / Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
45	0	1	18	1 SA			SM	Dark brown silty fine to coarse sand with gravel, occasional organics (roots) and brown silt lenses (loose, moist) (fill)	14	26	Rock in sampler tip; Low recovery; Resampled with 3-inch modified California sampler
	5	2	5	2				Grades to loose			
40	10	8	9	3 %F					22	44	

Note: See Figure A-1 for explanation of symbols.

Log of Boring GB1

GeoEngineers

Project: Prairie Line Trail Phase 1A
Project Location: Tacoma, Washington
Project Number: 0570-133-01

Figure A-2
Sheet 1 of 1

Tacoma: Date:8/15/14 Path:P:\0057013301\GINT\057013301.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_STANDARD

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
5/21/2014	5/21/2014	21.5	EKV / MM	Holocene Drilling Inc.	Hollow-Stem Auger

Hammer Data	140 (lbs) / 30 (in) Drop	Drilling Equipment	Diedrich D50 Turbo
Surface Elevation (ft) / Vertical Datum	45 / NGVD29	Top of Casing Elevation (ft)	
Easting (X) / Northing (Y)	47.248716 / -122.436557	Horizontal Datum	WGS84 (feet)

A 2 (in) well was installed on 5/21/2014 to a depth of 21.5 (ft).

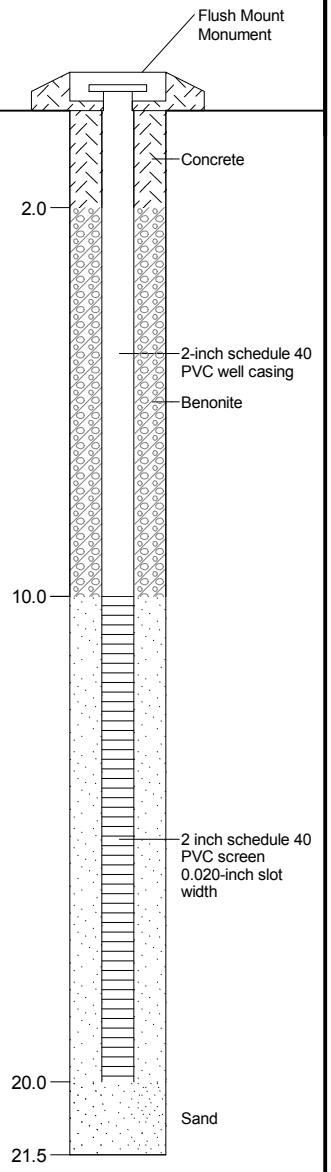
Groundwater

Date Measured	Depth to Water (ft)	Elevation (ft)

Notes:

Elevation (feet)	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample / Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)
	0						SM	Brown with mottling silty fine to coarse sand with gravel and occasional organics (loose, moist) (fill)		
40	5	10	32	1,2 SA %F					14	35
							SM	Brown silty fine to coarse sand with gravel (dense, moist) (glacial ice contact deposits)	11	28
							GP-GM	Brown fine to coarse gravel with silt and sand (very dense, moist) (glacial ice contact deposits)		
35	10	8	60	3						
30	15	0	50/2"							
							SP-SM	Brown fine to coarse sand with silt and occasional gravel (dense, moist) (glacial ice contact deposits)		
25	20	16	48	4						

WELL LOG



Note: See Figure A-1 for explanation of symbols.

Log of Boring GB2

GeoEngineers

Project:	Prairie Line Trail Phase 1A
Project Location:	Tacoma, Washington
Project Number:	0570-133-01

Figure A-3
Sheet 1 of 1

Tacoma: Date:8/15/14 Path:P:\0057013301\GINT\057013301.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_WELL

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	5/21/2014	5/21/2014	21.4	EKV	MM	Holocene Drilling Inc.	Hollow-Stem Auger

Surface Elevation (ft) Vertical Datum	Hammer Data	Drilling Equipment
44 NGVD29	140 (lbs) / 30 (in) Drop	Diedrich D50 Turbo

Easting (X) Northing (Y)	System Datum	Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
47.24842 -122.436753	WGS84 (feet)			

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample: Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0						SM	Dark brown silty fine to coarse sand with occasional gravel and organics (roots) (medium dense, moist) (fill)			
40		15	20	1 SA					21	28	CEC = 22 meq/100 g OC = 22%
	5	12	76	2 %F			SM	Brown silty fine to coarse sand with occasional gravel (very dense, moist) (glacial ice contact deposits)	8	30	CEC = 11 meq/100 g OC = 2%
35											
	10	5	57	3							
30											
	15	5	57	4				Grades to with gravel			
25											Groundwater observed at 19 feet at time of drilling
	20		50/5"	5							

Note: See Figure A-1 for explanation of symbols.

Log of Boring GB3

GeoEngineers

Project: Prairie Line Trail Phase 1A
Project Location: Tacoma, Washington
Project Number: 0570-133-01

Figure A-4
Sheet 1 of 1

Tacoma: Date:8/15/14 Path:P:\0057013301\GINT\057013301.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_STANDARD

Drilled Start	End	Total Depth (ft)	Logged By / Checked By	Driller	Drilling Method
5/21/2014	5/21/2014	11.5	EKV / MM	Holocene Drilling Inc.	Hollow-Stem Auger

Surface Elevation (ft) / Vertical Datum	Hammer Data	Drilling Equipment
41 NGVD29	140 (lbs) / 30 (in) Drop	Diedrich D50 Turbo

Easting (X) / Northing (Y)	System Datum	Groundwater: Date Measured	Depth to Water (ft)	Elevation (ft)
47.249127 / -122.436321	WGS84 (feet)			

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample / Sample Name Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
40	0						SM	Brown silty fine to coarse sand with gravel (loose, moist) (fill)			
		5	50/5"	1 SA			SM	Brown silty fine to coarse sand with gravel (dense, moist) (glacial ice contact deposits)	6	21	2 inch gravel in sampler tip CEC = 11 meq/100 g OC = 5%
35	5	4	50/3"	2			GP-GM	Brown fine to coarse gravel with silt and sand (very dense, moist) (glacial ice contact deposits)			CEC = 9 meq/100 g OC = 1%
							ML	Brown silt with occasional sand (hard, moist) (glacial ice contact deposits)			
30	10	18	50	3							

Note: See Figure A-1 for explanation of symbols.

Log of Boring GB4

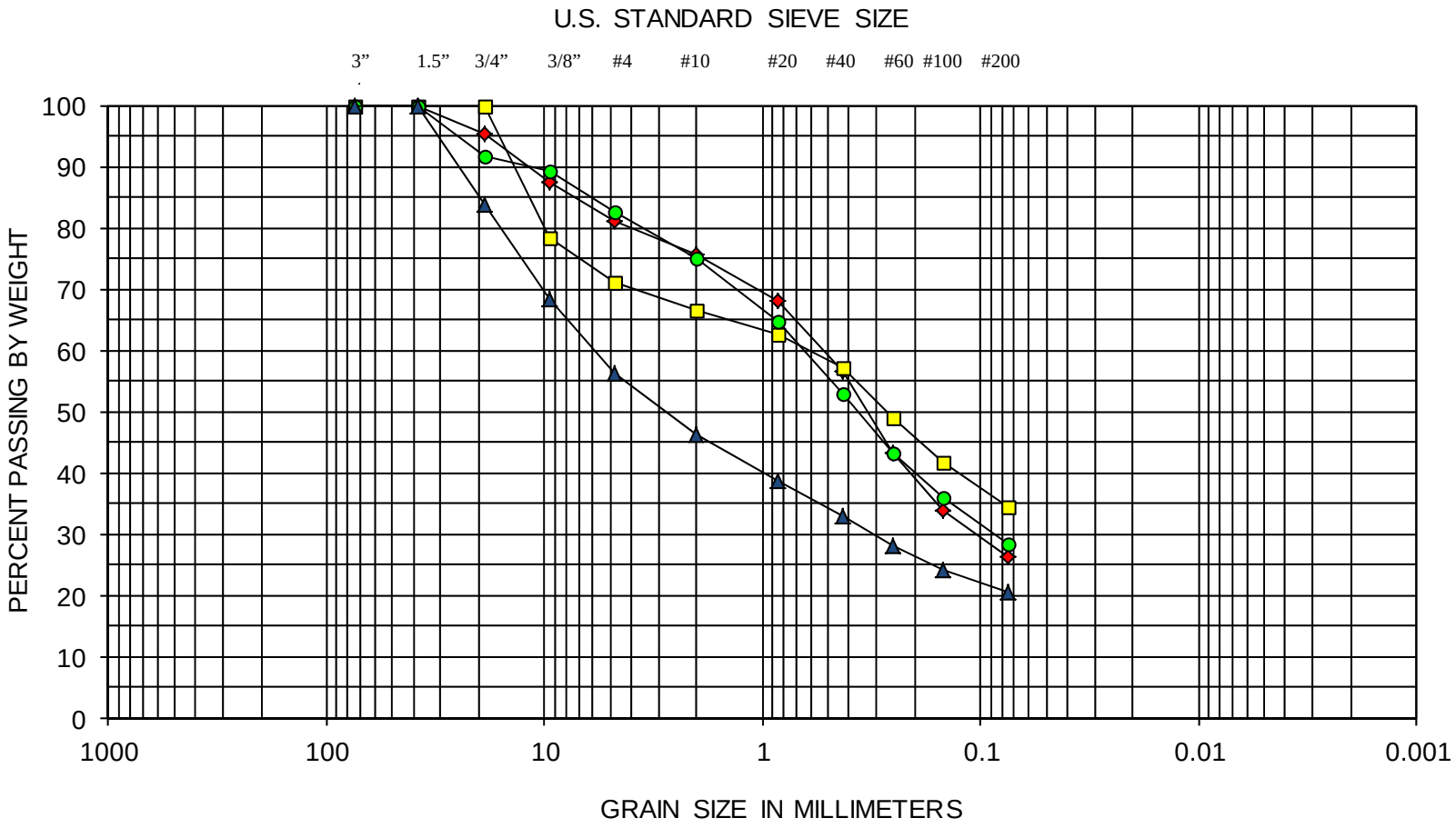
GeoEngineers

Project: Prairie Line Trail Phase 1A
Project Location: Tacoma, Washington
Project Number: 0570-133-01

Figure A-5
Sheet 1 of 1

Tacoma: Date:8/15/14 Path:P:\0057013301\GINT\057013301.GPJ DBTemplate\LibTemplate:GEOENGINEERS8.GDT/GEI8_GEOTECH_STANDARD

0570-133-01



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	MOISTURE (%)	SOIL CLASSIFICATION
◆	GB-1	2.5	13.6	Silty fine to coarse sand with gravel (SM)
□	GB-2	5	14.1	Silty fine to coarse sand with gravel (SM)
○	GB-3	2.5	20.5	Silty fine to coarse sand with gravel (SM)
△	GB-4	2.5	6.3	Silty fine to coarse gravel with sand (GM)

GeoEngineers

Figure A-6

Prairie Line Trail Phase 1A
Tacoma, Washington

Sieve Analysis Results

Am Test Inc.
13600 NE 126TH PL
Suite C
Kirkland, WA 98034
(425) 885-1664

Professional Analytical Services

Jun 6 2014
On-Site Environmental
14648 NE 95th ST
Redmond, WA 98052
Attention: David Baumeister

Dear David Baumeister:

Enclosed please find the analytical data for your project.

The following is a cross correlation of client and laboratory identifications for your convenience.

CLIENT ID	MATRIX	AMTEST ID	TEST
P1A-GB3-2.5	Soil	14-A007586	CEC-s, OM std mth
P1A-GB3-5	Soil	14-A007587	CEC-s, OM std mth
P1A-GB4-2.5	Soil	14-A007588	CEC-s, OM std mth
P1A-GB4-5	Soil	14-A007589	CEC-s, OM std mth

Your samples were received on Friday, May 23, 2014. At the time of receipt, the samples were logged in and properly maintained prior to the subsequent analysis.

The analytical procedures used at AmTest are well documented and are typically derived from the protocols of the EPA, USDA, FDA or the Army Corps of Engineers.

Following the analytical data you will find the Quality Control (QC) results.

Please note that the detection limits that are listed in the body of the report refer to the Practical Quantitation Limits (PQL's), as opposed to the Method Detection Limits (MDL's).

If you should have any questions pertaining to the data package, please feel free to conact me.

Sincerely,

Aaron W. Young
Laboratory Manager

Project #: 0570-133-01
PO Number: 05-183

BACT = Bacteriological
CONV = Conventionals
MET = Metals
ORG = Organics
NUT=Nutrients
DEM=Demand
MIN=Minerals

Am Test Inc.
13600 NE 126TH PL
Suite C
Kirkland, WA 98034
(425) 885-1664
www.amtestlab.com

Professional Analytical Services

ANALYSIS REPORT

On-Site Environmental
14648 NE 95th ST
Redmond, WA 98052
Attention: David Baumeister
Project #: 0570-133-01
PO Number: 05-183
All results reported on an as received basis.

Date Received: 05/23/14
Date Reported: 6/ 6/14

AMTEST Identification Number **14-A007586**
Client Identification **P1A-GB3-2.5**
Sampling Date **05/21/14, 13:20**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Cation Exchange Capacity	22.	meq/100g		0.5	SW-846 9081	EB	06/06/14

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Organic Matter	22.1	%			SM 2540G	AB	05/27/14

AMTEST Identification Number **14-A007587**
Client Identification **P1A-GB3-5**
Sampling Date **05/21/14, 13:25**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Cation Exchange Capacity	11.	meq/100g		0.5	SW-846 9081	EB	06/06/14

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Organic Matter	2.4	%			SM 2540G	AB	05/27/14

AMTEST Identification Number **14-A007588**
Client Identification **P1A-GB4-2.5**
Sampling Date **05/21/14, 14:40**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Cation Exchange Capacity	11.	meq/100g		0.5	SW-846 9081	EB	06/06/14

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Organic Matter	4.9	%			SM 2540G	AB	05/27/14

AMTEST Identification Number **14-A007589**
Client Identification **P1A-GB4-5**
Sampling Date **05/21/14, 14:45**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Cation Exchange Capacity	8.5	meq/100g		0.5	SW-846 9081	EB	06/06/14

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Organic Matter	1.1	%			SM 2540G	AB	05/27/14

Aaron W. Young
Laboratory Manager

Am Test Inc.
13600 NE 126th PL
Suite C
Kirkland, WA, 98034
(425) 885-1664
www.amtestlab.com

Professional Analytical Services

QC Summary for sample numbers: 14-A007586 to 14-A007589

DUPLICATES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	DUP VALUE	RPD
14-A007589	Cation Exchange Capacity	meq/100g	8.5	7.3	15.
14-A007589	Organic Matter	%	1.1	1.0	9.5

STANDARD REFERENCE MATERIALS

ANALYTE	UNITS	TRUE VALUE	MEASURED VALUE	RECOVERY
Cation Exchange Capacity	meq/100g	10.	9.1	91.0 %

BLANKS

ANALYTE	UNITS	RESULT
Cation Exchange Capacity	meq/100g	< 0.5

Site 3A

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000
TTY 711 or 800-833-6388 (For the Speech or Hearing Impaired)

CERTIFIED MAIL

March 7, 2005

Mr. Peter J. Grignon
United Way of Pierce County
1501 Pacific Avenue
Tacoma, WA 98402

Dear Mr. Grignon:

Thank you for submitting the results of your independent remedial action(s) for the Washington State Department of Ecology's (Ecology) review. Ecology appreciates your initiative in pursuing this administrative option under the Model Toxics Control Act (MTCA). Ecology's Toxics Cleanup Program has reviewed the following information regarding the underground storage tank (UST) decommissioning activities, soil remediation and ground-water monitoring at the United Way of Pierce County site, located at 1501 Pacific Avenue, Tacoma, Washington:

- Saltbush Environmental Services, Inc., **United Way of Pierce County UST Removal & Contamination Cleanup Report, 1501 Pacific Avenue, Tacoma, Washington 98401,** July 15, 1994,

- Saltbush Environmental Services, Inc., **United Way of Pierce County Contamination Delineation Report, 1501 Pacific Avenue, Tacoma, Washington 98402,** December 19, 1994,

- Saltbush Environmental Services, Inc., **Ground Water Assessment, The 1501 Pacific Avenue Project, Tacoma, Pierce County, Washington 98402,** May 22, 2003

- Robinson & Noble, Inc. & Saltbush Environmental Services, **Groundwater Monitoring, United Way of Pierce County, 1501 Pacific Avenue, Tacoma, Washington 98402,** April 2, 2004, August 4, 2004, October 26, 2004 & January 26, 2005.

Your reports will be kept in the Central Files of the Southwest Regional Office (SWRO) of Ecology for review by appointment only. Appointments can be made by calling the SWRO resource person, at (360) 407-6365.

In 1991, this property underwent a limited Phase II investigation that included a subsurface study of the central area of the vacant lot, now the parking lot, south of the building. This portion of the investigation consisted of the analysis of soil samples obtained during the excavation of test pits and of a geophysical survey performed to detect subsurface anomalies. The results of this investigation revealed the presence of an abandoned underground storage tank (UST) and diesel in the soil above the then applicable cleanup levels established under the Model Toxics Control Act (MTCA). The UST was estimated to have a capacity of approximately 1,000 gallons, based

on the visual observation at the time. Soil in the vicinity of the tank was sampled and diesel contamination was detected at a concentration of 3,300 mg/kg.

In June 1994, the UST discovered during the geophysical survey conducted in 1991 was removed. This heating oil tank had a volume of approximately 650 gallons and was discovered to have been leaking. Consequently, an estimated 1500 tons of diesel-contaminated soils were excavated during the tank removal. Based on the sampling results, soil concentrations of diesel increased to the northeast, appearing to indicate ground-water transport in that same direction. During this remediation, some of the contaminated soils remained in place since the excavation of all the contaminated soil could not be accomplished without endangering the integrity of the nearby building (according to the city engineer).

Additional investigations in October/November 1994 following the diesel-contaminated soil remediation consisted of soil samples obtained from five boreholes located primarily to the east and north of the former UST excavation to assist in establishing the vertical and horizontal extent of heating oil contamination. The boreholes penetrated to a depth of approximately 30 ft bgs with sampling performed at five-foot intervals. Sampling analysis confirmed that contaminated soils remained in the vicinity of the former UST excavation and seemed to support the results obtained during the UST removal activities.

In 1995, a 2,500-gallon heating oil UST was removed at a location near the southeast corner of the building. In contrast to the other UST, no visual signs of tank corrosion were apparent. Furthermore, petroleum-contaminated soils were absent based on field screening and on an analysis of soil samples from the tank pit.

On March 27 and 28, 2003, three ground-water monitoring wells were installed in the vicinity of the former UST excavation located in the parking lot south of the three-story building at 1501 Pacific Avenue. Soil samples were collected during the drilling of these wells. Ground-water samples were collected from the three wells on April 1, 2003. Additional work was performed on April 28, 2003 when a fourth monitoring well was installed to refine the determination of the ground-water flow direction and to sample down-gradient conditions to assess offsite impact. Water level measurements were taken on May 1 and the ground water from the fourth well was sampled for diesel range organics per the procedures followed during the initial sampling for the previous wells. Samples were collected from all four wells again on March 11, 2004, June 25, 2004, October 6, 2004, and December 27, 2004.

Based upon the above listed information, Ecology has determined that, at this time, the release of total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene and total xylenes (BTEX) into the soil and ground water no longer poses a threat to human health or the environment.

Therefore, Ecology is issuing this determination that no further remedial action is necessary at this site under MTCA, Chapter 70.105D RCW. However, please note that because your actions were not conducted under a consent decree with Ecology, this letter is written pursuant to RCW 70.105D.030(1)(i) and does not constitute a settlement by the state under RCW 70.105D.040(4) and is not binding on Ecology.

Ecology's no further action determination is made only with respect to the release(s) identified in the reports listed above. This no further action determination applies only to the area of the

property affected by the release(s) at 1501 Pacific Avenue, Tacoma, Washington, as identified in the report. It does not apply to any other release or potential release at the property, any other areas of the property, nor any other properties owned or operated by United Way of Pierce County, Mr. Peter Grignon, or their representatives.

Ecology will update its databases to reflect this "No Further Action" determination. Your site will not appear in future publications of the Confirmed & Suspected Contaminated Sites Report (previously known as the Affected Media and Contaminants Report).

The state, Ecology, and its officers and employees are immune from all liability and no cause of action of any nature may arise from any act or omission in providing this determination.

If you have any questions about any of the information presented in this letter, please contact me at (360) 407-6267.

Sincerely,

Charles S. Cline
Toxics Cleanup Program
Southwest Regional Office

CSC:ksc:United Way of Pierce CountyNFA

cc: Mr. John Hildenbrand, Robinson & Noble, Inc.
Mr. Michael Piechowski, Robinson & Noble, Inc.
Ms. Sharon Bell, Tacoma-Pierce County Health Dept.
Ms. Carol Johnston, State of Washington Dept. of Ecology
Trish Akana, State of Washington Department of Ecology (SW0539)

Site 3A

ROBINSON NOBLE SALTBUSH INC. Established 1947
GROUNDWATER & ENVIRONMENTAL SCIENTISTS

'05 JAN 31 AM 10:58

January 27, 2005

Chuck Cline
Department of Ecology
PO Box 47775
Olympia, WA 98504-7775

Dear Mr. Cline:

Enclosed, please find the fourth quarter 2004 monitoring report for United Way of Pierce County, 1501 Pacific Avenue, in Tacoma, WA. As you know, United Way entered into the Voluntary Cleanup Program as a result of the removal of underground storage tanks on their property in 1994 and 1995. Both tanks contained heating oil, one 650-gallon capacity and one 2,500-gallon capacity. During the tank removal, most of the impacted soil was excavated, however some material above cleanup levels remained. After the completion of the source reduction, groundwater monitoring was started in 2003 with the installation of a network of four monitoring wells.

After these wells were installed and our initial monitoring results were discussed, four quarterly monitoring events were completed. The results of the monitoring indicate that none of the samples collected during the four monitoring events had concentrations of target compounds at or above the analytical detection limit.

As discussed in the initial meeting, you indicated that the status of the NFA for the site would be determined after the review of a minimum of four quarters of monitoring data. At this time, it appears that we have met the conditions established for your review of the NFA status of the site. Should, after your review, it be determined that the site is eligible for an NFA, please advise us as to any conditions or other requirements that need to be incorporated into the NFA template in order for our client to complete this process.

Very Truly Yours,
Robinson, Noble & Saltbush, Inc.

Michael F. Piechowski, L.HG.
Senior Hydrogeologist

State of Washington
Hydrogeologist
592
Licensed Geologist
MICHAEL F. PIECHOWSKI

enclosure

Cc: Peter Grignon, United Way of Pierce County

3011 South Huson Street, Suite A Tacoma, Washington 98409 • (253) 475-7711 • Fax: (253) 472-5846
e-mail: mail@robinson-noble.com

Site 3A

ROBINSON NOBLE SALTBUSH INC. Established 1947
GROUNDWATER & ENVIRONMENTAL SCIENTISTS

RECE
DEPT. OF EC

'05 JAN 31 A10:58

January 26, 2005

United Way of Pierce County
Mr. Peter J. Grignon
1501 Pacific Avenue
Tacoma, Washington 98402

Re: Groundwater Monitoring
United Way of Pierce County
1501 Pacific Avenue
Tacoma, Washington 98402

Dear Mr. Grignon:

Robinson, Noble & Saltbush is pleased to present this letter report documenting the sampling and testing of ground water at the United Way of Pierce County property located at 1501 Pacific Avenue in Tacoma. This sampling was completed in accordance with the monitoring program requested by the Washington Department of Ecology as a part of the Voluntary Cleanup Program (VCP), entered into in an effort to receive a No Further Action letter (NFA) for the subject parcel. This report contains the data from the fourth of the planned four quarterly sampling events.

On December 27, Robinson, Noble & Saltbush personnel measured water levels and sampled each monitoring well at the project site. Initially, wells were opened up and water levels were measured to the nearest hundredth of a foot. Once measurements were completed, ground water was drawn from each well utilizing a variable-speed pump and dedicated tubing. Samples were collected after at least three well volumes of water were purged from each well and field measurements of temperature, conductivity, and total dissolved solids had stabilized. The samples were placed unfiltered into laboratory-supplied containers with the proper preservatives. Each bottle was labeled with the sample number, date and time of sampling, type of preservative, name of the sampler, and the sample location. The samples were immediately placed in a cooler with frozen blue ice and maintained at approximately 4° C.

Samples were submitted to Libby Environmental, LLC, an accredited laboratory, for analysis. Samples were analyzed for the presence of benzene, toluene, ethylbenzene, and total xylenes via EPA method 8021B, and total petroleum hydrocarbons via NWTPH-Dx/Dx Extended. Analytical results indicated that all of the wells had target compound concentrations below the applicable laboratory detection limits and thus were also below the applicable MTCA Method A cleanup levels. The table below summarizes the fourth quarter analytical data. Laboratory reports and sample chain-of-custody forms are attached for all four quarters of monitoring.

3011 South Huson Street, Suite A Tacoma, Washington 98409 ▪ (253) 475-7711 ▪ Fax: (253) 472-5846
e-mail: mail@robinson-noble.com

Site 3A

Table 1: Fourth Quarter 2004 Analytical Results (µg/L)

Well ID/ Analyte	Detection Limit	MW1	MW2	MW3	MW4	MTCA Method A Level
Benzene	1	ND	ND	ND	ND	**5**
Toluene	1	ND	ND	ND	ND	**1000**
Ethylbenzene	1	ND	ND	ND	ND	**700**
Total Xylenes	1	ND	ND	ND	ND	**1000**
NWTPH-Dx/Dx Ext. Diesel	200	ND	ND	ND	ND	**500**
NWTPH-Dx/Dx Ext. Mineral Oil	400	ND	ND	ND	ND	**500**
NWTPH-Dx/Dx Ext. Oil	400	ND	ND	ND	ND	**1000**

Bold Type indicates concentrations above MTCA Method A cleanup levels for ground water
ND indicates concentrations below the laboratory detection limits

Previous monitoring events were conducted after the installation of the monitoring wells in 2003. Data for diesel-range hydrocarbons from these monitoring events is presented in Table 2.

Table 2: April and May 2003 Analytical Results (at time of construction) (µg/L)

Well ID, Date/ Analyte (detection limit)	MW1 April 1, 2003	MW2 April 1, 2003	MW3 April 1, 2003	MW4 May 1, 2003	MTCA Method A Level
NWTPH-Dx/Dx Ext. Diesel (200)	300	**1200**	ND	ND	**500**

Bold Type indicates concentrations above MTCA Method A cleanup levels for ground water
ND indicates concentrations below the laboratory detection limits, listed in parenthesis

An electronic water-level sounder was used to measure the depth to ground water in each well prior to the purging and sampling of the monitoring wells. The depths measured are listed on Table 3. These depths and the relative elevations of the wells were used to determine the groundwater flow direction. As noted on the attached groundwater contour map (Figure 1), ground water was generally flowing to the south-southwest at the time of measurement. This is consistent with the last two quarters, but is markedly different than the previous monitoring events; where groundwater flow direction was generally to the southeast. Although water levels have risen in all of the wells since the third quarter measurements, the difference in flow direction remained consistent and still appears to be a result of a depressed water level at MW-2. The water level in this well is approximately ten feet deeper than when the well was installed.

As the flow direction is now pointing slightly uphill geographically, a possible explanation for the localized changes in the groundwater surface could be dewatering or an alteration in groundwater flow associated with the construction on and across Pacific Avenue that is depressing the water level in MW-2 relative to the other wells. Though no dewatering was directly observed at the time of our site visits, such activities are not out of the question as part of a construction project of this magnitude.

Site 3A

Table 3: Depth to Ground Water, December 27, 2004

Monitoring Well Identification	Depth to Ground Water* (feet)
MW-1	25.01
MW-2	16.97
MW-3	11.54
MW-4	18.00

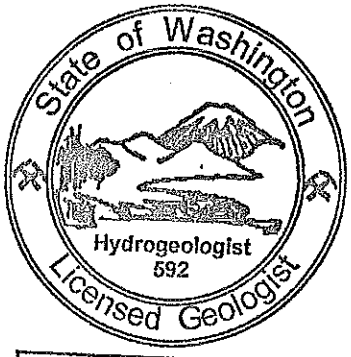
*The water levels were measured from the top of the 2-inch casing.

As noted previously in this letter, it is the intention of United Way to ask for a NFA letter from the Department of Ecology. Per our conversations with Chuck Cline of the Department of Ecology, the conditions of this NFA will be determined after Ecology's review of a minimum of four quarters of monitoring data. While water levels and flow direction fluctuated during the four quarters of monitoring, this is likely a result of seasonal changes and the construction activities off site in an upgradient direction, and should have no bearing on the quality of the monitoring data collected. As all four of the quarterly monitoring events have indicated that none of the target compounds were detected at or above analytical detection limits, the site should qualify for a NFA as discussed without the requirement for long-term groundwater monitoring, based on the conditions established in the initial meeting held between Ecology staff, Robinson, Noble & Saltbush, and United Way. We have requested that Ecology grant the requested NFA for this site.

A copy of this letter report and noted attachments is being sent to the Department of Ecology on your behalf. We will inform you of any additional requirements that Ecology may have prior to granting NFA status for the site. If you have any questions or require further assistance, please feel free to contact us by phone at (253) 475-7711 or email at mpiechowski@robinson-noble.com.

Respectfully submitted,
Robinson, Noble & Saltbush, Inc.

Michael F. Piechowski, L.HG.
Senior Hydrogeologist

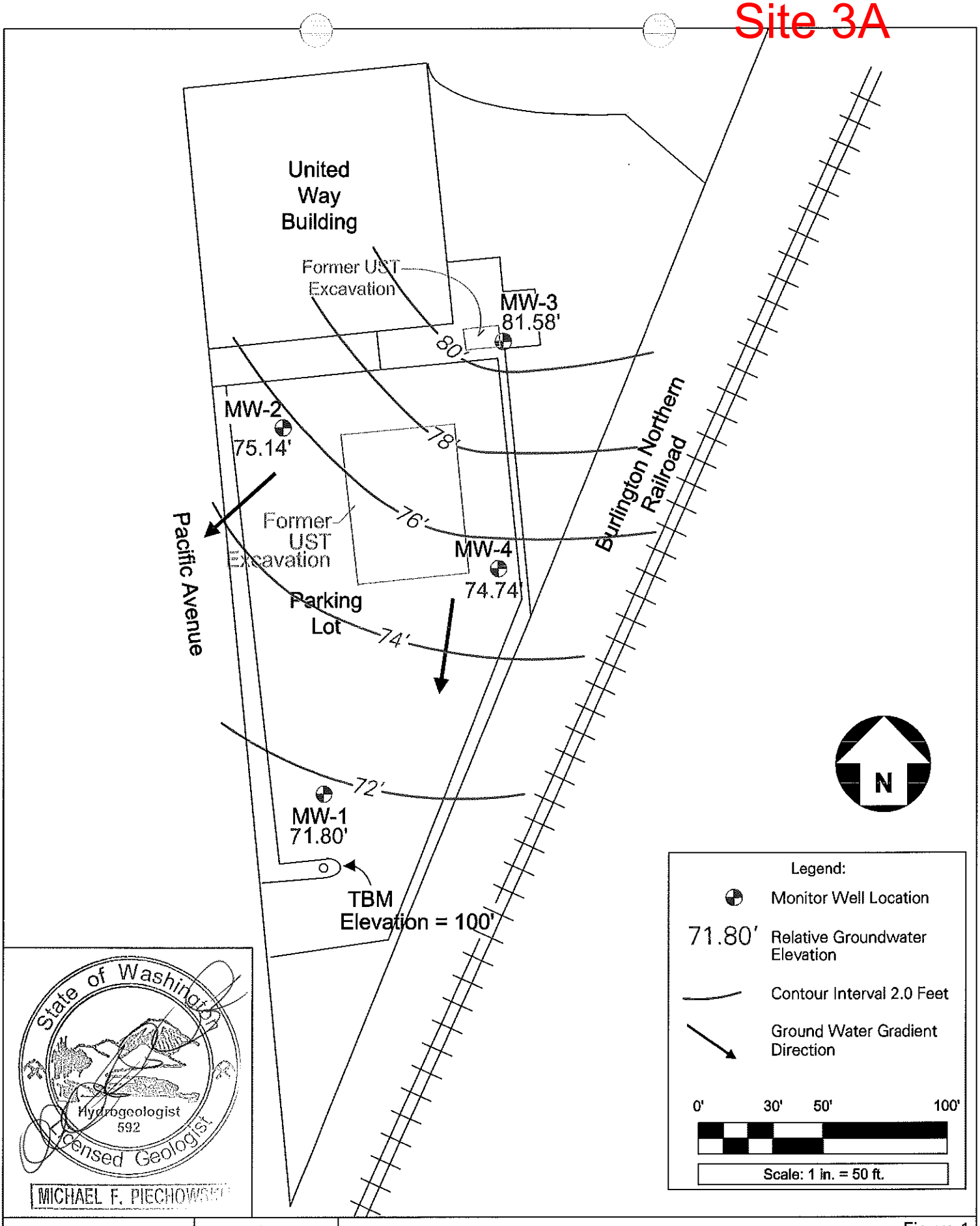


enclosures

cc: Department of Ecology – Chuck Cline

The statements, conclusions, and recommendations provided in this report are to be exclusively used within the context of this document. They are based upon generally accepted environmental and hydrogeologic practices and are the result of analysis by Robinson, Noble & Saltbush, Inc. staff. This report, and any attachments to it, is for the exclusive use of the United Way of Pierce County. Unless specifically stated in the document, no warranty, expressed or implied, is made.

Site 3A



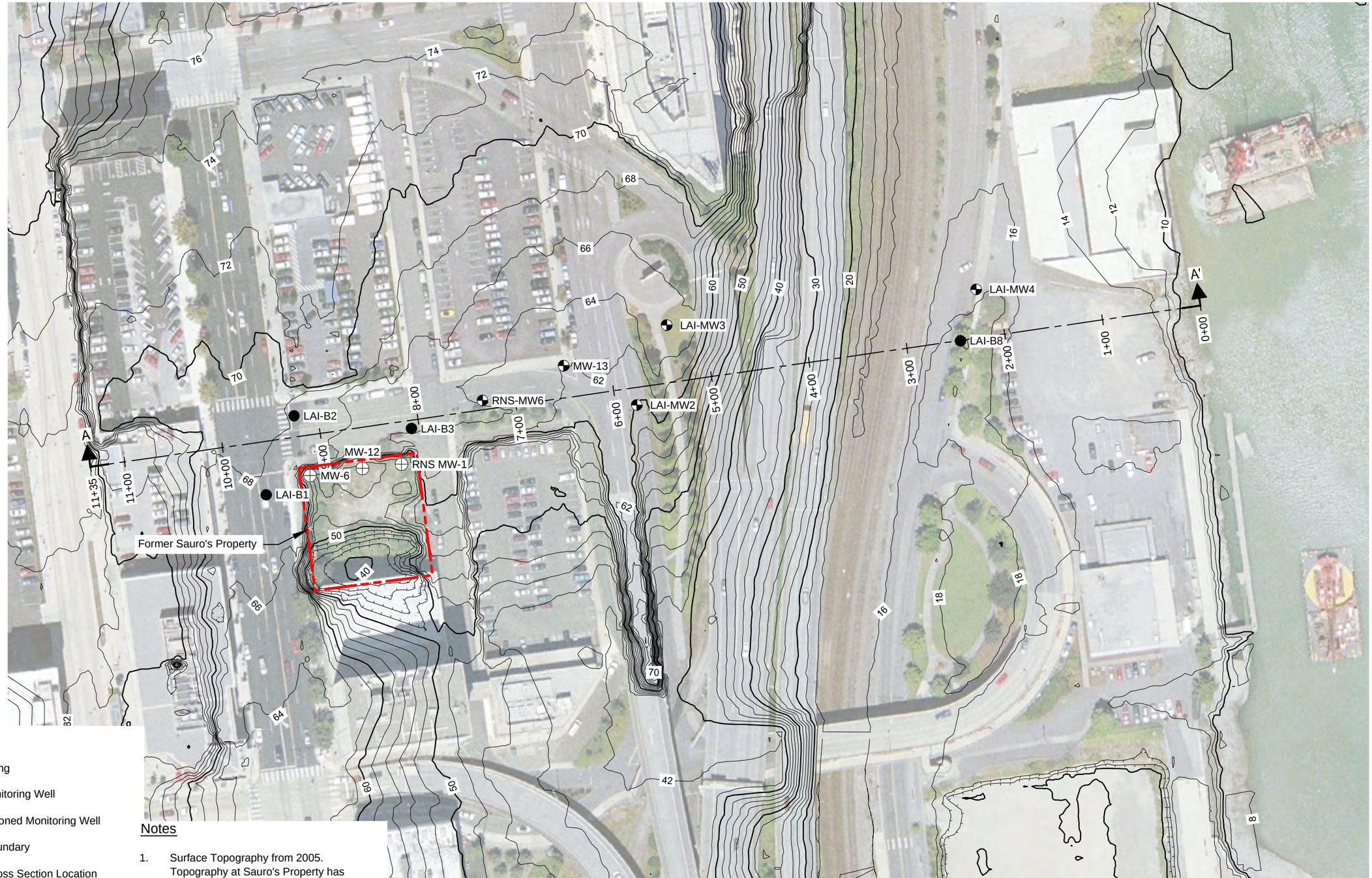
State of Washington
Hydrogeologist
592
Licensed Geologist
MICHAEL F. PIECHOWSKI

ROBINSON & NOBLE, INC.

T 20 N/R 3 E - 5
PM: MFP
January 2005
2145-001B

Figure 1
Detailed Site Location Map For United Way, Tacoma
Water Levels Measured December 27, 2004
United Way of Pierce Co.: United Way Site Groundwater Issues 2004

Site 3B



Legend

- Landau Boring
- Existing Monitoring Well
- Decommissioned Monitoring Well
- Property Boundary
- A A' Geologic Cross Section Location

Notes

1. Surface Topography from 2005. Topography at Sauro's Property has change since redevelopment in 2011.
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: © 2005 Google Earth, Puget Sound LiDAR Consortium 2005

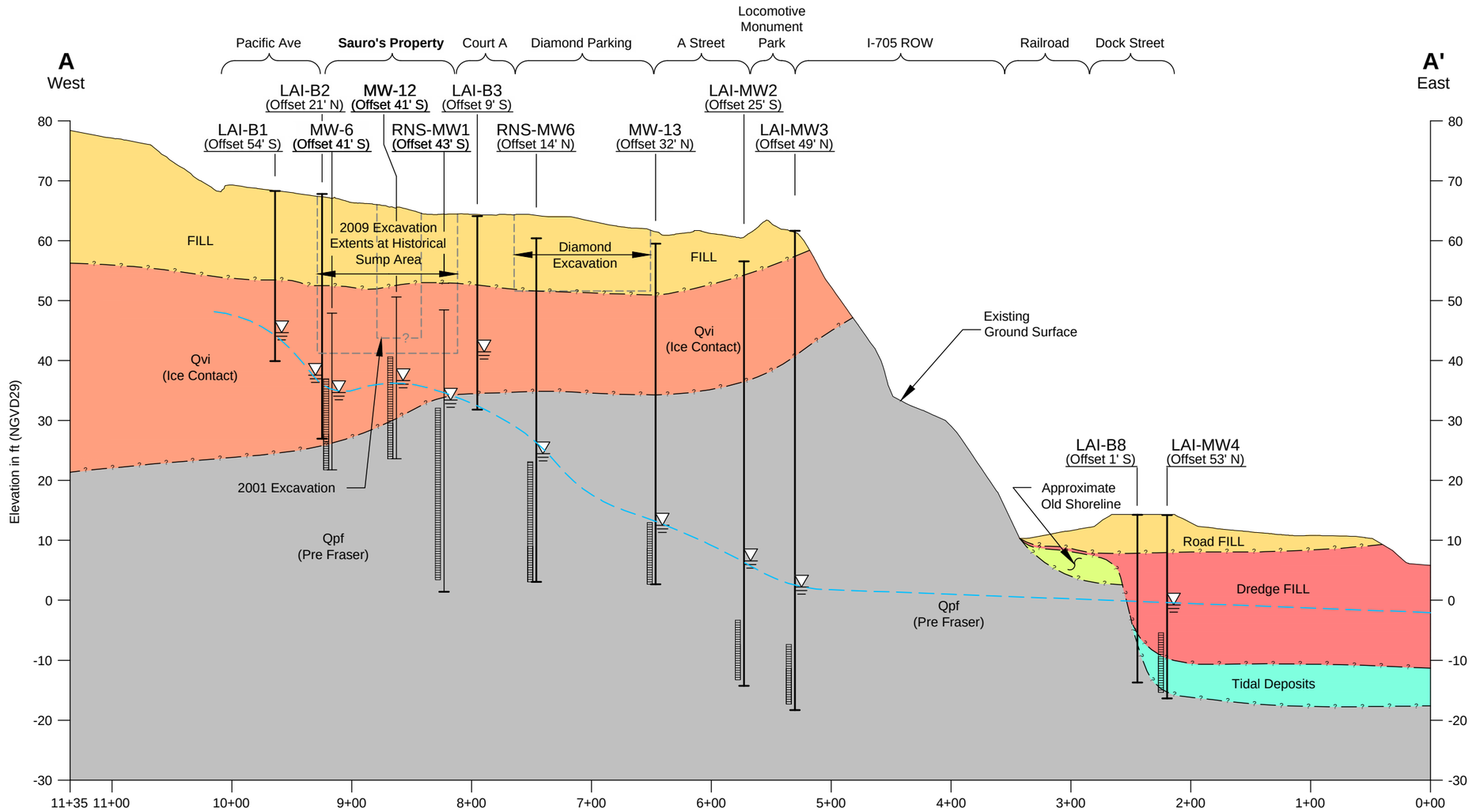
0 100 200
Scale in Feet

LANDAU ASSOCIATES

Sauro's Property RI/FS Tacoma, Washington	**Surface Topography and Geologic Cross Section Area**	Figure 1-3

Report | G:\Projects\094048\0130\14\RIFS 2014\Figure1-3_1-4.dwg (A) "Figure 1-3" 8/28/2014

Site 3B



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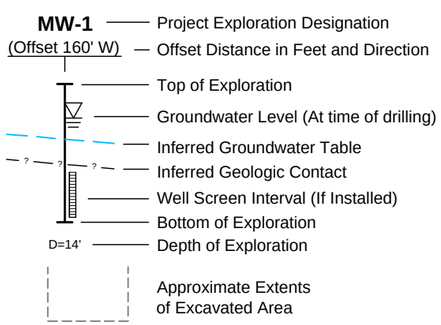


Notes

1. Soil descriptions are generalized, based on interpretation of field and laboratory data. Stratigraphic contacts are interpolated between borings and based on topographic features; actual conditions may vary.
2. See report text for descriptions of geologic units.
3. Profile derived from Puget Sound LiDAR Consortium 2005. For cross-section profile location see Figure 1-3.
4. Boring LAI-B8 used for geologic interpretation along Dock Street.
5. Approximate location of shoreline based on Atlas HA-617 (Bortleson, et al).
6. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 100 200

Horizontal Scale: 1"=100'
Vertical Scale: 1"=20'

LANDAU ASSOCIATES

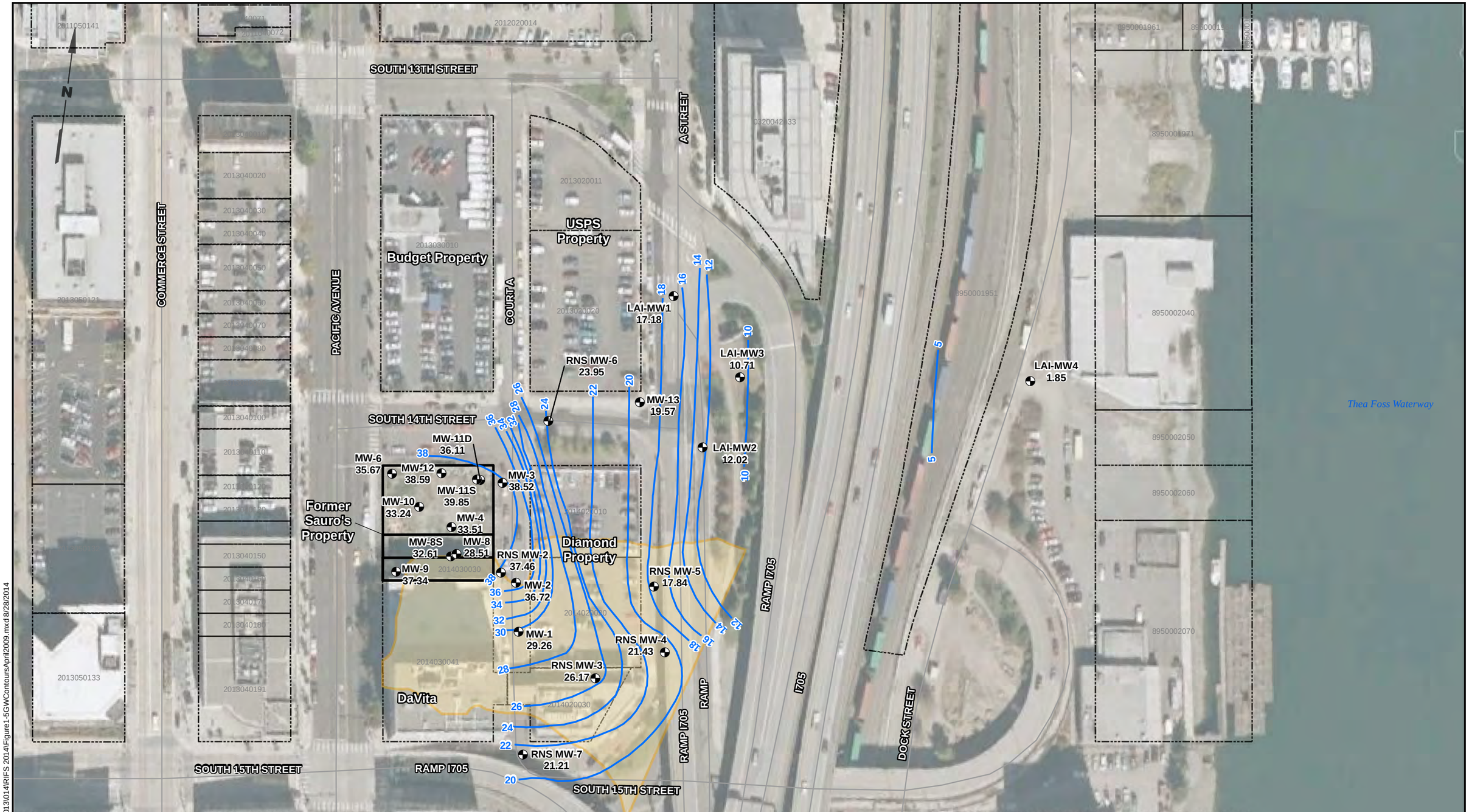
Sauro's Property RI/FS
Tacoma, Washington

Geologic Cross Section A-A'

Figure 1-4

| G:\Projects\094\0048\013\014\RIFS 2014\Figure1-3_1-4.dwg (A) "Figure 1-4" 8/28/2014

Site 3B



G:\Projects\094\048\013\014\RIFS 2014\Figure1-5GWContoursApril2009.mxd 8/28/2014

Legend

- Monitoring Wells
- Groundwater Contours
- Subject Property
- Historic Deep Gulch

Notes

1. Water levels shown were collected on 4/28/2009.
2. Historic gulch was present as of 1888; it was filled as downtown was developed.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 100 200

Scale in Feet

Data Source: Pierce County GIS; Sanborn Fire Insurance Map, 1888; Google Earth (Imagery Date: 11/8/2007).

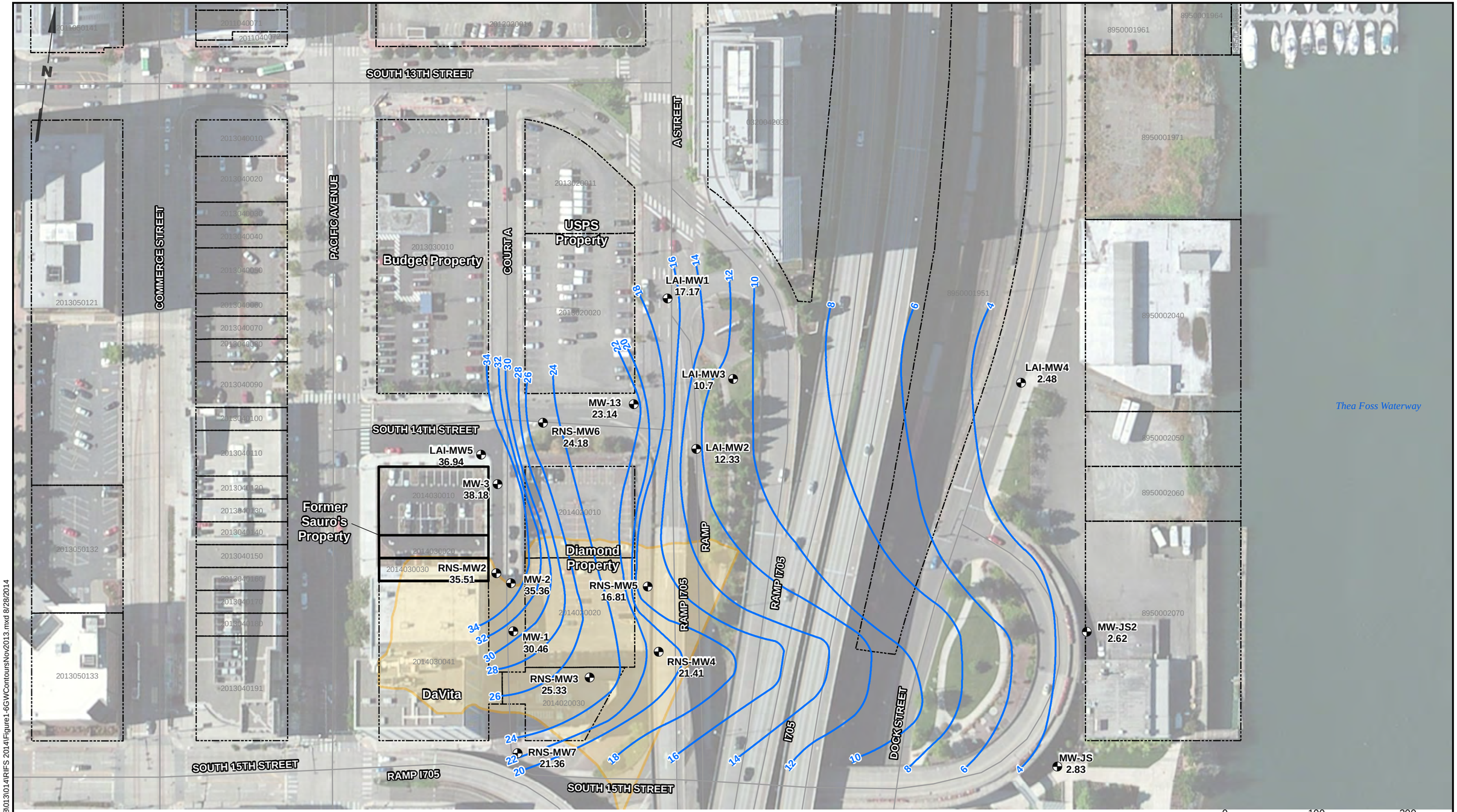
LANDAU ASSOCIATES

Sauro's Property RI/FS
Tacoma, Washington

Pre-Interim Action
Groundwater Elevation Contours
April 2009

Figure
1-5

Site 3B



Legend

- Monitoring Wells
- Groundwater Contours
- Subject Property
- Historic Deep Gulch

Notes

1. Water levels were collected by City staff on November 3. The measurement from RNS-MW5 was erroneous, and was replaced with a new measurement collected by LAI on November 6.
2. To reduce the effects of tidal fluctuation, LAI-MW4, MW-JS, and MW-JS2 were measured within minutes of each other.
3. Historic gulch was present as of 1888; it was filled as downtown was developed.
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 100 200

Scale in Feet

Data Sources: Pierce County GIS; Esri World Imagery 2011.

G:\Projects\094\048\013\014\RIFS 2014\Figure1-6GWContoursNov2013.mxd 8/28/2014

LANDAU ASSOCIATES

Sauro's Property RI/FS
Tacoma, Washington

Most Recent Groundwater Elevation Contours November 2013

Figure 1-6

Site 3B

Budget Property (Parking Lot)
USPS Property (Parking Lot)
Diamond Property (Parking Lot)
Existing Ground Surface
2001 Excavation and Sump Removal
A
Former Sauro's Property (City-Owned Pervious Pavement Parking Lot)
Geotextile Fabric Liner
DaVita
Steep Slopes
BNSF Railroad
FILL
Qvi (Ice Contact)
Potential Future Construction Excavation/ Underground Garage
Potential Exposures (Inhalation/Direct Contact)
Potential Shallow Groundwater
Potential Future Construction/Excavation
Potential Exposure (Direct Contact)
A'
Tidal Fluctuations
Bottom of 2009 Excavation
Road FILL
Qpf (Pre Fraser)
Seasonal Fluctuations
Dredge FILL
Tidal Deposits
Qpf (Pre Fraser)
Thea Foss Waterway

Approximate Depth in Feet
0
10
20
30
40
50
60
70
80
90
100
110

Legend

- Approximate Groundwater Elevation - Primary Flow Path
- Historic Excavation Area
- Current Extent of Site (Dissolved VOC Contaminated Groundwater)
- Groundwater Flow Direction
- Historic Release
- Potential Vapor Migration
- Contaminated Groundwater Exposure
- A A' Plume and Geologic Cross Section Location (See Note 2)

Notes

1. The current extent of the site represents the most recent extent of chlorinated solvents in groundwater at or above the MTCA Method A groundwater cleanup levels.
2. The depth scale, location of geologic contact units, and groundwater surface are approximate and generally reflect the cross-section profile location shown on Figure 4-3, located north of the former Sauro's property. More accurate hydrogeology is provided on Figure 1-4.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

| G:\Projects\094048\013014\RIFS 2014\Figure4-1Conceptual.dwg (A) "Figure 4-1" 8/28/2014

LANDAU ASSOCIATES

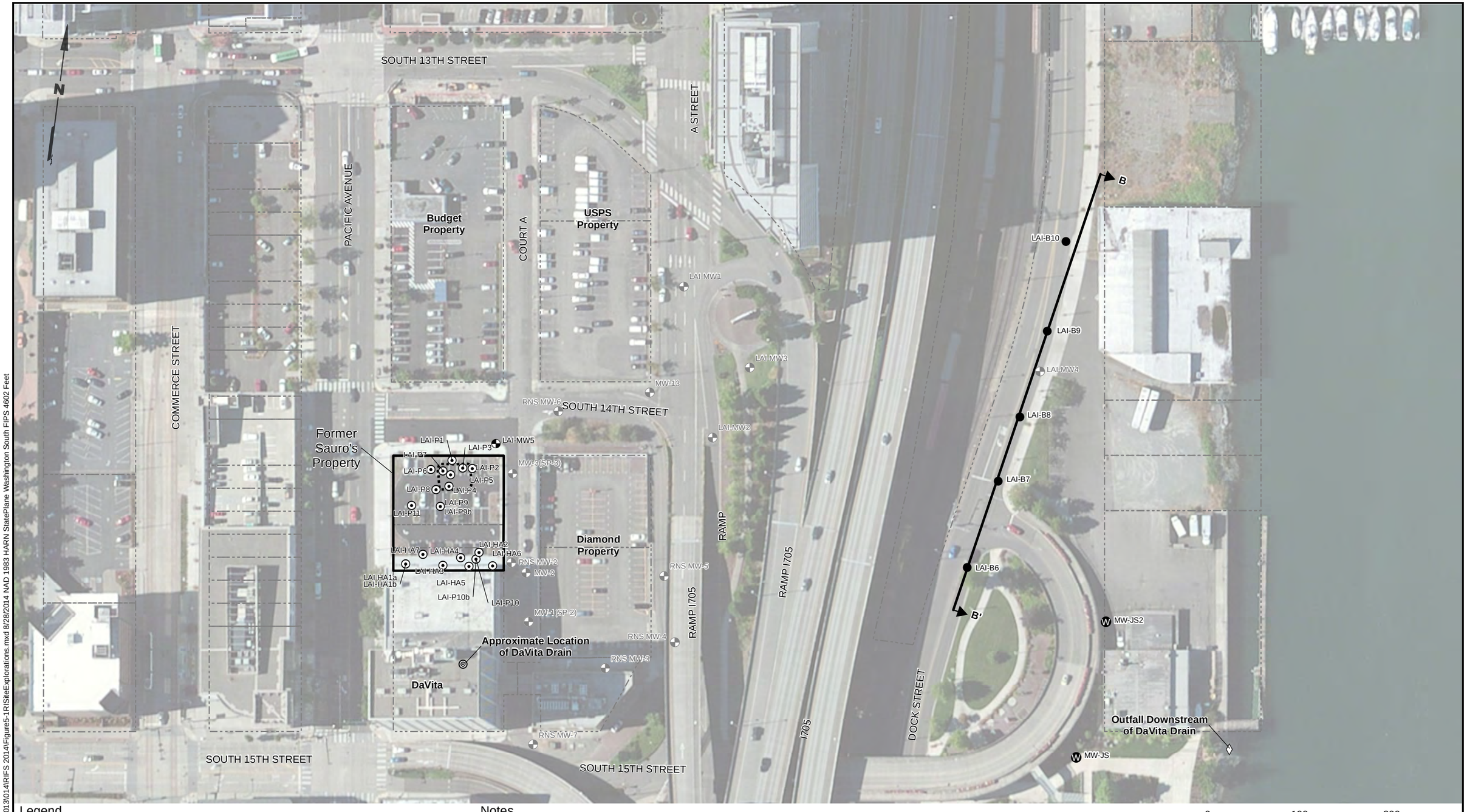
Not to Scale

Sauro's Property RI/FS
Tacoma, Washington

Conceptual Site Model

Figure 4-1

Site 3B



G:\Projects\094\048\013\014\RIFS 2014\Figure5-1RISiteExplorations.mxd 8/28/2014 NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet

Legend

- LAI Monitoring Well
- 2009 LAI Boring
- 2013 LAI Boring
- Other Wells
- Existing Pre-RI Monitoring Well
- 2001 Excavation and Sump Removal
- Cross Section Location
- Subject Property

LANDAU ASSOCIATES

Notes

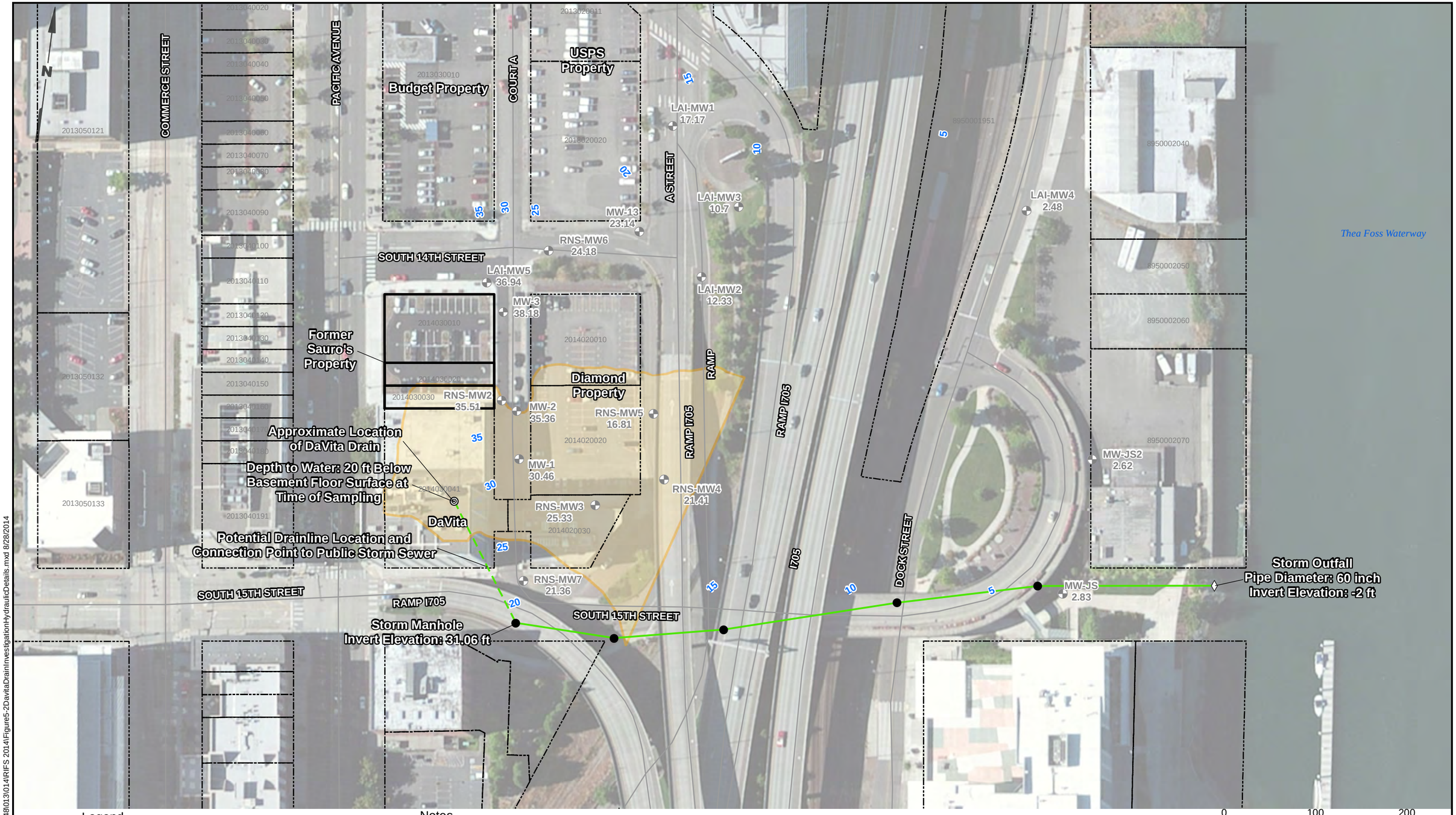
1. Soil samples collected at all RI soil boring locations. Samples collected in preparation for the 2009 interim action excavation.
2. Wells MW-JS and MW-JS2 are existing wells from a separate project unrelated to Sauro's. One was sampled in June and one was sampled in September 2013 during Sauro's quarterly RI sampling.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 100 200
Scale in Feet

Data Sources: Pierce County GIS; Esri World Imagery 2011.

Sauro's Property RI/FS Tacoma, Washington	**RI Site Explorations**	Figure 5-1

Site 3B



G:\Projects\094\048\013\014\RIFS 2014\Figure5-2DavitaDrainInvestigationHydraulicDetails.mxd 8/28/2014

Legend

- Existing Monitoring Wells
- Storm Manhole
- Storm Sewer
- Groundwater Contours
- Subject Property
- Historic Deep Gulch

Notes

1. Approximate location of public storm sewer line interpreted from the City of Tacoma Government Made Easy website; storm structure elevations from website.
2. Approximate location of private drainline connection from DaVita drain interpreted based on City of Tacoma field staff information.
3. Groundwater elevation contours from November 2013.
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Sources: Pierce County GIS; Esri World Imagery 2011.
Vertical Datum: NGVD29.

0 100 200
Scale in Feet

LANDAU ASSOCIATES

Sauro's Property RI/FS
Tacoma, Washington

DaVita Drain Investigation Hydraulic Details

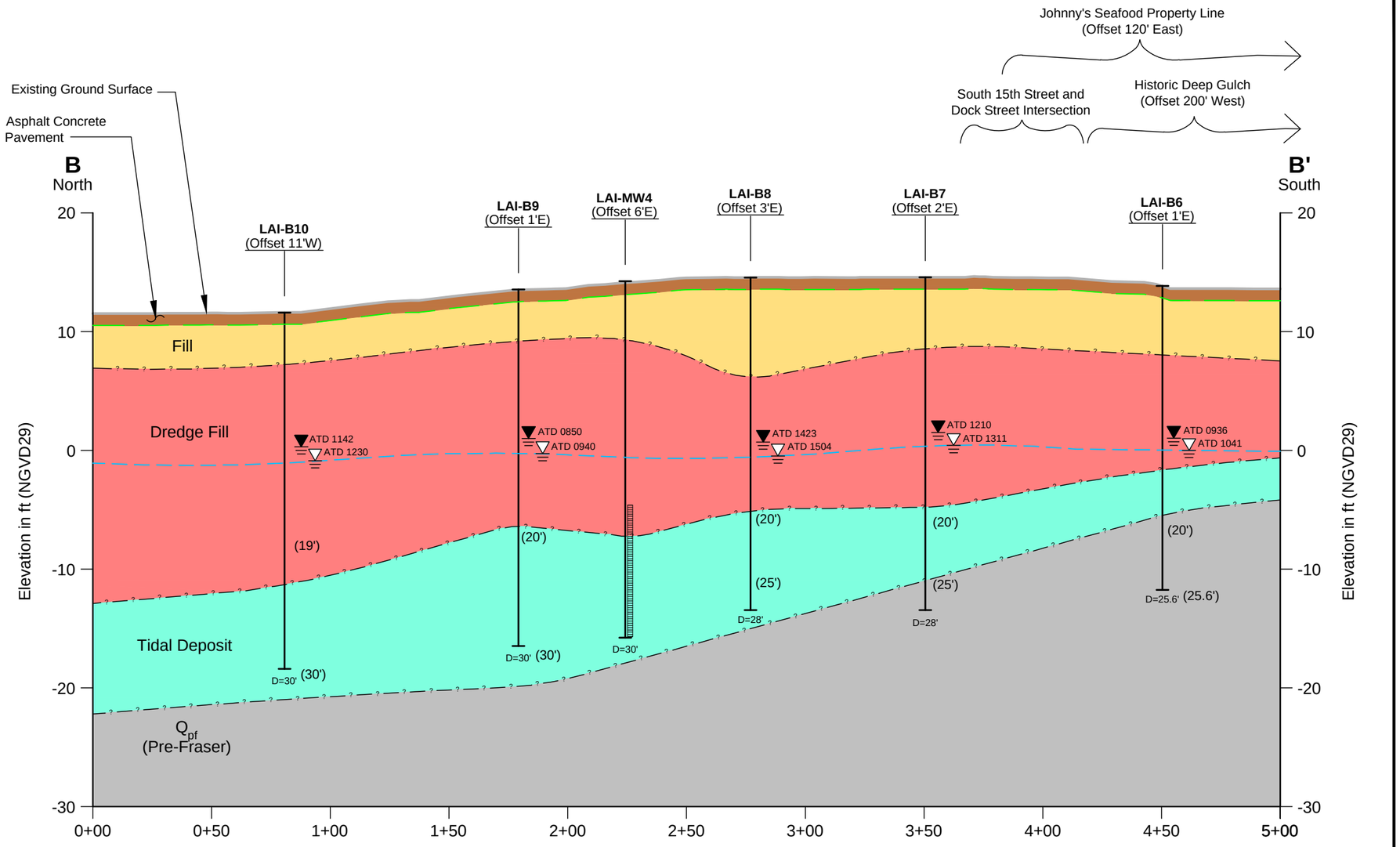
Figure 5-2

Site 3B

Legend

LAI-B10 (Offset 160' W) — Project Exploration Designation; Offset Distance in Feet and Direction

- Top of Exploration
- Groundwater Level (At first measurement)
- Groundwater Level (At second measurement)
- Inferred Groundwater Table
- Inferred Geologic Contact
- Well Screen Interval (If Installed)
- (19') — Descrete Sample Depth (ft)
- Bottom of Exploration
- D=30' — Depth of Exploration (ft)



Notes

1. Soil descriptions are generalized, based on interpretation of field data. Stratigraphic contacts are interpolated between borings and based on topographic features; actual conditions may vary. See Landau Associates RI/FS report text for descriptions of geologic units.
2. For Cross Section location, see Figure 4-1 .
3. Water level data for borings from November 2013.
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 — 50 — 100

Horizontal Scale: 1"=50'
Vertical Scale: 1"=10'

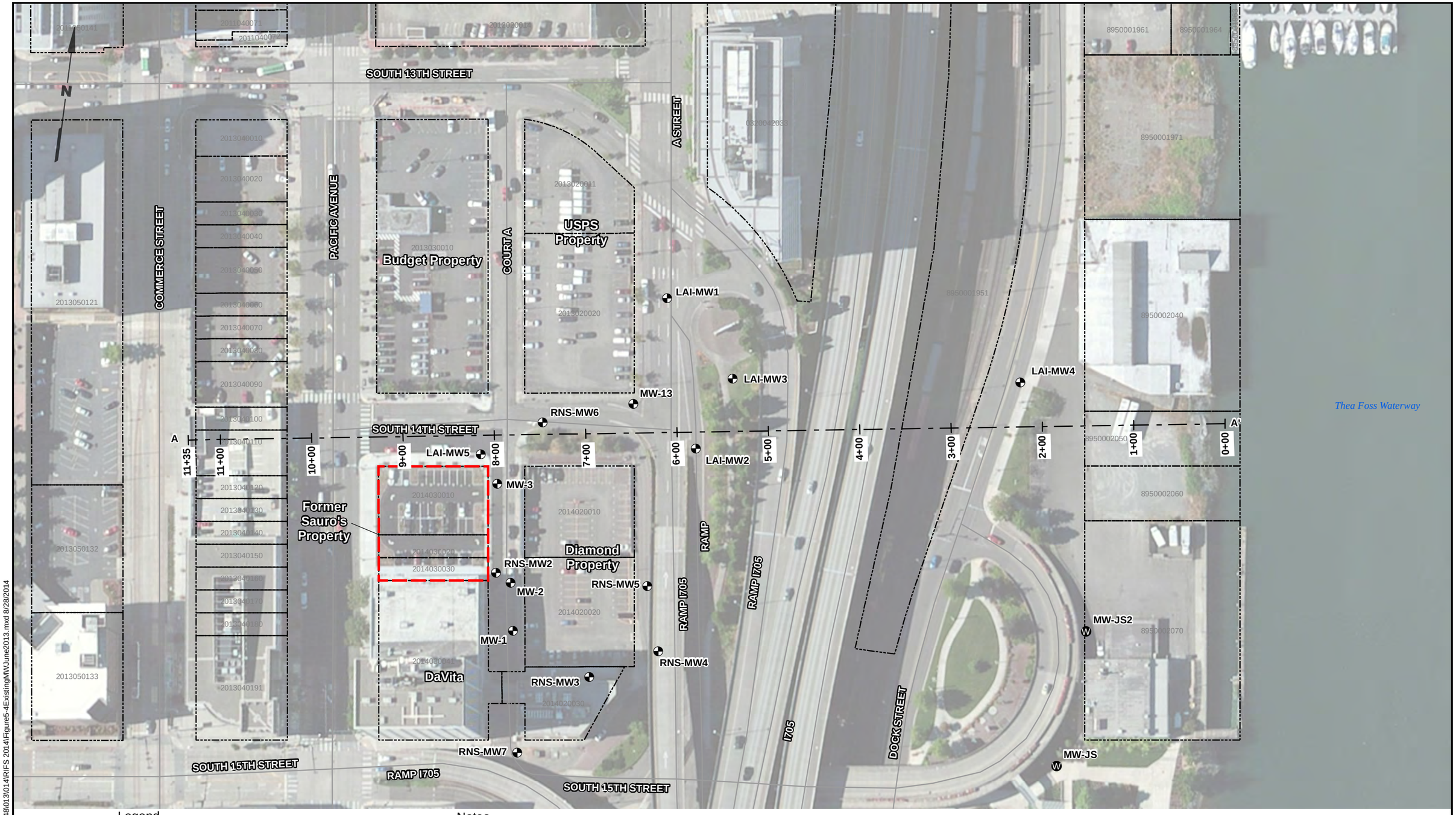
Source: Puget Sound Lidar Consortium 2005

Sauro's Property RI/FS Tacoma, Washington	**Dock Street - Direct Push Cross Section B-B'**	Figure 5-3

LANDAU ASSOCIATES

LANDAU ASSOCIATES, INC. | G:\Projects\094048\013014\RIFS 2014\Figure5-3DockStreet.dwg (A) "Figure 5-2" 8/28/2014

Site 3B



G:\Projects\094\048\013\014\RIFS 2014\Figure5-4ExistingMWJune2013.mxd 8/28/2014

Legend

- Quarterly Sampling RI Monitoring Wells
- Other Wells
- Subject Property
- Cross Section Location

0 100 200

Scale in Feet

Notes

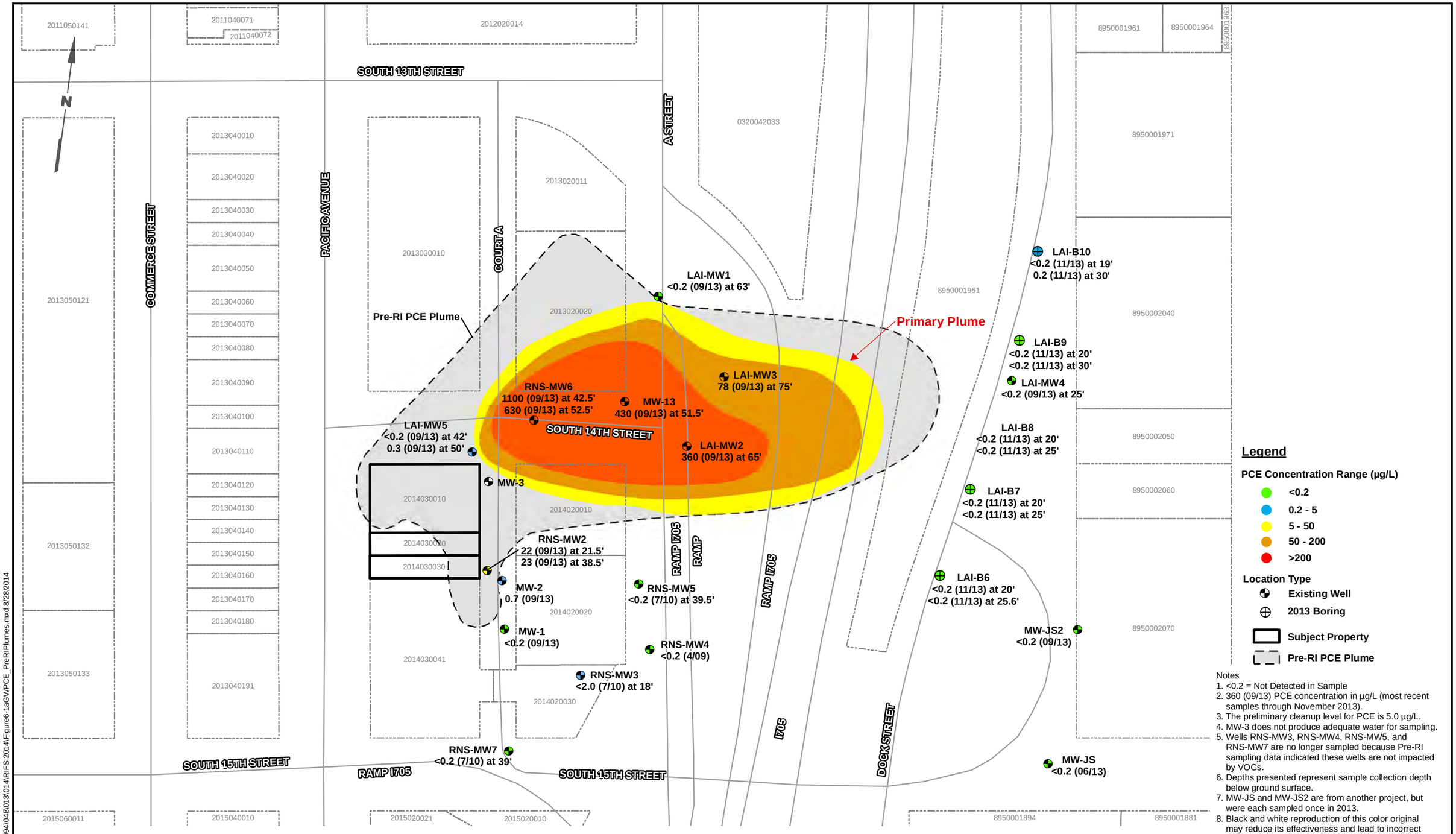
1. MW-3 was too dry to sample.
2. Wells MW-JS and MW-JS2 are existing wells from a separate project unrelated to Sauro's. One was sampled in June and one was sampled in September 2013 during Sauro's quarterly RI sampling.
3. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Sources: Pierce County GIS; Esri World Imagery 2011.

LANDAU ASSOCIATES

Sauro's Property RI/FS Tacoma, Washington	**Existing Monitoring Well Network and Cross Section Area**	Figure 5-4

Site 3B



Notes
1. <0.2 = Not Detected in Sample
2. 360 (09/13) PCE concentration in µg/L (most recent samples through November 2013).
3. The preliminary cleanup level for PCE is 5.0 µg/L.
4. MW-3 does not produce adequate water for sampling.
5. Wells RNS-MW3, RNS-MW4, RNS-MW5, and RNS-MW7 are no longer sampled because Pre-RI sampling data indicated these wells are not impacted by VOCs.
6. Depths presented represent sample collection depth below ground surface.
7. MW-JS and MW-JS2 are from another project, but were each sampled once in 2013.
8. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Source: Pierce County GIS

0 100 200
Scale in Feet

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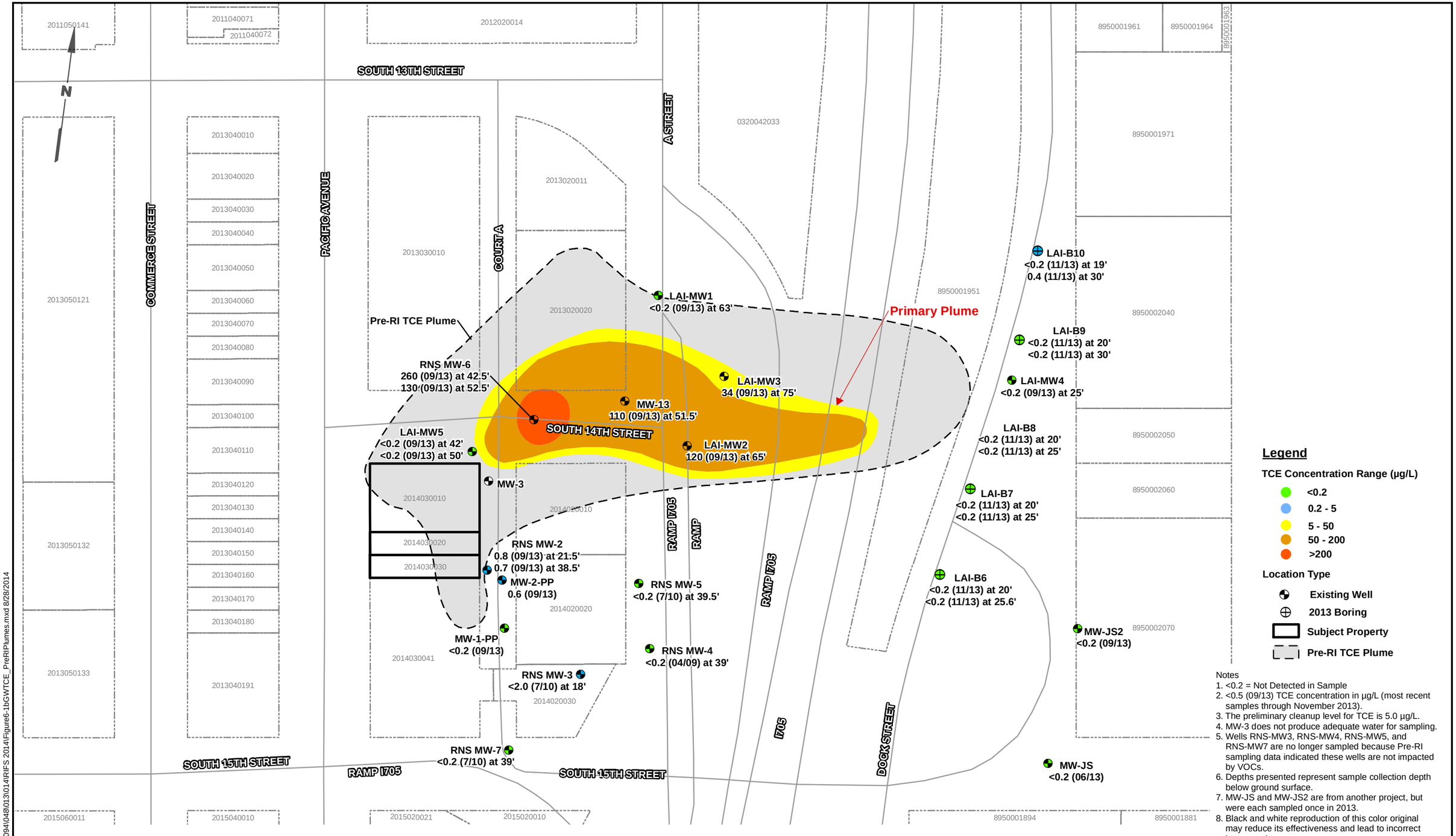
LANDAU ASSOCIATES

Sauro's Property RI/FS Tacoma, Washington	**RI Groundwater VOC Plumes Most Recent PCE Concentrations**	Figure 6-1a

Site 3B



Notes
1. <0.2 = Not Detected in Sample
2. <0.5 (09/13) TCE concentration in µg/L (most recent samples through November 2013).
3. The preliminary cleanup level for TCE is 5.0 µg/L.
4. MW-3 does not produce adequate water for sampling.
5. Wells RNS-MW3, RNS-MW4, RNS-MW5, and RNS-MW7 are no longer sampled because Pre-RI sampling data indicated these wells are not impacted by VOCs.
6. Depths presented represent sample collection depth below ground surface.
7. MW-JS and MW-JS2 are from another project, but were each sampled once in 2013.
8. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Source: Pierce County GIS

0 100 200
Scale in Feet

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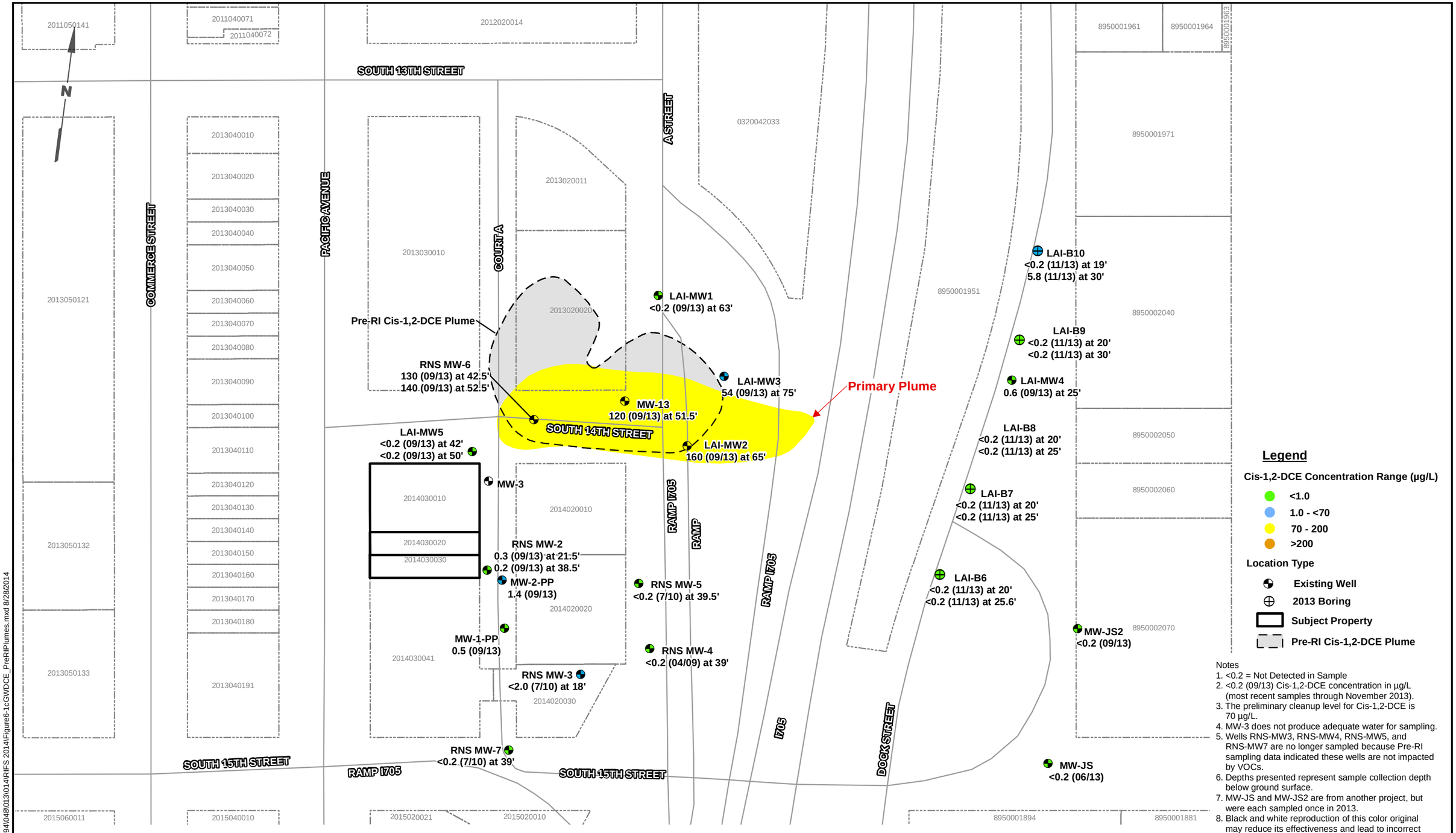
LANDAU ASSOCIATES

Sauro's Property RI/FS Tacoma, Washington	**RI Groundwater VOC Plumes Most Recent TCE Concentrations**	Figure 6-1b

Site 3B



Legend

Cis-1,2-DCE Concentration Range (µg/L)

- <1.0
- 1.0 - <70
- 70 - 200
- >200

Location Type

- Existing Well
- 2013 Boring
- Subject Property
- Pre-RI Cis-1,2-DCE Plume

Notes
1. <0.2 = Not Detected in Sample
2. <0.2 (09/13) Cis-1,2-DCE concentration in µg/L (most recent samples through November 2013).
3. The preliminary cleanup level for Cis-1,2-DCE is 70 µg/L.
4. MW-3 does not produce adequate water for sampling.
5. Wells RNS-MW3, RNS-MW4, RNS-MW5, and RNS-MW7 are no longer sampled because Pre-RI sampling data indicated these wells are not impacted by VOCs.
6. Depths presented represent sample collection depth below ground surface.
7. MW-JS and MW-JS2 are from another project, but were each sampled once in 2013.
8. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Source: Pierce County GIS

0 100 200

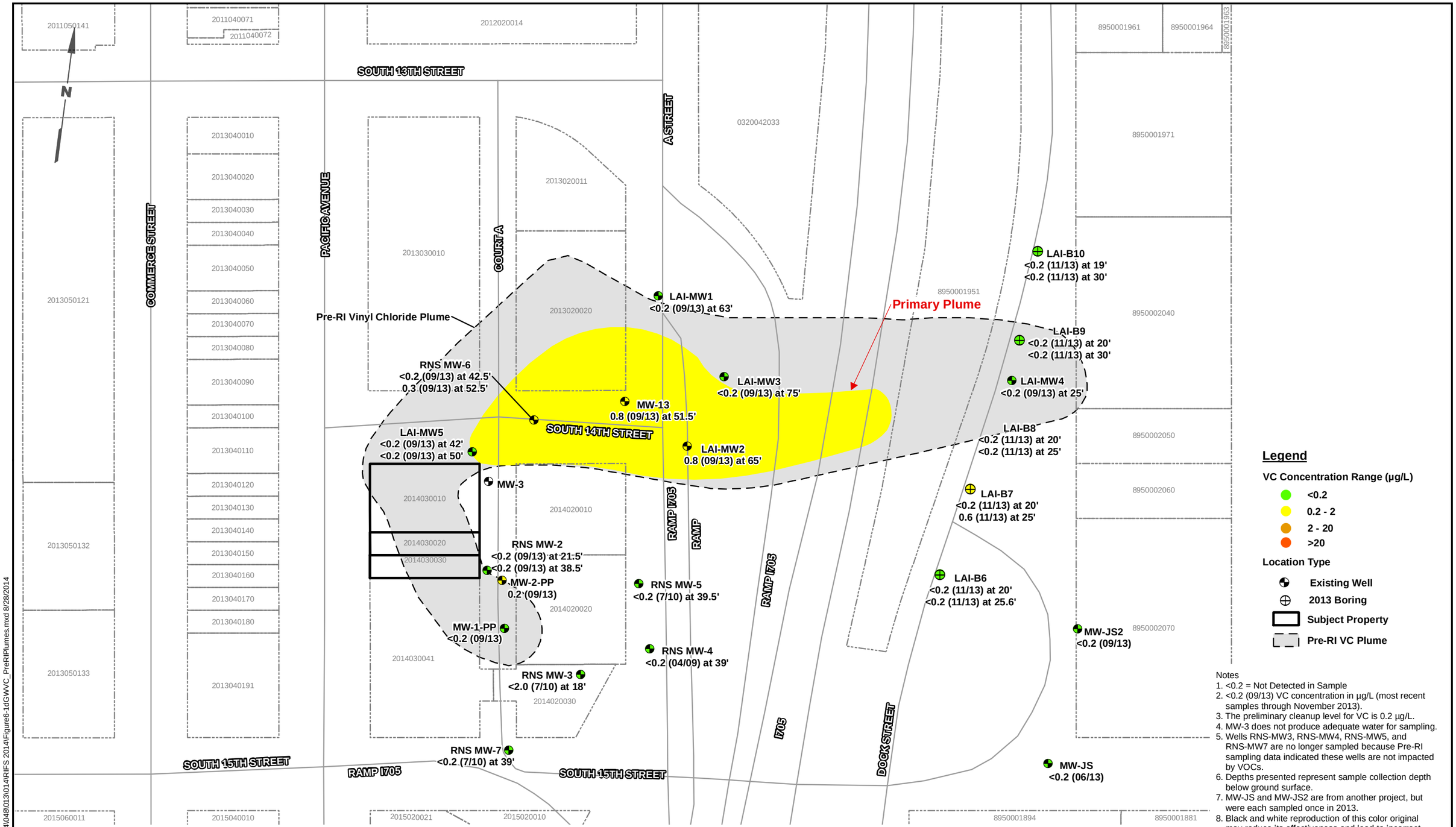
Scale in Feet

G:\Projects\094\048\013\014\RIFS 2014\Figure6-1cGWDCE_PreRIPlumes.mxd 8/28/2014

LANDAU ASSOCIATES

Sauro's Property RI/FS Tacoma, Washington	**RI Groundwater VOC Plumes Most Recent cis-1,2-DCE Concentrations**	Figure 6-1c

Site 3B



Notes
1. <0.2 = Not Detected in Sample
2. <0.2 (09/13) VC concentration in µg/L (most recent samples through November 2013).
3. The preliminary cleanup level for VC is 0.2 µg/L.
4. MW-3 does not produce adequate water for sampling.
5. Wells RNS-MW3, RNS-MW4, RNS-MW5, and RNS-MW7 are no longer sampled because Pre-RI sampling data indicated these wells are not impacted by VOCs.
6. Depths presented represent sample collection depth below ground surface.
7. MW-JS and MW-JS2 are from another project, but were each sampled once in 2013.
8. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Source: Pierce County GIS

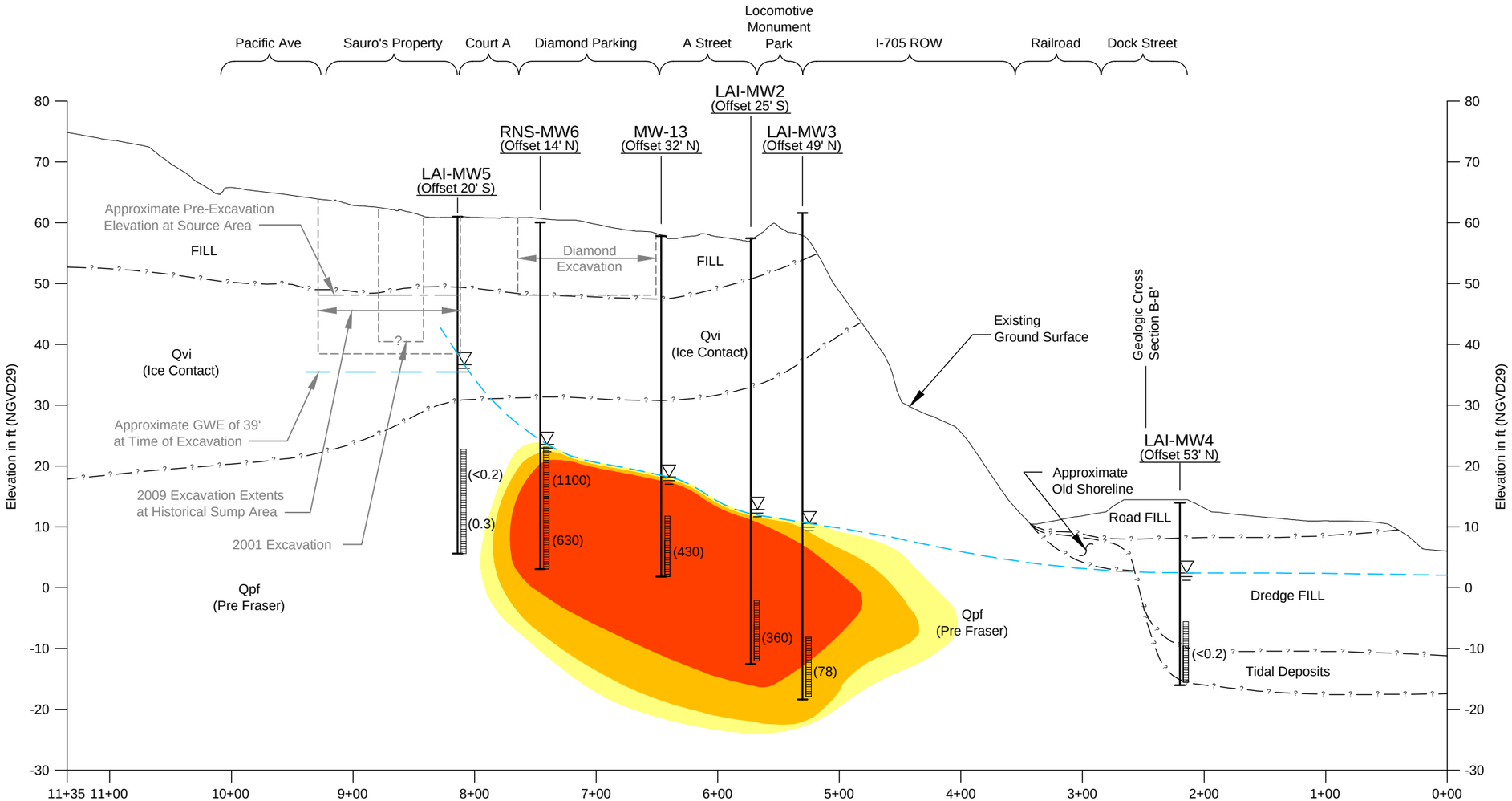
0 100 200
Scale in Feet

G:\Projects\094\048\013\014\RIFS 2014\Figure6-1dGWVC_PreRIPlumes.mxd 8/28/2014

LANDAU ASSOCIATES

Sauro's Property RI/FS Tacoma, Washington	**RI Groundwater VOC Plumes Most Recent Vinyl Chloride Concentrations**	Figure 6-1d

Site 3B



Legend

- **MW-1** — Project Exploration Designation
- (Offset 160' W) — Offset Distance in Feet and Direction
- Top of Exploration
- Groundwater Level
- Inferred Groundwater Table
- Inferred Geologic Contact
- Well Screen Interval
- (##) — PCE Concentration (εg/L)
- Bottom of Exploration
- Approximate Extent of Excavation Areas

PCE Concentration Range (εg/L)

Yellow	5 - 50
Orange	50 - 200
Red	>200

Notes:

1. Profile derived from Puget Sound LiDAR Consortium 2005. Cross-section profile location is shown on Figure 4-3, located north of the former Sauro's property.
2. PCE concentration data shown in micrograms per liter (Ũg/L). Data from September 2013.
3. Water level data from September 2013.
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 100 200

Horizontal Scale: 1"=100'
Vertical Scale: 1"=20'

LANDAU ASSOCIATES

Sauro's Property RI/FS
Tacoma, Washington

Vertical Extent of PCE Most Recent

Figure 6-2a

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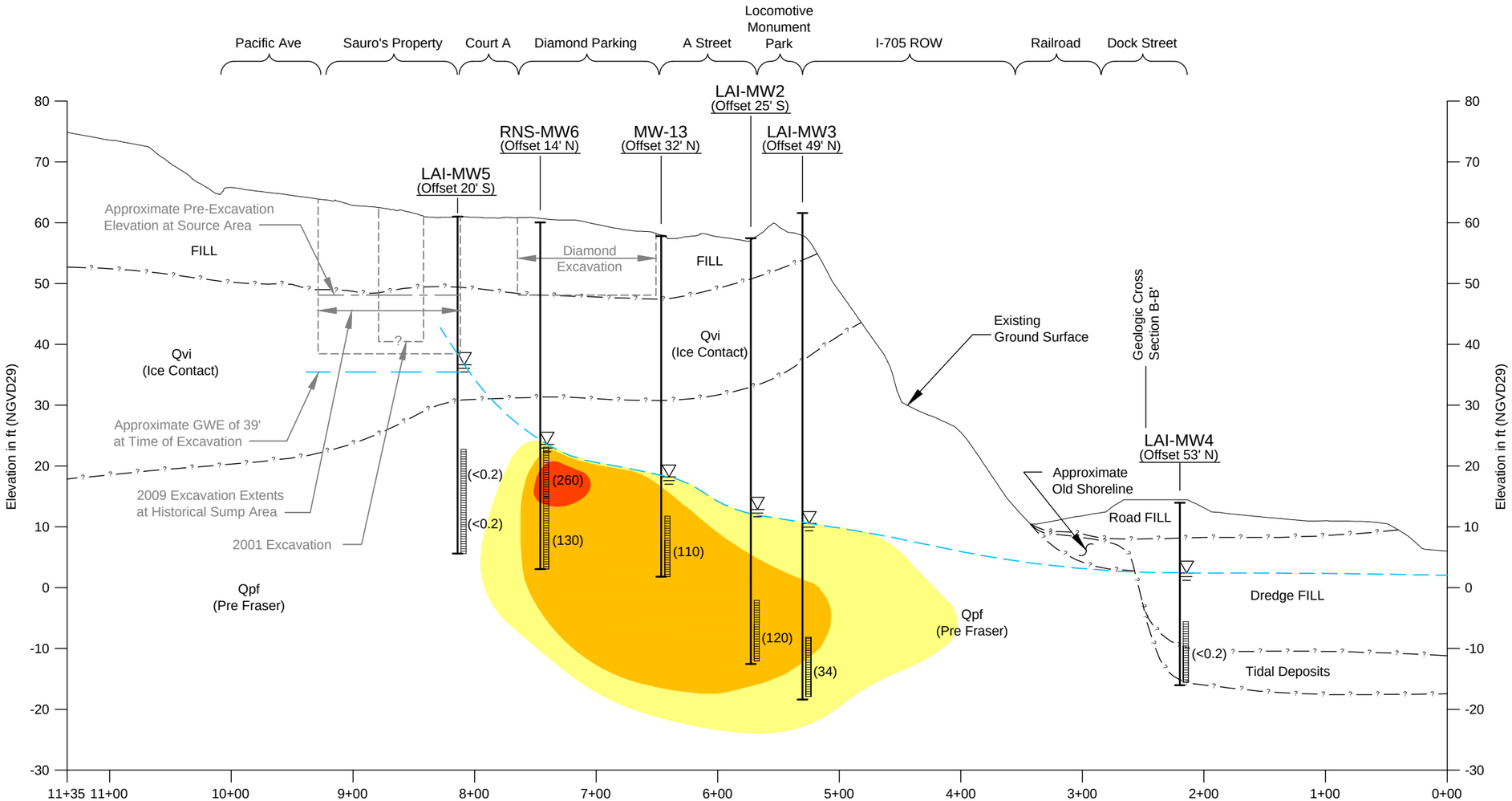
Site 3B



Legend

- MW-1 (Offset 160' W) — Project Exploration Designation; Offset Distance in Feet and Direction
- Top of Exploration
- Groundwater Level
- Inferred Groundwater Table
- Inferred Geologic Contact
- Well Screen Interval
- (##) — TCE Concentration (ε g/L)
- Bottom of Exploration
- Approximate Extent of Excavation Areas

TCE Concentration Range (ε g/L)

Yellow	5 - 50
Orange	50 - 200
Red	>200

Notes:

1. Profile derived from Puget Sound LiDAR Consortium 2005. Cross-section profile location is shown on Figure 4-3, located north of the former Sauro's property.
2. TCE concentration data shown in micrograms per liter (Ōg/L). Data from September 2013.
3. Water level data from September 2013.
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 100 200

Horizontal Scale: 1"=100'
Vertical Scale: 1"=20'

LANDAU ASSOCIATES

Sauro's Property RI/FS
Tacoma, Washington

Vertical Extent of TCE Most Recent

Figure 6-2b

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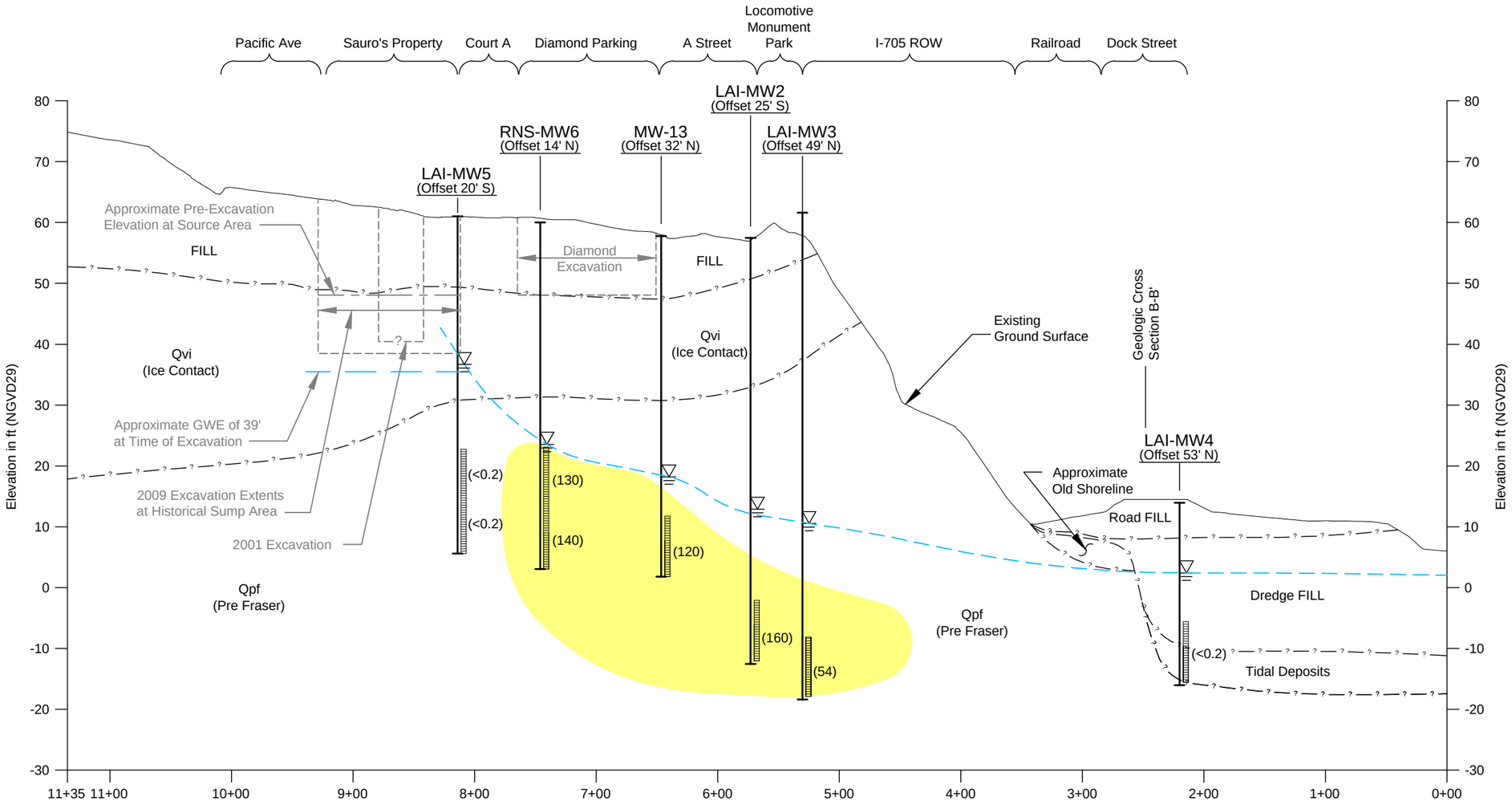
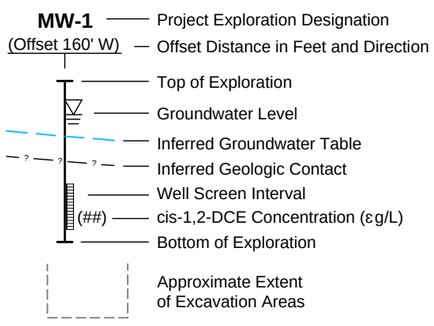
Site 3B



Legend



cis-1,2-DCE Concentration Range (εg/L)

Yellow	70-200

Notes:

1. Profile derived from Puget Sound LiDAR Consortium 2005. Cross-section profile location is shown on Figure 4-3, located north of the former Sauro's property.
2. cis-1,2-DCE concentration data shown in micrograms per liter (Cg/L). Data from September 2013.
3. Water level data from September 2013.
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 100 200

Horizontal Scale: 1"=100'
Vertical Scale: 1"=20'

LANDAU ASSOCIATES

Sauro's Property RI/FS
Tacoma, Washington

Vertical Extent of cis-1,2-DCE Most Recent

Figure 6-2c

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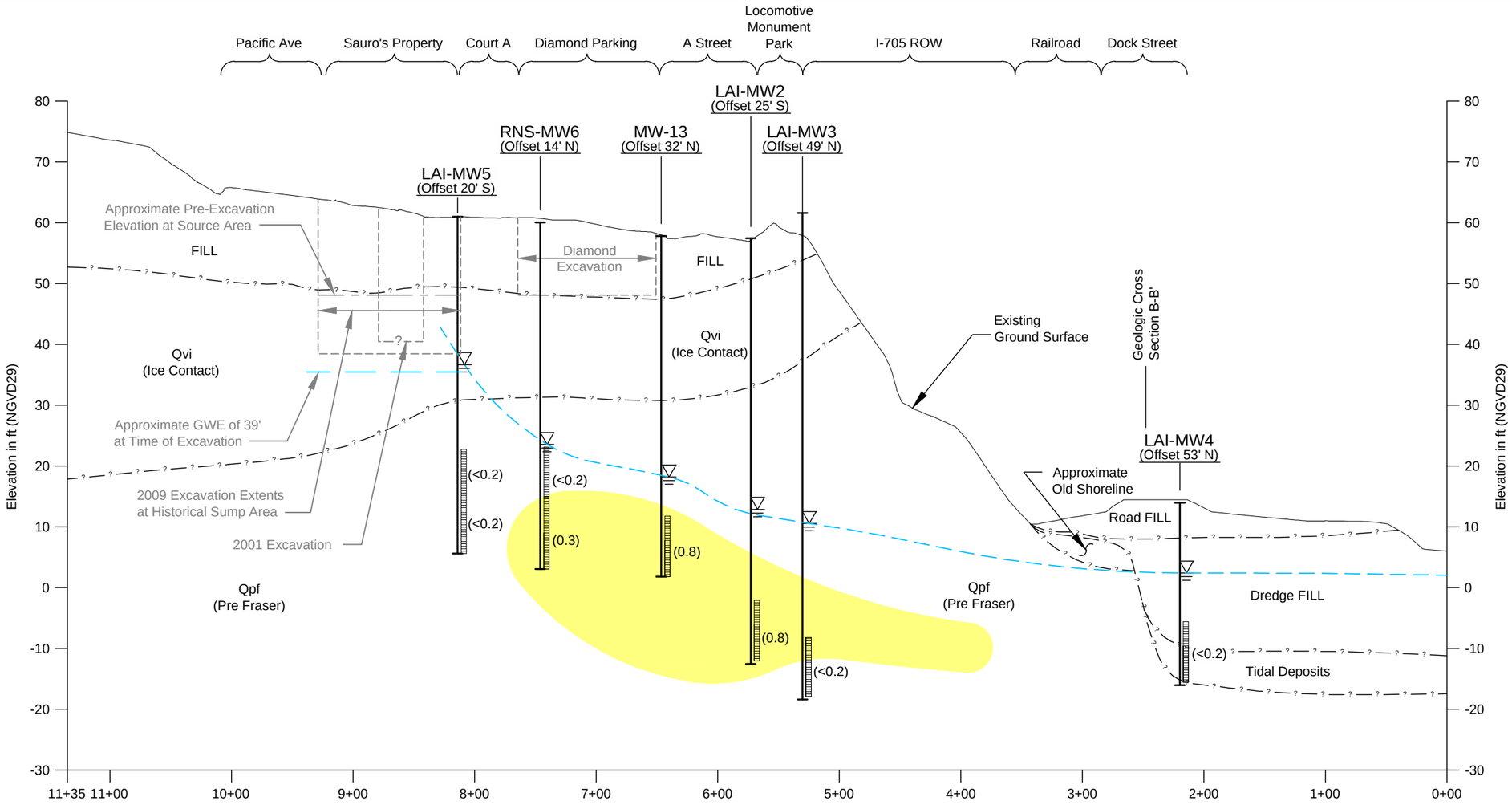
Site 3B



Legend

MW-1 — Project Exploration Designation
(Offset 160' W) — Offset Distance in Feet and Direction

- Top of Exploration
- Groundwater Level
- Inferred Groundwater Table
- Inferred Geologic Contact
- Well Screen Interval
- (##) — Vinyl Chloride Concentration (εg/L)
- Bottom of Exploration

Approximate Extent of Excavation Areas

Vinyl Chloride Concentration Range (εg/L)

Yellow 0.2 - 2

Notes:

1. Profile derived from Puget Sound LiDAR Consortium 2005. Cross-section profile location is shown on Figure 4-3, located north of the former Sauro's property.
2. Vinyl Chloride concentration data shown in micrograms per liter (Ōg/L). Data from September 2013.
3. Water level data from September 2013.
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 100 200
Horizontal Scale: 1"=100'
Vertical Scale: 1"=20'

LANDAU ASSOCIATES

Sauro's Property RI/FS
Tacoma, Washington

Vertical Extent of Vinyl Chloride Most Recent

Figure 6-2d

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Site 3B

Draft Technical Memorandum

TO: Marv Coleman, Washington State Department of Ecology

CC: Eric Huseby, City of Tacoma

FROM: Sierra Mott and Jennifer Wynkoop

DATE: March 9, 2017

RE: **Long-Term Groundwater Monitoring Status Report No. 3 for January 2017**
Former Sauro's Cleanerama Site
Tacoma, Washington
Project No. 0094048.090.093

Introduction

On behalf of the City of Tacoma (City), Landau Associates, Inc. (LAI) is providing results for long-term groundwater monitoring activities at the former Sauro's Cleanerama site (site). Figure 1 shows the site location. The City is conducting semi-annual sampling at nine monitoring wells as outlined in the Cleanup Action Plan (CAP; LAI 2014), which is part of the Agreed Order (No. DE 11080) between the City and Washington State Department of Ecology (Ecology). Under the CAP, the City is implementing a monitored natural attenuation (MNA) remedy that includes 2 years of semi-annual groundwater monitoring beginning in January 2016 followed by annual groundwater monitoring in subsequent years until groundwater at the site reaches cleanup goals (CAP estimate is 26 years of annual sampling). Groundwater monitoring includes collection of volatile organic compounds (VOCs) and MNA geochemical samples in accordance with the CAP.

Semi-Annual Groundwater Monitoring Program Summary

The existing site groundwater monitoring well network includes 17 wells. Of the 17 wells, 9 were selected for long-term monitoring under the CAP. Figure 2 shows the monitoring well network and the nine wells selected for continued monitoring. Table 1 presents a sampling matrix for the long-term monitoring wells.

LAI completed the first year of semi-annual sampling events in January and June 2016 (LAI 2016). The third sampling event was completed January 18, 2017; this status report presents results of the January 2017 sampling event. One additional semi-annual event will occur (July 2017) before the sampling is transitioned to annual frequency. LAI will make a recommendation on the timing of the annual sampling for either January or July, depending on concentration trends.

During the January 2017 sampling event, samples were collected in accordance with the Sampling and Analysis Plan (LAI 2013) and Table 1. VOC and MNA analyses are collected using a peristaltic pump at MW-2. The other eight wells are sampled using passive diffusion bags for VOCs and dedicated Waterra foot valves for MNA parameters. VOC samples at RNS-MW6 were collected at two discrete depths because of the relatively long screen (20 ft) and prior sampling has demonstrated stratification

within the well; all other wells are sampled at a single depth. All samples were submitted under proper chain of custody to TestAmerica Laboratories, Inc. (TestAmerica) located in Tacoma, Washington.

All groundwater samples were analyzed by the laboratory for VOC constituents of concern: tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-Dichloroethene (cDCE), and vinyl chloride (VC) and MNA parameters (nitrate, nitrite, total organic carbon [TOC], sulfate, sulfide, chloride, and dissolved gasses [acetylene, methane, ethane, and ethene]). Samples were analyzed by the following methods: VOCs by U.S. Environmental Protection Agency (EPA) Method 8260; nitrate/nitrite by EPA Method 300.0; TOC by EPA Method 5310B; sulfate/sulfide/chloride by EPA Method 4500; and dissolved gasses by EPA Method RSK-175. Field parameters were also collected, including conductivity and dissolved oxygen (DO) using a field meter (YSI model 556 or equivalent) and ferrous iron using a HACH® field test kit (Model IR-18C). A duplicate sample was collected at LAI-MW4 (Dup1) for quality control purposes. Data will be electronically submitted to Ecology's EIM system following submittal of this report. Table 2 presents the analytical methods, reporting limits, preservatives, and holding times. Table 3 presents VOC analytical data. Table 4 presents MNA analytical data. Time series plots of the VOC data are presented in Attachment 1.

Volatile Organic Compound Results

VOC analytical results from the January 2017 sampling event are consistent with historical results. At three wells, LAI-MW1; LAI-MW4; and LAI-MW5, all VOC concentrations have dropped below their respective laboratory reporting limits. At the six remaining wells, one or more VOCs exceed cleanup levels:

- LAI-MW2, MW13, and RNS-MW6 continue to have the highest concentrations of VOCs. Results indicate concentrations above cleanup levels for all four constituents with PCE and TCE concentrations having the largest exceedances of cleanup levels. Concentrations of PCE at these wells ranged from 390 micrograms per liter (µg/L) to 860 µg/L and concentrations of TCE ranged from 98 µg/L to 180 µg/L. The cleanup level for both TCE and PCE is 5 µg/L.
- LAI-MW3 results indicate concentrations of PCE and TCE continue to exceed cleanup levels; however, concentrations are somewhat lower (97 µg/L and 32 µg/L, respectively) than at the three wells discussed above.
- RNS-MW2 results indicate the concentration of PCE continues to exceed the cleanup level.
- MW2 results indicate the concentration of VC narrowly exceeded the cleanup level of 0.2 µg/L with a concentration of 0.44 µg/L.

VOC concentration time series plots (Attachment 1) were examined to identify data trends over time. Several wells have shown steady decreases in VOC concentrations, specifically LAI-MW1, LAI-MW4, and LAI-MW5 (currently non-detect for all VOCs). MW2 and MW-13 have also shown decreases in VOC concentrations over time. RNS-MW6 is sampled at two depths within the screen; recent data at this well appear to show decreasing trends from historical maximum concentrations in 2012 and

2013. Data trends at LAI-MW2 and LAI-MW3 are less clear, but VOC concentrations appear to have remained relatively stable over time with the exception of VC, which appears to be declining. Concentration trends at RNS-MW2 vary by constituent. VC is not detected at this well and TCE and cDCE concentrations appear to be declining; however, PCE concentrations continue to have an overall increasing trend. The laboratory data package for the most recent sampling event (January 2017) is provided in Attachment 2.

Monitored Natural Attenuation Results

Natural attenuation of chlorinated ethenes occurs through several mechanisms with the primary mechanism being biologically mediated reductive dechlorination. For reductive dechlorination to occur, the aquifer must be reducing. Measures of aquifer redox conditions include DO, oxygen-reduction potential, nitrate, ferrous iron, sulfate, and methane. MNA data appear to suggest favorable conditions for reductive-dechlorination at LAI-MW5 (near the source area) and LAI-MW4 (the most downgradient well). Indicators of reductive dechlorination are summarized below:

- Ferrous iron was detected at 4.5 milligrams per liter (mg/L) at LAI-MW4 and 2.0 mg/L at LAI-MW5.
- Sulfate was detected at low concentrations at LAI-MW4 (2.1 mg/L).
- Methane was detected at a concentration of 3.7 µg/L at LAI-MW4 and 12 µg/L at LAI-MW5.

At the remaining seven wells, data were not conclusive regarding the potential for reductive dechlorination; however, concentrations at most wells appear to be declining. The laboratory data package for the most recent sampling event (January 2017) is provided in Attachment 2. January 2017 MNA data is presented in Table 4.

Occurrence of Problems

None noted.

Planned Groundwater Monitoring Activities

Groundwater monitoring results will continue to be submitted to Ecology 60 days after completion of sampling activities. The next scheduled sampling event will occur in July 2017.

* * * * * * * * * *

Please contact us if you have any questions concerning groundwater monitoring activities or results presented in this status report.

LANDAU ASSOCIATES, INC.

Sierra Mott
Project Scientist

Jennifer Wynkoop
Senior Associate Scientist

SMM/JWW/jrc
[Y:\094\048.090\R\STATUS REPORTS\2017_01\SAUROS GW MONITORING JAN 2017.DOCX]

References

LAI. 2013. Draft Sampling and Analysis Plan, Former Sauro's Property, Tacoma, Washington. Landau Associates, Inc. January 24.

LAI. 2014. Draft Cleanup Action Plan, Former Sauro's Cleanerama Site, Tacoma, Washington. Landau Associates, Inc. September 5.

LAI. 2016. Memorandum: Long-Term Groundwater Monitoring Status Report No. 1 for January 2016, Former Sauro's Cleanerama Site, Tacoma, Washington. From Sierra Mott, Landau Associates, Inc., to Marv Coleman, Washington State Department of Ecology. March 3.

Attachments:

Figure 1: Vicinity Map
Figure 2: Sauro's Cleanerama Monitoring Well Network

Table 1: Sample Matrix
Table 2: Sampling Laboratory and Field Parameter Details
Table 3: Constituents of Concern Groundwater Analytical Results
Table 4: Monitored Natural Attenuation Parameters

Attachment 1: Constituents of Concern Concentration Time Series Plots
Attachment 2: January 2017 Laboratory Data Package

Site 3B

DRAFT

Data Source: Esri 2012

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LANDAU ASSOCIATES

Sauro's Cleanerama Tacoma, Washington	**Vicinity Map**	Figure 1

Site 3B

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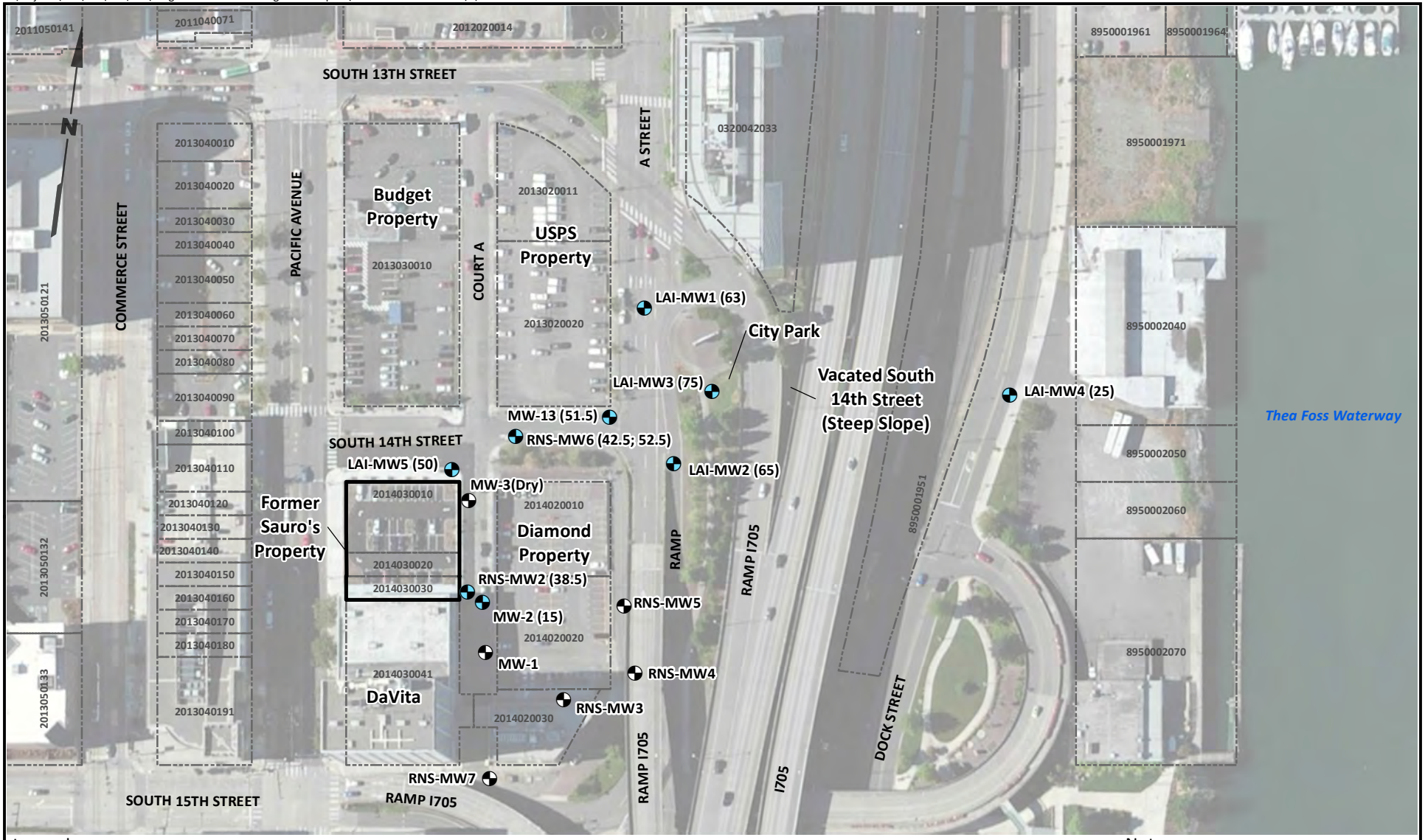


Legend

- Long-Term Groundwater Monitoring Well (and Well Depth)
- Other Existing Monitoring Well
- Subject Property
- Tax Parcels with Parcel ID

0 150 300

Scale in Feet

DRAFT

Data Source: Esri World Imagery, 2013.

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

LANDAU ASSOCIATES

Sauro's Cleanerama
Tacoma, Washington

Sauro's Cleanerama
Monitoring Well Network

Figure
2

Site 3B

DRAFT

Table 1
Sample Matrix
Sauro's Cleanerama
Tacoma, Washington

Location	VOC Sampling Depth (ft)	VOC Concentration Data Sampling Method	MNA Parameters Sampling Depth (ft)	MNA Parameters Sampling Method
LAI-MW1	63	PDB	63	WAT
LAI-MW2	65	PDB	65	WAT
LAI-MW3	75	PDB	75	WAT
LAI-MW4	25	PDB	25	WAT
LAI-MW5	50	PDB	50	WAT
MW2-PP	15	PP	15	PP
MW13	51.5	PDB	51.5	WAT
RNS-MW2	38.5	PDB	38.5	WAT
RNS-MW6 [(a)]	42.5 and 52.5	PDB	47.5	WAT

Note:
(a) For RNS-MW6, where there are two VOC sampling depths, the MNA sampling depth is the mid-point between the two VOC sampling depths.

Abbreviations/Acronyms:
ft = feet
MNA = monitored natural attenuation
PDB = passive diffusion bag
PP = peristaltic pump with dedicated tubing
VOC = volatile organic compound
WAT = (dedicated) Waterra foot valve (with dedicated 5/8-inch HDPE tubing)

Site 3B

DRAFT

Table 2
Sampling Laboratory and Field Parameter Details
Sauro's Cleanerama
Tacoma, Washington

Groundwater Analytical Parameters	EPA Analytical Method	Practical Quantitation Limit	Preservation	Maximum Holding Time (Days)
Volatile Organic Compounds				
Tetrachloroethene	8260C	0.2 µg/L	Add HCl to pH<2; Store cool at 6°C	14
Trichloroethene	8260C	0.2 µg/L	Add HCl to pH<2; Store cool at 6°C	14
cis-1,2-Dichloroethene	8260C	0.2 µg/L	Add HCl to pH<2; Store cool at 6°C	14
Vinyl Chloride	8260C	0.2 µg/L	Add HCl to pH<2; Store cool at 6°C	14
Monitored Natural Attenuation				
Chloride	SM 4500-CL-E	1.0 mg/L	Store cool at 6°C	28
Nitrate (NO_3) (Total) as N	353.2	0.2 mg/L [(a)]	Store cool at 6°C	48 hours
Nitrite (NO_2) (Total) as N	353.2	0.4 mg/L [(a)]	Store cool at 6°C	48 hours
Total Organic Carbon	SM 5310B	1.00 mg/L	Add 2mL 9N H2SO4 pH<2; Store at 6°C	28
Sulfate (SO_4) (Total)	SM 4500-SO_4 E	5.0 mg/L	Store cool at 6°C	28
Sulfide (SO_2) (Total)	SM 4500-S2 D	0.150 mg/L	Store cool at 6°C	7
AMEE	RSK 175	0.0050 mg/L	Store cool at 6°C	14

Groundwater Field Parameters	Data Collection Method	Instrument	Units
Monitored Natural Attenuation			
Conductivity	Field	YSI [(b)]	µS/cm
Dissolved Oxygen	Field	YSI	mg/L
Oxidation Reduction Potential	Field	YSI	units +/- mV
pH	Field	YSI	unitless
Temperature	Field	YSI	(°C)
Ferrous Iron (Fe^{2+})	Field	Hach® Kit	mg/L
Turbidity	Field	Turbidity Meter	NTU
Water Level	Field	Water Level Indicator	0.01 ft

Notes:
(a) Reporting limits for nitrate and nitrite were raised prior to the July 2016 sampling event due to laboratory capabilities.
(b) YSI shall be recalibrated daily.

Abbreviations/Acronyms:
AMEE = acetylene, methane, ethane, and ethene
°C = degrees Celsius
EPA = U.S. Environmental Protection Agency
ft = foot
µg/L = micrograms per liter
mg/L = milligrams per liter
mL = millimeters
mV = millivolts
µS/cm = microSiemens per centimeter
NTU = nephelometric turbidity units

Site 3B

DRAFT

Table 3
Constituents of Concern Groundwater Analytial Results - January 2017
Sauro's Cleanerama
Tacoma, Washington

Analyte	Groundwater MTCA Method A CUL or Federal/State MCL (µg/L)	Sample Location, Laboratory ID, Sample Date, and Sample Type										
		LAI-MW1 580-65491-2 1/18/2017 N	LAI-MW2 580-65491-3 1/18/2017 N	LAI-MW3 580-65491-4 1/18/2017 N	LAI-MW4 580-65491-5 1/18/2017 N	LAI-MW4 580-65491-12 1/18/2017 FD	LAI-MW5 580-65491-6 1/18/2017 N	MW2 580-65491-7 1/18/2017 N	MW13 580-65491-8 1/18/2017 N	RNS-MW2 580-65491-9 1/18/2017 N	RNS-MW6-42.5 580-65491-10 1/18/2017 N	RNS-MW6-52.5 580-65491-11 1/18/2017 N
Volatile Organic Compounds (µg/L; SW-846 8260C)												
cis-1,2-Dichloroethene	70 [(a)]	0.20 U	**120**	**39**	0.20 U	0.20 U	0.20 U	**0.75**	**73**	0.20 U	**140**	**110**
Tetrachloroethene	5	0.20 U	**390**	**97**	0.20 U	0.20 U	0.20 U	**0.54**	**430**	**25**	**860**	**570**
Trichloroethene	5	0.20 U	**120**	**32**	0.20 U	0.20 U	0.20 U	**0.30**	**98**	**0.51**	**180**	**130**
Vinyl Chloride	0.2	0.20 U	**0.80 J**	0.20 U	0.20 U	0.20 U	0.20 U	**0.44**	**0.73 J**	0.20 U	**0.33 J**	**0.53**

Notes:

(a) Cis-1,2-DCE does not have a MTCA Method A CUL for groundwater; therefore, the Federal/State primary MCL value of 70 µg/L is used as the CUL.
Bold text indicates detected analyte.
Green highlighting = compound detected above cleanup criteria.
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
U = The compound was not detected at the reported concentration.

Abbreviations:

µg/L = micrograms per liter
CUL = cleanup level
FD = field duplicate
ID = identification
MCL = maximum contaminant levels
MTCA = Model Toxics Control Act
N = primary sample

Site 3B

DRAFT

Table 4
Monitored Natural Attenuation Parameters
Sauro's Cleanerama
Tacoma, Washington

Sample Location:	LAI-MW1	LAI-MW2	LAI-MW3	LAI-MW4	LAI-MW4	LAI-MW5	MW2	MW13	RNS-MW2	RNS-MW6-52.5
Laboratory ID:	580-65491-2	580-65491-3	580-65491-4	580-65491-5	580-65491-12	580-65491-6	580-65491-7	580-65491-8	580-65491-9	580-65491-11
Sample Date:	1/18/2017	1/18/2017	1/18/2017	1/18/2017	1/18/2017	1/18/2017	1/18/2017	1/18/2017	1/18/2017	1/18/2017
Sample Type:	N	N	N	N	FD	N	N	N	N	N
Natural Attenuation Parameters (mg/L; EPA 300.0/SM 4500-S2-D/SM 5310B)										
Chloride	**72**	**12**	**17**	**24**	**24**	**14**	**25**	**14**	**42**	**25**
Nitrogen, Nitrate	**1.3**	0.20 U	**0.54**	0.20 U	0.20 U	0.20 U	**1.9**	**0.65**	**2.9**	**0.61**
Nitrogen, Nitrite	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U	0.40 U
Sulfate	**19**	**19**	**20**	**2.1**	**2.6**	1.2 U	**24**	**30**	**27**	**27**
Sulfide, Total	0.050 U	0.25 U	0.050 U	0.050 U	0.050 U	0.10 U	0.050 U	0.25 U	0.25 U	0.25 U
Total Organic Carbon	**2.6**	**5.6**	**1.8**	**3.6**	**3.5**	**9.6**	**2.7**	**1.7**	**1.2**	**1.9**
Dissolved Gasses (mg/L; RSK-175)										
Methane	0.0050 U	**0.024**	0.0050 U	**3.7 J-FD**	**4.6 J-FD**	**12**	**1.0**	**0.010**	0.0050 U	**0.036**
Ethane	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	**0.0087**
Ethene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Acetylene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Field Parameters										
Dissolved Oxygen (mg/L)	**2.17**	**6.97**	**1.31**	**2.35**	**2.13**	**1.81**	**1.67**	**2.21**	**6.37**	**2.77**
Oxidation Reduction Potential (mV)	**31.2**	**15.5**	**31.6**	**-18.3**	**-19.5**	**-26.0**	**38.9**	**37.7**	**35.8**	**41.9**
Iron (mg/L)	0.0	**1.5**	0.0	**4.5**	**4.5**	**2.0**	**0.5**	0.0	0.0	0.0

Notes:

Bold = detected compound

J-FD = The analyte was positively identified and was subsequently qualified as estimated due to field duplicate imprecision; the associated numerical value is the approximate concentration of the analyte in the sample.

U = The compound was not detected at the reported concentration.

Abbreviations:

mg/L = milligrams per liter

mV = millivolt

FD = field duplicate

ID = identification

N = primary sample

Site 3C

LEGEND

- Water Line
- Sanitary Sewer Line
- Power Underground
- MW-12 / 7.34 — Monitoring Well; Groundwater Elevation in feet- October 1, 2009
- B3 — Soil Boring
- VE-16 — SVE Well
- VE-11/ AS-11 — Sparging/SVE Well
- Property Boundary
- Estimated Direction of Ground Water Flow
- Estimated Extent of TPH-G >0.5 mg/L Benzene >0.005 mg/L
- 7.0 — Estimated Groundwater Elevation Contour in Feet
- Most Recent Sample Date | Benzene Concentration in mg/L | Gasoline Concentration in mg/L (e.g. 2/26/2008 | 73 | 11)

Note: 1. Gray indicates sample collected before remediation began.
2. MW-2 not used for groundwater contouring due to product presence.

State Route 705

Property Boundary- 1201 "A" Street

Columbia Bank Center (1301 "A" Street)

Underground Parking

Ramp Down to Parking Garage

MW-13 7.2 — 2/26/2008 | 12 | 0.63

MW-11(A) MW-11 7.3 — 2/26/2008 | 73 | 11

MW-14 6.85 — 3/11/2009 | 12 | <0.01

MW-12 7.34 — 2/26/2008 | 44 | 0.47

MW-7 — 3/22/2006 | 42 | 6.7; 2/26/2008 free product found in well

VE-14/AS-14

MW-9 — 3/22/2006 | <0.1 | <0.001

B4 VE-13/AS-13

12TH STREET

HCB-5

HCB-7

HCB-6

Abandoned Fill Port Waste Oil Tank

VE-15/AS-15 — 11/2/1999 | 4.9 | 0.12

HCB-3

HCB-4

Treatment Compound

B3

VE-12/AS-12 — 11/2/1999 | 0.33 | <0.001

Abandoned Fill Port Gasoline USTs

HCB-2

HCB-1

VE-11/AS-11

B8

SB-3

Estimated Footprint of USTs Closed in Place

B5

HC-4

2/26/2008 | <0.1 | <0.001

VE-10/AS-10

B9

VE-16

B2

MW-1 8.70

B1

B7

Former Exit Ramp (Now Blocked)

B6

Location of Former Pump Island

VE-2/AS-2 (Formerly MW-2) — 2/25/1998 | 0.051 | 0.014

11/2/1999 | 0.53 | 0.19

VE-4/AS-4 (Formerly MW-4)

MW-6 8.75 — 2/26/2008 | <0.1 | <0.001

"A" Street

N

0 20 40 Feet

Aspect consulting earth+water www.aspectconsulting.com a limited liability company

Site Map, Groundwater Elevations and Groundwater Chemistry

1201 A Street, Tacoma, Washington

DATE	April 2008
DESIGNED BY	JJP
DRAWN BY	JRS/SSC
REVISED BY	PMB
PROJECT NO.	030130
FIGURE NO.	1

Q:\Haub Brothers\030130 1201 A Street\2009-10 \030130-01.dwg

Table 1 - Groundwater Elevation Data

A Street Remediation, Tacoma, Washington

Well TOC Elevation in Feet	MW-1 69.76		MW-6 80.11		MW-7 73.34		MW-9 73.67		MW-11 72.43		MW-12 77.33		MW-13 69.00		MW-14 76.78	
Date	Depth to Water in feet	Groundwater Elevation in Feet	Depth to Water in feet	Groundwater Elevation in Feet	Depth to Water in feet	Groundwater Elevation in Feet	Depth to Water in feet	Groundwater Elevation in Feet	Depth to Water in feet	Groundwater Elevation in Feet	Depth to Water in feet	Groundwater Elevation in Feet	Depth to Water in feet	Groundwater Elevation in Feet	Depth to Water in feet	Groundwater Elevation in Feet
12/22/99	58.60	11.16	68.79	11.32	62.40	10.94	--	--	--	--	--	--	--	--	--	--
12/23/99	58.42	11.34	68.63	11.48	62.29	11.05	--	--	--	--	--	--	--	--	--	--
1/7/00	--	--	68.78	11.33	--	--	64.80	9.07	--	--	--	--	--	--	--	--
1/14/00	58.58	11.18	68.72	11.39	62.30	11.04	64.10	9.57	--	--	--	--	--	--	--	--
1/21/00	58.63	11.13	68.70	11.41	62.68	10.66	64.36	9.31	--	--	--	--	--	--	--	--
2/28/00	58.39	11.37	68.58	11.53	62.71	10.63	64.01	9.66	--	--	--	--	--	--	--	--
3/31/00	58.50	11.26	68.69	11.42	62.90	10.44	64.10	9.57	--	--	--	--	--	--	--	--
4/24/00	58.66	11.1	68.80	11.31	63.03	10.31	64.50	9.17	--	--	--	--	--	--	--	--
5/28/00	58.84	10.92	68.81	11.3	63.50	9.84	64.33	9.34	--	--	--	--	--	--	--	--
6/30/00	58.71	11.05	68.89	11.22	63.16	10.18	64.35	9.32	--	--	--	--	--	--	--	--
10/4/00	59.15	10.61	--	--	63.60	9.74	--	8.49	--	--	--	--	--	--	--	--
1/4/01	58.45	11.31	68.75	11.36	62.65	10.69	64.35	9.32	--	--	--	--	--	--	--	--
4/9/01	58.60	11.16	69	11.11	62.95	10.39	63.60	10.07	--	--	--	--	--	--	--	--
8/7/01	59.47	10.29	69.75	10.36	63.95	9.39	65.33	8.34	--	--	--	--	--	--	--	--
10/18/01	59.73	10.03	70.01	10.10	63.9	9.44	65.41	8.26	--	--	--	--	--	--	--	--
1/9/02	58.60	11.16	68.79	11.32	62.5	10.84	63.71	9.96	--	--	--	--	--	--	--	--
4/26/02	58.56	11.20	68.85	11.26	62.3	11.04	63.90	9.77	--	--	--	--	--	--	--	--
7/24/02	58.50	11.26	69.5	10.61	63.93	9.41	64.80	8.87	--	--	--	--	--	--	--	--
10/17/02	60.06	9.70	70.2	9.91	64.38	8.96	65.88	7.79	--	--	--	--	--	--	--	--
1/30/03	59.03	10.73	69.04	11.07	62.92	10.42	64.46	9.21	--	--	--	--	--	--	--	--
4/30/03	58.90	10.86	69.2	10.91	63.24	10.10	63.92	9.75	--	--	--	--	--	--	--	--
7/31/03	58.90	9.86	70.04	10.07	64.2	9.14	62.47	11.20	--	--	--	--	--	--	--	--
10/31/03	60.16	9.60	--	--	64.75	8.59	65.71	7.96	63.69	8.74	--	--	--	--	--	--
4/12/04	59.95	9.81	--	--	64.31	9.03	65.62	8.05	63.63	8.8	--	--	--	--	--	--
7/9/04	--	--	--	--	64.6	8.84	--	--	63.81	8.62	--	--	--	--	--	--
1/6/05	59.68	10.08	69.89	10.22	64.01	9.33	65.46	8.21	63.38	9.05	--	--	--	--	--	--
2/28/08	60.70	9.06	71.04	9.07	--	--	--	--	64.89	7.54	69.61	7.72	62.54	6.46	--	--
3/11/09	60.61	9.15	70.93	9.18	*66.5*	*6.84*	--	--	64.78	7.65	70.21	7.12	--	--	70.77	6.57
10/1/2009	61.06	8.70	71.36	8.75	*66.45*	*6.89*	--	--	*65.13*	7.3	69.99	7.34	61.8	7.2	70.49	6.85

Notes:
Italics Indicates that product was present, which may lower groundwater elevation
-- Not measured.

Site 3C

Table 2 - Analytical Results for Soil

A Street Remediation, Tacoma, Washington

Sample Location	Sample Depth	Date	Concentration in mg/kg TPH-G	Benzene	Toluene	Ethylbenzene	Xylenes	TPH-D	TPH-O
MW-12	65	2/4/2008	1,600	1.7	12	14	89	300 x	250 U
MW-12	80	2/4/2008	16	0.02 U	0.12	0.11	0.41	50 U	250 U
MW-13	55	2/5/2008	<2	0.02 U	0.02 U	0.02 U	0.06 U	50 U	250 U
MW-13	65	2/5/2008	<2	0.03	0.02 U	0.02 U	0.06 U	50 U	250 U
MW-14		2/23/2009	540	0.3 U	0.5 U	0.5 U	1.5 U	--	--
MW-14		2/23/2009	310	0.03 U	0.2	1.4	6.9	--	--
Cleanup Level [(1)]			*30*	*0.03*	*7*	*6*	*9*	*2000*	*2000*

Notes:

x = The pattern of peaks present is not indicative of diesel.

(1) MTCA Method A Cleanup Level for unrestricted use.

Site 3C

Site 3C

Table 3 - Analytical Results for Groundwater - TPH-G/BTEX

A Street Remediation, Tacoma, Washington

Sample Location	Date	Concentration in mg/L [1] TPH-G	Benzene	Toluene	Ethylbenzene	Xylenes
MW-1						
	7/16/1997 [3]	3.2	1.0	0.4	0.042	0.32
	12/12/1997 [3]	1.1	0.72	0.02 U	0.012	0.062
	2/25/1998 [3]	1.9	0.89	0.002	0.011	0.5
	11/2/1999	0.9	0.042	0.001 U	0.01	0.0022
	3/31/2000	0.13	0.001 U	0.001 U	0.001 U	0.001 U
	6/30/2000	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	10/4/2000	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	12/22/2000	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	4/7/2001	0.1 U	0.0044	0.001 U	0.001 U	0.001 U
	8/7/2001	0.3	0.027	0.025	0.001 U	0.0021
	10/18/2001	0.1 U	0.0014	0.001 U	0.001 U	0.001 U
	1/9/2002	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	4/26/2002	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	7/26/2002	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	10/17/2002	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	1/30/2003	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	4/30/2003	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	7/31/2003	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	10/31/2003	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	4/14/2004	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	1/6/2005	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	3/22/2006	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	2/26/2008	0.1 U	0.001 U	0.001 U	0.001 U	0.003 U
MW-2						
	7/16/1997 [3]	1.0	0.24	0.11	0.025	0.129
	12/12/1997 [3]	0.05 U	0.016	0.052	0.02 U	0.042
	2/25/1998 [3]	0.051	0.014	0.02 U	0.02 U	0.04 U
	Note: MW-2 Converted into Air Sparging Well, December 1999					
MW-4						
	7/16/1997 [3]	3.9	0.52	0.64	0.089	0.43
	12/12/1997 [3]	3.6	0.94	0.23	0.11	0.27
	2/25/1998 [3]	4.8	1.5	0.21	0.11	0.195
	Note: MW-4 Converted into Air Sparging Well, December 1999					

Site 3C

Table 3 - Analytical Results for Groundwater - TPH-G/BTEX

A Street Remediation, Tacoma, Washington

Sample Location	Date	Concentration in mg/L [1] TPH-G	Benzene	Toluene	Ethylbenzene	Xylenes
MW-5						
	12/12/1997 [3]	0.05 U	0.02 U	0.02 U	0.02 U	0.04 U
MW-6						
	12/12/1997 [3]	0.095	0.02 U	0.02 U	0.02 U	0.04 U
	10/18/2001	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	2/26/2008	0.1 U	0.001 U	0.001 U	0.001 U	0.003 U
MW-7						
	12/12/1997 [3]	59	3.8	11	1.2	5.9
	2/25/1998 [3]	95	8	13	1	6.2
	11/2/1999	380	19	24	3.9	23
	3/31/2000	28	13	12	0.33	3.8
	6/30/2000	35	11	7.8	0.6	3.8
	10/4/2000	60	14	12	0.29	4.4
	12/22/2000	61	7.2	4.9	0.77	3.3
	4/7/2001	170	8.4	7.8	0.37	5.2
	8/7/2001	55	12.0	9.0	0.17	4.4
	10/18/2001	20	2.4	2.0	0.10	1.0
	1/9/2002	18	1.2	0.85	0.26	2.7
	4/26/2002	1000	2.7	1.90	0.20	1.5
	7/26/2002	14	0.35	0.40	0.01	0.49
	10/17/2002	52	12.0	9.5	0.32	3.3
	1/30/2003	1.7	0.4	0.2	0.004	0.1
	4/30/2003	8.6	6.3	2.8	0.059	1.1
	7/31/2003	28	9.4	5.4	0.160	1.3
	10/31/2003	0.11	0.001 U	0.001 U	0.001 U	0.002
	1/29/2004	40	2.9	1.2	0.046	0.62
	4/14/2004	55	13	5.4	0.12	1.4
	7/9/2004	59	8.3	3.7	0.21	2.2
	1/6/2005	50	7.0	3.4	0.22	2.4
	3/22/2006	42	6.7	4.1	0.18	2.0

Site 3C

Table 3 - Analytical Results for Groundwater - TPH-G/BTEX

A Street Remediation, Tacoma, Washington

Sample Location	Date	Concentration in mg/L [1] TPH-G	Benzene	Toluene	Ethylbenzene	Xylenes
MW-9						
	6/25/98 [3]	3	0.37	0.023	0.073	0.153
	3/31/2000	5.9	2	0.34	0.16	0.69
	6/30/2000	24	0.7	0.053	0.053	0.17
	10/4/2000	1.8	0.42	0.0064	0.017	0.077
	12/22/2000	1.6	0.55	0.0037	0.057	0.027
	4/7/2001	0.81	0.41	0.004	0.042	0.033
	8/7/2001	0.88	0.22	0.0041	0.039	0.029
	10/18/2001	0.55	0.076	0.001 U	0.014	0.030
	1/9/2002	1.2	0.460	0.0041	0.100	0.011
	4/26/2002	0.26	0.013	0.0025	0.003	0.002
	7/26/2002	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	10/17/2002	0.45	0.005	0.003	0.001 U	0.002
	1/30/2003	0.1 U	0.004	0.001 U	0.001 U	0.001 U
	4/30/2003	0.36	0.001 U	0.001 U	0.0012	0.001 U
	7/31/2003	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	10/31/2003	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	4/14/2004	0.17	0.0042	0.001 U	0.001 U	0.0053
	1/6/2005	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
	3/22/2006	0.1 U	0.001 U	0.001 U	0.001 U	0.001 U
MW-11						
	10/31/2003	170	11	6.4	0.77	4.8
	1/29/2004	49	3	1.7	0.27	1.6
	4/14/2004	120	12	6.8	0.80	4.8
	7/9/2004	80	6.7	3.5	0.74	3.9
	1/6/2005	65	6.0	3.0	0.65	3.6
	3/22/2006	87	9.5	4.9	1.1	5.7
	2/26/2008	73	11	6.3	1.2	6.8
MW-12						
	2/26/2008	44	0.47	2.5	1.5	7.3
MW-13						
	2/26/2008	12	0.63	0.075	0.2	0.29
MW-14						
	3/11/2009	12	0.01 U	0.180	0.5	2.48
Cleanup Level [2]		*0.8*	*0.005*	*1*	*0.7*	*1*

Notes:
U = Not detected at listed reporting limit.
(1) Only data for detected constituents presented.
(2) MTCA Method A Cleanup Level for unrestricted use.
(3) Data reported by Black and Veatch, 1998.

Table 4 - Analytical Results for Groundwater - Other Analytes

A Street Remediation, Tacoma, Washington

Sample Location	Date	Concentration in mg/L [1] MTBE	EDC	EDB	Lead	TPH-D	TPH-O	Naphthalene
MW-11	2/26/2008	<0.01	1.1	0.049	0.0146	22 x	0.35 y	0.29
MW-14	3/11/2009	--	0.01 U	0.00001 U	--	--	--	--
Cleanup Level [2]		*0.02*	*0.005*	*0.00001*	*0.015*	*0.5*	*0.5*	*0.16*

Notes:
x = The pattern of peaks present is not indicative of diesel.
y = The pattern of peaks present is not indicative of motor oil.
-- = not analyzed
(1) Only data for detected constituents presented.
(2) MTCA Method A Cleanup Level for unrestricted use.

Site 3C

Table 5 - Product Thickness and Recovery Data

A Street Remediation, Tacoma, Washington

	MW-7					MW-11		
Date	Depth to Water in ft	Depth to Product in ft	Product Thickness	Water Removed in Gallons	Product Removed in Gallons	Depth to Water in ft	Depth to Product in ft	Product Thickness
4/7/09	66.37	65.11	1.26	9.16	0.88	64.73	n/a	0.00
4/27/09	65.68	65.36	0.32	1.6	0.04	--	--	--
10/7/09	66.45	65.64	0.81	1.47	0.29	69.99	69.91	0.08

Note:
-Water and product levels measured before product/water was removed with disposable bailer
- Not measured

Site 3C

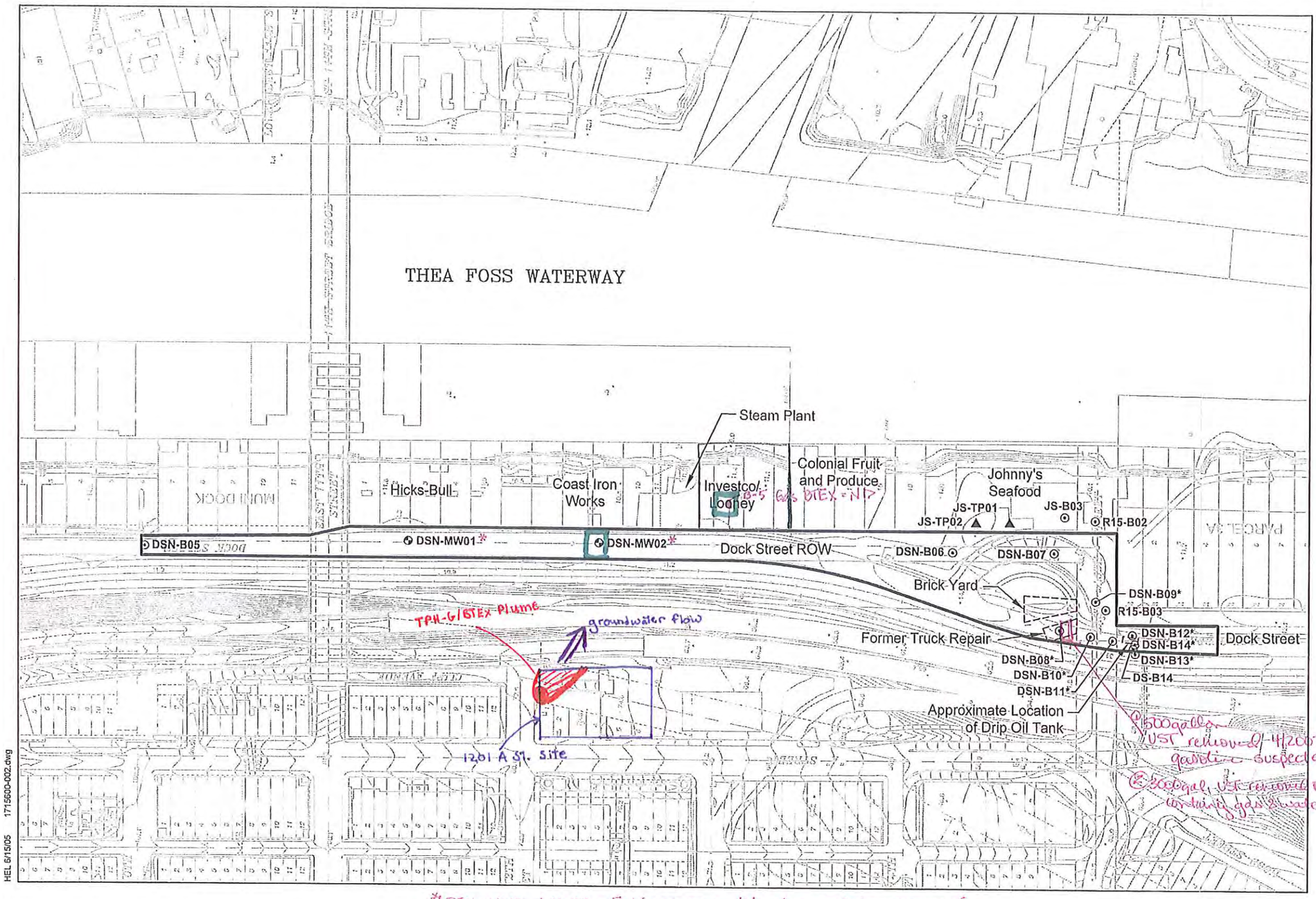
Site 3C

APPENDIX A

Site Exploration Plan with Significant Historical Features, Dock Street North ROW (Hart Crowser, 2005; annotated Aspect Consulting, 2008)

Site 3C

Site Exploration Plan with Significant Historical Features
Dock Street North ROW



HEL 6/15/05 1715600-002.dwg

* DSN-MW01 2-MW02 - Field screening did not suggest the presence of gasoline therefore soil & groundwater were only analyzed for PAHs, metals, diesel & oil.

HARTCROWSER
17156-00 6/05
Figure 2

Site 3D

Table 1

May 2014 Soil Chemical Analytical Data[1]

City of Tacoma - Prairie Line Trail
Tacoma, Washington

	Sample ID[2]	P1A-EB1-0-1.5	P1A-EB1-2-3	P1A-EB1-4-5	P1A-EB2-0-1.5	P1A-EB2-2-3	P1A-EB3-0-1.5	P1A-EB3-2-2.5	
	Sample Date	5/21/2014	5/21/2014	5/21/2014	5/21/2014	5/21/2014	5/21/2014	5/21/2014	
	Sample Depth (feet bgs)	0 to 1.5	2 to 3	4 to 5	0 to 1.5	2 to 3	0 to 1.5	2 to 2.5	MTCA Method A ULU
Method	Analyte (mg/kg)								
NWTPH-HCID[3]	Diesel-Range Petroleum Hydrocarbons	--	67 U	--	55 U	--	54 U	60 U	2,000
	Gasoline-Range Petroleum Hydrocarbons	--	27 U	--	22 U	--	22 U	24 U	910
	Lube Oil-Range Petroleum Hydrocarbons	--	**130**	--	**110**	--	110 U	120 U	2,000
NWTPH-DX[4]	Diesel-Range Petroleum Hydrocarbons	--	**34**	--	28 U	--	--	--	2,000
	Lube Oil-Range Petroleum Hydrocarbons	--	**130**	--	**140**	--	--	--	2,000
Metals[5]	Arsenic	11 U	13 U	12 U	11 U	12 U	11 U	12 U	20
	Barium	**97**	**430**	**78**	**110**	**300**	**76**	**340**	16,000[11]
	Cadmium	0.56 U	0.67 U	0.60 U	0.55 U	0.59 U	0.54 U	0.60 U	2.0
	Chromium	**35**	**26**	**44**	**58**	**25**	**53**	**20**	2,000[12]
	Lead	**50**	**740**	6.0 U	**25**	**110**	**20**	**55**	250
	Mercury	0.28 U	**0.38**	0.30 U	0.28 U	0.30 U	0.27 U	0.30 U	2.0
	Selenium	11 U	13 U	12 U	11 U	12 U	11 U	12 U	400[11]
	Silver	1.1 U	1.3 U	1.2 U	1.1 U	1.2 U	1.1 U	1.2 U	400[11]
VOCs[6]	Benzene	--	0.0022 U	--	0.0011 U	--	0.0010 U	0.0014 U	0.03
	Ethylbenzene	--	0.085 U	--	0.0011 U	--	0.0010 U	0.074 U	6
	Tetrachloroethene	--	0.085 U	--	0.0011 U	--	0.0010 U	0.074 U	0.05
	Toluene	--	0.011 U	--	0.0057 U	--	0.0050 U	0.0068 U	7
	Trichloroethene	--	0.0022 U	--	0.0011 U	--	0.0010 U	0.0014 U	0.03
	Total Xylenes[7]	--	0.17 U	--	0.0023 U	--	0.0020 U	0.15 U	9
PAHs[8]	1-Methylnaphthalene	**0.081**	**0.58**	0.0080 U	**0.16**	**0.68**	**0.043**	**0.40**	35[11]
	2-Methylnaphthalene	**0.082**	**0.79**	0.0080 U	**0.26**	**0.58**	**0.062**	**0.59**	320[11]
	Acenaphthene	**0.052**	**0.077**	0.0080 U	**0.015**	**0.031**	0.0072 U	**0.016**	4,800[11]
	Acenaphthylene	**0.054**	**0.042**	0.0080 U	**0.011**	**0.035**	0.0072 U	**0.023**	NE
	Anthracene	**0.21**	**0.11**	0.0080 U	**0.021**	**0.062**	**0.016**	**0.035**	24,000[11]
	Fluoranthene	**1.2**	**0.69**	0.0080 U	**0.12**	**0.38**	**0.063**	**0.093**	3,200[11]
	Fluorene	**0.051**	**0.078**	0.0080 U	**0.014**	**0.061**	**0.0079**	**0.050**	3,200[11]
	Naphthalene	**0.089**	**0.33**	0.0080 U	**0.12**	**0.25**	**0.036**	**0.22**	5
	Benzo(ghi)perylene	**0.47**	**0.22**	0.0080 U	**0.044**	**0.12**	**0.019**	0.040 U	NE
	Phenanthrene	**0.59**	**0.87**	0.0080 U	**0.15**	**0.63**	**0.086**	**0.33**	NE
	Pyrene	**1.2**	**0.70**	0.0080 U	**0.13**	**0.45**	**0.066**	**0.082**	2,400[11]
cPAHs[9]	Benzo (a) anthracene (TEF 0.1)	**0.63**	**0.38**	0.0080 U	**0.073**	**0.30**	**0.038**	**0.079**	MTCA ULU cleanup level for the TTEC of cPAHs is 0.1 mg/kg
	Benzo (a) pyrene (TEF 1)	**0.78**	**0.32**	0.0080 U	**0.069**	**0.22**	**0.033**	0.040 U	
	Benzo (b) fluoranthene (TEF 0.1)	**0.55**	**0.40**	0.0080 U	**0.058**	**0.21**	**0.028**	**0.041**	
	Benzo (J,k) fluoranthene (TEF 0.1)	**0.48**	**0.22**	0.0080 U	**0.040**	**0.13**	**0.023**	0.040 U	
	Chrysene (TEF 0.01)	**0.59**	**0.46**	0.0080 U	**0.074**	**0.37**	**0.042**	**0.078**	
	Dibenz (a,h) anthracene (TEF 0.1)	**0.15**	**0.095**	0.0080 U	**0.012**	**0.048**	**0.0072**	0.040 U	
	Indeno (1,2,3-cd) pyrene (TEF 0.1)	**0.43**	**0.19**	0.0080 U	**0.035**	**0.11**	**0.016**	0.040 U	
	TTEC of cPAHs (detect only)	**1.0**	**0.45**	NA	**0.09**	**0.30**	**0.04**	**0.01**	0.10

Notes:

[1] Chemical analysis performed by OnSite Environmental, Inc., of Redmond, Washington.

[2] Sample ID = Area number - environmental boring number - starting depth of sample [feet bgs] - end depth [feet bgs], Area P1A Environmental Boring 1 collected 0-1.5 feet bgs = P1A-GB1-0-1.5.

[3] Northwest Total Petroleum Hydrocarbons - Hydrocarbon Identification by Ecology-approved method NWTPH-HCID.

[4] Diesel and lube oil-range petroleum hydrocarbons by Ecology-approved method NWTPH-Dx.

[5] Resource Conservation Recovery Act (RCRA) metals analyzed by U.S. Environmental Protection Agency (EPA) 6000/7000 series method.

[6] Volatile Organic Compounds (VOCs) analyzed by U.S. Environmental Protection Agency (EPA) 8260C method.

[7] Total xylenes consists of m,p- and o- xylenes. The higher detection limit is shown.

[8] Polycyclic aromatic hydrocarbons (PAHs) and carcinogenic PAHs (cPAHs) were analyzed by EPA method 8270D/SIM. Other PAHs were analyzed but not detected.

[9] Model Toxics Control Act (MTCA) Method A cleanup level for gasoline is 30 mg/kg if benzene is detected or if the sum of toluene, ethylbenzene and xylenes are equal to or greater than 1% of the total gasoline detection.

[10] Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs) analyzed by EPA Method 8270D/SIM.

[11] MTCA Method B ULU criteria represented because MTCA Method A cleanup level has not been established.

[12] MTCA Method A cleanup level for Trivalent Chromium.

mg/kg = Milligram per kilogram | -- = Sample not analyzed | TTEC = Total Toxicity Equivalency Concentration | ULU = Unrestricted Land Use

MTCA = Model Toxics Control Act | bgs = Below ground surface | TEF = Toxic Equivalency Factor | NA = Not Applicable

U = Analyte was not detected at or greater than the listed reporting limit | EPA = United States Environmental Protection Agency | RCRA = Resource Conservation Recovery Act

Total Toxic Equivalent Concentration (TTEC) is the sum of each individual cPAH concentration multiplied by its corresponding TEF.

Bold font type indicates that the analyte was detected at a concentration greater than the respective laboratory reporting limit.

Bold font type and gray shading indicates that the detected concentration is greater than the respective MTCA cleanup level.

Site 3D

Table 2

November 2014 Soil Chemical Analytical Data

City of Tacoma - Prairie Line Trail
Tacoma, Washington

Composite Identifier	A		B	C		D	E	MTCA Method A ULU Cleanup Level
Test Pit Number(s)	TP1, TP2, TP3, TP4, TP5, TP6, TP7	TP2	TP2, TP3, TP4, TP5, TP6, TP7	TP8, TP9, TP10, TP11, TP12	TP11	TP8, TP9, TP10, TP11, TP12	TP13, TP14, TP15	
Sample Depth (feet bgs)	0 to 5	0 to 5	1.5 to 6	0 to 4	0 to 1	2 to 12.5	0 to 4.5	
Sample Type	Composite	Aliquot	Composite	Composite	Aliquot	Composite	Composite	
Disposal/Reuse Option	RCRA Subtitle D Landfill		Soil Recycling Facility/Inert Waste Landfill	RCRA Subtitle D Landfill		Soil Recycling Facility/Inert Waste Landfill	RCRA Subtitle D Landfill	
Applicable Sample[2] Numbers Used for Chemical Analysis	P1A-TP1-0-3 P1A-TP2-0-5 P1A-TP3-0-3 P1A-TP4-0-2.5 P1A-TP5-0-2.5 P1A-TP6-0-2.5 P1A-TP7-0-1.5	P1A-TP2-0-5[3]	P1A-TP2-5-6 P1A-TP3-3-4 P1A-TP4-2.5-4 P1A-TP5-2.5-4 P1A-TP6-2.5-3.5 P1A-TP7-1.5-3.5	P1A-TP8-0-4 P1A-TP9-0-4 P1A-TP10-0-2 P1A-TP11-0-1 P1A-TP12-0-3.5	P1A-TP11-0-1[3]	P1A-TP8-4-8 P1A-TP8-8-12.5 P1A-TP9-4-11.5 P1A-TP10-2-8 P1A-TP10-8-12.5 P1A-TP11-1-5 P1A-TP11-5-12 P1A-TP12-3-6.5	P1A-TP13-0-2.5 P1A-TP14-0-4.5 P1A-TP15-0-2.5	
NWTPH-HCID[4] (mg/kg)								
Gasoline-Range	-	-	23 U	23 U	-	22 U	-	30/100[11]
Diesel-Range	-	-	58 U	**DET**	-	55 U	-	2,000
Lube Oil-Range	-	-	120 U	120 U	-	110 U	-	2,000
NWTPH-Dx [5] (mg/kg)								
Diesel-Range Petroleum Hydrocarbons	-	-	-	**78**	-	-	-	2,000
Lube Oil-Range Petroleum Hydrocarbons	-	-	-	**110**	-	-	-	2,000
Metals[7] (mg/kg)								
Arsenic	12 U	-	12 U	11 U	-	11 U	13 U	20
Barium	**84**	-	**140**	**200**	-	**61**	**77**	16,000[12]
Cadmium	0.62 U	-	0.58 U	0.58 U	-	0.55 U	0.65 U	2.0
Chromium	**34**	-	**25**	**27**	-	**24**	**26**	2,000 [13]
Lead	**6.4**	-	**77**	**130**	-	**7.8**	**8.1**	250
Mercury	0.31 U	-	0.29 U	0.29 U	-	0.27 U	0.32 U	2.0
Selenium	12 U	-	12 U	11 U	-	11 U	13 U	400[12]
Silver	1.2 U	-	1.2 U	1.1 U	-	1.1 U	1.3 U	400[12]
TCLP Lead (mg/L)		-	-	0.2 U	-	-	-	5 [14]
PAHs[8] (mg/kg)								
Naphthalene	**0.23**	-	0.0077 U	**0.19**	-	**0.0084**	**0.36**	5
2-Methylnaphthalene	**0.36**	-	0.0077 U	**0.32**	-	**0.0080**	**0.45**	320[12]
1-Methylnaphthalene	**0.24**	-	**0.0087**	**0.2**	-	**0.0093**	**0.29**	35[12]
Acenaphthylene	0.041 U	-	0.0077 U	0.038 U	-	0.0073 U	**0.045**	NE
Acenaphthene	0.041 U	-	0.0077 U	0.038 U	-	0.0073 U	**0.075**	4,800[12]
Fluorene	0.041 U	-	0.0077 U	0.038 U	-	0.0073 U	**0.063**	3,200[12]
Phenanthrene	**0.32**	-	**0.012**	**0.25**	-	**0.0097**	**0.83**	NE
Anthracene	**0.068**	-	0.0077 U	**0.068**	-	0.0073 U	**0.34**	24,000[12]
Fluoranthene	**0.25**	-	**0.010**	**0.13**	-	0.0073 U	**0.85**	3,200[12]
Pyrene	**0.24**	-	**0.0096**	**0.14**	-	0.0073 U	**0.85**	2,400[12]
Benzo[g,h,i]perylene	**0.082**	-	0.0077 U	**0.060**	-	0.0073 U	**0.23**	NE
Carcinogenic PAHs (mg/kg)								
Benzo (a) anthracene (TEF 0.1)	**0.14**	-	0.0077 U	**0.073**	-	0.0073 U	**0.41**	MTCA ULU cleanup level for the sum of all cPAHs is 0.1 mg/kg
Benzo (a) pyrene (TEF 1)	**0.11**	-	0.0077 U	**0.046**	-	0.0073 U	**0.36**	
Benzo (b) fluoranthene (TEF 0.1)	**0.13**	-	0.0077 U	**0.085**	-	0.0073 U	**0.34**	
Benzo (J,k) fluoranthene (TEF 0.1)	**0.097**	-	0.0077 U	**0.056**	-	0.0073 U	**0.25**	
Chrysene (TEF 0.01)	**0.17**	-	0.0077 U	**0.11**	-	0.0073 U	**0.49**	
Dibenz (a,h) anthracene (TEF 0.1)	0.041 U	-	0.0077 U	0.038 U	-	0.0073 U	**0.075**	
Indeno (1,2,3-cd) pyrene (TEF 0.1)	**0.065**	-	0.0077 U	**0.047**	-	0.0073 U	**0.20**	
Total TTEC of cPAHs (detect only)	**0.15**	-	**-**	**0.07**	-	-	**0.49**	0.1
VOCs[9] (mg/kg)								
Benzene	-	0.00080 U	-	-	0.00082 U	-	-	0.03
Ethylbenzene	-	0.00080 U	-	-	0.00082 U	-	-	6
Toluene	-	0.0040 U	-	-	0.0041 U	-	-	7
Xylene[10]	-	0.0016 U	-	-	0.0016 U	-	-	9
Tetrachloroethene (PCE)	-	0.00080 U	-	-	**0.0014**	-	-	0.05
Trichloroethene (TCE)	-	0.00080 U	-	-	0.00082 U	-	-	0.03
Acetone	-	0.0088 U	-	-	0.0090 U	-	-	72,000[12]
2-Butanone (MEK)	-	0.0040 U	-	-	0.0041 U	-	-	48,000[12]

Site 3D

Composite Identifier	G	H		I			J	MTCA Method A ULU Cleanup Level
Test Pit Number(s)	TP16, TP17, TP18	TP15, TP16, TP17, TP18	TP16	TP19, TP20	TP19	TP20	TP19, TP20	
Sample Depth (feet bgs)	0 to 3	2 to 5	2.5 to 5	0 to 4	0 to 4	0 to 4	2 to 7.5	
Sample Type	Composite	Composite	Aliquot	Composite	Aliquot	Aliquot	Composite	
Disposal/Reuse Option	RCRA Subtitle D Landfill	Soil Recycling Facility		RCRA Subtitle D Landfill			Soil Recycling Facility	
Applicable Sample[2] Numbers Used for Chemical Analysis	P1A-TP16-0-2 P1A-TP17-0-2 P1A-TP18-0-3	P1A-TP15-2.5-5 P1A-TP16-2-2.5 P1A-TP16-2.5-5 P1A-TP17-2-3 P1A-TP18-3-3.5	P1A-TP16-2.5-5[3]	P1A-TP19-0-2 P1A-TP20-0-4	P1A-TP19-0-2[3]	P1A-TP20-0-4[3]	P1A-TP19-2-6 P1A-TP20-4-7.5	
NWTPH-HCID[4] (mg/kg)								
Gasoline-Range	-	23 U	-	25 U	-	-	22 U	30/100[11]
Diesel-Range	-	58 U	-	64 U	-	-	55 U	2,000
Lube Oil-Range	-	120 U	-	**DET**	-	-	110 U	2,000
NWTPH-Dx [5] (mg/kg)								
Diesel-Range Petroleum Hydrocarbons	-	-	-	52 U	-	-	-	2,000
Lube Oil-Range Petroleum Hydrocarbons	-	-	-	**340**	-	-	-	2,000
Metals[7] (mg/kg)								
Arsenic	12 U	12 U	-	13 U	-	-	11 U	20
Barium	**80**	**190**	-	**270**	-	-	**120**	16,000[12]
Cadmium	0.6 U	0.58 U	-	0.64 U	-	-	0.55 U	2.0
Chromium	**40**	**29**	-	**26**	-	-	**24**	2,000 [13]
Lead	**8.3**	**78**	-	**180**	-	-	**54**	250
Mercury	0.30 U	0.29 U	-	0.32 U	-	-	0.28 U	2.0
Selenium	12 U	12 U	-	13 U	-	-	11 U	400[12]
Silver	1.2 U	1.2 U	-	1.3 U	-	-	1.1 U	400[12]
TCLP Lead (mg/L)	-	-	-	0.2 U	-	-	-	5 [14]
PAHs[8] (mg/kg)								
Naphthalene	**0.22**	0.0077 U	-	**0.20**	-	-	**0.0099**	5
2-Methylnaphthalene	**0.34**	**0.0080**	-	**0.33**	-	-	**0.010**	320[12]
1-Methylnaphthalene	**0.22**	**0.0095**	-	**0.20**	-	-	**0.010**	35[12]
Acenaphthylene	**0.025**	0.0077 U	-	0.042 U	-	-	0.0073 U	NE
Acenaphthene	**0.025**	0.0077 U	-	0.042 U	-	-	0.0073 U	4,800[12]
Fluorene	**0.015**	0.0077 U	-	0.042 U	-	-	0.0073 U	3,200[12]
Phenanthrene	**0.34**	**0.013**	-	**0.22**	-	-	**0.013**	NE
Anthracene	**0.061**	0.0077 U	-	**0.071**	-	-	0.0073 U	24,000[12]
Fluoranthene	**0.23**	**0.012**	-	**0.13**	-	-	**0.012**	3,200[12]
Pyrene	**0.24**	**0.013**	-	**0.14**	-	-	**0.014**	2,400[12]
Benzo[g,h,i]perylene	**0.076**	0.0077 U	-	**0.050**	-	-	**0.0080**	NE
Carcinogenic PAHs (mg/kg)								
Benzo (a) anthracene (TEF 0.1)	**0.15**	0.0077 U	-	**0.075**	-	-	**0.0083**	MTCA ULU cleanup level for the sum of all cPAHs is 0.1 mg/kg
Benzo (a) pyrene (TEF 1)	**0.12**	0.0077 U	-	**0.049**	-	-	0.0073 U	
Benzo (b) fluoranthene (TEF 0.1)	**0.15**	0.0077 U	-	**0.065**	-	-	**0.0073**	
Benzo (J,k) fluoranthene (TEF 0.1)	**0.10**	0.0077 U	-	**0.053**	-	-	0.0073 U	
Chrysene (TEF 0.01)	**0.20**	0.0077 U	-	**0.10**	-	-	**0.011**	
Dibenz (a,h) anthracene (TEF 0.1)	**0.029**	0.0077 U	-	0.042 U	-	-	0.0073 U	
Indeno (1,2,3-cd) pyrene (TEF 0.1)	**0.065**	0.0077 U	-	0.042 U	-	-	0.0073 U	
Total TTEC of cPAHs (detect only)	**0.17**	**-**	-	**0.07**	-	-	**0.002**	0.1
VOCs[9] (mg/kg)								
Benzene	-	-	0.00069 U	-	0.00090 U	0.00074 U	-	0.03
Ethylbenzene	-	-	0.00069 U	-	0.00090 U	0.00074 U	-	6
Toluene	-	-	0.0034 U	-	0.0045 U	0.0037 U	-	7
Xylene[10]	-	-	0.0014 U	-	0.0018 U	0.0015 U	-	9
Tetrachloroethene (PCE)	-	-	0.00069 U	-	0.00090 U	0.00074 U	-	0.05
Trichloroethene (TCE)	-	-	0.00069 U	-	0.00090 U	0.00074 U	-	0.03
Acetone	-	-	0.0076 U	-	0.0099 U	0.0081 U	-	72,000[12]
2-Butanone (MEK)	-	-	0.0034 U	-	0.0045 U	0.0037 U	-	48,000[12]

Notes:

[1] Chemical analysis performed by OnSite Environmental, Inc., of Redmond, Washington.

[2] Sample ID = Project identifier - test pit number - starting depth of sample [feet bgs] -end depth [feet bgs], Test Pit 1 collected 0-3 feet bgs = P1A-TP1-0-3.

[3] Discrete sample analyzed for volatile organic compounds (VOCs).

[4] Washington State Department of Ecology (Ecology)-approved method NWTPH-HCID.

[5] Sample analyzed by Ecology-approved method NWTPH-Dx to further quantify diesel- and lube oil-range petroleum hydrocarbons.

[6] Ecology-approved method NWTPH-Dx with acid/silica gel cleanup.

[7] Polycyclic aromatic hydrocarbons (PAHs) were analyzed by U.S. Environmental Protection Agency (EPA) method 8270D/SIM.

[8] Resource Conservation Recovery Act (RCRA) metals analyzed by EPA 6000/7000 series method.

[9] VOCs were analyzed by EPA method 8260C. Other VOCs were analyzed but not detected.

[10] Total xylenes consists of m,p- and o- xylenes. The higher detection limit is shown.

[11] MTCA Method A cleanup level for gasoline is 30 mg/kg if benzene is detected or if the sum of toluene, ethylbenzene and xylenes are equal to or greater than 1% of the total gasoline detection.

[12] MTCA Method B ULU cleanup level represented because MTCA Method A cleanup level has not been established.

[13] MTCA Method A cleanup level for Trivalent Chromium.

[14] EPA Maximum Concentration for the chemical of concern regarding the Toxicity Characteristic waste designation criteria (40 CFR 261).

mg/kg = milligram per kilogram

MTCA = Model Toxics Control Act

U = Analyte was not detected at or greater than the listed reporting limit

DET = chemical of concern was detected at a concentration greater than the laboratory report limit.

TEF = Toxicity Equivalency Factor as defined in WAC 173-340-900 Table 708-2

RCRA = Resource Conservation and Recovery Act

Total Toxic Equivalent Concentration (TTEC) is the sum of each individual cPAH concentration multiplied by its corresponding TEF.

Bold type and shaded type indicates that the detected concentration is greater than the respective MTCA cleanup level.

Site 3D

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission.

Data Sources: ESRI Data & Maps, Street Maps 2005

Transverse Mercator, State Plane South, North American Datum 1983
North arrow oriented to grid north

Vicinity Map

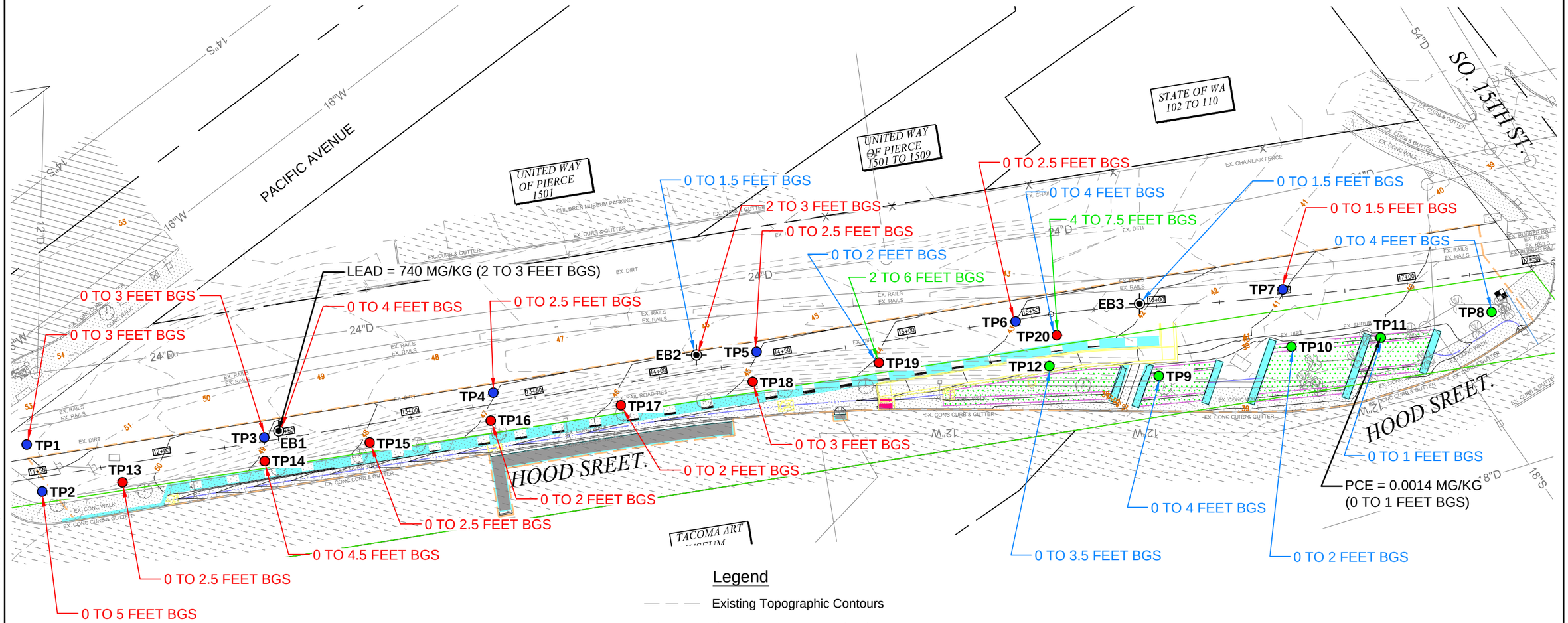
City of Tacoma - Prairie Line Trail Phase 1A
Tacoma, Washington

GeoEngineers

Figure 1

Map Revised: 23 December 2014 cgonzales
Path: \\tac\projects\0\0570133\GIS\0570133301_T200_F1.mxd
Office: TACO

Site 3D



Legend

- Existing Topographic Contours
- Proposed Topographic Contours
- EB-1 — Environmental Boring Location and Identification

Test Pit Location and Identification Related to Proposed Construction

- TP13 — Retaining Wall
- TP1 — Path
- TP9 — Stormwater Treatment Facility

Soil with cPAH Detections:

- 0 TO 3 FEET BGS — Vertical Extent of cPAHs Detected at a Concentration Greater Than the MTCA Method A ULU Cleanup Level (TTEC = 0.1 mg/kg)
- 0 TO 2 FEET BGS — Vertical Extent of cPAHs Detected at a Concentration Less Than MTCA Method A ULU Cleanup Level (TTEC = 0.1 mg/kg) But Observed to Be Visually Impacted
- 0 TO 6 FEET BGS — Vertical Extent of cPAHs Detected at a Concentration Less Than MTCA Method A ULU Cleanup (TTEC = 0.1 mg/kg) And Not Observed to be Visually Impacted

40 0 40
FEET

Notes:

TTEC = total toxicity equivalency concentration
PCE = tetrachloroethylene
MTCA = Model Toxics Control Act
bgs = below ground surface
ULU = Unrestricted Land Use
mg/kg = milligram per kilogram

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

Data Source: CAD file provided by BCRA Architects locations based on GeoEngineers.

Site Plan - Subsurface Locations and Vertical Extent of Contaminated and Impacted Soil

City of Tacoma - Prairie Line Trail Phase 1A
Tacoma, Washington

GeoEngineers

Figure 2

Office: TAC \\TAC\projects\0\0570133\01\CAD\0570133301_SitePlan_F2.dwg TAB:F1 hmara December 23, 2014

SECTION 4A. I-705/BNSF/DOCK STREET/SOUTH 15TH STREET ROW (CUT AND COVER AND TRENCHLESS)

Geotechnical

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Hart Crowser. 2000. Final Dock Street Site Specific Remedial Investigation, Thea Foss Upland Properties, April 3, 2000.

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Langseth Environmental Services. 2007. UST Site Assessment Report Addendum #1, Dock Street Site, April 18, 2007.

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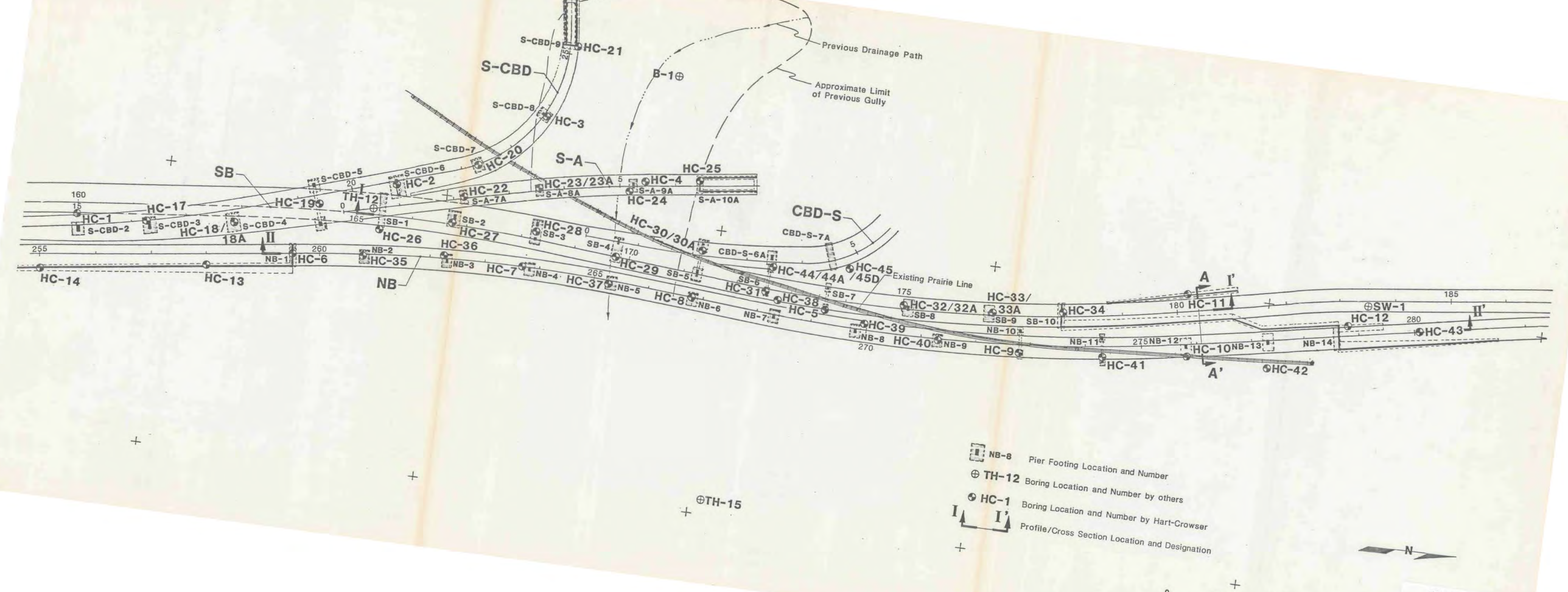
Geotechnical Reference Material


S-CBD-9
HC-21
S-CBD
S-CBD-8
HC-3
S-CBD-7
HC-20
S-A
HC-25
SB
S-CBD-5
S-CBD-6
HC-2
HC-22
S-A-7A
HC-23/23A
S-A-8A
HC-4
S-A-9A
HC-24
S-A-10A
HC-17
HC-19
TH-12
HC-1
S-CBD-2
S-CBD-3
HC-18/18A
S-CBD-4
SB-1
SB-2
HC-26
HC-27
HC-28
SB-3
SB-4
HC-30/30A
CBD-S
CBD-S-7A
CBD-S-6A
HC-44/44A
HC-45/45D
Existing Prairie Line
HC-14
HC-13
NB-1
HC-6
NB-2
HC-35
HC-36
NB-3
HC-7
NB-4
HC-37
NB-5
HC-8
HC-29
SB-5
SB-6
HC-31
HC-38
HC-5
NB-6
NB-7
SB-7
HC-32/32A
SB-8
HC-33/33A
SB-9
SB-10
HC-34
HC-39
NB-8
HC-40
NB-9
HC-9
NB-10
NB-11
NB-12
HC-10
NB-13
NB-14
HC-11
HC-12
SW-1
HC-43
HC-41
HC-42
NB
A
A'
I
I'
II
II'
B-1
Previous Drainage Path
Approximate Limit of Previous Gully
TH-15
NB-8 Pier Footing Location and Number
TH-12 Boring Location and Number by others
HC-1 Boring Location and Number by Hart-Crowser
Profile/Cross Section Location and Designation
N

Boring Log HC-29 (Pier SB-4)

SOIL
INTERPRETATION

STANDARD
PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY
TESTS

Approximate Ground Surface Elevation in Feet 13.6

Depth
Feet

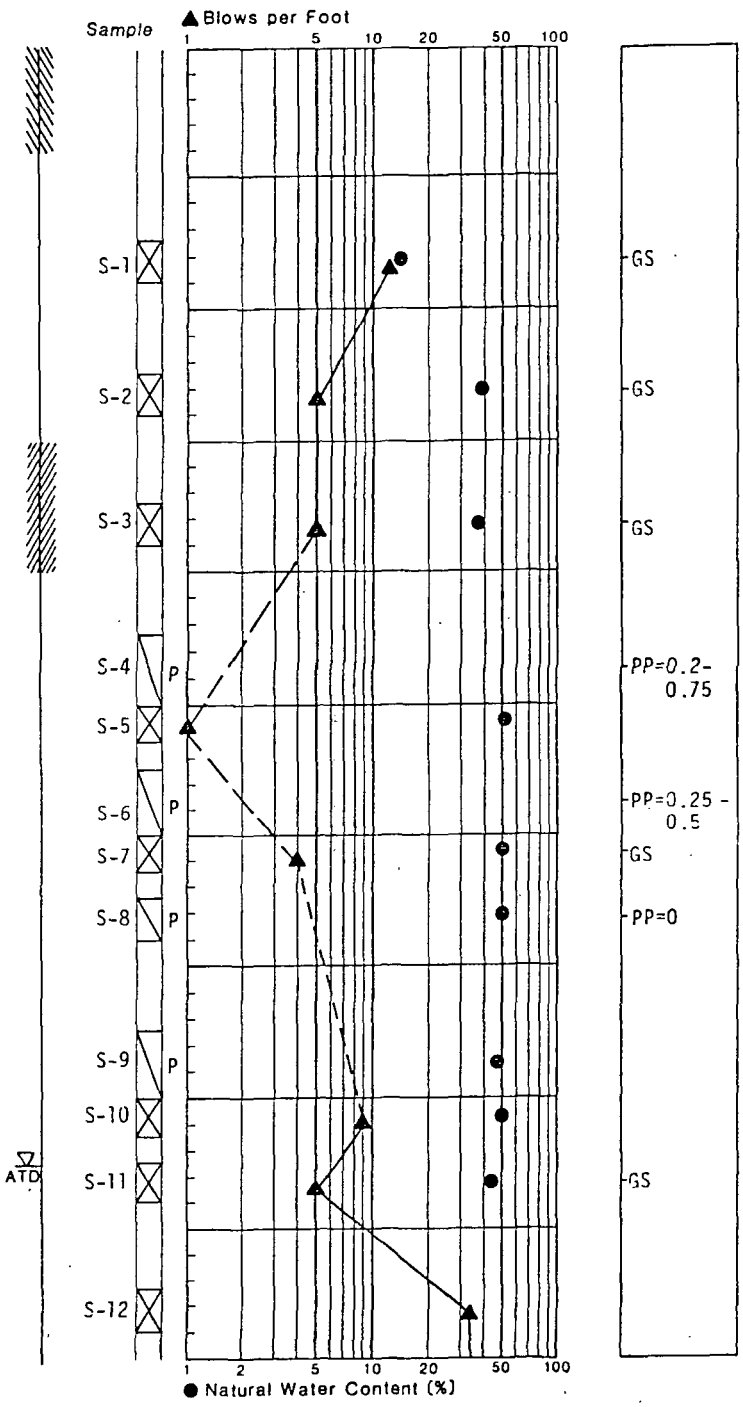
Medium dense, moist to wet, mottled tan, silty, gravelly, fine to medium SAND with scattered charcoal fragments. (FILL).

Medium stiff to soft, wet, gray to brown, fine sandy SILT with shells, Charcoal fragments and scattered organics (FILL?).

Very soft to soft, wet, brown, slightly sandy SILT with scattered organics (FILL?).

Medium stiff to stiff, wet, dark green to dark brown, slightly gravelly, sandy SILT with wood and charcoal fragments. (FILL?).

Dense, saturated, gray, sandy GRAVEL to gravelly SAND.



27009873
TF GeoT

J-1210-02 June 1983
HART-CROWSER & associates inc.
Sheet 1 of 2 Figure A-12

Boring Log HC-29

SOIL
INTERPRETATION

STANDARD
PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY
TESTS

Approximate Ground Surface Elevation in Feet

Depth
Feet

Sample

▲Blows per Foot

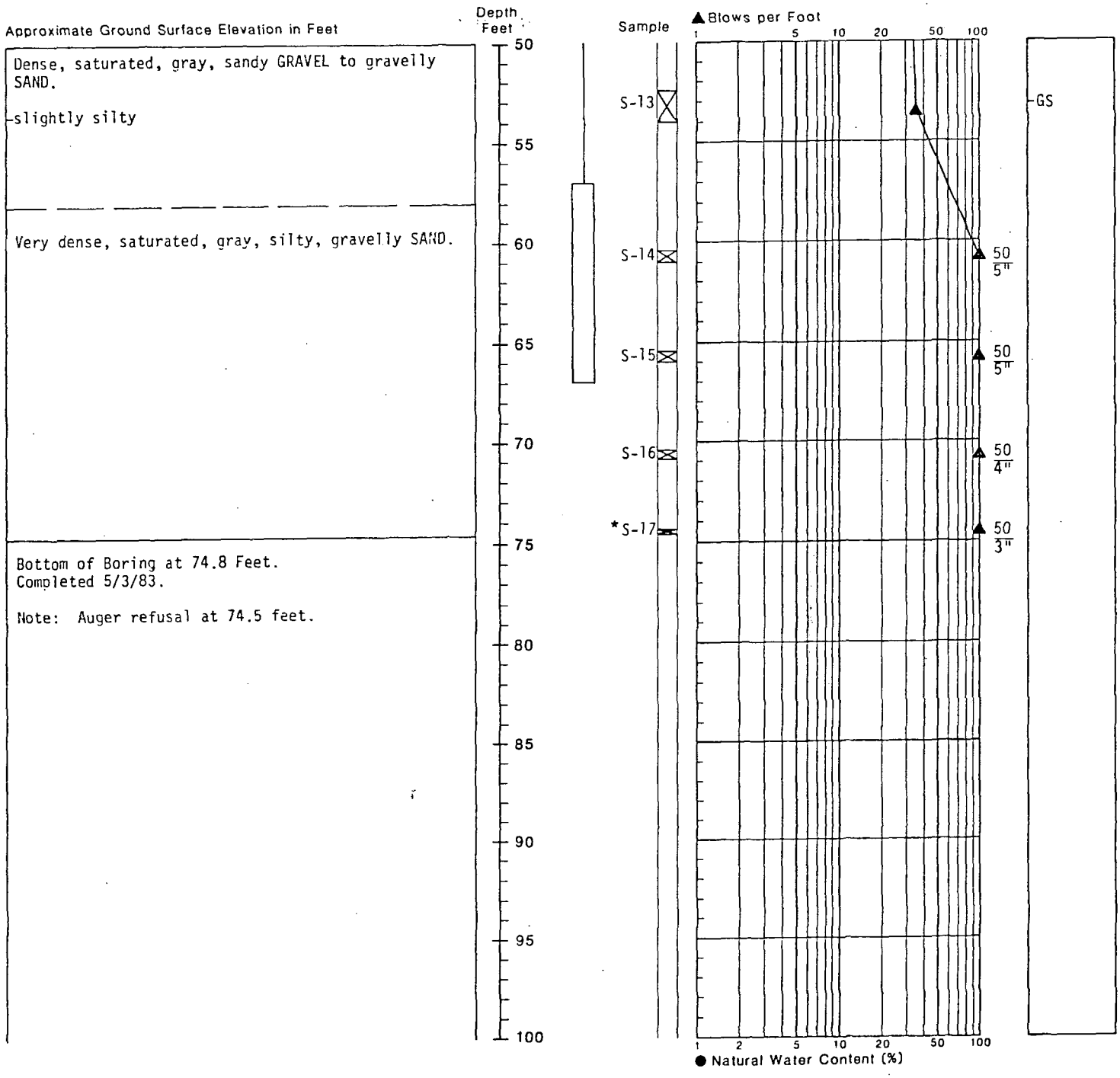
Dense, saturated, gray, sandy GRAVEL to gravelly SAND.

slightly silty

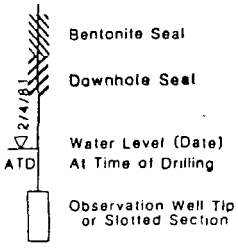
Very dense, saturated, gray, silty, gravelly SAND.

Bottom of Boring at 74.8 Feet.
Completed 5/3/83.

Note: Auger refusal at 74.5 feet.



Groundwater Level



Sampling

- 2" O.D. Split Spoon Sample
- 3" O.D. Shelby Tube Sample
- Cutting Sample
- ★ No Sample Recovery
- P Shelby Pushed

Laboratory Tests

GS	Grain Size Analysis
CN	Consolidation Test
K	Permeability Test
DS	Direct Shear
OU	Unconfined Compression, tsf
TV	Torvane, tsf
PP	Pocket Penetrometer, tsf
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained

Water Content (%)

Plastic Limit — Natural Water Content — Liquid Limit

Notes

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level, if indicated, is for the date specified and may vary with the time of year.
3. Water contents not determined for gravelly or very small samples.

J-1210-02 June 1983
HART-CROWSER & associates inc.
Sheet 2 of 2 Figure A-12

27009874
TF GeoT

Boring Log HC-37 (Pier NB-5)

SOIL
INTERPRETATION

STANDARD
PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY
TESTS

Approximate Ground Surface Elevation in Feet 13.4

Depth
Feet

Loose, wet, brown-black, silty, fine SAND to medium stiff, wet, trace gravelly, fine, sandy SILT with organics and charcoal fragments (FILL).

Soft, wet, dark brown, slightly fine sandy, peaty SILT with trace of GRAVEL (FILL).

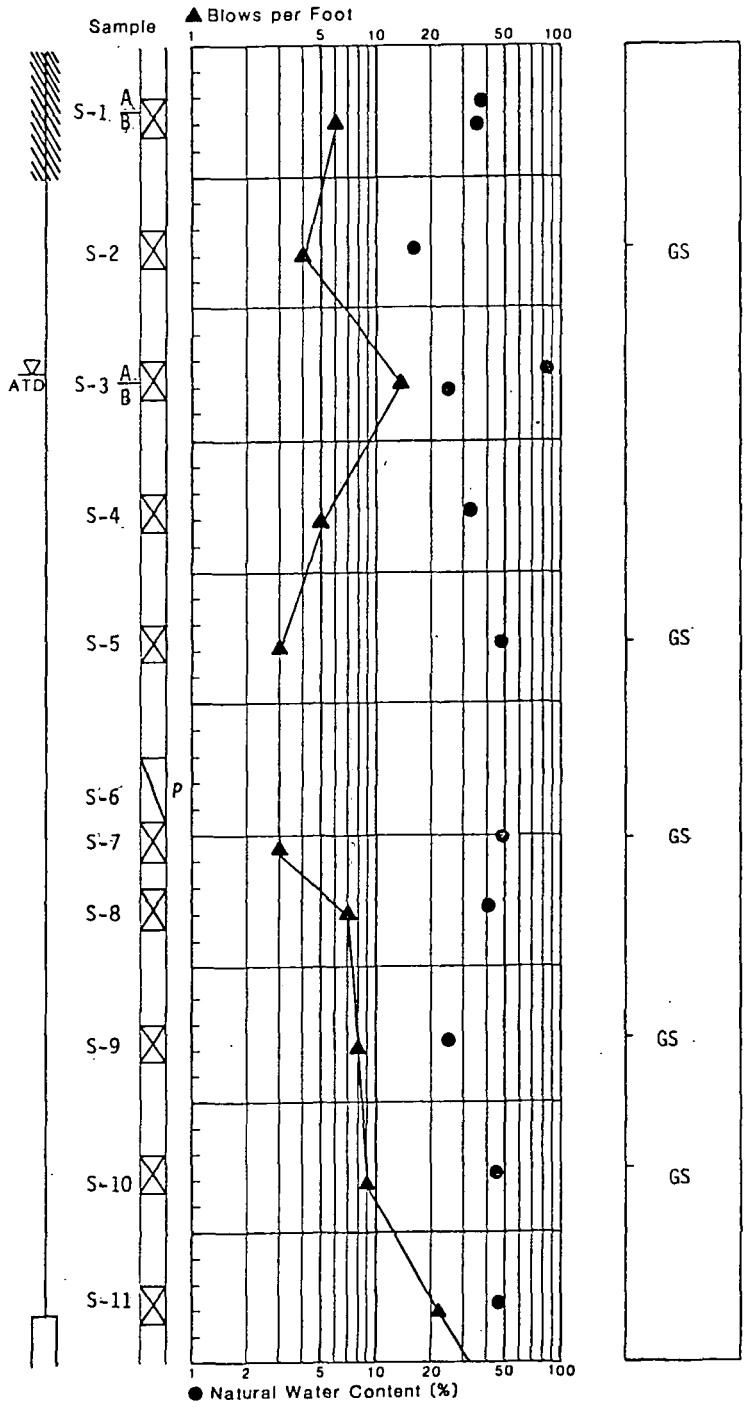
Loose, wet, gray, silty, gravelly SAND with purple ash and trace organics (FILL).

Soft, saturated, dark gray to brown, slightly sandy to sandy, clayey SILT with shells, charcoal fragments and organics (FILL?)

Loose, saturated, dark gray, silty, fine SAND with shells and organics (FILL?)

Stiff, wet, dark brown, fine, sandy SILT with slight organics (FILL?)

Medium dense, wet, dark brown, slightly silty, gravelly SAND with organics and cinder ash (FILL?)



27009882
TF GeoT

J-1210-02 June 1983
HART-CROWSER & associates inc.
Sheet 1 of 2 Figure A-20

Boring Log HC-37

SOIL INTERPRETATION

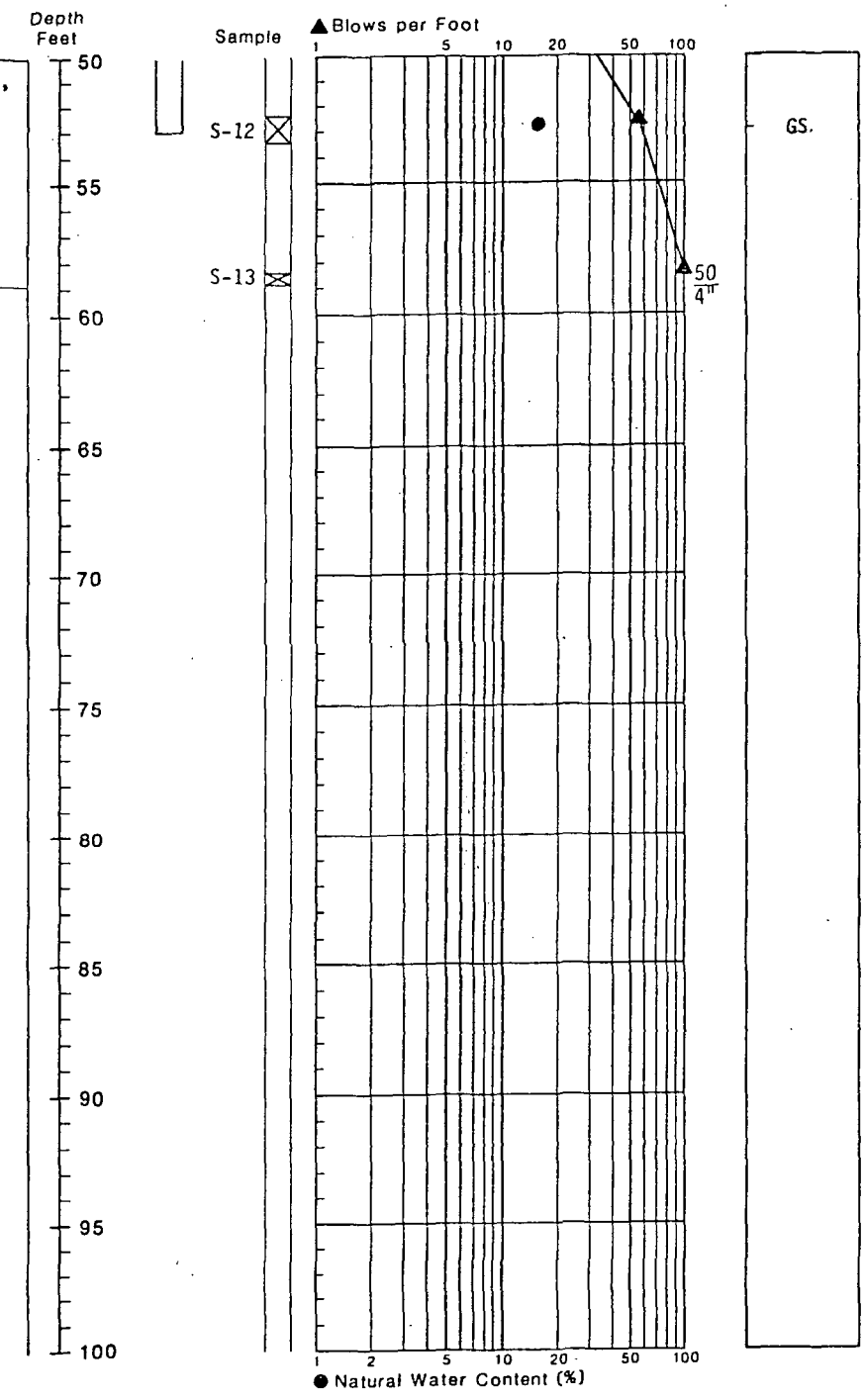
STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY TESTS

Very dense, saturated, gray, slightly silty, sandy, fine GRAVEL to gravelly SAND

Bottom of Boring at 58.8 Feet.
Completed 5/5/83.

Note: Auger refusal at 58.5 feet.



Groundwater Level

- Bentonite Seal
- 2/4/81 ATD — Water Level (Date) At Time of Drilling
- Observation Well Tip or Slotted Section

Sampling

- 2" O.D. Split Spoon Sample
- 3" O.D. Shelby Tube Sample
- Cutting Sample
- ★ No Sample Recovery
- P Shelby Pushed

Laboratory Tests

GS	Grain Size Analysis
CN	Consolidation Test
K	Permeability Test
DS	Direct Shear
QU	Unconfined Compression, tsf
TV	Torvane, tsf
PP	Pocket Penetrometer, tsf
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained

Water Content (%)

Plastic Limit — Natural Water Content — Liquid Limit

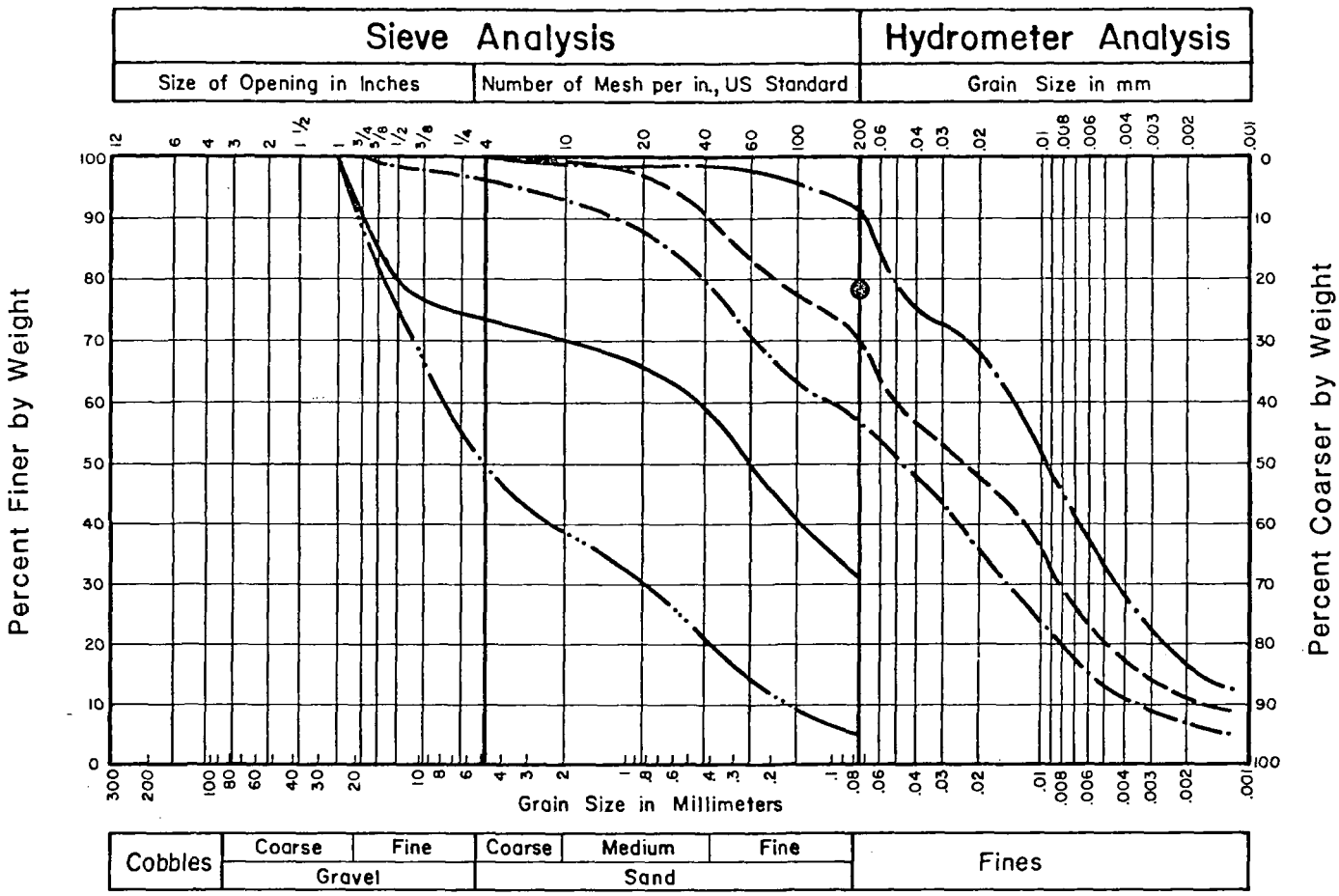
Notes

1. *Soil descriptions are interpretive and actual changes may be gradual.*
2. Water Level, if indicated, is for the date specified and may vary with the time of year.
3. Water contents not determined for gravelly or very small samples.

J-1210-02 June 1983
HART-CROWSER & associates inc.
Sheet 2 of 2 Figure A-20

27009883
TF GeoT

Grain Size Classification



LINE SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH IN FEET	CLASSIFICATION	UNIFIED SOIL CLASS.	WATER CONTENT PERCENT
———	HC-29	S-1	7.5 - 9.0	Gravelly, silty SAND	SM	13
●	HC-29	S-2	12.5 - 14.0	Sandy SILT	ML	37
— — —	HC-29	S-3	17.5 - 19.0	Sandy SILT	ML	42
——·——	HC-29	S-7	30.0 - 31.5	Slightly sandy SILT	ML	53
—·—·—	HC-29	S-11	42.5 - 44.0	Sandy SILT	ML	44
—··—	HC-29	S-13	52.5 - 54.0	Slightly silty, sandy GRAVEL	GP - GM	10

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TF GeoT

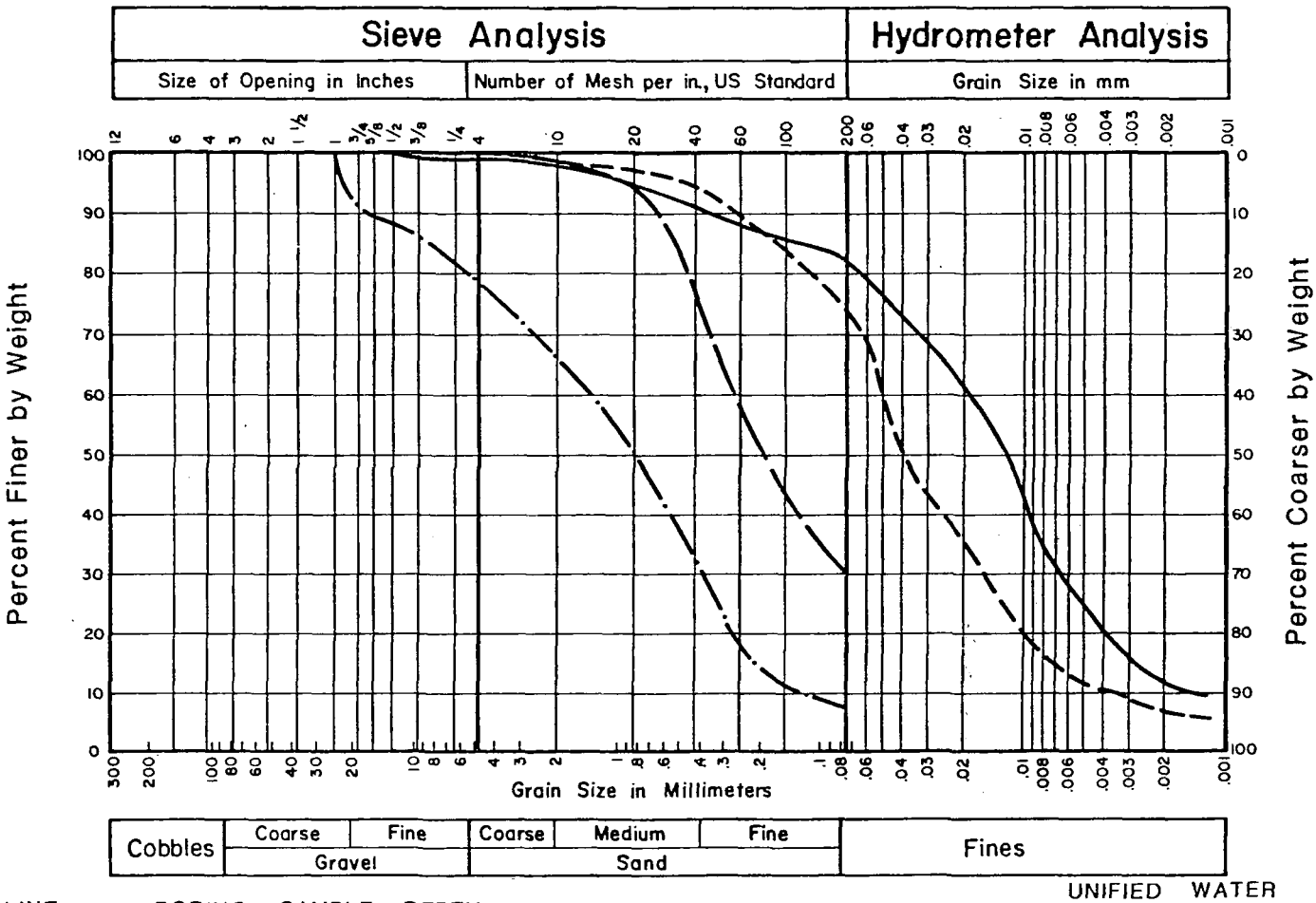
J-1210-02 May 1983

HART-CROWSER & associates, inc.

Figure B-11

40002959

Grain Size Classification



LINE SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH IN FEET	CLASSIFICATION	UNIFIED SOIL CLASS.	WATER CONTENT PERCENT
———	HC-37	S-7	29.5-31.0	Sandy SILT	ML	48.
— —	HC-37	S-9	37.5-39.0	Silty, medium to fine SAND	SM	25.
— — — —	HC-37	S-10	42.0-43.5	Sandy SILT	ML	44.
—·—·—	HC-37	S-12	52.0-53.5	Slightly silty, gravelly SAND	SM-SP	16.

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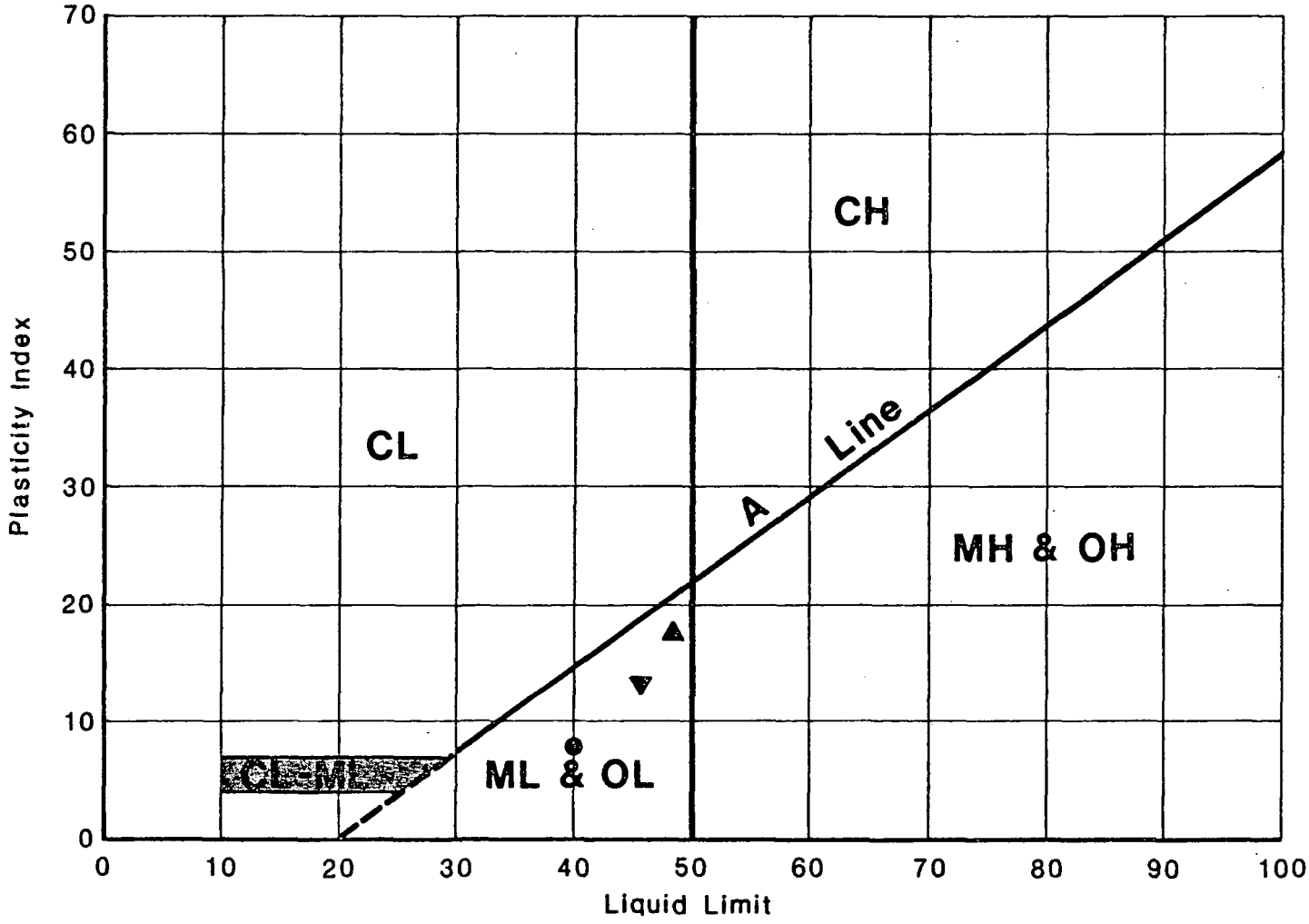
TF GeoT

J-1210-02 June 1983
HART-CROWSER & associates, inc.
Figure B-8

Plasticity Chart



SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH IN FEET	WATER CONTENT IN PERCENT NAT.	L.L.	P.L.	P.I.	CLASSIFICATION	USC
	HC-36	S-4	17.5-19.0	33	40	32	8	SILT	ML
	HC-37	S-7	29.8-31.0		49	31	18	SILT	ML
	HC-42	S-5	17.8-19.3	28	46	33	13	SILT	ML

27009911
TF GeoT

L.L. LIQUID LIMIT
P.L. PLASTIC LIMIT
P.I. PLASTICITY INDEX
USC UNIFIED SOIL CLASSIFICATION

J-1210-02 June 1983
HART-CROWSER & associates, inc.
Figure B-17

Draft
Dock Street ROW (North)
Site-Specific Remedial Investigation
Thea Foss Upland Properties

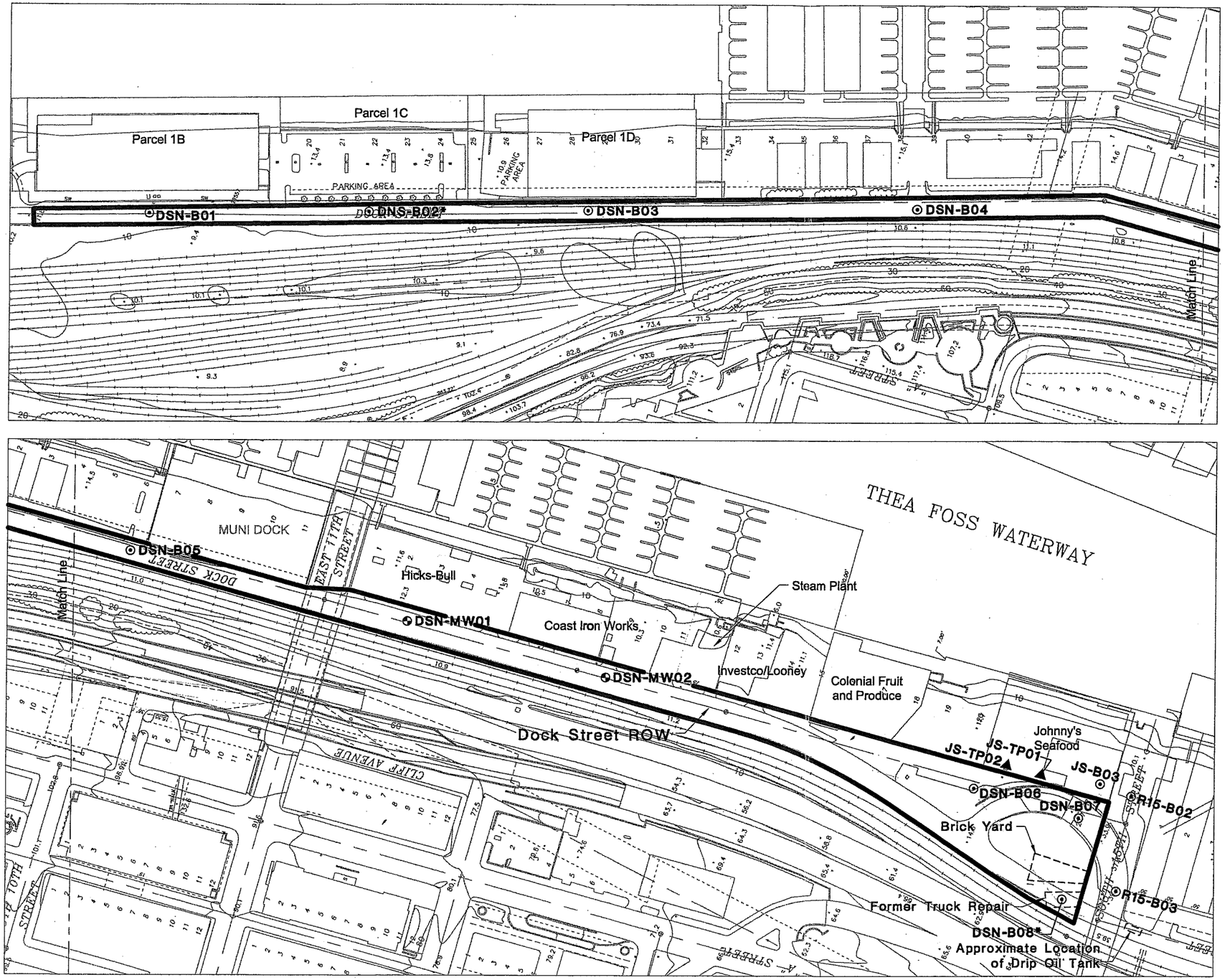
HARTCROWSER
Delivering smarter solutions

Prepared for
City of Tacoma

June 25, 2001
4676-70

Site Exploration Plan with Significant Historical Features

Dock Street ROW - North of 15th Street



Potentially Significant Historicol Area

DSN-B01* Boring Location and Number

*Indicates Groundwater Grab Sample Collected

DSN-MW01 Monitoring Well Location and Number

▲ JS-TP02 Test Pit Location and Number

N

0 100 200

Scale in Feet

HARTCROWSER

J-4676-70 6/01

Figure 2

dwl 6/25/01 1=1 xref=BASE 13 and Composite color.pc2
46767002

Key to Exploration Logs

Sample Description

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual-manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:
Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT, additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance.
Soil density/consistency in test pits is estimated based on visual observation and is presented parenthetically on the test pit logs.

SAND or GRAVEL Density	Standard Penetration Resistance (N) in Blows/Foot	SILT or CLAY Consistency	Standard Penetration Resistance (N) in Blows/Foot	Approximate Shear Strength in TSF
Very loose	0 – 4	Very soft	0 – 2	<0.125
Loose	4 – 10	Soft	2 – 4	0.125 – 0.25
Medium dense	10 – 30	Medium stiff	4 – 8	0.25 – 0.5
Dense	30 – 50	Stiff	8 – 15	0.5 – 1.0
Very dense	>50	Very stiff	15 – 30	1.0 – 2.0
		Hard	>30	>2.0

Moisture

Dry	Little perceptible moisture
Damp	Some perceptible moisture, probably below optimum
Moist	Probably near optimum moisture content
Wet	Much perceptible moisture, probably above optimum

Minor Constituents

	Estimated Percentage
Not identified in description	0 – 5
Slightly (clayey, silty, etc.)	5 – 12
Clayey, silty, sandy, gravelly	12 – 30
Very (clayey, silty, etc.)	30 – 50

Legends

Sampling Test Symbols

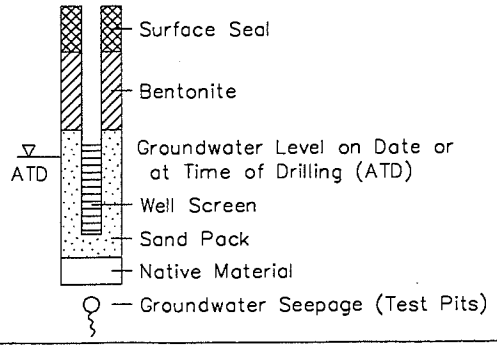
BORING SAMPLES

- Split Spoon
- Shelby Tube
- Cuttings
- Core Run
- * No Sample Recovery
- P Tube Pushed, Not Driven

TEST PIT SAMPLES

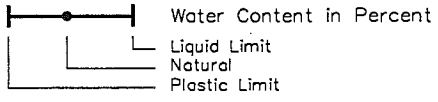
- Grab (Jar)
- Bag
- Shelby Tube

Groundwater Observations



Test Symbols

GS	Grain Size Classification
CN	Consolidation
UU	Unconsolidated Undrained Triaxial
CU	Consolidated Undrained Triaxial
CD	Consolidated Drained Triaxial
QU	Unconfined Compression
DS	Direct Shear
K	Permeability
PP	Pocket Penetrometer Approximate Compressive Strength in TSF
TV	Torvane Approximate Shear Strength in TSF
CBR	California Bearing Ratio
MD	Moisture Density Relationship
AL	Atterberg Limits
PID	Photoionization Detector Reading
CA	Chemical Analysis
DT	*In Situ* Density Test



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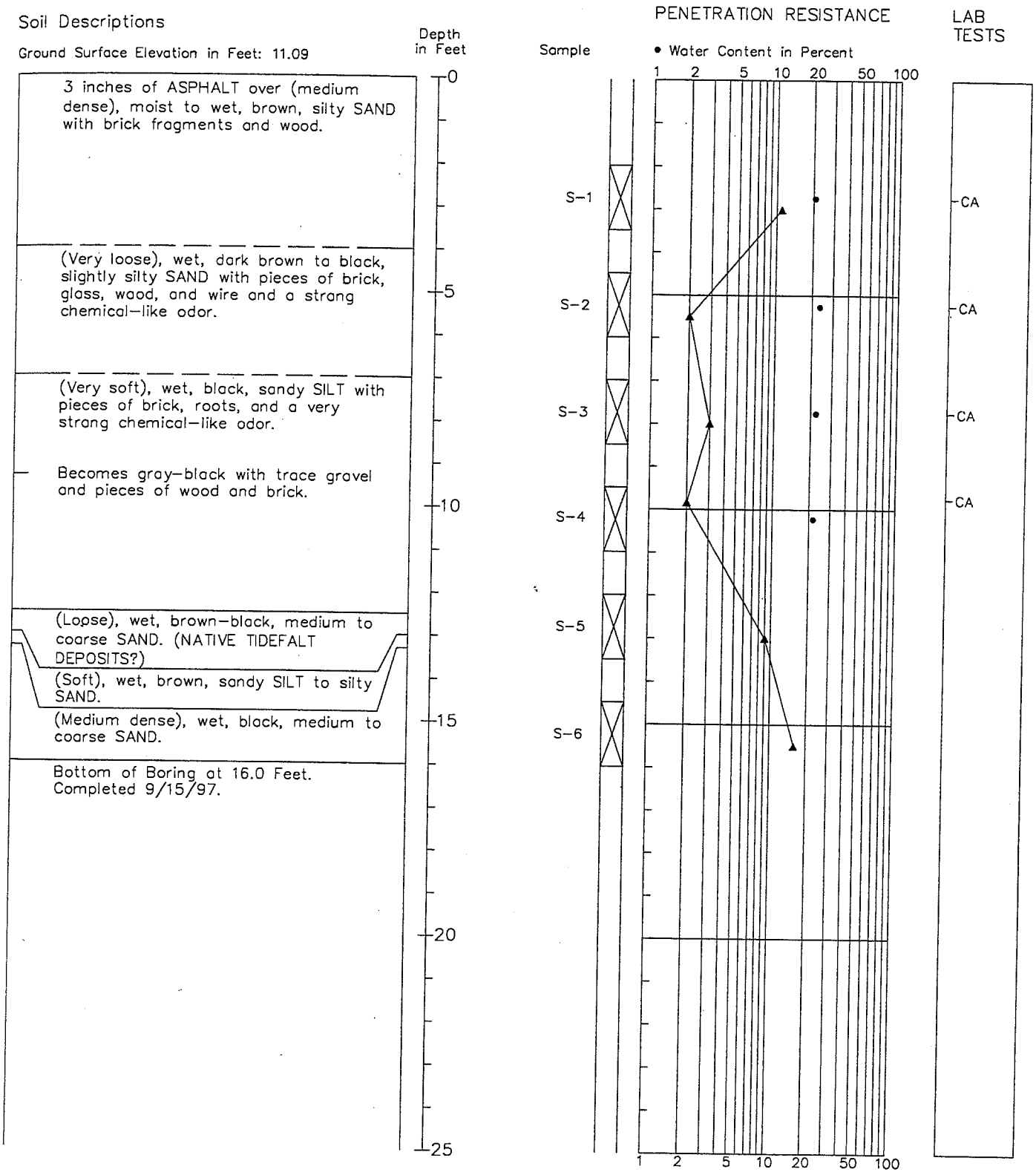
J-4676-70 6/01

Figure A-1

Boring Log R15-B02



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
4. Blow counts for all samples were obtained using a 3-inch diameter sampler with a 300 pound hammer falling 30 inches.

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Figure A-12

Boring Log R15-B03

Soil Descriptions

Ground Surface Elevation in Feet: 12.53

Depth in Feet

4 inches of ASPHALT over (medium dense), moist, tan–brown SAND with trace gravel and cobbles.

(Soft to very soft), wet, gray–brown, slightly sandy, gravelly SILT with reddish oxidation coloring.

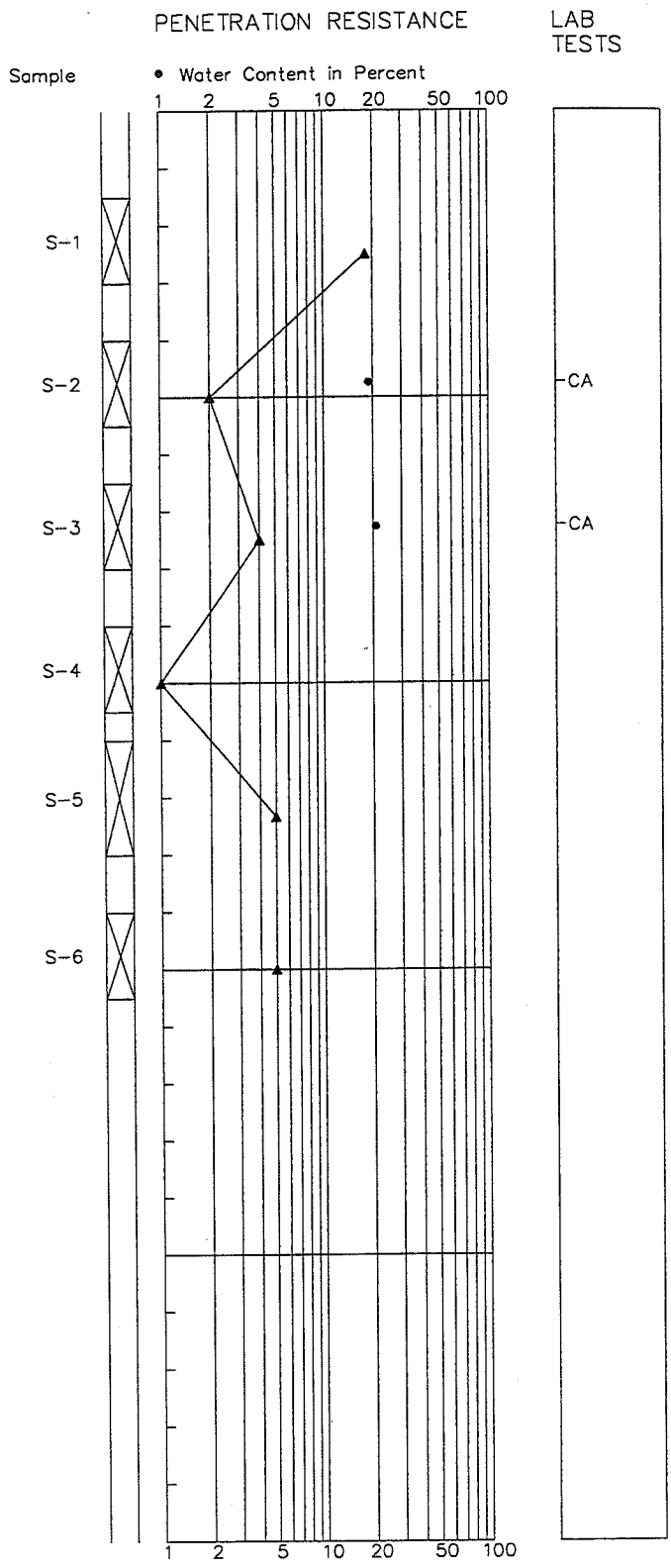
Becomes very sandy with cobbles.

Brick fragments and wood debris.

Grading to (loose), wet, gray, very silty SAND with trace gravel and cobbles.

(Loose), wet, dark brown to black SAND with some organic debris and a layer of slightly gravelly SILT. (NATIVE TIDEFLAT DEPOSITS?)

Bottom of Boring at 15.5 Feet. Completed 9/15/97.



1. Refer to Figure A–1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.
4. Blow counts for all samples were obtained using a 3–inch diameter sampler with a 300 pound hammer falling 30 inches.

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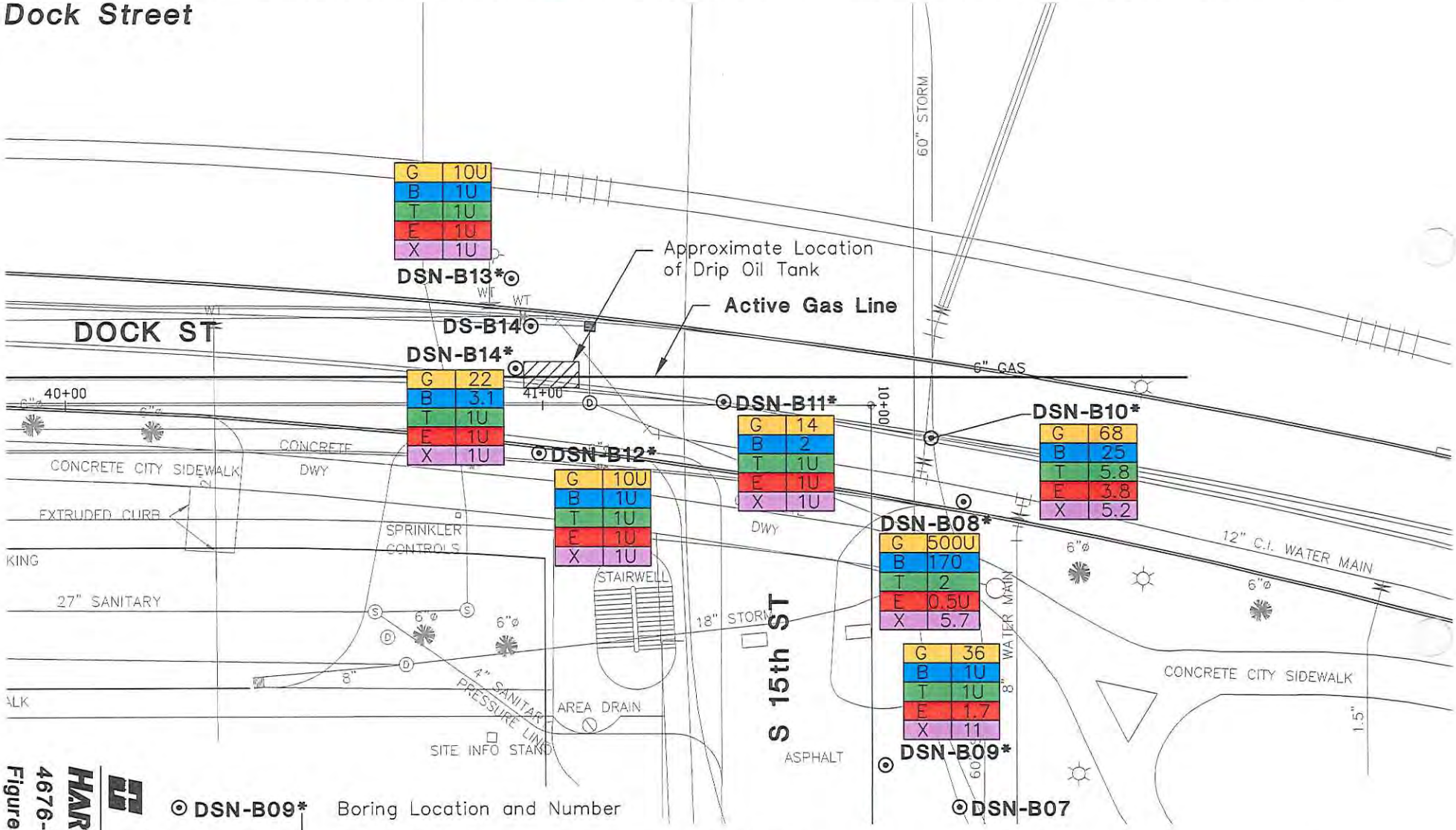
Figure A-13

HEL 4/2/02 1=1 charlie-8.pc2 46767008.dwg

Site and Exploration Plan with Selected Groundwater Quality Data

Dock Street



⊙ DSN-B09* Boring Location and Number

└ Indicates Location of Groundwater Grab Sample

TPH–G/BTEX Analytical Results in Groundwater

G	TPH–Gasoline
B	Benzene
T	Toluene
E	Ethylbenzene
X	Xylenes

U = Not Detected at Associated Detection Limit

Concentrations are in µg/L

N

0 30 60

Scale in Feet

HARTCROWSER 4676-70 4/02

Figure 1

Key to Exploration Logs

Sample Description

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual-manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:
Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT, additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance.
Soil density/consistency in test pits is estimated based on visual observation and is presented parenthetically on the test pit logs.

SAND or GRAVEL Density	Standard Penetration Resistance (N) in Blows/Foot	SILT or CLAY Consistency	Standard Penetration Resistance (N) in Blows/Foot	Approximate Shear Strength in TSF
Very loose	0 – 4	Very soft	0 – 2	<0.125
Loose	4 – 10	Soft	2 – 4	0.125 – 0.25
Medium dense	10 – 30	Medium stiff	4 – 8	0.25 – 0.5
Dense	30 – 50	Stiff	8 – 15	0.5 – 1.0
Very dense	>50	Very stiff	15 – 30	1.0 – 2.0
		Hard	>30	>2.0

Moisture

Dry	Little perceptible moisture
Damp	Some perceptible moisture, probably below optimum
Moist	Probably near optimum moisture content
Wet	Much perceptible moisture, probably above optimum

Minor Constituents

	Estimated Percentage
Not identified in description	0 – 5
Slightly (clayey, silty, etc.)	5 – 12
Clayey, silty, sandy, gravelly	12 – 30
Very (clayey, silty, etc.)	30 – 50

Legends

Sampling Test Symbols

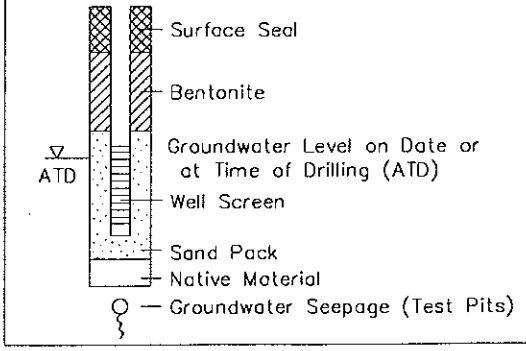
BORING SAMPLES

- Split Spoon
- Shelby Tube
- Cuttings
- Core Run
- * No Sample Recovery
- P Tube Pushed, Not Driven

TEST PIT SAMPLES

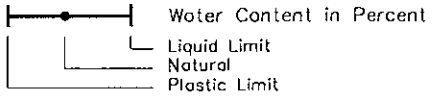
- Grab (Jar)
- Bag
- Shelby Tube

Groundwater Observation Wells



Test Symbols

GS	Grain Size Classification
CN	Consolidation
UU	Unconsolidated Undrained Triaxial
CU	Consolidated Undrained Triaxial
CD	Consolidated Drained Triaxial
QU	Unconfined Compression
DS	Direct Shear
K	Permeability
PP	Pocket Penetrometer Approximate Compressive Strength in TSF
TV	Torvane Approximate Shear Strength in TSF
CBR	California Bearing Ratio
MD	Moisture Density Relationship
AL	Atterberg Limits
PID	Photoionization Detector Reading
CA	Chemical Analysis
DT	*In Situ* Density Test



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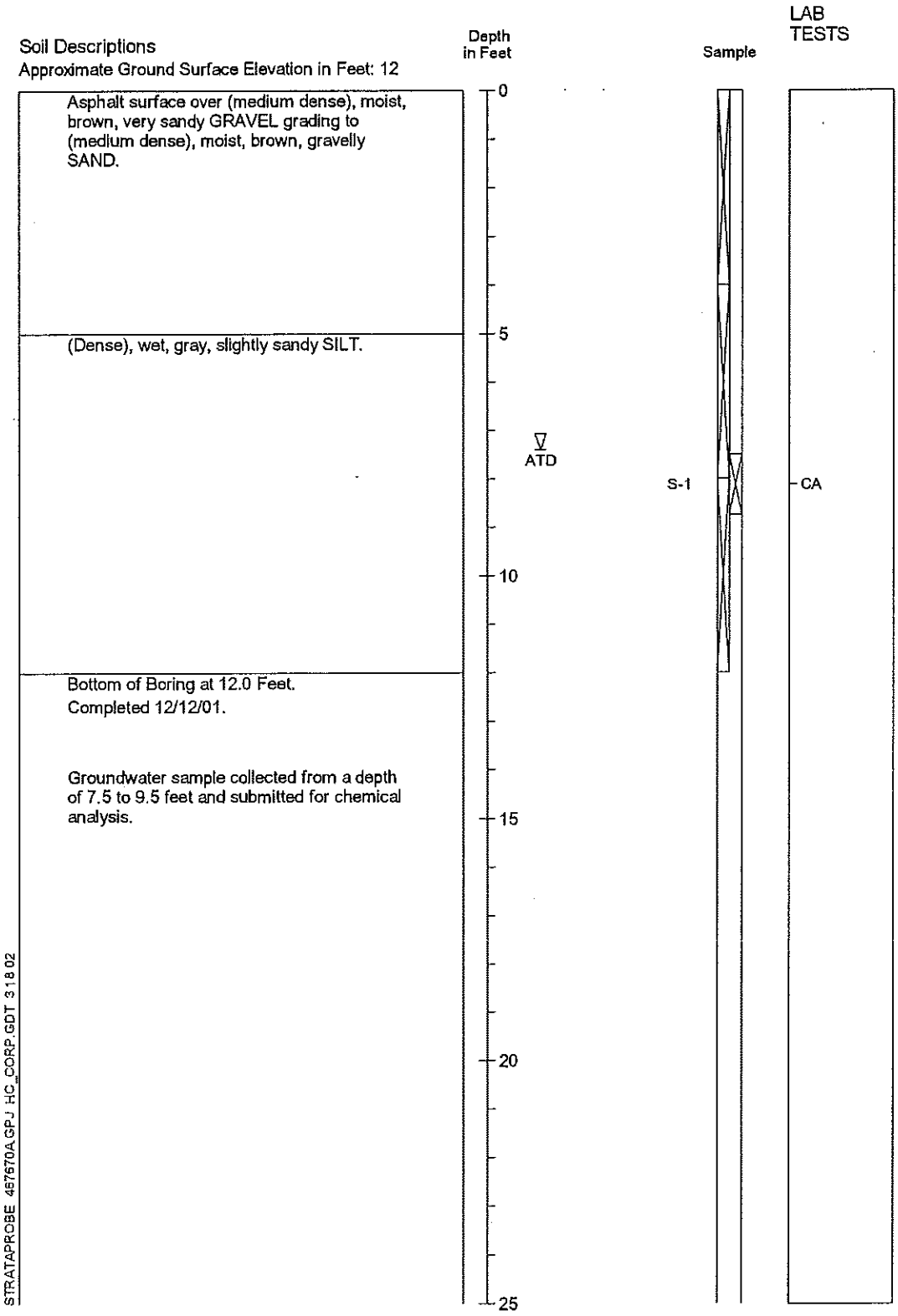
4676-70 2/02

Figure A-1

Strataprobe Boring Log DSN-B09



STRATAPROBE 467670A.GPJ HC_CORP.GDT 3 18 02

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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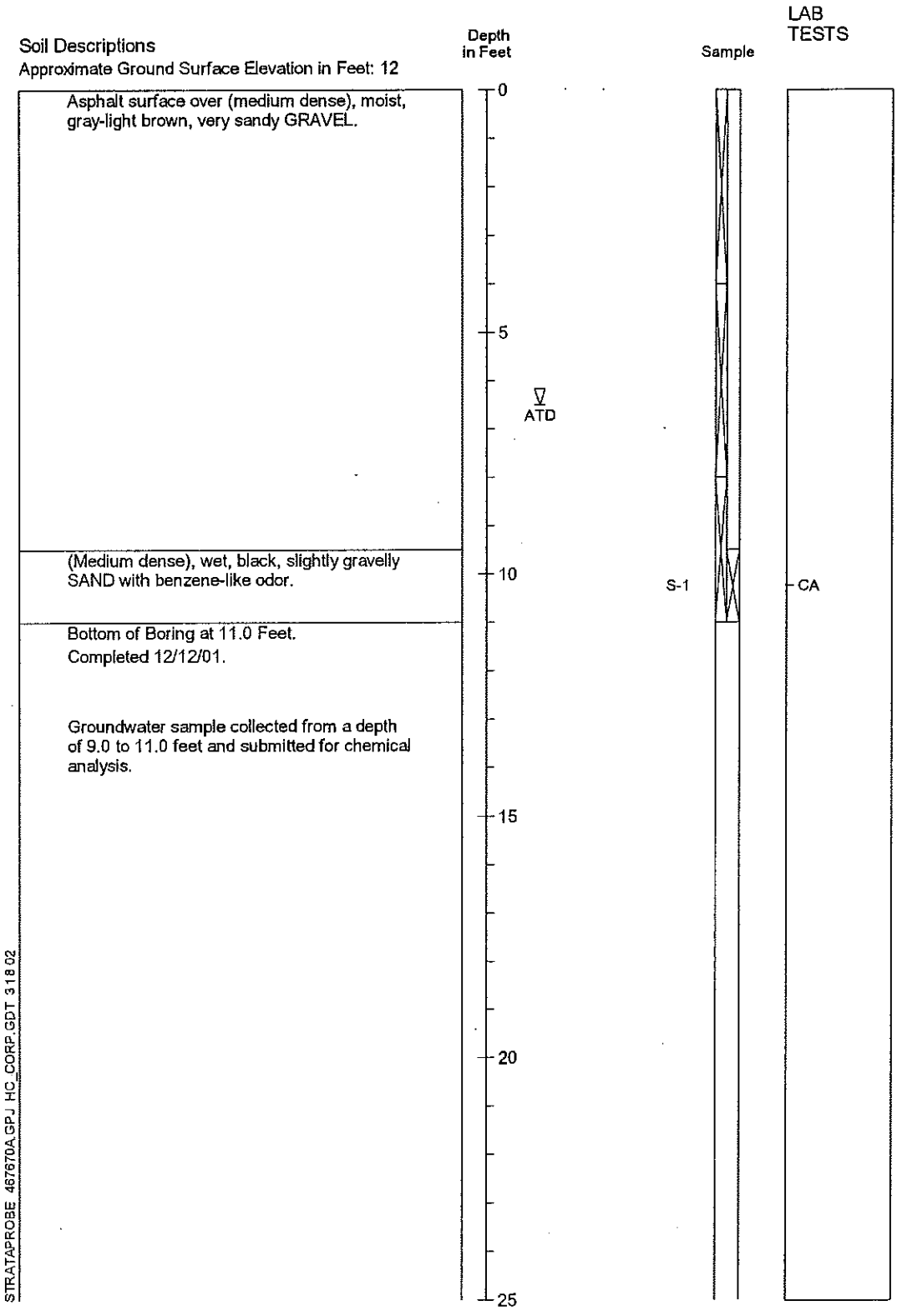
4676-70 12/01

Figure A-4

Strataprobe Bori Log DSN-B10



STRATAPROBE 467670A.GPJ HC_CORP.GDT 3 1 8 02

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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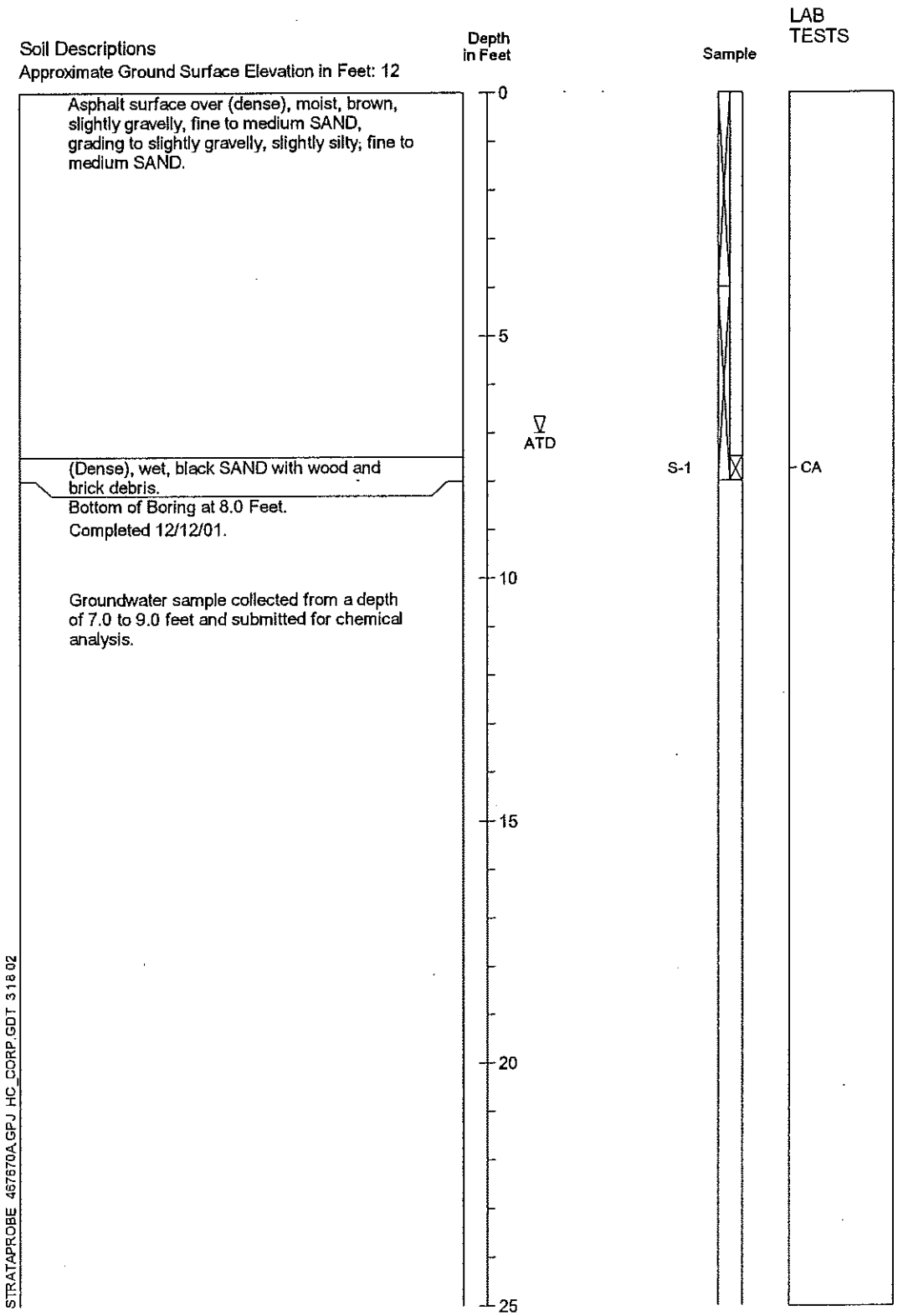
4676-70 *12/01*

Figure A-5

Strataprobe Boring Log DSN-B11



STRATAPROBE 467670A.GPJ HC_CORP.GDT 3.18.02

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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4676-70 12/01

Figure A-6

Site 4A-B

Tacoma-Pierce County Health Department

Site Hazard Assessment

Worksheet 1 - Summary Score Sheet

SITE INFORMATION

Site Name: Tacoma City of Dock St
Address: 1501 East Dock Street
City: Tacoma **County:** Pierce **State:** WA **Zip Code:** 98401
Range/Township/Section: 03E/20N/04
Latitude: 47.24932 **Longitude:** -122.43522
Facility Site Identification Number: 12454784

This site was assessed for the February 2014 update.

Date Submitted: **DRAFT February 3, 2014**

SITE DESCRIPTION

Location and Surrounding Area

There is not an attributed Pierce County Assessor tax parcel for the Tacoma City of Dock St site. The subject site is located in a City of Tacoma right of way. BNSF railroad tracks and Dock Street border the subject site to the west and east, respectively. The 15th Street Bridge is immediately north. The area is zoned "warehouse/residential". The Tacoma City of Dock St site lies at approximately ten to twenty feet (10'-20'') above sea level and slopes gradually downward to the east for approximately three hundred feet (300') to the Thea Foss Waterway. Nearby businesses include, condominiums, a museum, auto parking, office space and wholesale trade.

Historical Use

The development of Dock Street occurred early in the city's history; USGS maps dating back to 1888 clearly show Dock Street. The area has historically been a commercial and industrial area.

Soils, Geology and Receptors

A silty-sand with gravel fill material under lays the site to a depth of approximately six-feet below ground surface (6' bgs). The geological classification is quaternary alluvium. Tacoma-Pierce County Health Department (health department) staff documented water in the excavation. The City of Tacoma documented that groundwater did not exist in the excavation. Standing water was present at the bottom of the excavation, although the source of the water is unclear i.e., groundwater, surface runoff or another source entirely.

Known Releases and Regulatory Efforts

In 2000, the City of Tacoma discovered an unidentified underground storage tank (UST) during reconstruction of the Dock Street waterfront area. The UST laid in a six-foot deep bed of imported fill material and directly adjacent to several buried utilities.

On March 21, 2000, the health department issued a UST removal permit for the subject UST.

On March 23, 2000, CEcon Corporation (CEcon) excavated the fill material to expose the UST, revealing an approximate UST volume of 1,100 gallons. At this time, the UST was one-half full of thick, difficult to pump, sludge. After exposing the UST, CEcon observed several holes penetrated its ¼-inch thick, riveted steel design. CEcon collected two soil samples from soils beneath the limits of the excavation, at eight and one half feet (8.5') bgs, and requested gasoline range (TPH-gx) and diesel range (TPH-dx) hydrocarbon analysis; benzene, toluene, ethylbenzene and xylenes (BTEX) analysis; carcinogenic polycyclic aromatic hydrocarbon (cPAH) analysis and total metal analysis.

Laboratory analysis reported concentration of benzene, toluene and potentially chromium VI exceeding Model Toxics Control Act Method A Cleanup Levels for Unrestricted Land Use (MTCA – Soil). Adjacent gas and water utility lines prevented over-excavating the UST pit. After removal of the UST and collection of soil samples, CEcon returned the displaced fill material to the excavation at the direction of the City of Tacoma.

On July 18, 2001, the Washington State Department of Ecology (Ecology) issued a letter acknowledging receipt of the report entitled *Documentation of Removol of One Unknown Underground Storage Tank Environmental Cleanup, Roadway/Utilities Reconstruction Project Approximately 1501 Dock Street, Between South 15th and South 21st Streets Tacoma, WA* (Report), submitted by GeoScience Management, Inc.

Ecology stated that, "samples collected during the underground storage tank removal were not representative of the soil conditions". The letter indicated that further sample and analysis would be required prior to an agency determination on the site status.

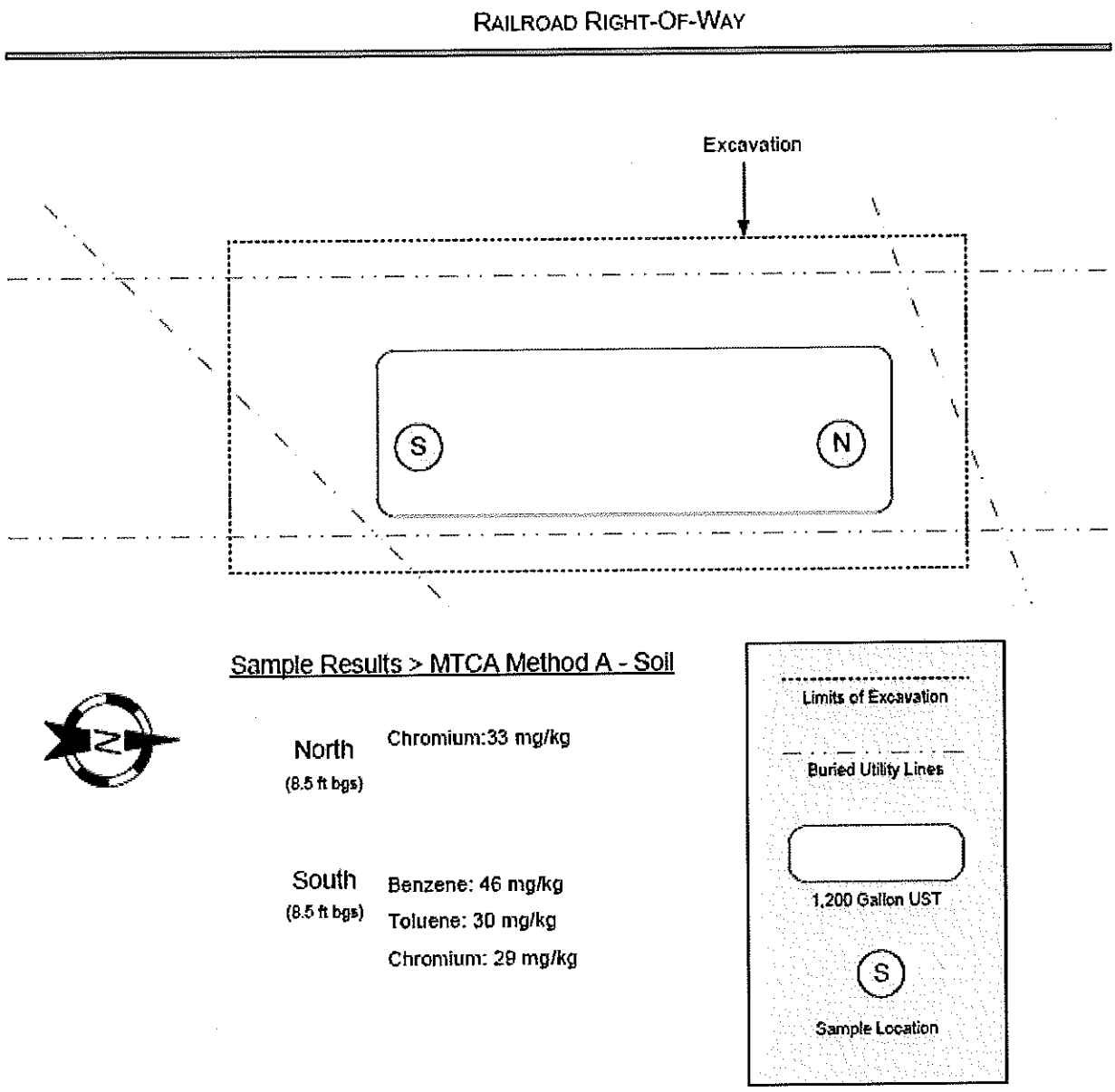
On September 30, 2011, Ecology placed the subject site on the Confirmed or Suspected Contaminated Sites List (CSCSL) within the Site Information System (SIS) database, with a status of "Awaiting SHA".

On December 9, 2013, Ecology issued a site hazard assessment (SHA) notification letter to the City of Tacoma.

See "Figure 1 – *Site Diagram*", for a site diagram and relevant sample results.

Site 4A-B

Figure 1 – *Site Diagram*



Site 4A-B

GeoScience Management, Inc. *Environmental Consulting Services*

18608 89th Avenue N.E. • Bothell, Washington 98011 • Telephone (425) 481-4538

June 6, 2000

RECEIVED
JUN 3 0 2000
CITY OF TACOMA
PUBLIC WORKS DEPT.
CONSTRUCTION DIV.

Mr. Rae Bailey, Project Coordinator
City of Tacoma, Public Works Department
Construction Management Division
747 Market Street, Room 332
Tacoma, WA 98402-3769

RE: Documentatiou of Removal of One Unknown Underground Storage Tank
Environmental Cleanup, Roadway /Utilities Reconstruction Project
Approximately 1501 Dock Street, Between South 15th and South 21st Streets
Tacoma, WA

Dear Mr. Bailey:

This report presents the results of CEcon Corporation (CEcon) and GeoScience Management, Inc.'s (GSM's) activities during the decommissioning by removal of one underground storage tank (UST) at the above referenced site (Figure 1). We understand that the previously unknown UST was discovered during general construction work in the area along dock street and the railroad tracks as part of the general reconstruction of the waterfront area. The area surrounding the site is predominantly commercial. The UST was located at approxiinately 1501 Dock Street; station 41+00 between South 15th Street and South 21st Street in Tacoma, WA (Figure 2). This report has been prepared in accordance with the "*Guidance for Site Checks and Site Assessments for Underground Storage Tanks,*" by Washington State Department of Ecology (Ecology), Toxics Cleanup Program, dated October 1992 and the "*Guidance for Remediation of Petroleum Contaminated Soils,*" dated April 1994. A completed copy of Ecology's *Site Check / Site Assessment Checklist*, and *UST Decommissioning Checklist* are included in Attachment A.

Scope of Work

The scope of work for this project consisted of the following tasks:

- Uncover, pump, rinse and inert the UST to allow safe removal from the ground;
- Clean and appropriately dispose of the UST, contents and cleaning fluids;
- Discuss the situation with Mr. Mark LaVerne of the Tacoma Pierce County Health Department (TPCHD) and collect appropriate soil samples from within the resulting cavity;
- Submit collected soil samples to Sound Analytical Services, Inc. (SAS) for chemical analyses for gasoline-, diesel, and oil-range petroleum hydrocarbons using Washington state method NWTPH-

Gx and -Dx, benzene, toluene, ethylbenzene and xylenes by EPA Method 8021B Modified, polycyclic aromatic hydrocarbon (PAH) compounds using EPA method 8270, and 8 RCRA total metals using EPA Method 6010; and

- Prepare this report documenting the completed field activities, the laboratory analysis and conclusions.

UST Removal

CEcon was requested by the City of Tacoma to conduct a UST removal related to a previously unknown UST discovered by City contractors while performing general construction work in the area. The UST was discovered lying directly adjacent to several buried utilities, including high-pressure water and gas lines. The area surrounding the UST consisted mainly of new, imported fill material, to a depth of approximately 6 feet below ground surface (bgs). On March 23, 2000, CEcon exposed the tank and determined that the tank was approximately one-half full of an unidentified, thick, sludge-like material. Attempts to pump the contents of the tank were generally unsuccessful. The tank was then inerted with dry ice, removed from the ground, and placed onto a flatbed truck for transport to CEcons' yard for cutting and cleaning. The tank measured approximately 150 inches long by 49 inches in diameter (approximately 1,100 gallons), and was constructed of approximately 1/4-inch thick, riveted metal. Several holes were observed in the tank after it had been removed (see photographs in Attachment B).

We understand that the soil removed from above and adjacent to the UST consisted entirely of clean, imported gravelly sand backfill which had been recently placed a part of the installation of the nearby buried utility lines. As such, this material was not tested, and was placed back into the excavation as fill after the UST had been removed. A representative from GSM met with Mr. Mark LaVerne of the TPCHD on site to discuss what chemical analyses would be appropriate for soil samples from the excavation. As additional excavation of soil was not possible due to the presence of buried utility lines, and because the surrounding material consisted entirely of clean, imported gravelly sand backfill to a depth of approximately 6 feet bgs, Mr. LaVerne suggested that soil samples be collected from beneath the level of water in the excavation (approximately 6 feet bgs). Samples were not collected from the excavation sidewalls above the level of standing water. Two soil samples were collected from a depth of approximately 8 ½ feet bgs, using the backhoe bucket, from the bottom of the excavation from beneath the location of the UST after it had been removed. Samples were collected from the teeth of the backhoe bucket using a stainless steel sampling spoon and placed into laboratory-prepared glass jars. The samples were then placed into a cooler containing blue ice, and transported under chain of custody to SAS for chemical analyses. The excavation was then backfilled with clean, imported backfill material under the direction of the City.

Analytical Results

The analytical results are summarized in Table 1. Laboratory reports are included as Attachment C. The sample designated "Bottom-North" did not contain gasoline-diesel-or oil-range petroleum hydrocarbons at concentrations at or above the analytical method reporting limit (MRL). Benzene,

ethylbenzene and total xylenes were reported at concentrations of 0.014 mg/kg, 0.011 mg/kg, and 0.01 mg/kg, respectively. Seven of the 17 PAH compounds analyzed for were reported to be present in the sample at concentrations above the MRL. The highest reported PAH concentration was 43 ug/kg naphthalene. Only one of the detected compounds, chrysene, which was reported at a concentration of 13 ug/kg, is considered a carcinogenic PAH. Barium, chromium, lead, and mercury were reported at concentrations of 52 mg/kg, 33 mg/kg, 5.2 mg/kg, and 0.33 mg/kg, respectively. All of the reported concentrations of analytes were below applicable Model Toxics Control Act, Method A or B cleanup levels.

The sample designated "Bottom-South" did not contain diesel-or oil-range petroleum hydrocarbons at concentrations at or above the MRL. Gasoline-range hydrocarbons were reported at a concentration of 72 mg/kg. Benzene, toluene, ethylbenzene and total xylenes were reported at concentrations of 46 mg/kg, 30 mg/kg, and 3.2 mg/kg, and 4.8 mg/kg, respectively. Nine of the 17 PAH compounds analyzed for were reported to be present in the sample at concentrations above the MRL. The highest reported PAH concentration was 190 ug/kg naphthalene. Three of the detected compounds, chrysene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene, which were reported at concentrations of 18 ug/kg, 18 ug/kg, and 11 ug/kg, respectively, are considered carcinogenic PAH's. Barium, chromium, lead, and mercury were reported at concentrations of 60 mg/kg, 29 mg/kg, 2.4 mg/kg, and 0.065 mg/kg, respectively. All of the reported concentrations of analytes were below applicable Model Toxics Control Act, Method A or B cleanup levels, with the single exception of benzene, which has a Method A cleanup level of 0.5 mg/kg in soil.

Waste Disposal

All sludge and cleaning fluids generated as part of cleaning and removing the tank, a total of 440 gallons of liquid and 6,000 pounds of solids, were disposed of by Onyx Environmental Services, LLC. Waste disposal documentation is contained in Attachment D. Laboratory testing results of waste materials for disposal/waste designation purposes are included in Attachment C.

Limitations

The services described in this report were performed consistent with generally accepted professional consulting principles and practices at the time the work was performed. 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, nor the use of segregated portions of this report.

Site 4A-B

GSM appreciates the opportunity to assist you on this project, and hope this information meets your current needs. If you have any questions, or wish to discuss any of the information presented in the attached report, please contact me at (425) 481-4538.

Sincerely,

Howard W. Small

Howard W. Small, R.G., C.P.G.
Project Manager

Attachments:
Table 1 – Soil Sample Analytical Data
Figure 1 – Vicinity Map
Figure 2 – Site Plan and Sample Locations
Appendix A – Ecology Site Check/Site Assessment Form and Closure and Site Assessment Notice
Appendix B – Project Photographs
Appendix C – Laboratory Reports
Appendix D – Waste Disposal Documentation

Site 4A-B

TABLE

Table 1
Summary of Soil Analytical Results

Table 1
Summary of Soil Analytical Results
Dock Street UST
Tacoma, WA

Sample Designation	Sample Depth (feet)	Sample Date	NWTPH-G					NWTPH-Dx		SemiVolatile Compounds	Total Metals
			Gasoline	Benzene	Toluene	Ethyl-benzene	Xylenes	Diesel	Oil		
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	ug/kg	mg/kg
Bottom-North	8.5	3/23/00	ND	0.014	ND	0.011	0.013	ND	ND	43 naphthalene 11 fluorene 34 Phenanthrene 11 Anthracene 27 Fluoranthene 25 Pyrene 13 Chrysene	52 Barium 33 Chromium 5.2 Lead 0.033 Mercury
Bottom-South	8.5	3/23/00	72	46	30	3.2	4.8	ND	ND	190 Naphthalene 11 Acenaphthalyene 39 Phenanthrene 30 Fluoranthene 27 Pyrene 18 chrysene 18 Benzo(a)pyrene 11 indeno(1,2,3-cd)pyrene 11 Benzo(g,h,I)perylene	60 Barium 29 Chromiun 2.4 lead 0.065 Mercury

Notes:
NWTPH-Gx by Washington State Methods
Benzene, Toluene, Ethylbenzene, and Xylenes by EPA Method 8021B Modified
NWTPH-Dx by Washington State Methods
SemiVolatile Organics Analyses by Method EPA 8270. Compounds Not Detected are not listed in Table.
Total Metals analyses by EPA Metod 6010. Metals Not Detected are not listed in Table.
Mg/kg units approximate parts per million (ppm) concentrations
Ug/kg units approximate parts per billion (ppb) concentrations

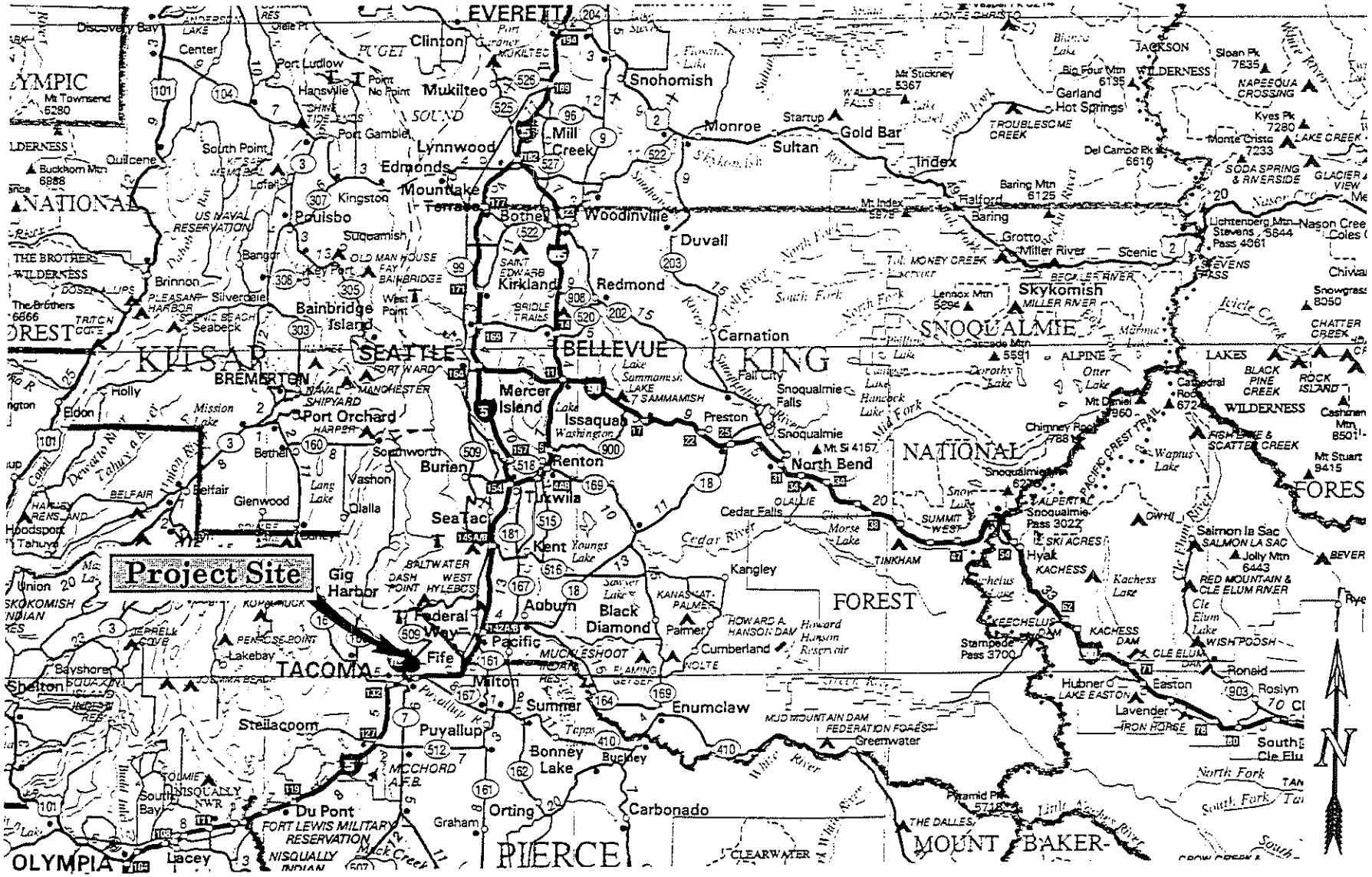
Site 4A-B

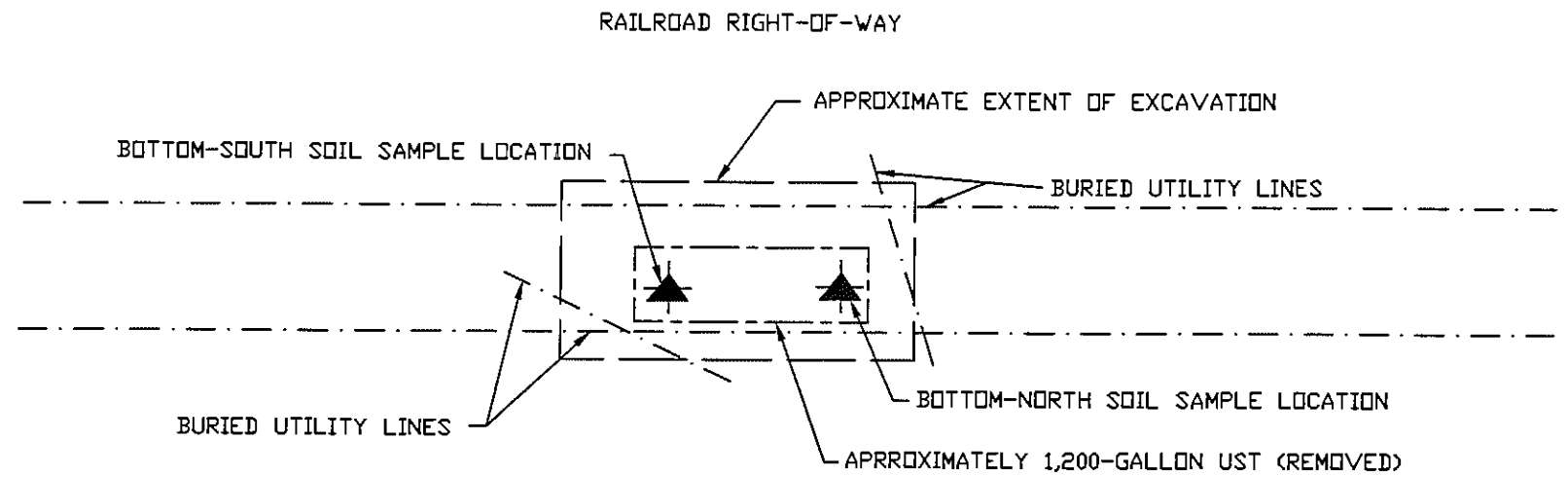
Site 4A-B

FIGURES

Figure 1
Vicinity Map

Figure 2
Site Plan and Sample Locations


Project Site
EVERETT
SEATTLE
BELLEVUE
TACOMA
OLYMPIA
BREMERTON
KITSAP
KING
PIERCE
SNOQUALMIE
NATIONAL
FOREST
MOUNT BAKER-
Discovery Bay
Port Ludlow
Mukilteo
Snohomish
Monroe
Sultan
Gold Bar
Index
Startup
Clinton
Lynnwood
Edmonds
Mountlake Terrace
Kingston
Poulsbo
Bainbridge Island
Brinnon
Silverdale
Seabeck
Port Orchard
Bremerton
Bothell
Woodinville
Duvall
Kirkland
Redmond
Carnation
Mercer Island
Issaquah
Fall City
Snoqualmie Falls
Preston
North Bend
Renton
Tukwila
SeaTac
Burien
Kent
Auburn
Black Diamond
Enumclaw
Gig Harbor
Federal Way
Fife
Milton
Pacific
Puyallup
Sumner
Bonney Lake
Orting
Carbonado
Graham
Du Pont
Lacey
Olympia
Shelton
Hoodsport
Belfair
Vashon
Olalla
Southworth
Port Gamble
Hansville
Point No Point
Quilcene
Center
Sequim
Skykomish
Stevens Pass
Scenic
Baring
Halford
Grotto
Miller River
Lennox Mtn
Cascade Mtn
Alpine Lakes
Wilderness
Mt Si 4167
Mt Daniel 7960
Chimney Rock
Snoqualmie Pass 3022
Hyak
Kachess
Kachess Lake
Keechelus Lake
Stampede Pass 3700
Cle Elum
Salmon La Sac
Jolly Mtn 6443
Red Mountain & Cle Elum River
Wish Poosh
Ronald
Roslyn
Easton
Hubner
Lake Easton
Lavender
Iron Horse
Greenwater
Mud Mountain Dam
Federation Forest
Howard A. Hanson Dam
Howard Hanson Reservoir
Tinkham
Summit West
Cedar Falls
Olallie
Cedar River
Green River
White River
Puyallup River
Skokomish River
Nisqually River
Nisqually Indian
Fort Lewis Military Reservation
McChord A.F.B.
Nisqually NWR
Mt Townsend 6280
Buckhorn Mtn 6888
The Brothers 6666
Mt Stickney 5367
Big Four Mtn 6135
Garland Hot Springs
Troublesome Creek
Del Campo Pk 6619
Baring Mtn 6125
Mt Index 5979
Lichtenberg Mtn 5844
Lennox Mtn 5294
Cascade Mtn 5591
Dorothy Lake
Otter Lake
Hancock Lake
Mid Fork
Pacific Crest Trail
Waptus Lake
Snow Lake
Morse Lake
Lake Sammamish
Lake Washington
Lang Lake
Youngs Lake
Kanaskat-Palmer
Pyramid Pk 5716
Sloan Pk 7835
Kyes Pk 7280
Monte Cristo 7233
Napeequa Crossing
Soda Spring & Riverside
Glacier View
Snowgrass 8050
Chatter Creek
Black Pine Creek
Rock Island
Cashmere Mtn 8501
Mt Stuart 9415
Fish Lake & Scatter Creek
Beverly
Ryegrass
Chiwaukum
Nason Creek
Coles
Tye
Roslyn
Cle Elum
South Cle Elum
Ellensburg
Yakima
Seattle
Tacoma
Olympia
Everett
Bellevue
Kirkland
Redmond
Renton
Auburn
Kent
Federal Way
Bellingham
Spokane
Wenatchee
Moses Lake
Pasco
Richland
Kennewick
Walla Walla
Clarkston
Lewiston
Pullman
Colville
Omak
Okanogan
Chelan
Ellensburg
Yakima
Toppenish
Sunnyside
Prosser
Grandview
Othello
Ritzville
Davenport
Odessa
Ephrata
Soap Lake
Quincy
George
Vantage
Cle Elum
Roslyn
Easton
Snoqualmie
North Bend
Carnation
Duvall
Woodinville
Bothell
Kirkland
Redmond
Bellevue
Issaquah
Mercer Island
Seattle
Tacoma
Olympia
Everett



BASE MAP ESTIMATED FROM FIELD MEASUREMENTS. CITY OF TACOMA INDICATED THAT UST WAS LOCATED AT APPROXIMATELY STA 41+00.

N

0 5 10 20
FEET

GeoScience Management, Inc.
Environmental Consulting Services
18608 89th Avenue NE
Bothell, Washington 98011

W.O. _____
DESIGN _____
DRAWN HW SMALL
DATE MAY 2000
SCALE 1 INCH = 10 FEET

FIGURE 2

SITE PLAN AND SOIL SAMPLING LOCATIONS
UNKNOWN UNDERGROUND STORAGE TANK
DOCK ST. BETWEEN S. 15TH & S. 21ST ST.
TACOMA, WA

Site 4A-B

Site 4A-B

Addendum to Field Report
UST Removal at 1501 Dock Street
Tacoma, Washington

UST System Data

Tank ID	Year Installed	Capacity	Tank Type	Product Stored	Status
1	Unknown	1,100 Gallons	Steel	Unknown	Closed

Tank History

The 1,100 Gallon Steel UST was installed at an unknown date and was used for purposes unknown to the City. The tank was removed with evidence of several holes throughout the tank. The Tank was cleaned and disposed of at General Metals.

Soil Characteristics

The Underground Storage Tank was located within the City of Tacoma's Right of Way along Dock Street. The soil excavated during the removal of the Underground Storage Tank consisted of imported Silty Sand with Gravel (Unified Soil Classification GM). This type of material was consistent throughout the excavation.

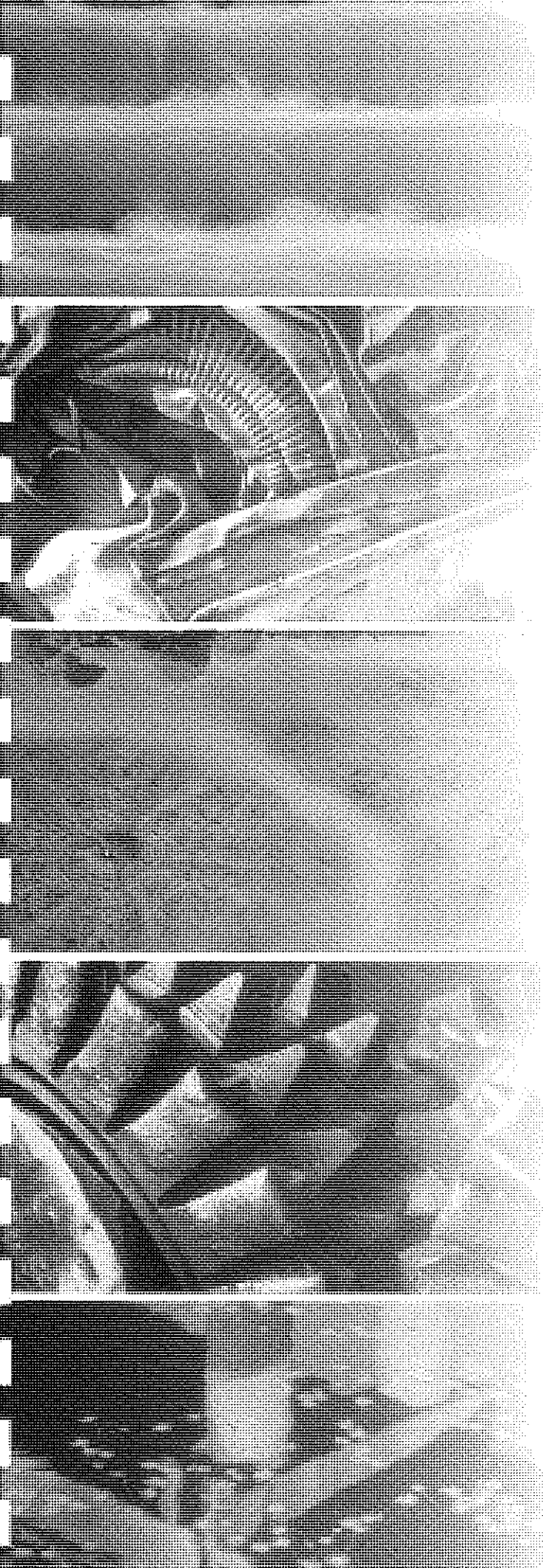
Well Log and Water Level Data

Within the City of Tacoma, areas removed from waterways, e.g., Thea Foss Waterway, and Commencement Bay, generally have a Water Table of 150 Feet above Sea Level. The Water Table along Dock Street is at Sea Level. Ground Water was not encountered in the excavation.

Description of Surrounding Land Use

Dock Street is located in an area that has historically been a business and industrial district.

Site 4A-B



Site-Specific Cleanup Action Plan (SCAP)
Dock Street North Right of Way (ROW)
Thea Foss Upland Properties
Consent Decree 94-10917 6

Prepared for
The City of Tacoma
Public Work Engineering

June 15, 2005
17156-00

HARTCROWSER
Delivering smarter solutions

Site 4A-B

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Site 4A-B

SITE-SPECIFIC CLEANUP ACTION PLAN (SCAP)
DOCK STREET NORTH RIGHT OF WAY (ROW)
THEA FOSS UPLAND PROPERTIES
CITY OF TACOMA

INTRODUCTION

This document presents the Site-Specific Cleanup Action Plan (SCAP) for the Dock Street North Right of Way (ROW) located in Tacoma, Washington (Figure 1). The work described in this SCAP will complete the cleanup activities for Dock Street under Consent Decree 94-10917 6 between the Washington State Department of Ecology (Ecology) and the City of Tacoma (City). The cleanup of the Dock Street ROW south of East 15th Street is now generally complete, and the project is in the post-construction groundwater monitoring phase.

The project involves utility replacement and roadway upgrades in the Dock Street North ROW, in conjunction with area-wide property improvements for the Thea Foss Redevelopment effort. The ROW is an asphalt-paved roadway, and no changes to the current land use are anticipated. The primary concern with respect to environmental issues includes soil and groundwater quality during construction activities.

Area-Wide Cleanup

In 1994, the City voluntarily entered into an Administrative Order of Consent (AOC) with the United States Environmental Protection Agency (EPA) for cleanup of the Thea Foss Waterway, and the above-referenced Consent Decree with the Ecology for cleanup of the adjacent uplands. Cleanup work administered under the AOC and Consent Decree is closely related, and the respective in-water and upland cleanup areas share a common boundary at mean higher high water (MHHW) (MHHW is 11.8 elevation feet mean lower water [MLLW]). Ultimate compliance with provisions of both the AOC and Consent Decree will result in a cleanup action extending from the mouth to the head of the Thea Foss Waterway, and will include the adjacent City-owned uplands.

Site-Specific Cleanup Actions

This SCAP identifies the cleanup actions required for the Dock Street North ROW as defined by terms of the Thea Foss Redevelopment Cleanup Action Plan (CAP), Exhibit C to the Consent Decree. This SCAP was prepared following completion of a draft remedial investigation (RI) performed for the Dock Street

North ROW (Hart Crowser 2001a). The RI identifies site contamination issues and assesses the applicability of the Thea Foss Redevelopment CAP for purposes of planned construction and redevelopment activities. The RI includes an analysis of the nature and extent of contamination and historical sources. The RI also addresses the applicable cleanup alternatives for the site, given the identified environmental conditions and redevelopment scenarios. The final RI report is currently in preparation following resolution and disposition of review comments from Ecology.

This SCAP will be made available for public comment in accordance with WAC 173-340-600 of the Washington State Model Toxics Control Act (MTCA). Following the 30-day public comment period, a final SCAP will be issued and included as an amendment to the Consent Decree. The City of Tacoma will implement the final SCAP, with submittal of appropriate design, construction, and monitoring plans to Ecology for review.

SITE DESCRIPTION

The Dock Street North ROW includes the paved street area from East 15th Street to approximately 470 feet north of East 11th Street. As shown on Figure 2, the project also includes two additional areas associated with project development and cleanup:

- The triangular-shaped parcel located west of Dock Street and immediately north of East 15th Street; and
- The portion of the Dock Street ROW extending approximately 200 feet south of East 15th Street.

The latter area south of East 15th Street was added to the redevelopment project to facilitate necessary utility upgrades. Although not included with the draft RI for the Dock Street North ROW, this area will be incorporated by reference into the final RI. Site cleanup standards, alternatives, construction activities, and regulatory provisions addressed by this SCAP are applicable to the entire Dock Street North ROW project, including the portion south of East 15th Street.

The draft RI also identified approximately 700 feet of additional ROW north of the currently defined project area as part of the Dock Street North project. No construction or disturbance is currently planned in this area, however, and this 700-foot extension is expected to present minimal environmental concerns.

Historical Land Use

The Dock Street ROW was platted in the early 1880s and was originally tideland fronting a steep bluff to the west. Circa 1890, the tidelands were filled with material dredged from the current waterway area and material blasted from the adjacent hillside under the ownership of the Tacoma Land Company, then a subsidiary of the Northern Pacific Railroad Company. By 1893, stretches of Dock Street were planked roadways with railroad tracks. In 1910, Northern Pacific Railway transferred control of Dock Street to the City of Tacoma. By the late 1920s, certain portions of Dock Street were paved with concrete. No other uses of the Dock Street alignment, other than for transportation purposes, have been identified, with the exception of the triangular parcel near the south end of the study area.

Roadway

Given the lack of industrial development within the Dock Street ROW itself, historical filling beneath the ROW represents the most probable source of potential contamination over much of the project area. Fill materials were typically generated from local industrialized areas and may contain petroleum-hydrocarbons, related organic constituents, and metals typical of such areas.

Triangular Parcel

The triangular parcel north of South 15th Street was identified in 1896 as the site of McPower's lumberyard with refrigerated beer storage occurring in a building west of the lumberyard. Circa 1900, when the Oregon-Washington Railway Bridge was built across the Thea Foss Waterway, the access ramps for the span were located on the eastern side of the triangular Dock Street parcel.

Later tenants in the vicinity of the former lumberyard include unspecified merchants and storage (1910s), the Gladding McBean and Company brickyard (1920s), and a produce warehouse (1950s). A truck repair facility replaced the former beer storage building (southwest parcel corner) sometime before 1950. In the northern portion of the triangular parcel, at the foot of an access ramp for the bridge, a converted railroad car housed the Dock Street Diner from at least the 1940s into the 1950s. However, in the mid-1950s, these structures were demolished, the land was used for parking and storage of building materials. In the mid-1970s, and the bridge and its access ramps were dismantled.

Coal Gas Supply Lines Abandoned Drip Oil Tank

An abandoned coal gas supply line is located along the Dock Street ROW near South 15th Street. Segments of this abandoned line have also been encountered at other locations beneath Dock Street. In March 2000, a 1,100-gallon underground storage tank (UST) was removed near the intersection of the Dock Street and South 15th Street (Figure 2), and was thought to have been a drip oil tank for coal gas supply lines. Hart Crowser completed subsequent explorations to determine the nature and extent of petroleum hydrocarbons and related chemical constituents, including benzene (Hart Crowser 2002). As noted below, elevated concentrations of polycyclic aromatic hydrocarbons (PAHs) were detected in soils near the location of the former UST and vicinity, but an additional source is suspected. Gasoline-range hydrocarbons, benzene, and related volatile constituents were detected in groundwater at several locations and may be related to the abandoned coal gas supply line as a possible source.

Asbestos-Insulated Pipe

During remediation of the Dock Street South ROW near Parcel 3, an abandoned steam line was uncovered and removed. The line was a 6-inch steel pipe encased in asbestos wrapping and surrounded by a 12-inch-diameter concrete pipe. Similar asbestos-wrapped piping could also potentially be encountered in the Dock Street North ROW during construction.

SITE CHARACTERIZATION

This section summarizes the physical characteristics and environmental quality of site soil and groundwater for the Dock Street North ROW. A more detailed discussion of physical subsurface conditions and the nature and extent of contamination is provided in the draft RI for Dock Street North, and a follow up memorandum (Additional Soil and Groundwater Samples Analytical Results Dock Street ROW near East 15th Street, Hart Crowser 2002). Locations of previous subsurface explorations are identified on Figure 2. Soil and groundwater samples with exceedances of applicable MTCA cleanup levels are listed in Tables 1 and 2, respectively. These results are also displayed on Figures 3 and 4.

Soil Characteristics and Quality

Subsurface Stratigraphy

Over much of the ROW area, soils encountered during previous exploration efforts consisted up to about 2 feet of subgrade fill beneath asphalt pavement. This material overlies silty sands believed to be dominantly dredge material from the late 1800s. Additional fill materials types are present near the triangular parcel area just north of East 15th Street. Prior to filling, a ravine was present along the approximate east-west alignment of East 15th Street. The ravine was filled over time, likely with material from the hillside to the west and/or other fill materials. The mixed fill materials encountered are quite variable and range from black silt to gravel. Wood was encountered in Strataprobes DSN-B08, DSN-B11 and DSN-B12, and brick debris was encountered in DSN-B08, DSN-B11, and DSN-B13. With the exception of trace amounts of coal near the upper contact of the dredge fill in probe DSN-B02, no evidence of subsurface debris was noted.

Soil Quality

Petroleum hydrocarbon-like odors were noted in soil samples during probing for DSN-B06, DSN-B07, DSN-B08 (location of the former truck repair yard), and DSN-B10. The depth occurrence of the odors was variable at each location. There were some low-level concentrations of oil-range hydrocarbons detected in a sample from probe DSN-B08, but the concentrations were below applicable MTCA cleanup levels.

Shallow soil samples from probes DSN-B12 and DSN-B14 contained concentrations of total carcinogenic PAHs (cPAHs) exceeding the MTCA Method B cleanup level of 0.137 milligrams per kilogram (mg/kg), expressed as benzo(a)pyrene equivalents (BaP). Total cPAH concentrations up to 15.13 mg/kg were calculated using the toxicity equivalent methodology presented in WAC 173-340-708(8). PAHs were also detected in a sample from probe DSN-B07, but at a concentration below the MTCA cleanup level. PAHs identified throughout the project area may be associated with petroleum hydrocarbons as well as non-petroleum sources such as burnt wood, coal-related materials, tar products, and coal ash. Locations and depths of soil quality criteria exceedances are shown on Figure 3.

The shallow soil sample from probe DSN-B07 contained arsenic at a concentration of 179 milligrams per kilogram (mg/kg). This concentration exceeded the MTCA cleanup level of 20 mg/kg based on natural background concentrations in soil.

Other analytical results were generally non-detect or below cleanup levels for PAHs, metals, and benzene, toluene, ethylbenzene, and xylenes (BTEX).

Groundwater Characteristics and Quality

Groundwater Conditions

Groundwater was encountered between depths of about 6 and 11 feet in borings and wells drilled in Dock Street. Net groundwater flow in the vicinity of Dock Street is toward the Thea Foss Waterway and water levels in the fill between Dock Street and the waterway are influenced by the tide. Based on experience at other sites along the waterway, the effects of the tide are expected to be significantly dampened beneath Dock Street. A water level fluctuation on the order of 0.5 foot was observed in monitoring wells DSN-MW01 and DSN-MW02 during high and low tide measurements made on March 20 and 21, 2001.

Groundwater Quality

Benzene was detected in a groundwater sample from Strataprobe DSN-B08 at a concentration of 170 micrograms per liter (µg/L), exceeding the MTCA Method B cleanup level of 71 µg/L. Low concentrations of toluene (2 µg/L) and xylenes (5.7 µg/L) were also detected in exploration DSN-B08. Gasoline-range hydrocarbons and one or more BTEX constituents were also detected in DSN-B09, DSN-B10, DSN-B11, and DSN-B14, but below applicable MTCA cleanup levels. A grab groundwater sample from exploration DSN-B09 located just north of East 15th Street was non-detect for benzene, indicating that any benzene plume is not very wide-spread downgradient from the DSN-B08 location where benzene exceeded the MTCA cleanup level.

The distribution of gasoline and BTEX detections in groundwater does indicate an obvious source of contamination. Gasoline and BTEX detections in groundwater also do match up well with petroleum hydrocarbon detections in soil. The distribution of these constituents indicates that coal gas line may be the most likely source, with the storm line acting as a preferential flow path.

Arsenic concentrations in DSN-MW01, DSN-MW02, and DSN-B08 (1.0, 1.8, and 4.8 µg/L, respectively) also exceeded the groundwater cleanup level of 0.14 µg/L. PAHs were detected in DSN-B12 at concentrations well below applicable cleanup levels.

SITE CLEANUP STANDARDS

Soil Cleanup Standards

The cleanup standards for the site soils were developed according to Chapter 173-340 WAC and are defined in the Thea Foss Upland Redevelopment Consent Decree and Cleanup Action Plan (State of Washington 1994). On February 12, 2001, the cleanup standards were updated according to the MTCA Amendments. For the purposes of this SCAP, the cleanup levels reflect updates from the MTCA Amendments, as provided for by the Consent Decree. Applicable standards are based on protection of groundwater and surface water, and on estimates of reasonable maximum exposure expected for protection of human health. In general, the residential use scenario as defined in MTCA represents the reasonable maximum exposure scenario for direct contact in the development site areas because of the potential for residential uses.

Cleanup levels for the chemicals of concern identified in Dock Street soils including arsenic, benzene, and cPAHs are discussed in the following paragraphs.

Arsenic

The arsenic soil cleanup level of 20 mg/kg, which is based MTCA Method A for direct contact and protection of groundwater, as adjusted for natural background for soil.

Benzene

The cleanup level for benzene in soils is 34.5 mg/kg based on groundwater protection under MTCA Method B. No benzene was detected in site soils during previous investigations; however, benzene was detected in groundwater.

Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)

The cleanup level based on residential contact exposures for individual cPAH compounds is 0.137, or 1 mg/kg for the sum of cPAH compounds using the toxicity equivalent methodology presented in WAC 173-340-708(8).

Contingency Petroleum Hydrocarbon Cleanup Levels

Total Petroleum hydrocarbons (TPHs) have not previously identified as constituents of concern for the Dock Street North ROW. As a contingency, cleanup levels are provided for petroleum hydrocarbons if encountered during

excavation. For planning purposes, this SCAP establishes the following contingency cleanup levels for TPH based on MTCA Method A screening levels:

Gasoline-Range TPH (Without BTEX)	100 mg/kg
Gasoline-Range TPH (With BTEX present)	30 mg/kg
Diesel-Range TPH	2,000 mg/kg
Heavy Oil-Range TPH	2,000 mg/kg
Mineral Oil-Range TPH	4,000 mg/kg

Groundwater Cleanup Standards

Groundwater cleanup levels are based on the protection of marine surface water including protection of aquatic life (marine chronic criteria; Chapter 173-201A WAC) and the protection of human health from consumption of aquatic organisms (40 CFR 131). Protection of surface water is applicable for the site since groundwater in the fill is not considered a current or future potable drinking water source. It is also unlikely that any contaminant in the shallow groundwater will be transported to an area where groundwater is a current or potential source of drinking water. Finally, there are no apparent impacts to the waterway from upland groundwater. Given the 90-plus years since the fill soils were placed, and the available groundwater quality data, the soil contaminants in Dock Street are not expected to impact groundwater or surface water quality in the future.

The distance from Dock Street to the waterway and the low mobility of the identified contaminants suggests there are no impacts to groundwater (Hart Crowser 2001a). In addition, groundwater in the fill is not a current drinking water source, nor is considered to be a future drinking water source based on the high dissolved solids content of the water as a result of saline mixing. It would be difficult to develop a drinking water source because of the potential for saline intrusion that would occur with any groundwater pumpage (i.e., salt water would be pulled further into the aquifer). Municipal controls restrict the placement of drinking water wells in the fill aquifer and wells presently using the deeper aquifer as a drinking water source are in areas much removed from the project area.

The following cleanup levels are established for arsenic, benzene, cPAHs, and a contingency for TPH. Contingency TPH cleanup levels are based on Method A levels for protection groundwater as a default.

Arsenic	0.14 µg/L
cPAHs	0.031 µg/L
Gasoline-Range TPH (Without BTEX present)	1,000 µg/L
Gasoline-Range TPH (With BTEX)	800 µg/L
Diesel-Range TPH	500 µg/L
Heavy Oil-Range TPH	500 µg/L
Mineral Oil-Range TPH	500 µg/L

CLEANUP ACTION PLAN

The MTCA requires that cleanup actions to protect human health and the environment comply with cleanup standards and other applicable state and federal laws, and provide for compliance monitoring. The Thea Foss Waterway Redevelopment CAP defined in Exhibit C of the Consent Decree was developed in accordance with these requirements. In addition to the requirements of this SCAP, the Consent Decree calls for compliance with property redevelopment plans, and applicable or relevant and appropriate requirements (ARARs).

Ecology has determined that the cleanup actions specified in the area-wide Consent Decree CAP apply to the Dock Street North site based on the results of the draft RI this project. The cleanup actions identified in the Consent Decree that are potentially applicable to the Dock Street ROW include:

- Contaminated soil will be isolated below 3 feet of clean soil cover, a building, or a pavement cap.
- If small quantities of soil occur, which are defined and localized, can be readily accessed, are technically and economically treatable, and pose a significant threat to human health and the environment were the soil to

remain, they will be removed for off-site disposal. Such soils will identified based on exceedances of remediation levels derived from Reasonable Maximum Exposure (RME) levels, as defined below in this SCAP.

- For utility installations, the trenches will be constructed in accordance with state and city standards with the additional requirement that 1 foot of overexcavation occur, or that a geofabric lining be used to provide a clean perimeter around the outside of the utility trench.

- In all cases where residual contamination above MTCA cleanup levels remains following remediation, institutional controls will be implemented to control future excavations, provide for long-term maintenance of the surface cap, and potentially provide for routine environmental monitoring.

To facilitate environmental cleanup, one of the strategies adopted by Ecology and the City in the Consent Decree CAP was to accomplish cleanup in the context of the site redevelopment. This is intended to facilitate cleanup and ensure a timely and cost-effective process. To assess appropriate cleanup actions for the Dock Street North ROW, improvements associated with the area-wide redevelopment were considered.

Proposed Redevelopment Plans

The current plan for the Dock Street ROW calls for replacing, upgrading, and/or installing several utility lines, and regrading and replacing the roadway. This includes installation of storm sewer, sanitary sewer, and water line utilities. A joint utility trench, with a transition area to existing utilities adjacent to the Municipal Dock area, will be completed. Following utility installation, the street will then be regraded and completed with an asphaltic-concrete pavement cap. In general, redevelopment grades will require filling Dock Street above the present elevation.

Cleanup Action Alternatives

The applicable cleanup alternatives identified for Dock Street in the Dock Street Site-Specific Remedial Investigation report include:

Alternative 1—No Action

No action is an applicable alternative where no contamination is identified and/or where no utility or re-paving work is planned and the existing roadway serves as a suitable cap. The existing soil and groundwater quality data indicate

the identified contamination beneath Dock Street does not pose a threat to human health or the environment under existing conditions.

Alternative 2—Isolation by Cap or Cover

Isolation by cap or cover is applicable and is provided in many areas by the existing pavement. Isolation by pavement cap will be provided into the future by the new roadway pavement, sidewalks, parking area, and/or soil cover. Figure 5 presents the areas where isolation by cap or cover will occur under the Dock Street improvement plans.

Alternative 3—Excavation and Treatment

Excavation and treatment of soils are applicable in areas where affected soils are to be excavated for utility installation, relocation, and/or upgrade. The Consent Decree CAP specifies the cleanup required for utility trenches. In addition to meeting state and federal standards for construction, trenches are to be overexcavated to allow for a minimum 1-foot perimeter of clean soil outside the standard trench dimensions, or be lined with a geofabric, to limit future exposures. This alternative applies to excavated soils containing constituent concentrations in excess of the Remediation Levels, or soils that cannot be reused for structural fill for Alternative 2 that contain constituent concentrations in excess of MTCA cleanup levels.

Soil Remediation Levels

The presence of a pavement cap and implementation of institutional controls will prevent direct contact exposures to children under a residential scenario. However, the Consent Decree requires that "hot spot" soils which pose a significant threat to human health and the environment be remediated. To evaluate what soils pose a significant risk, it is necessary to establish remediation levels. Remediation levels are set using alternate RME scenarios that reflect the highest exposure that can occur under current and potential future site exposure considering, among other factors, the potential for institutional controls to fail.

The alternate RME for the Dock Street North site would be based on protection of construction or utility workers. By virtue of its use as a roadway, now and into the future, Dock Street has the characteristics similar to an industrial property (as defined in WAC 173-340-745(b)(i)) including:

- People do not live or grow food there;
- Access is limited;

- Operations are characterized by noise, odors, and truck traffic; and
- The area is paved.

The only contact with subsurface soils would be through utility work, thus the alternate RME scenario for Dock Street is industrial by nature. Although in close proximity to residentially zoned property, the adjacent land use will not include any ground floor residential use. In addition, the hazardous substances are relatively immobile, and access to site soils is virtually impossible given use as a roadway. Furthermore, institutional controls will be implemented for this and the other upland properties under this Consent Decree.

Dock Street is intended to remain as a ROW into the future with subsurface utilities supporting the adjacent waterfront properties. The only potential for future exposure to soil contamination would be for construction workers during subsurface utilities work. Therefore, the alternate RME level would represent an adult worker with limited ingestion rates because of engineered controls that are inherent in a permanent roadway. From the perspective of protecting human health through direct contact exposures, soil remediation levels based on industrial land use represents the alternate RME.

Arsenic

The MTCA Method C industrial soil cleanup level for arsenic as a carcinogen is 87.5 mg/kg. The Method C industrial soil cleanup level for arsenic is based on ingestion of soil. As discussed above, the future construction worker at Dock Street is assumed to have an exposure frequency and duration that is less than the MTCA industrial worker. Therefore, an arsenic remediation level of 87.5 mg/kg based on industrial exposures is expected to represent protective criteria (i.e., more stringent and conservative than is likely to occur given the frequency of utility repairs and upgrades).

Benzene

The MTCA Method C cleanup level for benzene as a carcinogen is 2,390 mg/kg. The Method C cleanup level is based on ingestion of soil.

cPAHs

The MTCA Method C cleanup level for cPAHs, 18 mg/kg as a BaP equivalent. This cleanup level applies to individual cPAHs, as well as the sum of all cPAHs based on the toxicity equivalent methodology. These criteria are more stringent and conservative than is likely to occur given the frequency of utility repairs and

upgrades. The future construction worker is expected to be exposed to site soils only during initial installation of utilities and during utility repairs and upgrades.

Petroleum Hydrocarbons – Contingency Remediation Level

For planning purposes this SCAP establishes contingency remediation levels for TPH in the gasoline and heavier hydrocarbon ranges. The primary pathways of concern are soil to groundwater for gasoline-range TPH, and direct contact for the diesel-range and heavier fractions. To address these pathways, the following contingency remediation levels are established:

Gasoline-Range TPH (Without BTEX present)	1,000 mg/kg
Gasoline-Range TPH (With BTEX present)	300 mg/kg
Diesel-Range and Heavier TPH	20,000 mg/kg

The contingency remediation levels represent 10 times the contingency cleanup levels derived from MTCA Method A. The lack of free phase product in site groundwater during the previous site investigations further supports this approach. If encountered, soils with visible sheen or other indications of product phase petroleum hydrocarbons would be subject to removal and off-site treatment and/or disposal under the contingency remediation levels.

Detailed Description of Selected Alternative for Dock Street North

The selected alternative for Dock Street North includes excavation of impacted soils and isolation by cap or cover. Isolation will occur with new roadway pavement, soil cover and sidewalks, and asphalt parking. These elements will provide a cap to isolate future exposures to subsurface soils. In addition, the installation of new utilities and regrading will require removal of some of the excavated soils.

The cleanup action for the Dock Street ROW is depicted in plan view on Figure 5 and in cross section on Figure 6. Specific elements of the cleanup design are discussed below.

Site Preparation

Site preparation for Dock Street utilities and grading will consist of the following:

- Breaking up existing asphalt or sawcutting asphalt for utility construction and cut areas during grading. Debris will need to be removed and recycled or disposed of in permitted facility; and

- Abandoning and replacing, or modifying affected monitoring wells. Monitoring wells that will not be used for future monitoring will be abandoned in accordance to Chapter 173-160 WAC, Minimum Standards for Construction and Maintenance of Wells. Wells that will continue to be monitored will be protected during construction, with surface monuments modified as necessary.

Excavation of the Dock Street Soils

Soils will be excavated for utility trenches and regrading as called for in the roadway improvement design drawings. Three technologies were considered for soils excavated for the Dock Street improvements. These include using excavated soils as backfill, treating contaminated soils using thermal desorption as applicable, and landfilling of unsuitable materials. Each of these are discussed below.

Technology 1 - Backfill of Excavated Soils

It is expected that most of the soils excavated during Dock Street improvements will be placed back beneath the roadway. It is important to note that the new storm and water pipelines will be installed in the same or nearby locations as the existing pipelines. It is expected that the soils within these trenches will be generally clean and free of debris.

Replacement of the excavated soil as backfill is essentially a reuse and recycling alternative. Reuse and recycling are preferred alternatives under MTCA 173-340-360 if the residual constituent concentrations are below the remediation levels established in this SCAP.

Technology 2 - Thermal Desorption of Excavated Soils

Soil recycling through the use of off-site thermal desorption is a feasible soil treatment alternative for soils that exceed remediation levels for cPAHs, and contingency remediation levels for petroleum hydrocarbons. This technology involves heating the soil to temperatures of up to 900 to 1,100 degrees Fahrenheit, causing volatilization of contaminants. Soil exiting the treatment unit must meet MTCA Method A cleanup levels before reuse.

Thermal desorption is a preferred treatment because it is a permanent solution in that the contaminants are destroyed. There are, however, restrictions placed upon incoming soils by the facilities that are relevant for Dock Street soils. The soils must have a generally low fines content and water content.

Technology 3 – Off-Site Landfilling of Excavated Soils

Some soil may require landfilling where there is substantial debris and/or where constituent concentrations exceed remediation levels. Excavated soils with high silt and/or water contents will also require landfilling, along with other non-recyclable debris.

Handling of Excavated Soil

The preferred alternative for handling soil excavated from the trenches will be to replace the soil as trench backfill, as practical. Excavated soil from existing utility trenches is expected to be relatively clean. Soils tested outside of the utility trenches during the remedial investigation generally cleanup criteria as discussed above (i.e., below MTCA cleanup levels). However, soil located outside of the existing utility backfill is more likely to contain contaminants typical of the area historical development fill. Most of the soil tested in this area was dredge fill, which is expected to contain minimal, if any, contamination. It is expected that much of the soil excavated for the utilities beneath Dock Street can be replaced as trench backfill if structurally suitable.

Excavated soils will be stockpiled separately based on the field screening using vapor analyzers, visual, odor, and common-sense criteria. Commercially available field screening kits may also be used, as applicable. Field personnel should take note of any soils with a sheen, odor, or discoloration and should be aware of the possibility that abandoned coal gas lines and USTs, or abandoned asbestos-encased steam pipes may be encountered. Apparently suitable utility backfill will be segregated from soils not appropriate for backfill. Debris materials and any obvious waste material would not be suitable for backfilling. Soils not used for backfill will be sampled and chemically characterized to determine appropriate disposition. Stockpiled soils that appear to contain waste materials would be sampled and analyzed at a minimum for arsenic, benzene, PAHs, and petroleum hydrocarbons (as applicable based on the source of the material and field indicators). Soils with constituents exceeding remediation levels will be thermally treated and recycled, or landfilled based on the criteria discussed above.

Dewatering

Utility excavations may potentially encounter groundwater, and dewatering may be required depending on the trench construction method(s) used. Dewatering water will require special handling considerations and a permit will be needed if discharged to the City sanitary sewer lines. It is expected that temporary holding tank for settling will be required as a minimum pre-treatment measure prior to sanitary sewer discharge. Although a less likely disposal scenario, construction dewatering water discharged to the waterway or to ground would require additional regulatory approvals. Appropriate water quality characterization sampling and analysis would be conducted prior to discharge under any of the scenarios described.

Geotechnically Unsuitable Backfill

Another consideration is debris if encountered in mixed fill material. Brick, glass, asphalt, wood, and concrete debris were noted in previous explorations in Dock Street. Separation of these materials and alternate disposition may be required to meet project specification requirements, with associated recycling, or appropriate off-site disposal.

Geotechnically unsuitable soils typically contain excess silt or other materials and cannot be meet compaction specifications for backfilling purposes without reconditioning. Reconditioning of geotechnically unsuitable soil is an alternative to landfilling, but would require specialized soil handling (e.g., a staging area to spread soils for drying and/or for adding admixtures to the soil to make them reusable, stockpiling and chemical testing, etc.). Reconditioned soil would then need to meet the approval of a geotechnical inspector for reuse, as well as meet remediation levels for individual constituents. Under these conditions, geotechnically unsuitable soils could be used as backfill. Alternatively, these soils could be used at the Tacoma landfill as daily cover, or hauled to a suitable off-site disposal facility.

Pavement Cap and Soil Cover

The final street pavement and areas of sidewalk with soil cover will act as a cap to physically isolate residual soil contaminants present in the subsurface. The cap will prevent direct contact with subsurface soils and limit future infiltration of precipitation over much of the Dock Street North ROW area.

Stormwater Drainage

Stormwater collection is an integral part of the cap design for Dock Street as well as for the area-wide cleanup efforts. Dock Street is planned to slope westward at a 4 percent grade to direct roadway runoff away from the waterway. Roadway runoff from Dock Street will then be routed through catch basins to the storm sewer lines beneath Dock Street.

Stormwater drainage from the redevelopment sites will also be directed to the storm sewer beneath Dock Street. Replacement and upgrade of the existing storm drains within the Dock Street ROW are an important part of the stormwater management system for the cleanup of the waterfront property along the west side of Dock Street.

Compliance Monitoring

Compliance monitoring is performed to confirm that human health and the environment are protected during the construction, and operation and maintenance of the cleanup action. Compliance monitoring also confirms that the cleanup action has attained the cleanup standards prescribed by the cleanup plan and confirms the long-term effectiveness of the remedial action. Compliance monitoring will be performed according to the criteria specified in WAC 173-340-410 and -360(8) and the Consent Decree as follows:

- Protection Monitoring will be implemented during construction by ensuring that site workers are appropriately trained in health and safety and that a health and safety and contingency plans for encountering hazardous materials are available during construction. Soils that are obvious waste materials will be stockpiled on an adjacent property with appropriate contact and runoff controls.

- Performance Monitoring will be performed during construction on all soils where suspect contaminants are identified during excavation. Suspect soils will be stockpiled separately and chemically analyzed for constituents identified in this SCAP that are suspected to be present. Appropriate treatment and/or disposal will be performed on excavated soils in accordance the Consent Decree, this SCAP, and with applicable facility permits.

- Confirmation Monitoring will be performed by collecting groundwater monitoring data following completion of the roadway pavement. The groundwater monitoring will ensure that the disturbance of the soil during construction and the replacement of excavated fill soils will not cause future

leaching of contaminants to groundwater. A compliance monitoring plan will be submitted as part of the remedial design documents.

JUSTIFICATION OF CLEANUP ALTERNATIVE

MTCA requires that any alternative selected for site remediation must meet, as a minimum, four threshold criteria:

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

In addition, this SCAP shall use permanent solutions to the maximum extent practicable and consider public concerns. The selected alternative meets these criteria as described below.

Protection of Human Health and the Environment

The cleanup action protects human health and the environment by eliminating the potential for direct contact with subsurface soils. Besides the limited use of streets by pedestrians, the roadway, sidewalks, and soil cover itself will prevent contact with contaminated soils. As the preferred alternative, geotechnically suitable soils excavated from the site will be used as backfill unless they contain constituents exceeding remediation levels presented herein. Soils contaminated above remediation levels will be stockpiled and treated or landfilled, eliminating future direct contact concerns.

Groundwater quality in Dock Street has been impacted beyond background levels, but the data indicate that Dock Street soils are not acting as a source of contamination to groundwater. Thus backfilling with excavated fill soils should be protective of groundwater quality. Surface water runoff will be routed westward to storm drains. The cleanup action thus eliminates potential impacts to surface waters and marine sediment.

Compliance with Cleanup Standards

The selected cleanup alternatives were chosen to comply with the Consent Decree and the RME scenario expected into the future.

Compliance with Applicable or Relevant and Appropriate Requirements

Applicable or relevant and appropriate requirements (ARARs) associated with the following laws and regulations apply to the Dock Street North ROW:

Federal Laws and Regulations

- 33 USC 1251 *et. Seq.* (Clean Water Act) and 40 CFR 230;
- 40 CFR 131 Subpart D (Federally Promulgated Water Quality Standards);
- Subtitles C and D - 42 USC 6921-6949a and 40 CFR Part 268 (Resource Conservation and Recovery Act - RCRA);
- 20 CFR Subpart 1910.120 (Occupational Safety and Health Act); and
- Executive Order 11988 (40 CFR Part 6, Appendix A - Flood Plain Management).

State Laws and Regulations

- Chapter 70.105 RCW (Washington State Hazardous Waste Management Act) and Chapter 173-303 WAC (State Dangerous Waste Regulations);
- Chapter 90.48 RCW (State Water Pollution Control Act);
- Chapter 90.70 RCW (Puget Sound Water Quality Act);
- Chapter 173-201A WAC (Water Quality Standards for Surface Waters of the State of Washington);
- Chapter 173-14 WAC (Shoreline Management Act);
- Chapter 75-20 RCW (State Hydraulic Code) and Chapter 220-11 WAC (Hydraulic Code Rules);
- Chapter 70.95 (Solid Waste Management - Reduction and Recycling);
- Chapter 70.94 RCW (Washington Clean Air Act);
- Chapter 173-160 WAC (Minimum Standards for Construction and Maintenance of Wells);

- Chapter 43.21C RCW (State Environmental Policy Act) and Chapter 197-11 WAC (State Environmental Policy Act Rules); and
- Washington Industrial Safety and Health Act (WISHA).

Cleanup activities described in this SCAP comply with the ARARs of the laws and regulations listed above. Other administrative approvals and authorizations which are separate from substantive requirements will be complied with as part of the permitting process.

Compliance Monitoring

Compliance monitoring will be provided during and post-construction as described above. Protection monitoring will be implemented during construction, and performance monitoring will include implementation of treatment or disposal of obvious waste material that is encountered. Post-construction confirmation groundwater monitoring will be performed to ensure that groundwater quality is not adversely impacted by construction activities.

Short-Term Effectiveness

The short-term effectiveness considers how the cleanup action impacts human health and the environment during the construction phase and prior to the attainment of cleanup standards. The primary risk during construction for Dock Street is workers coming in direct contact with contaminated soils during excavation and grading. The soils sampled to date do not indicate that constituent concentrations that would exceed construction work risk levels are present. In addition, exposures to contaminated materials that may be encountered during construction can be addressed through a worker health and safety plan, reducing dust generation by watering, and by constructing on-site drainage and erosion control measures.

Additional Criteria

Long-Term Effectiveness

The long-term effectiveness of the cleanup action is evaluated in terms of the magnitude of residual risk and the adequacy and reliability of the cleanup action. The residual risk will be dramatically reduced, or even eliminated, by capping the site with asphalt, concrete, and fill (to raise grade) for the Dock Street construction. In addition to the risk reduction offered by capping, the cleanup action further reduces residual risk by implementing treatment and/or disposal options for contaminated excavated materials.

Permanent Reduction of Toxicity, Mobility, or Volume

This evaluation criterion addresses the preferential implementation of treatment technologies that permanently and significantly reduce toxicity, mobility, and volume of the hazardous substances present. Given the nature of the expected fill materials and their age, a capping alternative is appropriate. Soils with cPAH, benzene, and petroleum hydrocarbon concentrations exceeding their applicable remediation levels will be considered for treatment using a thermal desorption technology. Thermal desorption reduces the toxicity, mobility, and volume of contaminants in soil permanently.

Implementability/Technical Feasibility

The technologies chosen in the cleanup action have been implemented and used reliably elsewhere to remediate contaminated soil with similar characteristics.

Cost

Backfilling the trenches with excavated soil will be the most cost-effective and practicable alternative for the soils based on the soil quality measured to date. Given the long-term use of the Dock Street corridor as a ROW, no significant additional risk reduction is achieved by treatment and/or disposal of all excavated soils. Given that soils are treated (as possible) where the applicable remediation levels are exceeded, and that the contaminants are isolated by a cap, the preferred alternative will be protective of human health and the environment and at the same time provide the most practicable approach to cleanup.

SUBSTANTIVE REQUIREMENTS FOR PERMITS

Persons conducting cleanup under a MTCA consent decree are exempt from having to obtain certain state and local permits or approvals. Instead, the substantive requirements of those permit laws must be complied with as part of the MTCA cleanup. The following are the applicable substantive requirements:

Community Concerns, WAC-340-360(5). State and community acceptance will be evaluated during public review and comment on the draft SCAP. The final SCAP will be modified based on the comments received.

Ecology, Chapter 90.48 RCW, Water Pollution Control. Construction design and implementation shall include measures to prevent any discharge into any

waters of the state any organic or inorganic matter that shall cause or tend to cause pollution of such waters according to the determination of Ecology.

Ecology, Chapter 70.105 RCW, Hazardous Waste Management. Remedial action shall not allow for handling and disposal of dangerous wastes in any manner not in compliance with the Act and Chapter 173-303 WAC.

State Environmental Policy Act (SEPA - Chapter 43.21C RCW) and SEPA Rules (Chapter 197-11 WAC). Rules on the integration of MTCA and SEPA provided in WAC 197-11-250 through -268 list applicable requirements for the project. Implementation of the site remediation action triggers SEPA environmental review (e.g., SEPA checklist), threshold determination, and public notice. Pursuant to WAC 197-11-060(5) and WAC 197-11-630, a review was done to ensure compliance of the remedial action with SEPA. Ecology issues a Mitigated Determination of Nonsignificance was issued for the site, and a public comment period was conducted concurrent with that for the site-specific RI and Consent Decree CAP.

Puget Sound Air Pollution Control Agency, Regulation I of the Puget Sound Air Pollution Control Agency. The remedial action will be performed so as to not allow the emission of any air contaminants in violation of the visual standard established by Section 9.03 of the regulation. The remedial action will be performed that allows the emission of particulate matter in violation of Section 9.04 of the regulation.

The remedial action will also be performed that allows the emission of air contaminates in violation of Section 9.11 of the regulation. Remedial action shall be performed that allows the emission of fugitive dust in violation of Section 9.15 of the regulation. Equipment utilized on site for the remedial action will be maintained in such a manner as to not be in violation of Section 9.20(b) of the regulation.

Regulation III of the Puget Sound Clean Air Agency. The numerical standards for compliance with air emissions regulations that apply to remedial action on the site are those listed in Appendix A, Acceptable Source Impact Levels, of the regulation. Demolition of buildings, incidental to the site remedial actions, shall be performed in accordance with Sections 4.02 and 4.03 with respect to the removal of asbestos-containing materials.

City of Tacoma, Storm Water Management Manual. Project activities will comply with provisions of the City of Tacoma Storm Water Management Manual and underlying regulations for storm water management in accordance with the National Clean Water Act, the Puget Sound Water Quality

Management Plan, and the National Pollutant Discharge Elimination System Stormwater Permit. For environmental cleanup and redevelopment activities comply with best management practices identified in Section A5 of manual "Construction and Demolition Activities" and Section A6 " Other Activities."

City of Tacoma, Chapter 13.10, Shoreline Regulations. The construction design will include:

- Measures to minimize erosion during and after construction and for the replanting of the site after construction;
- Measures to minimize potential for introducing contaminants to surface waters, depleting and contaminating groundwater, and increasing surface water runoff;
- Provisions for facilities or appurtenances for disposal of sanitary waste and shall monitor the use of chemicals, fertilizers, and other pollutants in such a manner so as to not degrade existing levels of surface water and groundwater quality. Dust control measures, including plants and vegetation where feasible shall be taken; and
- Signs required for safety and security will be allowed. All signs will be of permanent materials.

City of Tacoma, Chapter 70, Uniform Building Code - Excavation and Grading. Grading and excavation requirements include:

- Slope cut surfaces will be no steeper than safe for intended use, and will be no steeper than two horizontal to one vertical (2H:1V). Typical excavation trenches are expected to be 2H:1V. Detrimental amounts of organic material will not be permitted in fill.
- No rock or similar irreducible material with a maximum dimension greater than 6 inches shall be buried or placed in fill.
- The top cut slopes will not be made nearer to a site boundary line than one-fifth of the vertical height of the cut with a minimum of 2 feet and a maximum of 10 feet. The setback may need to be increased for any required interceptor drains or other utilities.
- Unless otherwise indicated on the approved grading plan, drainage facilities and terracing will conform to the provisions of Section 7012 for cut or fill slopes steeper than 3H:1V.

- The faces of cut and fill slopes will be prepared and maintained to control against erosion. This control may consist of effective planting. The protection for slopes will be installed as soon as practicable and prior to calling final approval.

City of Tacoma, Chapter 12.08 City Code. The project will comply with provisions for acceptance of any water generated discharged into the City sanitary or storm sewer systems.

Tacoma Pierce County Health Department, Waste Disposal Authorization. The project will comply with provisions for acceptance of any soils to be disposed of at the City of Tacoma Municipal Landfill according to criteria developed for the facility.

SCHEDULE FOR IMPLEMENTATION

The cleanup action described in this SCAP will be completed within a reasonable time frame. Factors to be considered in establishing the cleanup time frame shall be in accordance with WAC 173-340-360(6). The following tasks are planned for implementation of this cleanup action.

Task 1 — Submit to Ecology a Draft Engineering Design Report (EDR), construction plans and specifications, maintenance plan, compliance monitoring plan, and financial assurance documents (hereafter "Remedial Design Documents").

Schedule. Within one year of entry by the court of the amendment to the Area-Wide Consent Decree to include the SCAP for this site.

Task 2 — Submit final documents listed in Task 1 that incorporate Ecology's comments on the draft documents.

Schedule. Within 30 days of receipt of Ecology's comments on the drafts.

Task 3 — Begin implementation of SCAP.

Schedule. In accordance with the schedule approved in the Remedial Design documents.

Task 4 — Submit as-built documentation of the cleanup and final financial assurance documents and procedures for periodic

adjustment.

Schedule. In accordance with the schedule approved in the Remedial Design documents.

Task 5 Perform long-term monitoring, operation and maintenance.

Schedule. In accordance with the schedule approved in the Remedial Design Documents.

REFERENCES

Hart Crowser 2001a. Draft Final Dock Street (North) Site-Specific Remedial Investigation, Thea Foss Upland Properties. June 25, 2001.

Hart Crowser 2001b. Use of MTCA Amendments, 2001 Memorandum, Thea Foss Upland Properties along Dock Street and North of South 15th Street. November 2, 2001.

Hart Crowser 2002. Additional Soils and Groundwater Samples Analytical Results Memorandum, Dock Street ROW near South 15th Street. April 16, 2002.

State of Washington Department of Ecology v. City of Tacoma and Metropolitan Park District of Tacoma, Consent Decree 94-10917 6, filed October 7, 1994.

Thea Foss Waterway Public Esplanade and Dock Street Phase I, Tacoma, Washington, Design Development Phase I. July 10, 1998.

F:\docs\jobs\1715600\Draft Dock Street North SCAP.doc

Site 4A-B

Table 1 - Summary of Soil Exceedances
Dock Street North ROW

Analyte Group	Analyte Name	Analyte Value in mg/kg	Qualifier	Depth in Feet	Sampling Date	Sample ID	MTCA Screening Level in mg/kg
Metals, Total	Arsenic	179		0 to 4	2/14/2001	DSN-B07-S-1	20
PAHs	Total cPAHs BaP	0.545 TE		2 to 3.5	9/15/1997	R15-B02-2-3.5	0.137
PAHs	Total cPAHs BaP	3.746 TE		7 to 8.5	9/15/1997	R15-B02-7-8.5	0.137
PAHs	Total cPAHs BaP	0.609 TE		9.5 to 11	9/15/1997	R15-B02-9.5-11	0.137
PAHs	Total cPAHs BaP	0.326 TE		4 to 5.5	9/15/1997	R15-B03-4-5.5	0.137
PAHs	Total cPAHs BaP	0.508 TE		6.5 to 8	9/15/1997	R15-B03-6.5-8	0.137
PAHs	Total cPAHs BaP	15.13 TE		7 to 8	12/12/2001	DSN-B12-S-1	0.137
PAHs	Total cPAHs BaP	0.248 TE		7 to 8.5	12/12/2001	DSN-B14-S-1	0.137

TE = Toxicity Equivalent
Explorations R15-B02 and R15-B03 are located adjacent to Dock Street North ROW excavation areas. Soil data for these borings are presented for reference purposes.

Site 4A-B

Table 2 - Summary of Groundwater Exceedances
Dock Street North ROW

Analyte Group	Analyte Name	Analyte Value in ug/L	Qualifier	Sampling Date	Sample ID	MTCA Screening Level in ug/L
Metals, Dissolved	Arsenic	1.0	J	3/20/2001	DSN-MW01	0.14
Metals, Dissolved	Arsenic	1.8	J	3/20/2001	DSN-MW02	0.14
Metals, Dissolved	Arsenic	1.7		2/14/2001	DSN-B02	0.14
Metals, Dissolved	Arsenic	4.8		2/14/2001	DSN-B08	0.14
BTEX	Benzene	170		2/14/2001	DSN-B08	71

J - Indicates associated value is estimated

Site 4A-B

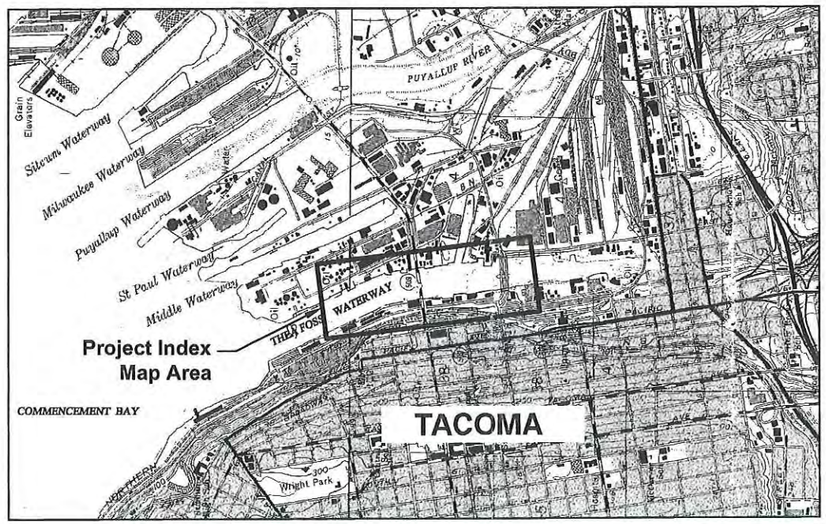
Site 4A-B

Figures

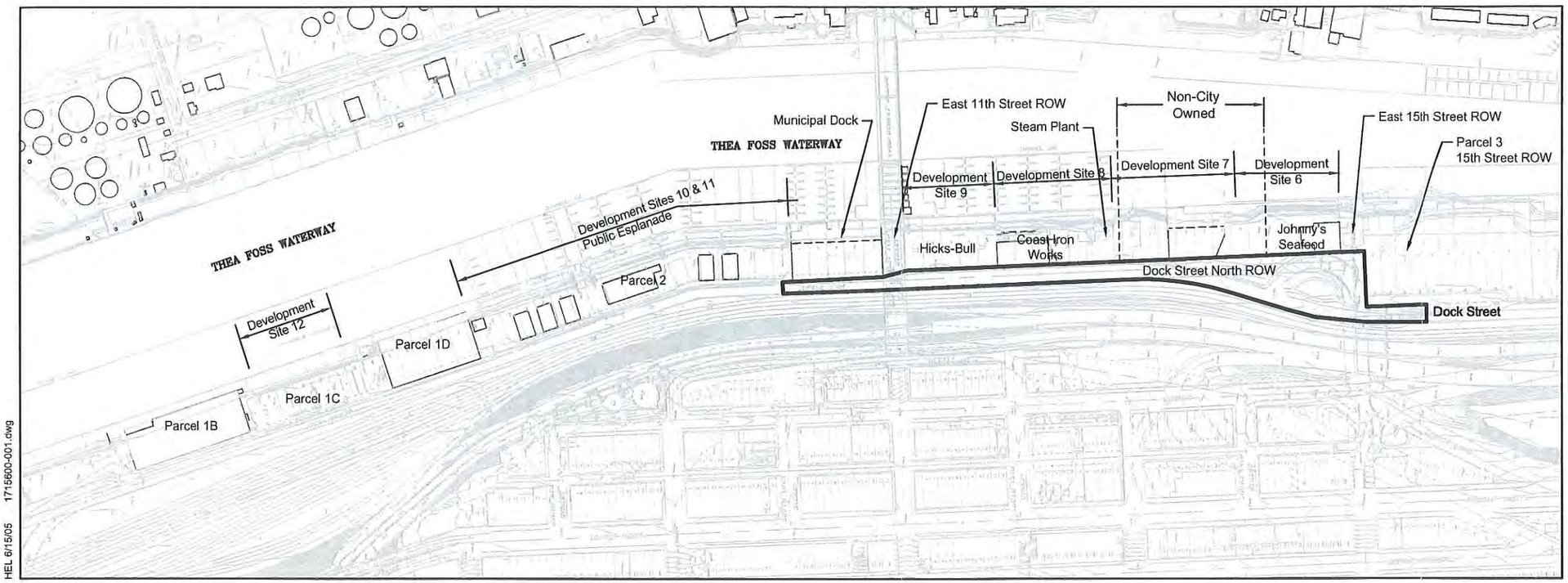
Site 4A-B

Vicinity Map

Regional Vicinity Map



Project Index Map

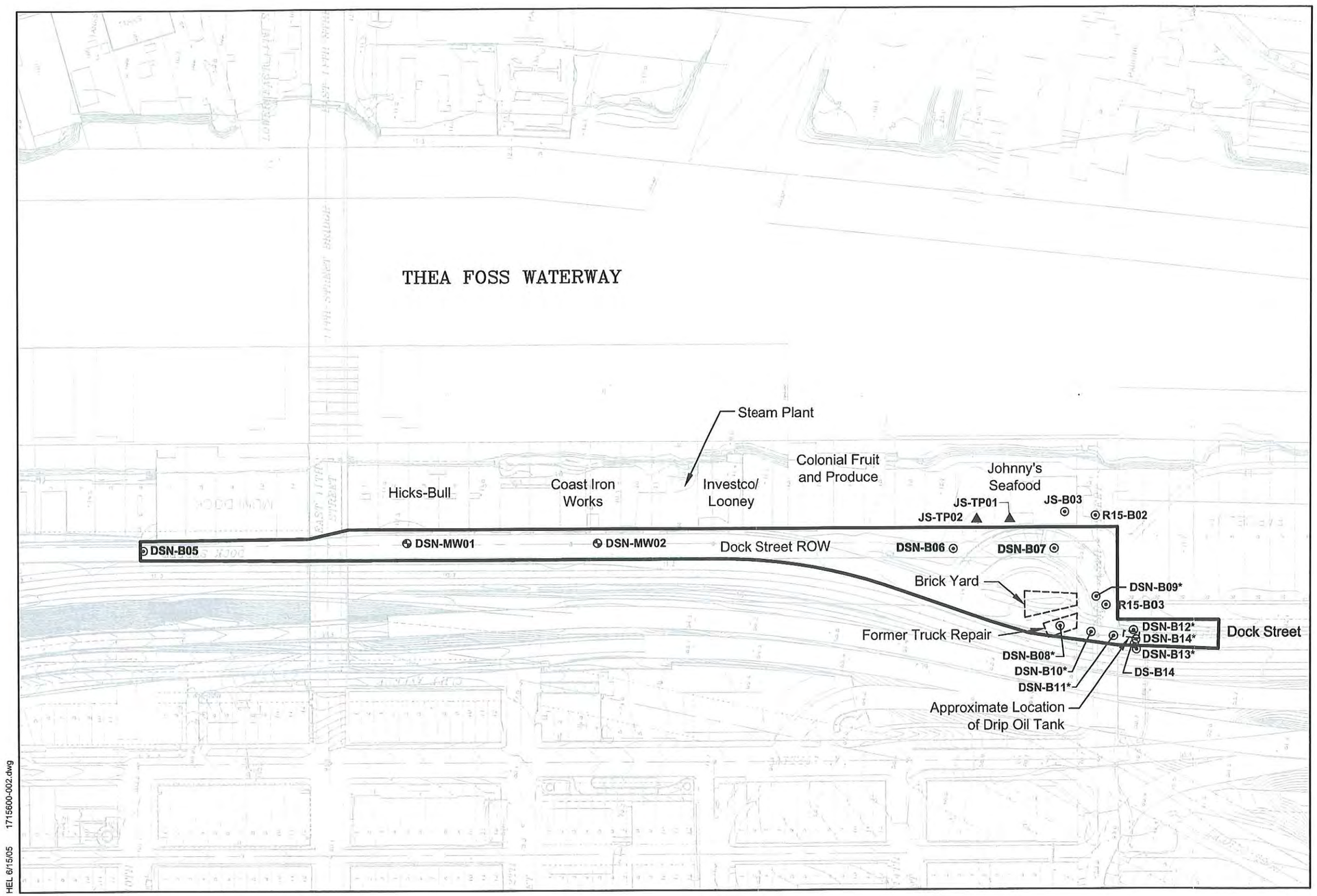


HEL 6/15/05 1715600-001.dwg

HARTCROWSER
17156-00 6/05
Figure 1

Site 4A-B

Site Exploration Plan with Significant Historical Features
Dock Street North ROW



Exploration Location and Number

DSN-B01* ⊙ Boring — Indicates Grab Groundwate Sample Collected

DSN-MW01 ⊕ Monitoring Well

JS-TP02 ▲ Test Pit

Potentially Significant Historical Area

N

0 200 400

Scale in Feet

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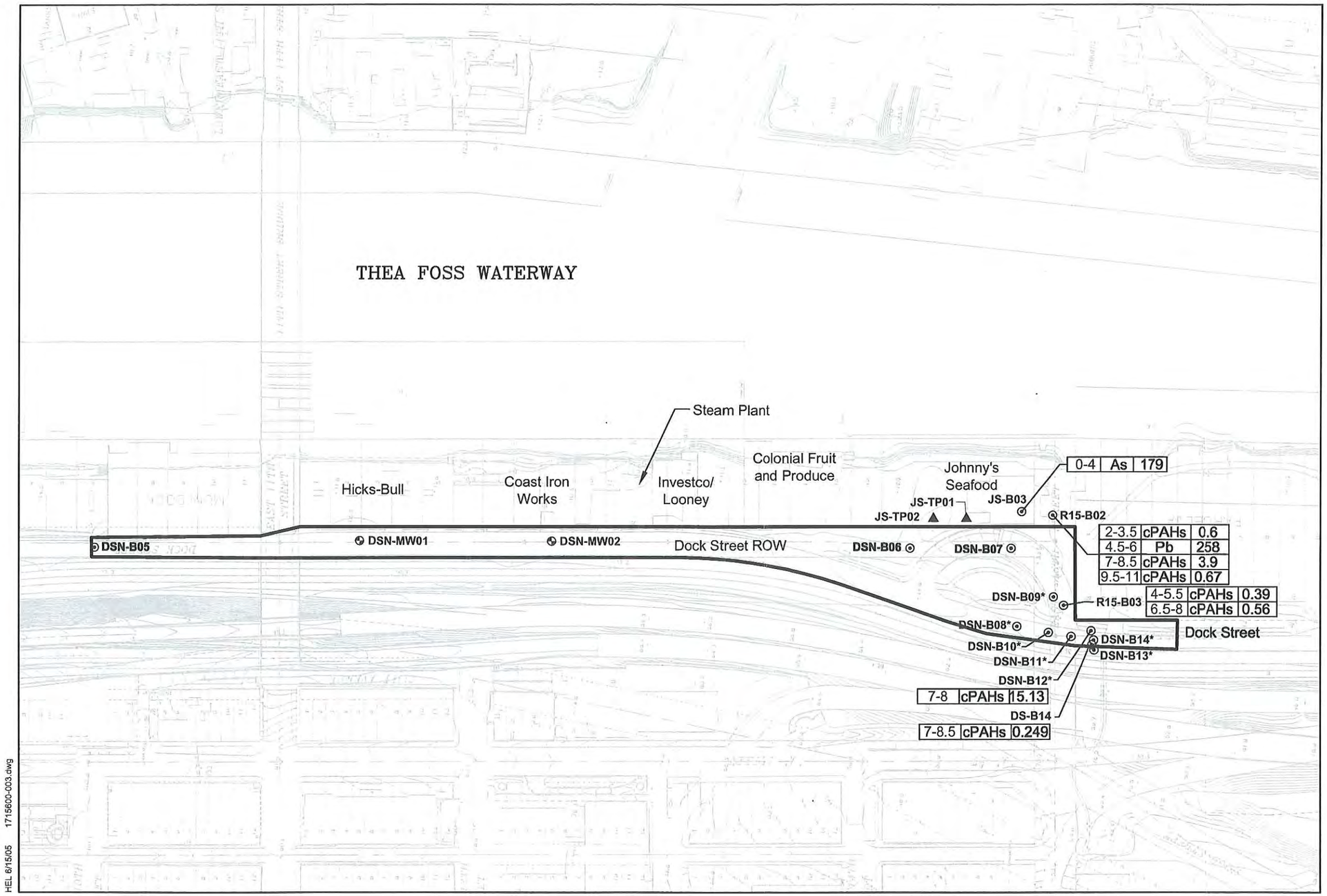
17156-00 *6/05*

Figure 2

Site 4A-B

Soil Exceedance Data Summary
Dock Street North ROW



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Exploration Location and Number

DSN-B01* ⊙ Boring

Indicates Grab Groundwate Sample Collected

DSN-MW01 ⊗ Monitoring Well

JS-TP02 ▲ Test Pit

Constituent

As Arsenic

cPAHs cPAHs

Pb Lead

[0-4] Sample Depth in Feet

[179] Concentration in mg/kg (Where one or more cPAH Compound exceeds the Cleanup Level the total cPAH Concentration is shown)

N

0 200 400

Scale in Feet

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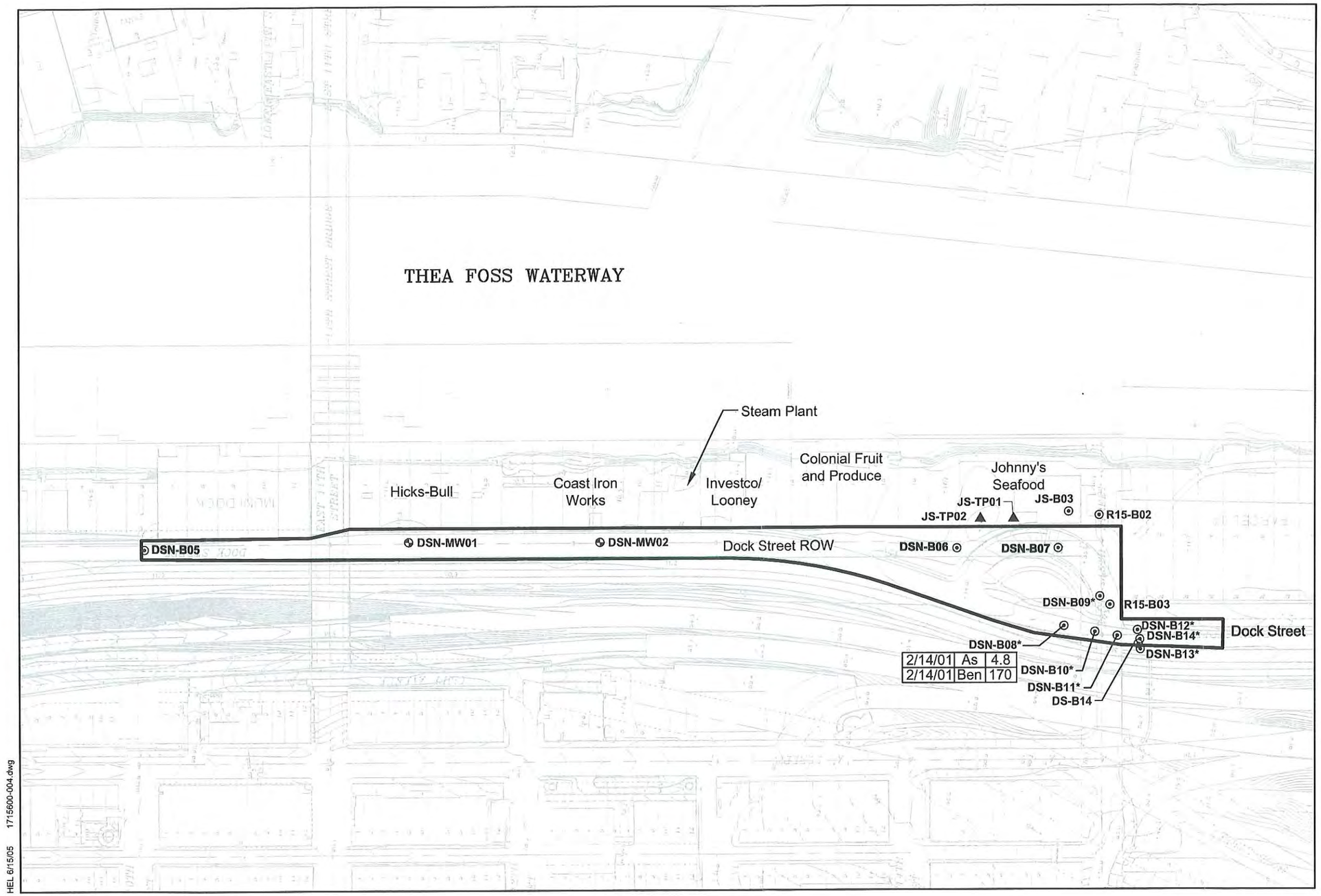
17156-00 *6/05*

Figure 3

Site 4A-B

Groundwater Exceedance Data Summary
Dock Street North ROW



Exploration Location and Number

DSN-B01* ⊙ Boring

Indicates Grab Groundwate Sample Collected

DSN-MW01 ⊕ Monitoring Well

JS-TP02 ▲ Test Pit

Constituent

As Arsenic

Ben Benzene

2/14/01 Date Sampled

4.8 Concentration in ug/L

N

0 200 400

Scale in Feet

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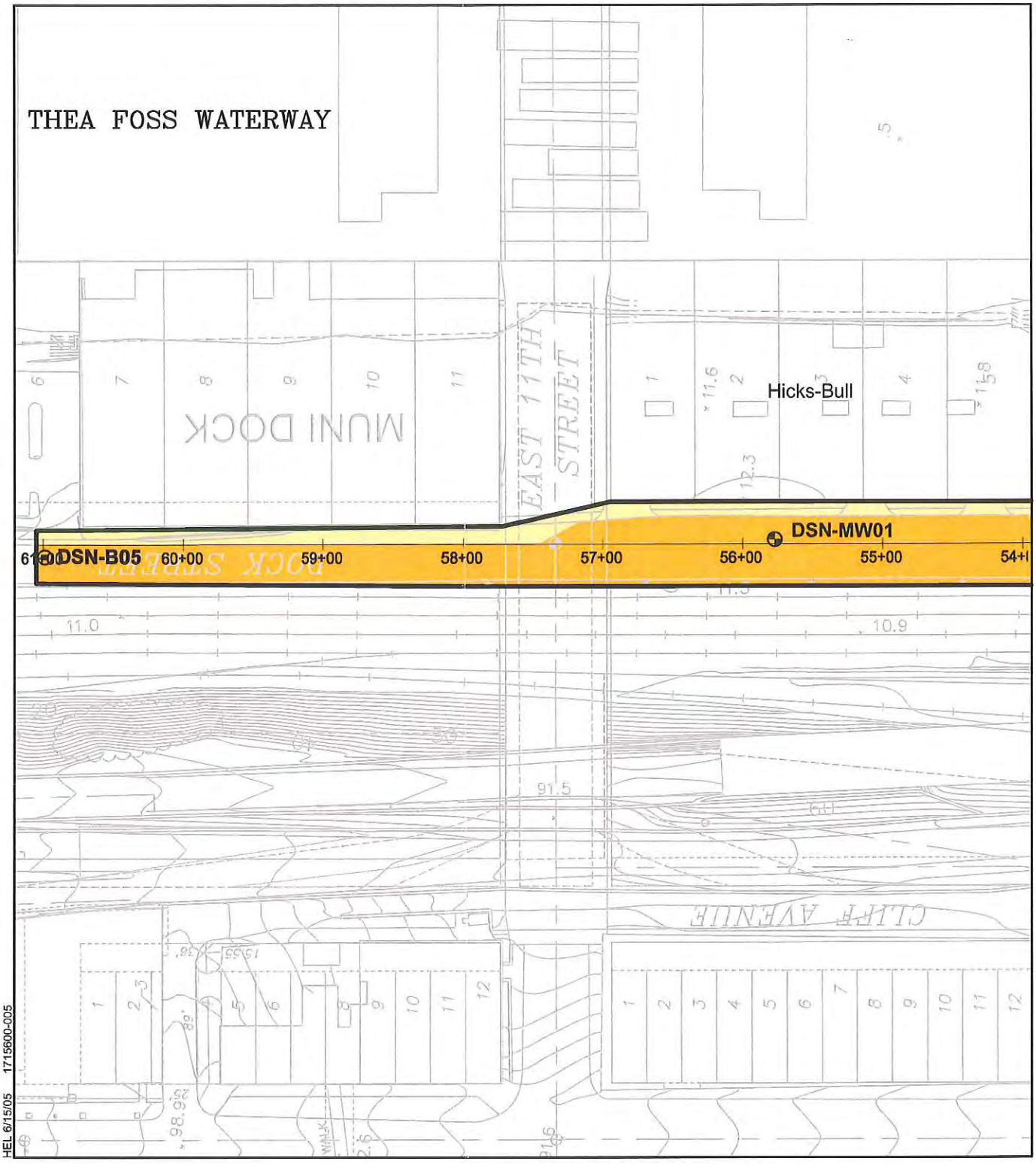
17156-00 *6/05*

Figure 4

Site 4A-B

Proposed Cleanup Action Plan
Dock Street North ROW



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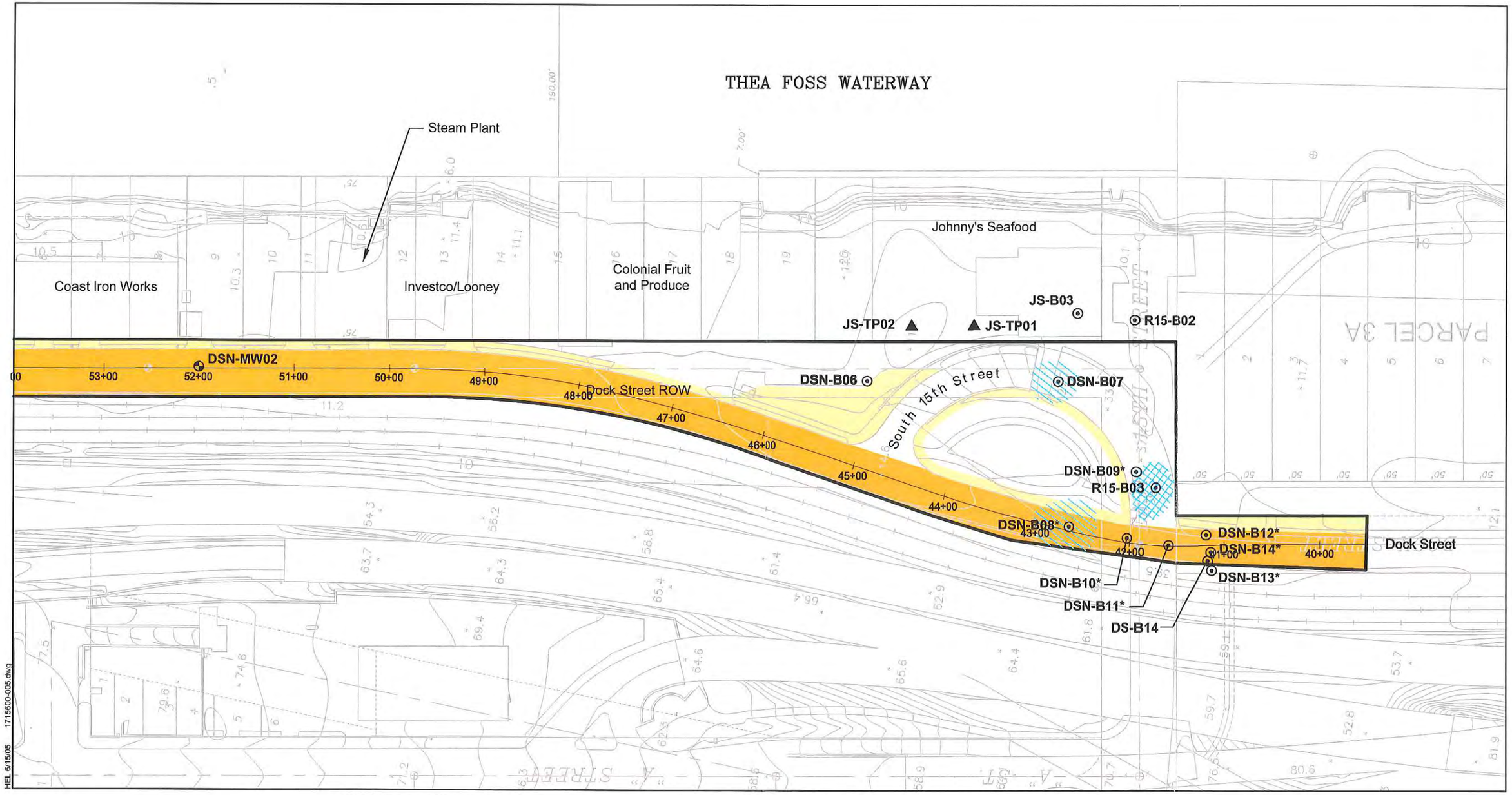
Site 4A-B



Exploration Location and Number

- DSN-B01* ⊙ Boring — Indicates Grab Groundwater Sample Collected
- DSN-MW01 ⊕ Monitoring Well
- JS-TP02 ▲ Test Pit

Area of Potential Soil Cleanup

- 0 to 4 Feet
- 4 to 10 Feet
- Extent of Sidewalk and Soil Cover
- Extent of Pavement Cap

N

0 100 200

Scale in Feet

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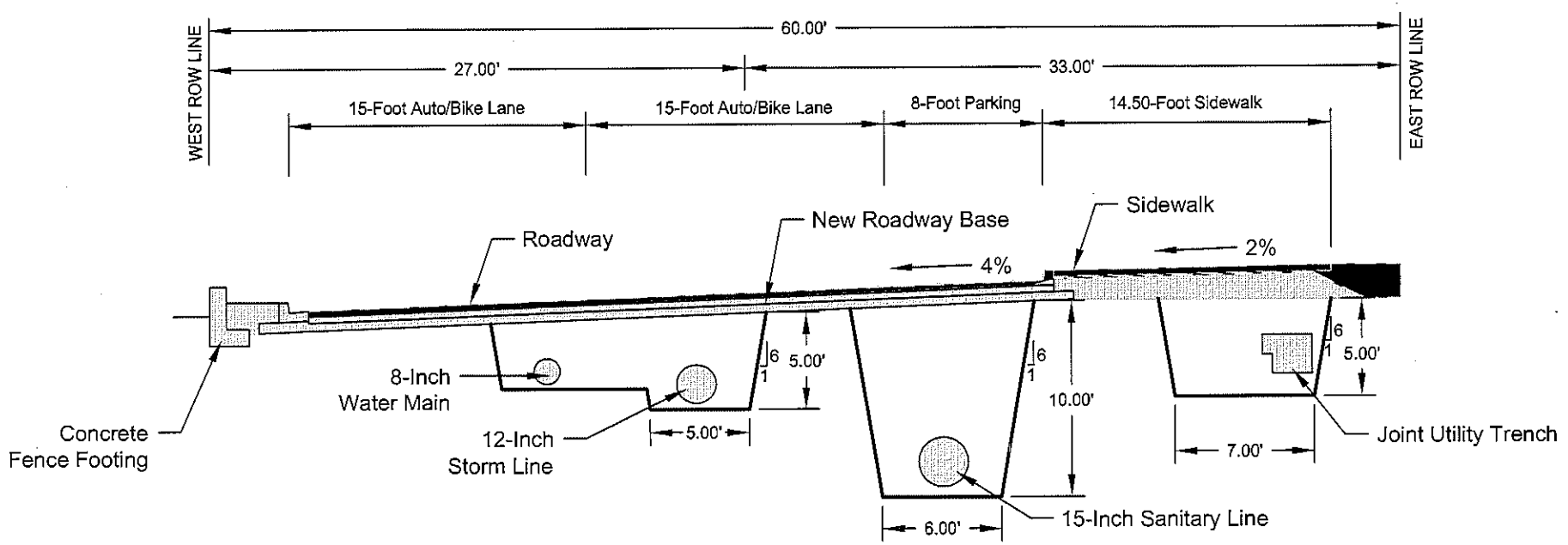
Figure 5

Cross Section of Cleanup Action Plan
Dock Street North ROW



Source: Base map prepared from drawing provided by...

0 8 16
Scale in Feet

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Figure 6

Site 4A-B

Site 4A-B

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'02 OCT 28 A11 :27

Anchorage

MEMORANDUM

Boston

DATE: April 16, 2002

TO: Bill Iyall, City of Tacoma

FROM: Joe Morrice and Barry Kellems, Hart Crowser

Denver

RE: **Additional Soil and Groundwater Samples Analytical Results**
Dock Street ROW near South 15th Street
4676-70

Edmonds

This memorandum presents analytical results for soil and groundwater samples collected in the Dock Street Right of Way (ROW) near South 15th Street (Figure 1). This sampling had two related purposes. The first was to define the extent and source area of benzene previously detected in groundwater above applicable cleanup levels at location DSN-B08. One possible source area identified prior to this investigation was a former coal gas drip oil tank that was encountered and removed during utility upgrades in Dock Street south of 15th Street (location shown on Figure 1). The Washington State Department of Ecology (Ecology) expressed concern that an adequate level of soil and groundwater sampling had not been performed in association with this tank removal. Therefore, the second purpose of the current sampling and analysis was to provide soil and groundwater quality data in the vicinity of the former tank to support tank closure.

Eureka

Jersey City

This work supplements the previous Site-Specific Remedial Investigation (RI) performed for Dock Street North of 15th Street (Hart Crowser 2001a). Site investigation and cleanup of the Dock Street ROW is being conducted under Consent Decree 94-10917 6 between the Ecology and the City of Tacoma and Metropolitan Parks District of Tacoma. Cleanup levels for soil and groundwater (Table 1) developed as part of the Consent Decree were used to screen chemistry data presented in this memorandum.

Juneau

Long Beach

SUMMARY OF PREVIOUS INVESTIGATIONS

Portland

Results of previous soil and groundwater investigations are presented in the RI reports for the Dock Street ROW for south and north of 15th Street (Hart Crowser 2000 and 2001a). Documentation of the tank removal and results of associated soil quality analyses are

Seattle

1910 Fairview Avenue East
Seattle, Washington 98102-3699
Fax 206.328.5581
Tel 206.324.9530

Site 4A-B

presented in the Dock Street Closure Report for south of 15th Street (Hart Crowser 2001b). The following sections summarize relevant results of the RIs and the tank removal work.

Soil and Groundwater Quality Results from Remedial Investigations

There are three Strataprobe explorations (DS-B14, DSN-B07, and DSN-B08 as shown on Figure 1) from previous investigations in the Dock Street ROW near South 15th Street. Soil samples from each of the borings were submitted for chemical analysis. A groundwater sample from DSN-B08 was also collected and submitted for analysis. Analytical results from these explorations are presented in Tables 2 through 7.

Soil samples from DS-B14, located immediately west of the former tank, were non-detect for diesel-, oil-, and gasoline-range hydrocarbons; benzene, toluene, ethylbenzene, and total xylenes (BTEX); and polycyclic aromatic hydrocarbons (PAHs). No groundwater sampling was performed at this location.

PAHs and diesel- and oil-range hydrocarbons were either not detected or were detected at concentrations below cleanup levels in soil samples collected from DSN-B07, located approximately 60 feet east of Dock Street. Analyses were not performed for gasoline-range hydrocarbons or BTEX. Groundwater samples were not collected at this location.

Soil samples from DSN-B08 were non-detect for PAHs and gasoline- and diesel-range hydrocarbons. Very low concentrations of oil-range hydrocarbons (51 mg/kg) were detected in a shallow soil sample from this boring. A groundwater sample collected from this boring was non-detect for gas-, diesel-, and oil-range hydrocarbons. However, benzene was detected at a concentration of 170 ug/L, exceeding the cleanup level of 71 ug/L. Low concentrations of toluene (2 ug/L) and xylenes (5.7 ug/L) were also detected. The benzene detection at this location prompted the current round of investigation.

Tank Removal

In March 2000, a 1,100-gallon UST was removed at the location shown on Figure 1. The tank is thought to have been a drip oil tank for coal gas supply lines. Several parties sampled the tank contents (water and non-aqueous product), including the City, Hart Crowser, and CeCon, a tank removal contractor. The analytical results for these samples are presented in Table 8 as Tank Water, Tank Product, and Dock "L" (a product sample). Both water and product in the tank had extremely high BTEX concentrations, with benzene concentrations in water as high as 430,000 ug/L.

The tank was beneath both an active natural gas line and an abandoned 6-inch coal gas line extending north-south along Dock Street. The abandoned line appears to parallel the active gas line, which is shown on Figure 1. Segments of the abandoned line were reportedly removed to a distance of 50 feet south and 10 feet north of the tank. This line was encountered at other locations in Dock Street where it occasionally contained liquid with a petroleum-like odor. The occurrence of this liquid was reportedly more frequent between the South 15th Street and South 18th Street ROWs. Liquid encountered in the line was drained, collected in a drum, and later analyzed for BTEX. The four BTEX compounds (presented as 6-inch-Diameter Line Liquid in Table 8) were detected at high concentrations, with a benzene concentration of 12,000 ug/L.

ADDITIONAL SAMPLING AND ANALYSIS RESULTS

Six soil borings (DSN-B09 through DSN-B14) were drilled on December 12, 2001, using a Strataprobe direct push drill rig. Boring logs for these and previous explorations at the site are included in Attachment A. DSN-B12, DSN-B13, and DSN-B14 were drilled downgradient, upgradient, and at the location of the former tank, respectively, to assess whether there are any ongoing environmental impacts associated with the tank. DSN-B09 was drilled to help delineate the downgradient extent of the benzene detected in groundwater at DSN-B08. DSN-B10 and DSN-B11 were drilled between DSN-B08 and the likely location of the former coal gas line. DSN-B10 is also located next to the utility trench for a 60-inch storm drain, which may be acting as a preferential flow path.

Generally, soils encountered consisted of 1 to 9 feet of sand and gravel fill over mixed sand and silt fill. Wood was encountered in borings DSN-B11 and DSN-B12, and brick debris was encountered in borings DSN-B11 and DSN-B13. A benzene or gasoline-like odor was also noted at the bottom of DSN-B10.

One soil and one groundwater sample from each boring were collected at the water table. These samples were submitted for analysis of gasoline-range hydrocarbons and BTEX. Samples from borings DSN-B12 and DSN-B14, located at and downgradient from the former tank, were also submitted for analysis of PAHs. Results of soil and groundwater chemical analyses are presented in Tables 2 through 7.

Individual PAHs were detected in soil at both locations (DSN-B12 and DSN-B14). Total carcinogenic PAHs (cPAHs), expressed as a benzo(a)pyrene (BaP) equivalent based on toxicity equivalency factors, exceed cleanup levels at both locations. It is important to note that the individual cPAHs analyzed for in the tank product samples (benzo(a)anthracene,

benzo(a)pyrene, benzofluoranthenes, and chrysene) were not detected above a detection limit of 0.93 mg/kg. This detection limit is higher than the detected concentrations at DSN-B14, but significantly lower than the concentrations at DSN-B12. Therefore, although the tank may reasonably be the source of cPAHs in soil at DSN-B14, it is most likely not the source at DSN-B12. A more likely source of PAHs at DSN-B12 is the wood encountered at the bottom of the boring, which may be a remnant of creosote-treated decking or pilings.

Very low concentrations of PAHs, well below cleanup levels, were detected in groundwater at DSN-B12, downgradient from the former tank. PAHs were not detected in groundwater at DSN-B14. This indicates that the detect PAHs in soil are not significantly impacting groundwater.

Gasoline-range hydrocarbons and BTEX were not detected in soil samples from any location sampled during this study. These constituents were also not detected in groundwater samples collected from DSN-B12 and DSN-B13, located downgradient and upgradient from the tank. Gasoline-range hydrocarbons and one or more of the BTEX constituents were detected in the other four groundwater samples collected from the new borings, in addition to the BTEX detections at previous boring DSN-B08.

Analytical results for gasoline and BTEX in groundwater are shown graphically on Figure 1. Locations of gasoline and BTEX detections in groundwater are downgradient of the likely position of the abandoned 6-inch coal gas line, with the highest concentrations occurring near the 60-inch storm line at DSN-B08 and DSN-B10. This distribution indicates that the coal gas line is the most likely source for these constituents, with the storm line acting as a preferential flow path. A groundwater sample from DSN-B09 was non-detect for benzene, indicating that any benzene plume is not very wide-spread downgradient from DSN-B08.

CONCLUSIONS AND RECOMMENDATIONS

Analytical results indicate that cPAHs remain in soil at the former tank location above Consent Decree cleanup levels. Elevated cPAHs were also detected at DSN-B12, but do not appear to be associated with the former tank, as the concentrations of several constituents at this location are higher than concentrations in product samples from the tank. No cPAH groundwater impacts above Consent Decree cleanup levels were identified. Because groundwater is not impacted and the existing paved street effectively limits potential direct exposure, excavation of these soils is not necessary under the terms of the Consent Decree. If future subsurface utility work is performed at these locations, any excavated soils should be stockpiled and tested for proper disposal or reuse.

Gasoline-range hydrocarbons and BTEX were detected in groundwater at several locations. The detections were below Consent Decree cleanup levels, with the exception of the benzene detection at DSN-B08. No soil source was identified. However, the distribution of detections indicates that the 6-inch former coal gas line is the most likely source, with the 60-inch storm line acting as a preferential flow path allowing contaminants to migrate to DSN-B08. A groundwater sample collected downgradient from DSN-B08 was non-detect for benzene, indicating any plume does not extend far downgradient.

Based on the benzene-impacted groundwater, some form of source removal will most likely be required. As work progresses on Dock Street north of 15th Street, the continuation of the former coal gas line should be identified and removed. Any liquid within the line should be collected and tested to determine whether it is in fact the source of benzene. Similarly, soils immediately adjacent to the line should be tested to determine whether they have been impacted by the line and could be acting as a source of benzene to groundwater.

Attachments:
References
Table 1 – Soil and Groundwater Cleanup Levels and Soil Contamination Maximums
Table 2 – Carcinogenic PAH Results for Soil Samples
Table 3 – Non-Carcinogenic PAH Results for Soil Samples
Table 4 – BTEX and TPH-G Results for Soil Samples
Table 5 – Carcinogenic PAH Results for Groundwater Samples
Table 6 – Non-Carcinogenic PAH Results for Groundwater Samples
Table 7 – BTEX and TPH Results for Groundwater Samples
Table 8 –Chemical Analysis Results Associated with Tank and 6-inch Line Removal
Figure 1 – Site and Exploration Plan with Selected Groundwater Quality Data
Attachment A – Strataprobe Boring Logs

F:\docs\jobs\467670\BenzeneExplorationMemo.doc

Site 4A-B

REFERENCES

Hart Crowser 2000. Final Dock Street ROW Site-Specific Remedial Investigation. Thea Foss Uplands Property Consent Decree 94-10917-6. April 2000.

Hart Crowser 2001a. Draft Dock Street ROW (North) Site-Specific Remedial Investigation. Thea Foss Uplands Property Consent Decree 94-10917-6. June 2001.

Hart Crowser 2001b. Site Closure Report, Dock Street Right of Way Including Portions of Adjacent Parcels 7, 9, and 10. Thea Foss Upland Properties Consent Decree 94-10917 6. October 2001.

F:\docs\jobs\467670\BenzeneExplorationMemo.doc

Site 4A-B

Table 1 - Soil and Groundwater Cleanup Levels and Soil Contamination Maximums

Constituent	Soil Cleanup Level in mg/kg	Maximum Soil Concentration in mg/kg	Groundwater Cleanup Level in ug/L
TPH[a]:			
Gasoline-Range Organics (BTEX Restrictions)	**100**	5,000	**1,000**
Gasoline-Range Organics (All other GRO)	**30**	5,000	**800**
Diesel-Range Organics	**2,000**	5,000	**500**
Heavy Oil	**2,000**	5,000	**500**
Benzene	34.5	250	71.0
Toluene	16,000	5,000	200,000
Ethylbenzene	8,000	5,000	29,000
Xylenes	160,000	5,000	16,000
Total cPAHs (as BAP)[d]	**0.137**	10.0	0.031
Antimony	32.0	320	4,300
Arsenic	**0.7** (20[b])	200	**0.14**[g]
Cadmium	80.0	400	**9.3**[f]
Chromium (VI)[e]	**240**	4,000	50.0
Copper	2,960	29,600	**3.1**[f]
Lead	250[c]	2,500	**8.1**[f]
Mercury	24.0	240	0.025
Nickel	1,600	16,000	**8.2**[f]
Zinc	24,000	240,000	**81**[f]
PCB (Total)	**0.5**	50.0	0.030

Notes:

Bold values have been revised from original Table 1 in the Consent Decree to reflect new MTCA Amendments of February 2001.

[a] TPH cleanup criteria are based on Method A Cleanup Standards. TPH Cleanup levels may be adjusted using site-specific risk assessment procedures outlined in MTCA Method B and C equations.

[b] The arsenic Method B risk-based cleanup standard is 0.7 mg/kg, while the cleanup level based on Washington State background is 20 mg/kg. The arsenic Method B and C soil cleanup criteria no longer use a GI absorption fraction of 0.4.

[c] Soils cleanup levels for lead are not defined under Method B or Method C. The Method A cleanup level is used for the direct contact value.

[d] Total cPAHs calculated using toxicity equivalent methodology presented in WAC 173-340-708(8).

[e] The chromium VI cleanup standards are based on an updated oral reference dose of 0.003 mg/kg/day (previous oral RfD was 0.005 mg/kg/day).

[f] Cleanup standard based on WAC 173-201A Marine Water Chronic.

[g] Cleanup standard based on Federal Ambient Water Quality Criteria (40CFR 131) for human consumption of aquatic organisms

Table 2 - Carcinogenic PAH Results for Soil Samples
Dock Street

Sample I.D.	Date Sampled	Units	Benzo(a) anthracene	Benzo(a) pyrene	Total Benzo-fluoranthenes	Chrysene	Dibenz(ah) anthracene	Indeno (1,2,3-cd)pyrene	Total cPAHs BaP
DS-B14-1-4	9/17/1997	mg/kg	0.095 U	0.095 U	0.095 U	0.095 U	0.095 UJ	0.095 UJ	ND
DS-B14-13-16	9/17/1997	mg/kg	0.099 U	0.099 U	0.099 U	0.099 U	0.099 UJ	0.099 UJ	ND
DS-B14-7-10	9/17/1997	mg/kg	0.099 U	0.099 U	0.099 U	0.099 U	0.099 UJ	0.099 UJ	ND
DSN-B07-S-1	2/14/2001	mg/kg	0.11	0.099 UJ	0.16 J	0.099 U	0.099 UJ	0.099 UJ	0.072
DSN-B07-S-3	2/14/2001	mg/kg	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	ND
DSN-B07-S-4	2/14/2001	mg/kg	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	ND
DSN-B08-S-1	2/14/2001	mg/kg	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	ND
DSN-B08-S-3	2/14/2001	mg/kg	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	ND
DSN-B12-S-1	12/12/2001	mg/kg	13.0	11.0	15.0	16.0 J	1.0	5.0	15.13
DSN-B14-S-1	12/12/2001	mg/kg	0.291	0.185	0.311	0.347 J	0.092 U	0.092 U	0.249

U - Indicates value was not detected at associated detection limit
J - Indicates value was estimated
ND - Not detected.

Site 4A-B

Table 3 - Non-Carcinogenic PAH Results for Soil Samples
Dock Street

Sample I.D.	Date Sampled	Units	2-Methyl-naphthalene	2-Chloro-naphthalene	Benzo(g,h,i) perylene	Acenaph-thene	Acenaph-thylene	Anthra-cene	Fluoran-thene	Fluorene	Naph-thalene	Phenan-threne	Pyrene
DS-B14-1-4	9/17/1997	mg/kg	0.095 U	0.095 U	0.095 UJ	0.095 U	0.095 U	0.095 U	0.095 U	0.095 U	0.095 U	0.095 U	0.095 U
DS-B14-13-16	9/17/1997	mg/kg	0.099 U	0.099 U	0.099 UJ	0.099 U	0.099 U	0.099 U	0.099 U	0.099 U	0.099 U	0.099 U	0.099 U
DS-B14-7-10	9/17/1997	mg/kg	0.099 U	0.099 U	0.099 UJ	0.099 U	0.099 U	0.099 U	0.099 U	0.099 U	0.099 U	0.099 U	0.099 U
DSN-B07-S-1	2/14/2001	mg/kg	0.099 U	0.099 U	0.099 UJ	0.099 U	0.099 U	0.099 U	0.099 U	0.099 U	0.099 U	0.099 U	0.1
DSN-B07-S-3	2/14/2001	mg/kg	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U	0.094 U
DSN-B07-S-4	2/14/2001	mg/kg	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.076 U	0.07 U
DSN-B08-S-1	2/14/2001	mg/kg	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
DSN-B08-S-3	2/14/2001	mg/kg	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U	0.09 U
DSN-B12-S-1	12/12/2001	mg/kg	0.2		5.0	1.0	0.81	7.0	29.0	2.0	0.26	27.0	43.0
DSN-B14-S-1	12/12/2001	mg/kg	0.092 U		0.092 U	0.092 U	0.092 U	0.094	0.49	0.092 U	0.092 U	0.36	0.61

U - Indicates value was not detected at associated detection limit
J - Indicates value was estimated
Blank indicates sample not analyzed for specific analyte.

Site 4A-B

Site 4A-B

Table 4 - TPH-G and BTEX Results for Soil Samples
Dock Street

Sample I.D.	Date Sampled	Units	Gasoline	Benzene	Toluene	Ethylbenzene	Total Xylenes
DSN-B08-S-2	2/14/2001	mg/kg	4.1 U	0.24 U	0.20 U	0.20 U	0.20 U
DSN-B09-S-1	12/12/2001	mg/kg	4.6 U	0.5 U	0.5 U	0.5 U	0.5 U
DSN-B10-S-1	12/12/2001	mg/kg	4.6 U	0.5 U	0.5 U	0.5 U	0.5 U
DSN-B11-S-1	12/12/2001	mg/kg	4.6 U	0.5 U	0.5 U	0.5 U	0.5 U
DSN-B12-S-1	12/12/2001	mg/kg	4.6 U	0.5 U	0.5 U	0.5 U	0.5 U
DSN-B13-S-1	12/12/2001	mg/kg	4.7 U	0.5 U	0.5 U	0.5 U	0.5 U
DSN-B14-S-1	12/12/2001	mg/kg	4.6 U	0.5 U	0.5 U	0.5 U	0.5 U

U - Indicates value was not detected at associated detection limit

Table 5 - Carcinogenic PAH Results for Groundwater Samples
Dock Street

Sample I.D.	Date Sampled	Units	Benzo(a) anthracene	Benzo(a) pyrene	Total Benzo-fluoranthenes	Chrysene	Dibenz(ah) anthracene	Indeno (1,2,3-cd)pyrene
DSN-B12	12/12/2001	µg/L	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U
DSN-B14	12/12/2001	µg/L	1.1 U	1.1 U	1.1 U	1.1 UJ	1.1 U	1.1 U

U - Indicates value was not detected at associated detection limit
J - Indicates value is estimated

Site 4A-B

Table 6 - Non-Carcinogenic PAH Results for Groundwater Samples
Dock Street

Sample I.D.	Date Sampled	Units	2-Methyl-naphthalene	Benzo(g,h,i) perylene	Acenaph-thene	Acenaph-thylene	Anthra-cene	Fluoran-thene	Fluorene	Naph-thalene	Phenan-threne	Pyrene
DSN-B12	12/12/2001	µg/L	1.0 U	1.0 U	2.0	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.4	1.2
DSN-B14	12/12/2001	µg/L	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U

U - Indicates value was not detected at associated detection limit

Site 4A-B

Site 4A-B

Table 7 - TPH-G and BTEX Results for Groundwater Samples
Dock Street

Sample I.D.	Date Sampled	Units	Gasoline	Benzene	Toluene	Ethylbenzene	Total Xylenes
DSN-B08	2/15/2001	µg/L	500 U	170.0	2.0	0.5 U	5.7
DSN-B09	12/12/2001	µg/L	36.0	1.0 U	1.0 U	1.7	11.0
DSN-B10	12/12/2001	µg/L	68.0	25.0	5.8	3.8	5.2
DSN-B11	12/12/2001	µg/L	14.0	2.0	1.0 U	1.0 U	1.0 U
DSN-B12	12/12/2001	µg/L	10.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DSN-B13	12/12/2001	µg/L	10.0 U	1.0 U	1.0 U	1.0 U	1.0 U
DSN-B14	12/12/2001	µg/L	22.0	3.1	1.0 U	1.0 U	1.0 U

U - Indicates value was not detected at associated detection limit

Site 4A-B

Table 8 - Chemical Analysis Results Associated with Tank and 6-inch Line Removal

Sample ID	Tank Water	Tank Product	Dock "L"	6-Inch-Diameter Line
Matrix	Water	Product	Product	Liquid
Sampler	Hart Crowser	Hart Crowser	CeCon	Hart Crowser
Sampling Date	3/10/2000	3/10/2000	3/24/2000	1/14/2000
Unit	ug/L	mg/kg	mg/kg	ug/L
VOCs				
Acetone	34,000	NA	NA	NA
Benzene	430,000	NA	27,000	12,000
n-Butylbenzene	NA	NA	81	NA
Ethylbenzene	3,200	NA	780	1,000
Isopropylbenzene	NA	NA	26 J	NA
Methylene Chloride	2,000 U	NA	75 U	NA
Naphthalene	NA	NA	950	NA
n-Propylbenzene	NA	NA	63 J	NA
Styrene	13,000	NA	4,000	NA
Toluene	180,000	NA	24,000	17,000
Xylenes	40,000	NA	13,100	7,900
1,3,5-Trimethylbenzene	NA	NA	640	NA
1,2,4-Trimethylbenzene	NA	NA	1,000	NA
SVOCs				
2-Methylnaphthalene	NA	420	340	NA
2-Methylphenol	NA	60	NA	NA
4-Methylphenol	NA	72	NA	NA
Benzo(a)anthracene	NA	10 U	0.93 U	NA
Benzo(a)pyrene	NA	10 U	0.93 U	NA
Benzofluoranthenes	NA	10 U	0.93 U	NA
Benzo(g,h,i)perylene	NA	10 U	0.93 U	NA
Benzoic Acid	NA	560	NA	NA
Benzyl Alcohol	NA	93	NA	NA
bis(2-Ethylhexyl)phthalate	NA	10 U	NA	NA
Chrysene	NA	10 U	0.93 U	NA
Fluoranthene	NA	10 U	0.93 U	NA
Naphthalene	NA	3,600	2,700	NA
Phenanthrene	NA	10 U	2	NA
Phenol	NA	170	NA	NA
Pyrene	NA	10 U	67	NA

Notes: NA – Not analyzed
J - Estimated value
U - Not detected at associated detection limit

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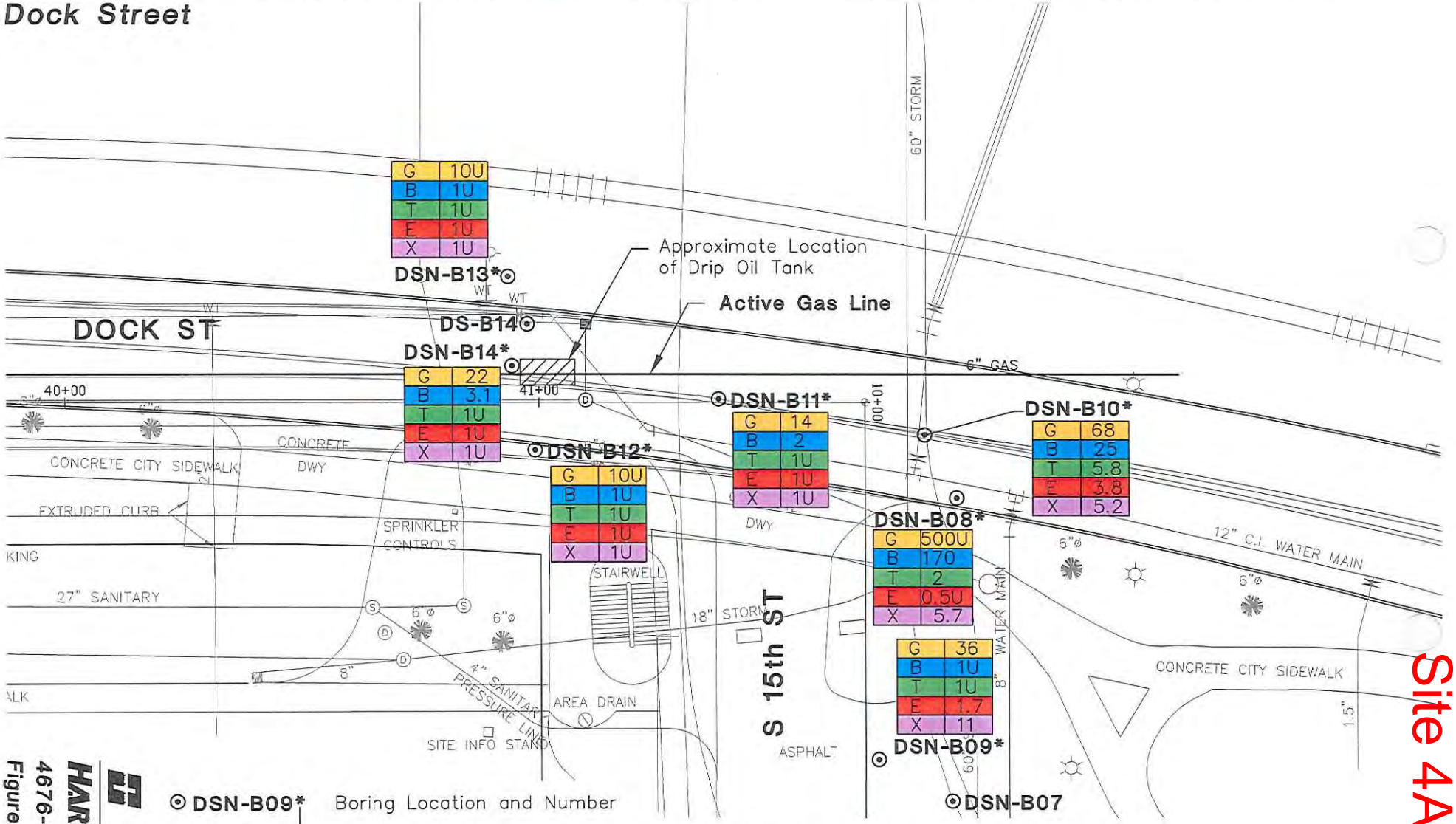
Site and Exploration Plan with Selected Groundwater Quality Data

Dock Street



⊙ DSN-B09* Boring Location and Number

└ Indicates Location of Groundwater Grab Sample

TPH–G/BTEX Analytical Results in Groundwater

G	TPH–Gasoline
B	Benzene
T	Toluene
E	Ethylbenzene
X	Xylenes

U = Not Detected at Associated Detection Limit

Concentrations are in µg/L

N

0 30 60

Scale in Feet

HARTCROWSER 4676-70 4/02 Figure 1

Site 4A-B

Site 4A-B

ATTACHMENT A
STRATAPROBE BORING LOGS

Site 4A-B

Langseth
ENVIRONMENTAL SERVICES, INC.

RECEIVED
MAY 11 2007
Washington State
Department of Ecology

April 18, 2007

Scott Morse
Active Construction, Inc.
P.O. Box 191
Gig Harbor, WA 98335

RE: Underground Gasoline Storage Tank Removal Project

Dear Mr. Morse:

Enclosed is the *UST Site Assessment Report, Addendum #1,* for the recently completed underground gasoline storage tank (UST) removal project at the City of Tacoma Dock Street Project in Tacoma, WA. As summarized in the report, visual and olfactory observations and field screenings indicated that petroleum-contaminated soil (PCS), above the MTCA Method A cleanup level for unrestricted land use, was detected in the UST pit area. The soil sample obtained from under the removed UST, subsequent to PCS excavation at approximately 10' below ground surface (bgs) was at the non-detect level. Because of the location of the UST pit, no additional safe PCS excavation was possible. No groundwater was encountered during the project. This tank removal project is now complete.

Thank you again for the opportunity to work with you on this project. Please give me a call if you have any questions regarding this or any future projects.

Sincerely,

Tom Langseth
Langseth Environmental Services, Inc.

Cc: Mark Henry, City of Tacoma, Public Works Construction Division
Rob Olson, Tacoma Pierce County Health Department
Washington State Department of Ecology, SW Regional Office

7517 Portland Avenue, Suite A, Tacoma, WA 98404 • Phone: (253) 536-6961 • Fax: (253) 548-0201
E-Mail: Langsethes@email.com

Site 4A-B

Langseth
ENVIRONMENTAL SERVICES, INC.

UST SITE ASSESSMENT REPORT
ADDENDUM #1

Dock Street Site

SITE LOCATION:
City of Tacoma Dock Street Project
Tacoma, WA

PROPERTY OWNER / SITE CONTACTS:
City of Tacoma
C/O Mark Henry
Public Works Construction Division
253-591-5771

Active Construction
C/O Scott Morse
Operations Manager
253-606-9455

Underground Gasoline Storage Tank
Removal Project

April 18, 2007

7517 Portland Avenue, Suite A, Tacoma, WA 98404 • Phone: (253) 536-6961 • Fax: (253) 548-0201
E-Mail: Langsethes@email.com

Site 4A-B

UST SITE ASSESSMENT REPORT
ADDENDUM # 1

DOCK STREET SITE

W.D.O.E. Site ID # Not Registered

SITE LOCATION:
City of Tacoma Dock Street Project
Tacoma, WA 98402

PROPERTY OWNER & PROJECT CONTACTS:
City of Tacoma
C/O Mark Henry
Public Works Construction Division
253-591-5771

Active Construction, Inc.
C/O Scott Morse
253-606-9455

Underground Gasoline Storage Tank
Removal Project

This report was compiled by Tom Langseth, registered and licensed with the Washington State Department of Ecology to perform environmental site assessments in accordance with WAC 173-340 through the International Code Council.

This site is located in Pierce County, inside the city limits of Tacoma, WA. Site is located in a commercial area of downtown Tacoma. Property is owned by the City of Tacoma. The site is an active construction undertaking known as the Dock Street Project. Project construction is being completed by Active Construction, Inc. Contact person for Active Construction is Scott Morse, 253-606-9455. Project is being overseen by both the Washington State Department of Ecology (WDOE) and the City of Tacoma. WDOE contact for the project is Marv Coleman, 360-407-6259. City of Tacoma contact for the project is Mark Henry, 253-591-5771.

Site 4A-B

This project entailed the removal of one approximate 470-gallon underground storage tank (UST) used for the suspected storage and dispensing of gasoline. The tank was located in the middle of Dock Street at the project location known as station 42+04. The tank was discovered under approximately 5' of earth cover approximately 6' – 8' east of Dock Street center line. Soil conditions in the excavation area consisted of a silty, rocky, clay type material (Unified Soil Classification System group symbol of SC, with typical names such as clayey sands, sand-clay mixtures) to a depth of at least 10'. No groundwater was encountered during this tank removal project. The utility trench was approximately 6' wide the length of the road width.

On April 10, 2007, Langseth Environmental Services, Inc. was notified by Active Construction that they had discovered an UST at the Dock Street Project. While excavating for a new water line across Dock Street the UST was unearthed. Langseth personnel mobilized to the Dock Street site and discovered that the UST had been removed and placed in the project staging yard under the SR-509 Bridge. Subsequent to UST removal, Active Construction had excavated approximately one foot of olfactory evident petroleum-contaminated soil (PCS) from around the tank pit area and they were beginning the water line ditch backfill and compaction activities. The PCS had also been hauled and stockpiled in the project staging area yard. One grab soil sample was obtained from the previously excavated PCS located at the staging area. The tank was discovered to be full of dirt and liquid. Langseth Environmental personnel cleaned the tank on site and placed the soil removed from inside of the UST in the PCS stockpile. The tank was then loaded and hauled to the Langseth yard for disposal.

Approximately 1 – 1.5 hours later Langseth Environmental Services was notified that the previously backfilled and compacted water line excavation was to be re-excavated per Tacoma Pierce County Health Department (TPCHD) requirements. Langseth personnel re-mobilized to the site and observed the trench re-excavation. Utilizing strictly visual and olfactory methods, approximately 10 yards of PCS was re-excavated from the utility trench / UST pit area. Per the TPCHD representative on site, one soil sample was then obtained from the trench/pit bottom at an approximate 10' depth. The excavation area was then refilled and re-compacted to allow for the new water line installation. The previously removed UST was loaded and hauled back to the staging yard per instructions from Active Construction management. On April 13, 2007 the tank was again picked up from the staging area and hauled back to the Langseth yard for disposal at the Schnitzer Steel facility in Tacoma, WA.

Soil sampling was conducted in accordance with Washington State Department of Ecology guidelines.

Site 4A-B

The sample was collected utilizing the backhoe and/or hand tool method, utilizing clean hand tools and sampling containers provided by the laboratory. VOC sampling was accomplished utilizing the EPA 5035A method. Sample was stored in an iced chest on the site and during transport to the lab. The sample was taken to Spectra Laboratories, 2221 Ross Way, Tacoma, WA, for analysis. The soil sample was tested utilizing the NWTPH-G, SW846 8260B, and SW846 6010B methods. These analytical procedures test for the presence of gasoline, benzene, toluene, ethylbenzene, xylenes, and lead.

Permits for this project were obtained from the Tacoma Pierce County Health Department and the Washington State Department of Ecology. Field screening of the tank pit and excavated soil was accomplished utilizing strictly visual and olfactory methods. Rob Olsen, Environmental Health Specialist with the TPCHD, was on site during the re-excavation portion of the project to inspect the removed tank and the pit re-excavation. The removed tank was cleaned on site and then taken to Langseth Environmental Services, Inc. facility prior to final disposal at Schnitzer Steel, Inc., as per applicable federal, state, and local regulations. Permits and manifests are enclosed.

The laboratory analytical result of the obtained sample was at the non-detect level. Based on the soil sample analytical result and visual observations during this tank removal project, it is the conclusion of this consultant that petroleum-contaminated soil, above the MTCA Method A cleanup level for unrestricted land use, is present in the tank pit area of this site. As concluded in the original UST Site Assessment Report (March 29, 2007), compiled by Associated Environmental Group, LLC "Residual PCS, at concentrations exceeding Ecology MTCA Method A cleanup levels, remains at the subject site. Therefore confirmation soil samples were not collected. This area is within a larger remedial investigation project under the Puget Sound Initiative and according to Mr. Marv Coleman (Ecology), future characterization and remedial work is anticipated for the subject site."

Enclosed are site and sampling location maps, in addition to laboratory analytical data, the chain-of-custody form and the UST cleaning and disposal manifest. Pertinent permits, WDOE documentation, and photographs taken during the project are located at the end of the report.

This report has been prepared for the exclusive use of Active Construction and the City of Tacoma and their agents, in accordance with generally accepted professional practices for the nature and condition of the work completed in the same or similar localities, at the time the work was performed. The findings contained herein are relevant to the dates of the Langseth Environmental Services, Inc. UST removal project and should not be relied upon to represent conditions at later dates.

Site 4A-B

No additional warranty is expressed or implied. In the event that changes in the nature, usage or layout of the property or nearby properties are made, the conclusions and recommendations contained in this report may not be valid. If additional information becomes available, it should be provided to Langseth Environmental Services, Inc. so that the original conclusions and recommendations can be modified as necessary.

Sincerely,

Tom Langseth
Registered Site Assessor
Langseth Environmental Services, Inc.

Cc: Toxics Cleanup Program, Department of Ecology
Rob Olson, Tacoma Pierce County Health Department
Mark Henry, City of Tacoma Public Works Construction Division

Site 4A-B

SITE & SAMPLING

LOCATION MAPS

Site 4A-B
COMMENCEMENT BAY
PUYALLUP RIVER
SAINT PAUL WATERWAY
MIDDLE WATERWAY
THEA FOSS WATERWAY
DOCK WATERWAY
STADIUM WY S
SCHUSTER PKWY
E PORTLAND AV
SAINT HELENS AV
TACOMA AV
YAKIMA AV
DIVISION AV
PACIFIC AV
JEFFERSON AV
MARTIN LUTHER KING JR WY
WRIGHT PARK
STANLEY PLGD
McCARVER PLGD
PEOPLES PK
PEOPLES COMM CTR
FERRY PK
JEFFERSON PK
LARRY FROST PK
8TH & I PK
FIREMANS PARK
MURRY MORGAN BRIDGE
705
509
5
PICKS COVE MARINA
BNSF/UP RR
BNSF RR
PUYALLUP
SAINT PAUL
MINNEAPOLIS
TACOMA DOME
STADIUM HS
PO
MUS
STA
FS
EXIT 133
WILEY AV

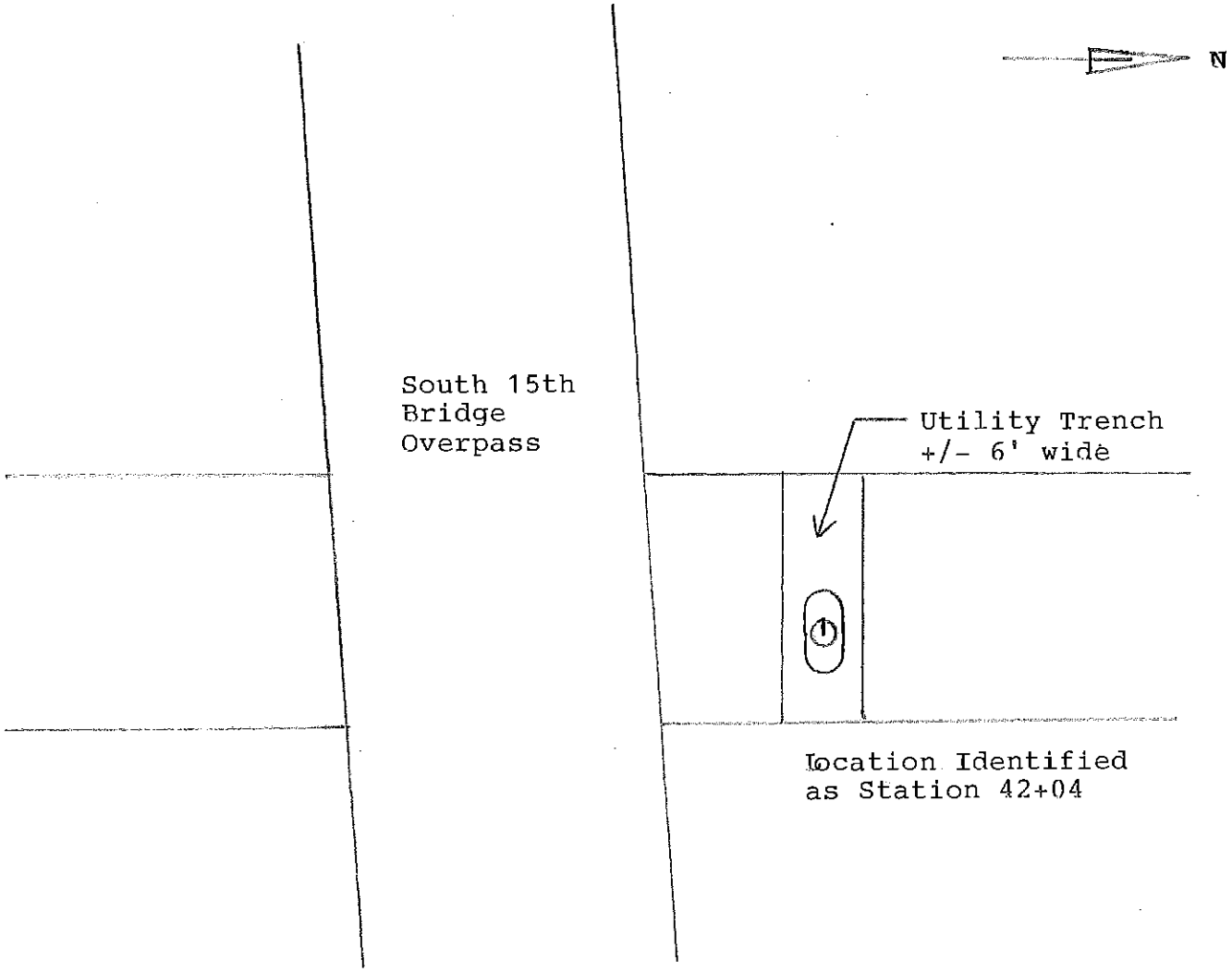
Site 4A-B

UST Location
© 2007 Europa Technologies
Pointer 47°15'01.19" N 122°26'06.61" W elev 15 ft Streaming 100%
Eye alt 1455 ft

Site 4A-B

Site and Sampling Location Map

ACI / City of Tacoma
Dock Street Project



Sample #	Location
1.	Under removed UST @ 10'

[not to scale]

Site 4A-B

SOIL SAMPLE RESULTS TABLE

Dock Street Project

Site Location:
City of Tacoma Dock Street Project
Tacoma, WA 98402

Sample Date: March 10, 2007

Sample #	MTBE	Lead	Gasoline	Benzene	Ethylbenz	Toluene	Xylenes
1	< 0.025	< 4	< 5	< 0.025	< 0.025	0.079 B	< 0.025
MTCA Cleanup Level		**250**	**30/100**	**0.03**	**6**	**7**	**9**

Bold indicates above MTCA Cleanup Level
Soil sample results reported in mg/Kg = ppm (parts per million)
B = Also found in trip blank. Result is not blank-corrected. Blank corrected result = Non Detect
"<" indicates not detected at the listed detection limits
Gasoline by NWTPH-G, BTEX by SW846 8260B, Lead by SW846 6010B

SAMPLE #	LOCATION
1	Under removed UST & after PCS excavation @ +/- 10'

Site 4A-B

ASSOCIATED
ENVIRONMENTAL
GROUP, LLC

UST SITE ASSESSMENT REPORT

Conducted on:
Dock Street Site
Tacoma, WA

March 29, 2007

Prepared for:
Evergreen Environmental
Mr. Larry Miller
PO Box 167
Aberdeen, WA 98520

Prepared by:

Dean E. Phillips, RSA, AHERA
Environmental Project Manager
AHERA No: 05-1356
ICC No: 5267497-U2/U7

Reviewed by:

Michael S. Chun, RSA, AHERA
General Manager/Principal
AHERA No: 05-1356
ICC No: 1006368-U1/U2/U7

AEG Project #: 07-137

Site 4A-B

Table of Contents

1.0 INTRODUCTION 2
1.1 Subject Site 2
2.0 UST DECOMMISSIONING 3
2.1 Soil Sampling and Laboratory Analyses 3
3.0 CONCLUSIONS & Recommendations 5

FIGURE
Figure 1: Site Diagram

TABLE
Table 1: Summary of Soil Analytical Results

APPENDICES
Appendix A: Site photographs
Appendix B: Support Documents

1728 State Avenue NE, Suite 101 ▪ Olympia, WA ▪ 98506
Phone: 360-352-9835 ▪ Fax: 360-352-8164 ▪ email: admin@aegwa.com

Site 4A-B

1.0 INTRODUCTION

Associated Environmental Group, LLC (AEG) has completed an Underground Storage Tank (UST) Site Assessment at the E. Dock Street site located in Tacoma, WA. This UST site assessment report documents the UST decommissioning work and the subsequent site characterization activities.

AEG supervised the removal of one abandoned UST, approximately 3,000 gallon in capacity that was partially filled in place with control density fill (CDF). Based on the results of the initial soil samples collected and analyzed by AMEC environmental consultants representing the City of Tacoma, it appears that the UST was utilized for gasoline storage. The abandoned UST was discovered during utility work performed along Dock Street in Tacoma, WA. The site assessment included inspecting the excavated UST and collecting soil samples to identify petroleum contaminated soils within the excavation area.

1.1 Subject Site

The subject site is located just off the shoulder along the south bound lane of E. Dock Street near the S 15th street overpass. There is no additional information on the former usage and/or the installation date of the UST. Figure 1, *Site Diagram*, presents the location of the UST and adjoining features at the subject site.

Site 4A-B

2.0 UST DECOMMISSIONING

On March 12, 2007, AEG directed the decommissioning of the abandoned 3,000-gallon UST. AEG was contracted by Evergreen Environmental to perform decommissioning services on the UST. The 3,000-gallon single wall steel construction tank was discovered during utility work along Dock Street and still contained gasoline mixed with water and CDF. (Refer to Figure 1).

Upon removing the overburden soil over the UST, the tank was inerted with compressed Carbon Dioxide (CO^2) and checked with the Oxygen and Lower Explosive Limit (LEL) gas meter. Approximately 12 inch access port was cut on the top of the UST to vacuum out the gas/water mixture along with the CDF. After the majority of the CDF was removed from the UST by Provac, a subcontractor, the tank was removed from the pit and transported to a staging yard under the SR-509 Bridge. The tank was thoroughly inspected and confirmed to have numerous corrosion holes ranging in size from pin hole sized to 2-inch in diameter. Based on the safe O^2 readings, access ports were cut at both ends of the tank, and the residual gas contaminated CDF was cleaned out by Provac.

Petroleum contaminated soils (PCS) were identified through out the excavation area. The excavation depth was approximately 9 feet below ground surface (bgs) by 12 feet in width by 25 feet in length. All excavated soil exhibited a strong petroleum fuel odor.

Based on onsite discussions with Mr. Rob Olsen of the Tacoma Piece County Health Department (TPCHD) and Mr. Marv Colman of Department of Ecology (Ecology), two soil samples were collected from the bottom of the excavation pit and the PCS was left in place for future remedial action. Photographs of the UST excavation activities are presented in Appendix A, *Site Photographs*.

2.1 Soil Sampling and Laboratory Analyses

Soil samples, Dock-01 and Dock-02 were collected from the bottom of the excavation pit, at 9.5 feet below ground surface, after the UST was removed. All samples were observed to document soil lithology, color, moisture content, and sensory evidence of impairment. All soil samples were classified in the field and immediately transferred to laboratory provided 40-ml VOA glass vials with septum sealed Teflon-lined screw caps and 4 oz. glass jars. Soil sampling for gasoline range total petroleum hydrocarbons (TPHs) and gasoline constituents (including benzene, toluene, ethylbenzene, and total xylenes - BTEX) and field preservation methods followed methods set forth by Ecology's Method 5035A, "*Collecting and Preparing Soil Samples for VOC Analysis*" which minimizes volatile organic compound losses. The soil samples were placed in a portable chilled ice chest and transported to Libby Environmental Chemistry Laboratory (Libby), a Washington State certified analytical laboratory located in Olympia, Washington, for analysis following industry standard chain-of-custody procedures.

Site 4A-B

The soil samples were submitted for analysis of gasoline range TPHs, gasoline constituents BTEX, and other petroleum compounds in accordance with the State of Washington Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Table 830-1, *Required Testing for Petroleum Releases*. Table 1, *Summary of Soil Analytical Results*, presents analytical soil results as compared to Ecology MTCA Method A soil cleanup levels. Analytical laboratory results are presented in Appendix B, *Support Documents*.

Site 4A-B

3.0 CONCLUSIONS & RECOMMENDATIONS

The findings and conclusions derived during the UST Site Assessment for the subject site are as follows:

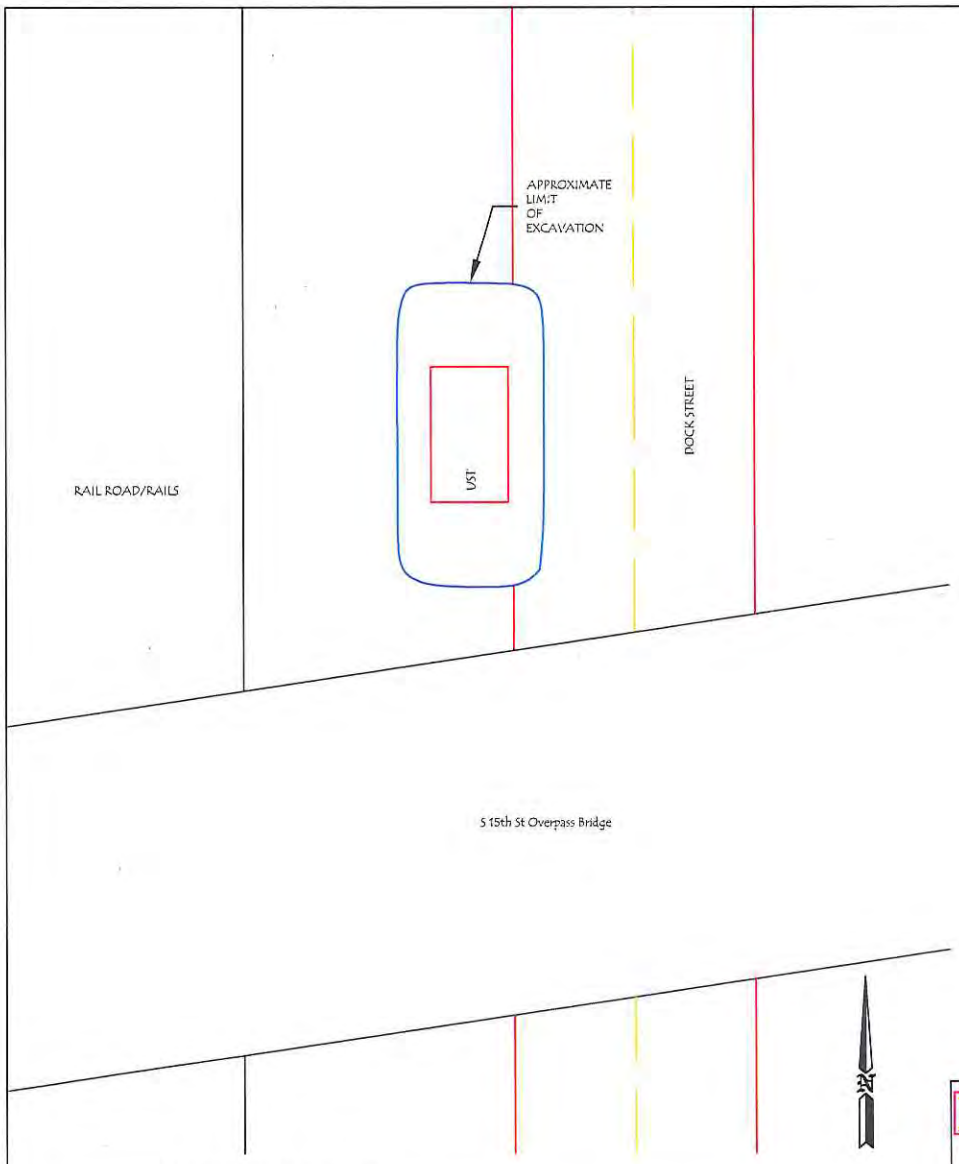
- The 3,000-gallon gasoline UST at the subject site was decommissioned and disposed of offsite. The tank had multiple holes, some as large as two inch in diameter.

- Analytical results of soil sample Dock-02 indicated presence of elevated concentrations of gasoline range TPHs, at 212 milligrams per kilogram (mg/Kg), and elevated benzene concentrations in samples Dock-01 and Dock-02, at 0.059 mg/Kg and 0.044 mg/Kg, respectively. These concentrations are above Ecology MTCA Method A soil cleanup level for gasoline range TPHs at 30 mg/Kg and benzene at 0.03 mg/Kg.

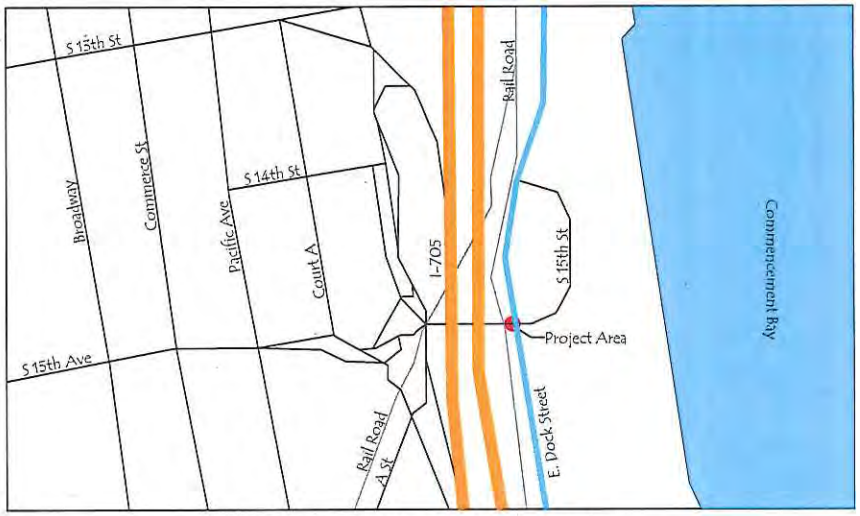
- Analytical results also indicated detectable concentrations of other gasoline constituents and additives including toluene, ethylbenzene, total xylenes, and naphthalenes; however, these concentrations are below Ecology MTCA Method A soil cleanup levels.

- Groundwater was not encountered during excavation activities.

Discussion:
Residual PCS, at concentrations exceeding Ecology MTCA Method A cleanup levels, remains at the subject site. Therefore, confirmation soil samples were not collected. This area is within a larger remedial investigation project under the Puget Sound Initiative and according to Mr. Colman (Ecology), future characterization and remedial work is anticipated for the subject area.



DRAWING SCALE: 1"= 10'



SITE VICINITY MAP (Not to Scale)

Notes: (a) The locations of all features shown are approximate.
(b) This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document.

Reference: Drawing created from sketch provided by AEGs' personnel.

ASSOCIATED ENVIRONMENTAL GROUP, LLC
Environmental Consulting and Contracting
1728 State Avenue NE, Suite 101
Olympia, WA 98506
(360) 352-9835 Fax (360) 352-8164

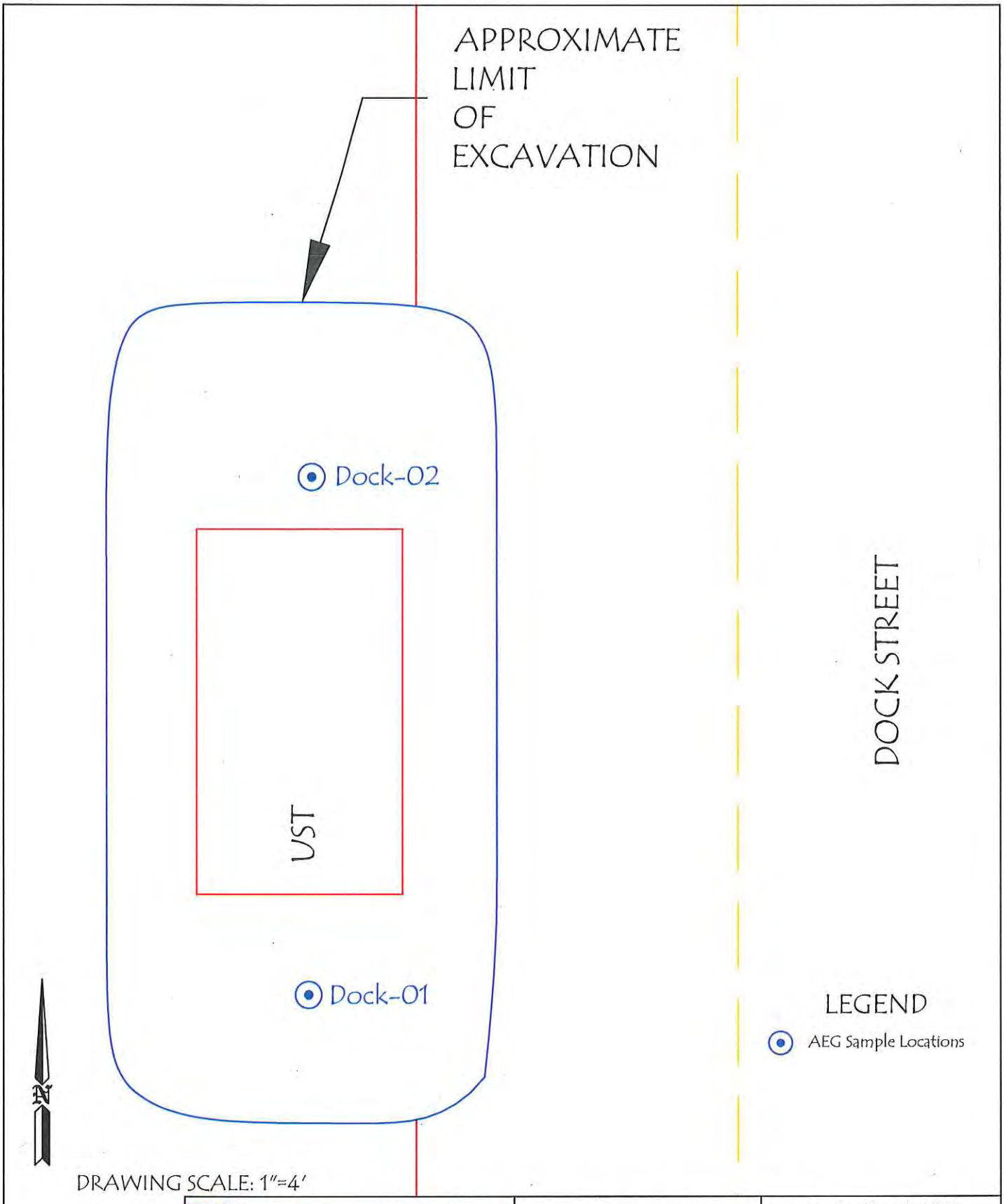
FIGURE 1
SITE VICINITY MAP

Dock Street UST
Dock Street
Tacoma, WA

Project:	Date:
07-137	03/26/07

Site 4A-B

Site 4A-B



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Olympia, WA 98506
(360) 352-9835 Fax (360) 352-8164

FIGURE 2

SITE LAYOUT

Dock Street UST
Dock Street
Tacoma, WA

Project# 07-137	Date: 03/26/07
File: Evergreen	Sheet

Table 1 Summary of Soil Analytical Results
Dock Street UST Decommissioning
Tacoma, Washington

Sample Number[1]	Sample Depth (feet)	Date Sampled	BTEX[2] (mg/Kg)				Gasoline[3] (mg/Kg)	Table 830-1 Constituents (mg/Kg)[2]				
			Benzene	Toluene	Ethylbenzene	Total Xylenes		1,2-Dichloroethane (EDC)	1,2-Dibromoethane (EDB)	Total Naphthalenes	MTBE	Total Lead
Dock-01	9.5	3/13/07	**0.059**	<0.02	0.059	<0.05	<10	<0.02	<0.02	<0.2	<0.05	7
Dock-02	9.5	3/13/07	**0.044**	<0.02	0.63	0.24	**212**	<0.02	<0.02	<0.2	<0.05	34
PQL			0.02	0.02	0.05	0.05	10	0.02	0.02	0.2	0.05	4
Ecology MTCA Method A Cleanup Levels			**0.03**	7	6	9	**30****	*	0.005	5	0.1	250

Notes:
[1]Approximate sample location is shown in Figure 2
[2]Analyzed by EPA 8021B.
[3]Analyzed by Northwest Method NWTPH-Gx
mg/Kg - milligrams per kilogram
MTBE = methyl tertiary-butyl ether
"<"= not detected above laboratory limits
"*" Ecology has not designated a cleanup level for this compound.
"**" Ecology cleanup level for gasoline range TPHs with presence of benzene
PQL=Practical Quantitation Limits
Bold indicates the detected concentration exceeds the MTCA Method A levels

Site 4A-B

Site 4A-B

ASSOCIATED ENVIRONMENTAL GROUP, LLC

SITE PHOTOGRAPHIC RECORD

Project No.: 07-137

Project Name: Dock Street

Photo #1:	UST exposed and being prepared to be inerted.

Photo #2:	Removal of the UST from the pit.

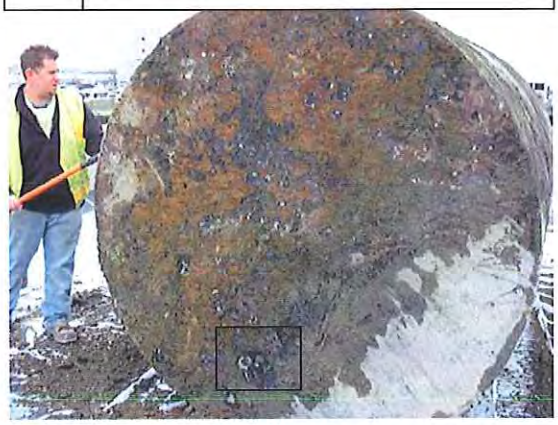

Photo #3:	UST showing pitting, corrosion, and holes.

Photo #4:	Multiple 1/2 to 2 inch holes at the end of the tank.

Photo #5:	UST showing pitting, corrosion, and holes.

Photo #6:	Limited PCS removal using Vacuum truck.

1728 State Avenue, Suite 101 • Olympia, WA • 98506-4557
Phone: 360-352-9835 • Fax: 360-352-8164 • Email: mchun@aegwa.com

OR 1024

Site 4A-O

Final Parcel 3 and 15th Street ROW Site-Specific Cleanup Action Plan

Thea Foss Upland Properties
Consent Decree 94-10917 6

HARTCROWSER
Sphere smarter solutions

Prepared for
City of Tacoma
Public Works Engineering

June 1, 2000
J-4676-34

COT00021492

SITE DESCRIPTION

Parcel 3 and the 15th Street ROW are located between Dock Street and the Thea Foss Waterway as shown on Figure 1. The Parcel 3 site includes Block 59, Lots 1 through 22. The 15th Street Right of Way (ROW) is located immediately adjacent to Parcel 3 on the north. Under the City's new boundary line adjustments Parcel 3 is redefined as Parcels A through C with Parcel A occurring along the waterfront (future public Esplanade site) and Parcels B and C lying along Dock Street (future redevelopment sites). The 18th Street ROW is located immediately south of Parcel 3.

Redevelopment plans for this parcel include public access and recreational uses along the waterfront property and 15th Street ROW. Private development sites are presently planned for the western portion of Parcel 3. To accommodate the redevelopment plans of Parcel 3, five separate Site-Specific Cleanup Action Plans (SCAPs) are addressed in this report. These include:

- **SCAP 9.** The waterfront between 15th Street and 18th Street planned for public recreational use (Public Esplanade) based on the City of Tacoma's Design Development Plans (Phase I) for the Thea Foss Waterway Public Esplanade and Dock Street (ARRJW, July 10, 1998);

- **SCAPs 10, 11, and 12.** The western portion of Parcel 3 adjacent to Dock Street planned as private redevelopment sites—identified as Development Sites 3 through 5 based on the City of Tacoma's Schematic Design, 15th Street to 21st Street, Thea Foss Waterway Public Esplanade (ARRWJ, 1997); and

- **15th Street ROW.** Future site of public access and park area based on the City of Tacoma's Schematic Design for the Thea Foss Waterway Public Esplanade (ARRJW, 1997).

SCAP 9 Area Conditions

SCAP 9 includes the area between 15th and 18th Streets along the waterfront. This area is currently planned for development of a public esplanade. Under the Consent Decree, the City may address the area between MHHW and Mean Lower Low Water (MLLW) with concurrence by EPA which has jurisdiction below MHHW under the AOC for the Thea Foss Waterway cleanup. The Thea Foss Waterway remedial design plans identify the Parcel 3 waterfront as a "No Action" area, except for the northernmost area (from about Lot 8 and north) where a thick cap is planned. SCAP 9 extends to the MLLW (elevation -6.33 TPWD datum) in this "No Action" area.

SCAP 12 Area Conditions

SCAP 12 is the northernmost development site (Development Site 5) located between Dock Street and the western boundary of the proposed esplanade. This area is inclusive of Lots 1 through 6 and a portion of Lot 7. The north half of a view corridor for public access to the Esplanade is assumed to occur in the southern SCAP area based on the present layout of the development sites/view corridors. The view corridor covers Lot 7.

The SCAP 12 area existing grade is primarily at elevation 12 feet (TPWD). SCAP 12 is presently primarily lawn area; however, an asphalt parking lot surrounded by concrete sidewalk exists adjacent to Dock Street. In addition, the asphalt walkway traverses portions of the eastern extent of the SCAP, but is primarily within SCAP 9 at this location. These features will be demolished/removed during the cleanup of SCAP 11.

15th Street ROW Area Conditions

The 15th Street ROW is located immediately north of Parcel 3 and includes the band of property approximately 80 feet in width below the 15th Street ramp between MHHW and Dock Street. This area is planned as park and public access area for the waterfront. Site grades are consistent with the development sites to the south. The 15th Street ROW is presently primarily roadway and an asphalt-paved area for parking. Concrete sidewalks provide access to the site from Dock Street.

Historical Land Use

Railroad interests controlled Parcel 3 from its initial development to its purchase by the City in 1991. The following section briefly summarizes industrial activities, which have contributed to the soil quality issues characterized in the remedial investigation (Hart Crowser, 1998).

Lots 1 through 12

The north end of the parcel (Lots 1 through 4) was originally developed as a coal yard. Machine shop/metal treating plants (hot and cold galvanizing) were in operation on these lots from the early 1900s to about 1930. A wholesaler of windows, doors, roofing materials, and paints operated in this area from about 1930 until it burned to the ground in 1938. This was also the fate of the adjacent cement, lime, concrete, and building materials operation on Lots 5 through 7. This company had expanded from Lots 5 through 7 into the then-vacant land to

the south and extended operations through Lot 11. The building materials operation maintained trucks near Lot 7.

Lots 13 through 18

A major foundry/machine shop was located on Lots 13 through 18. The plant cast and machined parts (i.e., brass and iron parts) used in the ship repair industry. Coking ovens were used in the process. A dry dock was also located in the area, which may have released paint chips with copper/mercuric compounds until about 1905. Unfilled slip areas at the north and south end of these lots existed from the waterway to Dock Street up to about 1905. These slips received spoil materials from the adjacent industrial activities and subsequent to 1905 were completely filled. In 1922, a veneer plywood plant began production of fir and hardwood plywood. Oil and gas tanks were used, as well as a "wood treating oil sprayer" complex along the south property line.

Lots 19 through 22

A coal yard and storage area for cement, lime, sand and gravel, bricks, and tile first occupied this area (Lots 19 through 22) in the late 1880s. In 1915, ownership changed, but continued the building materials operations. A concrete batch plant was added, in addition to locating a roofing division on the property. A truck repair facility was in operation along Dock Street as well.

REMEDIAL INVESTIGATION FINDINGS

This section briefly summarizes the physical characteristics and environmental quality of site soil and groundwater for SCAPs 9 through 12 and the 15th Street ROW. A more detailed discussion of physical subsurface conditions and the nature and extent of contamination, including figures and cross sections, is provided in the Parcel 3 RI (Hart Crowser, 1998). The remedial investigation findings define areas for cleanup action. Figure 2 presents a map showing the principal areas of identified contamination.

Soil Characteristics and Quality

Parcel 3 and 15th Street ROW Soil Stratigraphy

Variable fill materials comprise the upper 10 to 15 feet of soils beneath Parcel 3, generally averaging about 12 feet. Below these fill materials, native tideflat soils occur. The fill materials are a complex mixture of silt, sand, and gravel, with wood, bricks, and other construction-related debris. The fill materials overlie native tideflat soils to an elevation of roughly 0 feet (TPWD).

The following units were classified based on materials that were encountered in explorations for Parcel 3, combined with interpretations that have been developed for other Thea Foss upland parcels. They are described below in sequence of occurrence from the former tideflat level up to the present ground surface:

- **Native Tideflat.** These soils are typically a dark brown to olive-brown, very silty, fine sand to sandy silt, with shells and organic material. The native tideflat soils are observed at depths of about 10 to 15 feet beneath Parcel 3, corresponding to an elevation at or slightly below 0 feet across most of the parcel.

- **Dredge Fill.** These soils are typically a gray to brown and black, fine sand, silty sand, and/or sandy silt. The initial filling on Parcel 3 occurred below Dock Street and the existing wharves during the initial (1889-1890) dredging of the waterway. Interpretation of remedial investigation data indicates that roughly 700 feet of the waterfront area (roughly Lots 6 to 21) does not include dredge fill in the filling sequence.

- **Upland Fill.** Fill materials from upland sources to the west are primarily silty sand and gravel mixtures with debris consisting of wood, brick fragments, and concrete pieces. This material was placed below Dock Street and intermixed with Mixed Fill that was likely placed during the 1905-1907 redevelopment of the area. The elevation of the site and most adjacent parcels were likely raised approximately 3 to 4 feet from the original wharf and street level.

- **Mixed Fill.** The Mixed Fill is commonly a brown to gray sand and gravel, with some silty zones. Debris is abundant in much of the fill and primarily includes brick, concrete, wood (some possibly treated), and coal. This variable fill material was placed in multiple episodes over the dredge fill, or tideflat if the dredge fill was not present (e.g., along the center of the proposed Esplanade, Lots 6 to 21). The fill material is variable in nature across Parcel 3 and was placed in different areas at different times. The filling is conceptualized as three different types of activities; material associated with the circa 1905 waterfront redevelopment, areas (such as slips) which received multiple episodes of filling before and after the 1905 activities and at least up until 1912, and filling and regrading associated with existing building demolition and property redevelopment.

- **Recent Fill.** This is primarily a silty sand and gravel material with debris similar to that of the Mixed Fill. This interpreted latest fill sequence on Parcel 3 is generally related to more recent development across the site.

Soil Quality Issues

The primary contaminants identified in Parcel 3 soils and within the 15th Street ROW are carcinogenic polycyclic hydrocarbons (cPAHs), total petroleum hydrocarbon (TPH) (oil-range), and lead. Specific areas of the site, primarily within the southcentral SCAP 11 area, have one or more contaminants at concentrations above soil contamination maximum concentrations (CAP maximums). Occasional exceedences of arsenic, and single exceedences of copper and pentachlorophenol were also identified on Parcel 3, but the relative magnitude and frequency of exceedence are much less than for cPAHs, TPH-oil, or lead.

The majority of the contaminants appear to be associated with burnt materials (wood and coal) disseminated within the Mixed Fill soils. The detected TPH is comprised of heavy-end hydrocarbons, which have low mobility and pose negligible risk to groundwater. Likewise, the data indicate that other constituents above cleanup levels have not impacted groundwater. Figure 2 presents a summary of the principal areas of contaminant occurrence identified by the Remedial Investigation (Hart Crowser, 1998). More detailed information on the soil quality is presented in the Remedial Investigation report.

SCAP 9 (Public Esplanade)

The soil quality issues along the waterfront portion of the property—SCAP 9—are predominantly associated with debris within the Mixed Fill soils. Specific soil quality issues by depth are summarized below.

- **0- to 3-Foot Depth.** cPAHs and TPH-oil (TPH-O) are the primary constituents detected above cleanup levels within the upper 3 feet of soils in SCAP 9. The cPAH concentrations range up to 18.5 mg/kg and the highest concentrations are most often associated with burned wood. TPH-O concentrations range up to 3,300 mg/kg, which is below the risk-based value of 5,700 mg/kg established based on sample analysis using Ecology's Interim TPH Policy (Hart Crowser, 1998).

- **3- to 7-Foot Depth.** Similar to the upper soils, cPAHs and TPH-O were the primary constituents detected within the 3- to 7-foot depth-range in the SCAP 9 area. In addition, an area of localized metal exceedences occurs in Lots 1 through 3. The metals contamination is interpreted to be slag-related

- **3- to 7-Foot Depth.** Similar to the 0- to 3-foot-depth range, only low-level cPAH soil contamination was detected. Some slag or metal may be encountered due to the proximity of this SCAP area to the northeast corner of Parcel 3 (SCAP 9 area) where historical machine shop and galvanizing activities occurred.

15th Street ROW (Public Access Park)

Soil cleanup levels for cPAHs were exceeded in shallow soils within the 15th Street ROW with concentrations ranging up to 3 mg/kg. Nearest the waterway bank, elevated metal concentrations (lead, arsenic, and copper) were detected at depth on the adjacent Parcel 3, and could be expected in this area. Depth-specific issues identified are summarized below.

- **0- to 3-Foot Depth.** cPAHs exceed cleanup levels, but concentrations are relatively low (less than 2.9 mg/kg). Encountering soils within the ROW with metals, TPH-O, and cPAH contamination should be considered based on the data collected on the adjacent Parcel 3 area where past disposal likely occurred and may overlap the 15th Street ROW area.

- **3- to 7-Foot Depth.** Only low-level cPAH and metal soil contamination was detected in this area. Again, in the area along the waterway bank, some slag or metal may be encountered due to the proximity of this area to the Parcel 3 area of past disposal.

Groundwater Characteristics and Quality

Groundwater Occurrence

Depth to groundwater beneath most of Parcel 3 ranged from about 5 to 9 feet (about elevation 2 to 6 feet [TPWD]) during our exploration period. For the purpose of cleanup action/remedial design, a mean-high groundwater elevation of 5.5 feet is assumed, which is consistent with the Mean Higher High Water level (MHHW) of the Thea Foss Waterway and groundwater elevations observed on other upland parcels.

The shallow groundwater system beneath Parcel 3 is tidally influenced, with some areas along the waterway more responsive to tide levels than others. P3-MW01 is located about 85 feet from the waterway and indicated less than 0.1 foot of fluctuation during our measurements, whereas other areas along the waterway to the south (e.g., RD3-UMW-3 and R21-MW02) have exhibited as much as 3 to 5 feet of tidal fluctuation, respectively. Tidal response is a function of material type, quantity of debris, and distance from the waterway. In addition

to tidal fluctuations, seasonal fluctuations of several feet could also be observed based on data from surrounding parcels.

Groundwater in the vicinity of Parcel 3 is presumed to flow toward the Thea Foss Waterway during most of the tide cycle. During high tide, it is likely that groundwater flows inland from the waterway forming a temporary "saddle" in the groundwater surface. This periodic groundwater reversal results in mixing of fresh and salt water, which is confirmed by specific conductivity measurements made during the remedial investigation (Hart Crowser, 1998).

Groundwater and Surface Water Quality

Groundwater quality beneath Parcel 3 is similar to area background conditions, with no apparent groundwater quality impacts attributable to site soil quality issues. Groundwater quality data for Parcel 3 are available from downgradient well P3-MW01 and upgradient well P3-MW02. Monitoring well P3-MW01 is located immediately adjacent and downgradient of the area of the highest lead, TPH, and cPAH exceedences (See Figure 2). The lack of demonstrated impact to groundwater quality, after much of the fill materials have been in-place for several decades, indicates that the potential for exposure through groundwater or surface water pathways is low as discussed in the remedial investigation. Thus groundwater quality is not considered a cleanup issue for Parcel 3.

SITE CLEANUP STANDARDS

Soil Cleanup Standards

The cleanup standards for the site soils were developed according to Chapter 173-340 WAC and are defined in the Thea Foss Upland Redevelopment Consent Decree and Cleanup Action Plan (State of Washington, 1994). These standards are based on protection of groundwater and surface water, and on estimates of reasonable maximum exposure (RME) expected for protection of human health. The residential use scenario as defined in MTCA represents the reasonable maximum exposure scenario for direct contact in the development site areas because of the potential for residential uses. The residential cleanup levels are used for evaluation of data from Parcel 3 and the 15th Street ROW. Table 1 presents the cleanup standards planned for the Parcel 3 site.

Total Petroleum Hydrocarbons (TPH)

The Consent Decree states that the 200 mg/kg TPH soil cleanup level (MTCA Method A) is deliberately conservative and allows for reassessment of the TPH cleanup level to account for site-specific characteristics and current cleanup

policies. Results from the remedial investigation conducted on Parcel 3, as well as the other upland parcels, indicate that nearly all of the TPH detected is oil-range hydrocarbon. The data also indicate the TPH is typically associated with burnt materials (wood, treated wood, coal, coal ash, etc.) rather than petroleum. These heavy-end hydrocarbons are related to turn-of-the-century industrial land filling activities and do not contain readily leachable components. Lack of leachability is demonstrated by lack of hydrocarbons detected in groundwater in the area of the highest TPH occurrence on Parcel 3, as well as from data collected on other upland parcels.

Alternative cleanup levels for the non-carcinogenic TPH fractions, which are protective of human health and the environment, were calculated using Ecology's Interim TPH Policy as part of the Parcel 3 Remedial Investigations. A risk level (hazard quotient of 1) of 5,700 mg/kg was calculated for the non-carcinogenic components of the hydrocarbons detected in characteristic Parcel 3 fill materials. Based on these data, the TPH cleanup level for Parcel 3 is set at 5,700 mg/kg.

Relatively high concentrations of TPH detected in the southcentral portion of the site (SCAP 11 and border of SCAP 9) within the 4- to 6-foot-depth range exceed the TPH cleanup level of 5,700 mg/kg. In this same area the groundwater quality data indicate that the TPH has not impacted groundwater quality. Any excavated soil in this area will require remediation. Although the risk-based cleanup level is not exceeded in many of the soil samples in other areas, the TPH generally occurs with cPAHs. It is the cPAHs that pose potential risks and will require cleanup actions should soils be moved or excavated in other areas of the site.

Carcinogenic Polycyclic Aromatic Hydrocarbons (cPAHs)

Carcinogenic PAHs are the most common contaminant identified throughout the project area and appear to be primarily associated with non-petroleum sources such as burnt wood, coal-related materials, and ash. The cleanup level based on residential contact exposures for individual cPAH compounds is 0.137, or 1 mg/kg for the sum of the seven cPAH compounds. The remedial action goal will be to prevent direct contact with cPAHs in soil and sediment.

Lead

The lead soil cleanup level identified in the Consent Decree is the MTCA Method A cleanup standard of 250 mg/kg, which was based on preventing unacceptable blood lead levels. Although there is more recent evidence developed by the EPA's Science Advisory Board based on the IEUBK model that lead levels up to 400 mg/kg are protective of children under a residential use

scenario, Ecology has not yet accepted these data. The cleanup level for lead will remain at 250 mg/kg.

Lead exceedences occur within the SCAP 11 and view corridor of SCAP 10/11 areas at depths above the groundwater level. Also, the northeast corner of the Esplanade SCAP 9 indicated concentrations of lead in the metallic slag-like material encountered in this area. The soils in these areas will require remedial action if encountered in excavations.

Groundwater Cleanup Standards

Groundwater cleanup levels are based on the protection of marine surface water including protection of aquatic life (marine chronic criteria; Chapter 173-201A WAC) and the protection of human health from consumption of aquatic organisms (40 CFR 131). Protection of surface water is applicable for the site since groundwater in the fill material is not considered a current or future potable drinking water source. It is also unlikely that a contaminant in the shallow groundwater will be transported to an area where groundwater is a current or potential source of drinking water. Finally, there are no apparent impacts to the waterway from upland groundwater. Given the age of the fill soils, and the available groundwater quality data, the soil contaminants detected in Parcel 3 are not expected to impact groundwater quality in the future.

CLEANUP ACTION PLAN

The Model Toxics Control Act (MTCA) requires all cleanup actions to protect human health and the environment, comply with cleanup standards and other applicable state and federal laws, and provide for compliance monitoring. The Thea Foss Waterway Redevelopment Cleanup Action Plan defined in Exhibit C of the Consent Decree between Ecology and the City of Tacoma (1994) was developed in accordance with MTCA requirements. The Consent Decree calls for Site-Specific Cleanup Action Plans (SCAPs) to be developed to address cleanup on specific City-owned properties relative to the terms of the area-wide Cleanup Action Plan (CAP) of the Consent Decree, compliance with applicable ARARs, and property redevelopment plans.

Ecology has determined that the cleanup actions specified in the area-wide Consent Decree CAP apply to the Parcel 3 site based on the results of the Remedial Investigation (Hart Crowser, 1998). The cleanup actions identified in the Consent Decree that are potentially applicable to Parcel 3 include:

- If the property is proposed for use as commercial/retail, open space, or upper story residential uses, contaminated soil will be isolated below 3 feet of clean soil cover, a building, or a pavement cap. Remediation measures could include excavating and treating up to 3 feet of soil to MTCA Method B standards followed by backfilling using clean soil covers and/or caps.

- If the property is proposed for redevelopment with ground floor residential uses, contaminated soil will be remediated to the depth of the mean-high groundwater level to meet MTCA Method B cleanup standards.

- Small quantities of contaminated soil, which are defined and localized, can be readily accessed, are technically and economically treatable, and pose a significant threat to human health and the environment were the soil to remain, shall be remediated.

- Where utilities are installed, the trenches will be constructed in accordance with state and city standards with the additional requirement that 1 foot of overexcavation, or a geofabric lining, be used to provide a clean perimeter around the outside of the utility trench.

- In all cases where residual contamination remains following remediation, institutional controls will be implemented to control future excavations, provide for long-term maintenance of the surface cap, and potentially provide for routine environmental monitoring.

To facilitate environmental cleanup, one of the strategies adopted by Ecology and the City of Tacoma in the Consent Decree CAP was to accomplish cleanup in the context of the site redevelopment. This would ensure that the cleanup was accomplished in a timely and cost-effective manner. To assess appropriate cleanup actions for Parcel 3, the CAP requirements were evaluated with respect to the development plans for the SCAPs within Parcel 3 and the 15th Street ROW areas.

SCAP 9—Redevelopment as Public Use Area

The SCAP 9 area is planned for redevelopment as public open space with recreational uses. Design plans for the Thea Foss Public Esplanade (ARRJW, 1998) identify a development alternative that includes beaches with upper elevation benches of saltmarsh vegetation, pierheads with future boat launches, and walkways along the waterfront esplanade surrounded by lawn area with trees. The plan also calls for reshaping of the waterfront bank to include treatments consistent with aquatic habitat enhancement and integration of the

cleanup actions being completed under the Thea Foss Waterway in-waterway remedial design project.

SCAPs 10 through 12—Future Private Development

The SCAP 10 through 12 areas are proposed as private development sites. At this time, the nature of the developments is unknown, although they will be expected to comply with the terms of the Consent Decree and this SCAP. Even though the specific development plan for the SCAPs is unknown, it is expected that they will include a building over most of the area. The development plan could also include use of the subgrade area for parking or other use. For the purpose of cleanup actions under the Consent Decree, any subgrade area is defined as the depth below final grade to the mean-high groundwater level (approximately elevation 5.5 feet, TPWD).

Associated with the development sites are view corridors which will allow public access to the esplanade and waterfront. At this time, we have assumed the view corridor locations as depicted in the Schematic Design plans for the Esplanade (ARRJW, 1997); however, their locations may vary per Foss Development Plan guidelines. For the purpose of this report we have assumed that half of each view corridor is associated with the adjacent development site.

15th Street ROW—Redevelopment as Public Use Area

The 15th Street ROW area is planned as public open space. Schematic Design plans, Thea Foss Public Esplanade (ARRJW, 1997) identify an alternative that includes lawn areas, constructed wetlands, stream channels, and walkways through the park and along the waterfront esplanade (See Figure 6). Similar plans for reshaping the waterfront bank are likely to include treatments consistent with aquatic habitat enhancement and integration of the cleanup actions under the Thea Foss Waterway in-waterway project.

Cleanup Action Alternatives

The applicable cleanup alternatives identified for the Parcel 3 site, based on the Site-Specific Remedial Investigation include the following:

Alternative 1—No Action

The No Action Alternative is applicable on those portions of Parcel 3 where the existing soil cover provides a sufficient barrier from contact with deeper soils that contain contaminants, and where protection of groundwater from deeper soils is not of concern. No Action may be applicable to the 15th Street ROW as

the existing pavement provides a suitable cap preventing direct contact with subsurface soils. This alternative may apply to portions of Parcel 3 where contaminants are more than 3 feet below ground surface, however, because of the variable nature of the fill, there is potential for contaminants to occur in areas where no data were collected.

Alternative 2—Isolation by Cap or Cover

Isolation by cap or cover is applicable for the contaminated soils on Parcel 3 and the 15th Street ROW. Isolation may include pavement or building slabs, or soil cover placed to a thickness to provide a barrier to prevent direct contact exposure. Depending on the existing and proposed grades, isolation using 3 feet of soil cover could require overexcavation of contaminated material where shallow soil contamination occurs at the site. In areas where excavations to the groundwater surface are made exposing contaminated soil, a pavement or soil cover cap will be required above the subgrade soils.

Alternative 3—Excavation and Treatment

To meet the 3-foot soil cover criteria in areas that will not be paved, over-excavation may be needed in some areas as indicated above. In addition, excavation and treatment of soils is applicable for contaminated soils encountered under the following scenarios:

- During general site grading (i.e., within 3 feet of final grade);
- From utility trench excavations;
- From excavations to the mean high groundwater level with the private development sites; and
- Miscellaneous excavations required for development components (e.g., building foundation pilecaps).

The preferred treatment alternative for the excavated soil is permanent treatment. Much of the cPAH/TPH soil can be recycled using thermal desorption technology. In areas having metals concentrations in exceedence of MTCA Method A residential criteria, thermal desorption may be not feasible. In this case, landfill disposal would be an appropriate option. Given the nature of the fill, substantial screening may be required to separate out debris. Debris material would also be landfilled, unless suitable for recycling.

Determination of Treatment/Disposal Applicability for Excavated Soils

This section generally presents the manner in which excavated soils will be handled during site grading, utility excavations, and overexcavations for

miscellaneous development elements such as pile caps, etc. More specific treatment and disposal actions will be addressed in the remedial design and construction documents, which will follow the site-specific cleanup action plans.

Stockpiling and Chemical Testing of Excavated Soils

A combination of field screening and use of remedial investigation results are proposed for determination of the need for designation testing of soils for treatment/disposal applicability. The following conditions will require stockpiling and chemical characterization of soils encountered in excavations, as a minimum:

- All excavated soils from within one of the areas of the site shown on Figure 2, which presents the interpreted extent of specific contaminant issues. Supplemental field explorations with sampling and analysis may be needed to further define the extent of contamination and/or address gaps in data between explorations, especially where contaminants are expected. If supplementary sampling and analysis are conducted at the site, the need for stockpiling/testing soils must reflect any changes in the interpretations of contaminant extent;

- Soils having visual signs of contamination (including, but not limited to, oxidation or discoloration) or noticeable odor;

- Soils with tar, oily residue, or burned debris content;

- Soils that register "hits" or signs of potential contamination on field screening devices; and

- Soils within the Mixed Fill unit containing debris such as coal, slag, cinders, creosote-treated piling, asphalt, etc. This also includes concrete debris in soils having visible staining or signs of contamination.

Otherwise, soils within areas that have been demonstrated to be below cleanup levels can be used on site as fill without undergoing stockpiling and chemical testing. The applicability for the type of fill (i.e., general fill for grading versus structural fill) will need to be assessed by a geotechnical engineer based on the final design plans. Debris sorting will be required for soils containing substantial concrete debris prior to reuse (Note that all other debris would indicate the need for stockpiling and testing). Concrete debris without visible signs of contamination could be recycled on site for reuse in the fill, or alternatively, transported to a construction debris recycling operation or debris landfill.

Treatment and/or Disposal

If sampling and analysis results for soils that have been stockpiled according to the above criteria exceed cleanup levels, treatment or disposal of these soils will be required. The evaluation of the applicability of treatment and disposal option follows:

Thermal Desorption. Thermal treatment is applicable for cPAH- and TPH-contaminated soils with relatively low levels of metals. This is a preferred remediation method since contaminants are permanently destroyed in the process of treatment. Debris sorting will be required for this treatment technology. This can either be conducted on site or performed by the treatment facility.

Class D (Lined) Landfill. This disposal alternative is applicable for all waste materials below dangerous waste levels, such as creosote-treated timber piling, construction debris, and metal slag. For excavated material with soil quality above cleanup levels and sufficient debris (i.e., debris quantity and relative size is such that is not practical and/or cost-effective for debris sorting or recycling), this is the appropriate cleanup alternative.

Stabilization and Solidification. This will only be required if areas of slag are encountered that have leachable lead or other metals at or near the dangerous waste level based on TCLP testing. If material approaches the dangerous waste level, it will be stabilized by solidification, and then disposed of in a Class D landfill.

Reuse of Excavated Soils for Fill

In general, the reuse of excavated soils will be limited for soils at the Parcel 3 and 15th Street ROW sites. Soils must generally meet the provisions discussed below for reuse as fill (note that this is not an inclusive list). A geotechnical engineer must approve the soils for use as fill during construction, especially if used for support of structures. Generally speaking, soils would be reused as general fill for meeting site grades if soil meets the following criteria:

- Soil quality meets cleanup levels;
- Free of large-sized debris;
- Free of organic debris (e.g., wood): and
- Unsaturated (i.e., at a water content conducive to compaction).

Stockpiled soils that have undergone verification testing and are below cleanup levels may be reused as fill. In addition, soils that do not require stockpiling and

chemical testing (according to the requirements provided above in this section) can be reused as fill.

Remediation Levels

In some areas, local excavations of contaminated materials may be desired based on observations of potentially contaminated materials during site redevelopment activities. Under the Consent Decree provision for removal of small, readily accessible quantities of soil with significant risk, overexcavation of these materials may be undertaken. For this case, remediation levels are established to define the boundaries of the area to be excavated.

The remediation levels are established based on the assumptions of an exposure scenario of a utility and/or construction worker coming into contact with site soils 150 days per year for 20 years (using equations from WAC 173-340-745). These criteria are more stringent and conservative than is likely to occur given the short period of construction and the low frequency of utility repairs and upgrades. Additionally, as discussed above, these levels would only be used to determine boundaries of an overexcavation given that a suitably protective cleanup action (i.e., pavement cap and/or soil cover) is already being implemented. Soil remediation levels are proposed as follows:

- Total cPAHs concentrations shall not exceed the MTCA industrial cleanup level of 20 mg/kg; this criteria is more stringent and conservative than is likely to occur given the frequency and duration of exposure for a construction and/or utility worker;

- Lead concentrations shall not exceed the MTCA industrial cleanup level of 1,000 mg/kg; this criteria is more stringent and conservative than is likely to occur given the frequency and duration of exposure for a construction and/or utility worker;

- The TPH concentration shall not exceed 15,000 mg/kg based on a conservative estimate of the residual saturation levels for a fuel oil in granular site soils. Using a conservative assumption that all of the non-carcinogenic hydrocarbons present on the site are the more toxic aromatic compounds, the Method C industrial cleanup level for non-carcinogenic TPH would be 105,000 mg/kg. However, although this concentration may be protective of direct contact exposures, soils with this level of TPH likely contain free product. A TPH concentration of 15,000 mg/kg is not expected to exceed residual saturation based on granular site soils and the fuel oil nature of the TPH indicated by existing site chemistry as indicated in Table 2 below, and

the lack of free phase product observed in soil with TPH concentration of 12,000 mg/kg.

Table 2 - Ranges of Residual Liquid Hydrocarbon Concentrations in the Unsaturated Zone (API, 1993)

Medium	Gasolines in mg/kg	Middle Distillates in mg/kg	Fuel Oils in mg/kg
Coarse gravel	950	2,200	4,900
Coarse sand and gravels	1,500	3,500	7,800
Medium to coarse sand	2,800	6,500	15,000
Fine to medium sand	4,700	11,000	24,000
Silt to fine sand	7,600	17,000	39,000

Description of Selected Alternatives—Parcel 3 Public Esplanade (SCAP 9 Area)

The cleanup action selected for the SCAP 9 Public Use Area will include a combination of Alternatives 2 and 3. No action is generally not applicable for Parcel 3 given that site development will require excavation for grading, construction of development components, and utilities, and that the remedial investigation indicates that areas of contamination are likely to be encountered.

Isolation by soil cover or pavement cap will occur over most of the esplanade (SCAP 9) area. Based on proposed grades for the upland area and waterway bank improvements, some overexcavation will be required to provide a minimum 3-foot soil cover. As shown on Figures 3 and 5, overexcavation of 1 to 3 feet may be needed throughout SCAP 9 where the final grades are either at existing grade or within 1 to feet of existing grade. Overexcavation in these areas would occur prior to placing clean fill. The western portion of the SCAP is planned as paved area paralleling the waterfront for public access. In pavement areas (See Figure 4), overexcavation will not required because the pavement will act as the cap preventing any future contact with the subsurface soils.

Based on the soil quality results from the remedial investigation and our understanding of past disposal practices along the bank of the waterway, most excavated soils generated from grading and utility excavations will require treatment and/or disposal subsequent to stockpiling and chemical testing. A portion of these materials may be reusable as non-structural fill. For this to occur, soil quality must be in accordance with the cleanup levels, the soil must be geotechnically suitable, and the soil must be generally free of debris (refer to previous section on "Determination of Treatment/Disposal Applicability").

Description of Selected Alternatives—15th Street Public ROW (Park/View Corridor)

The cleanup action selected for the 15th Street ROW area is based on the future development plans for the area. Under the current condition, a no action alternative is feasible because of the integrity of the existing pavement over most of the ROW. However, under proposed redevelopment plans for a public park (ARRJW, 1997), which may include constructed wetlands, stream, and lawn areas, Alternatives 2 and 3 would be applicable.

Preliminary design work has considered the 15th Street ROW as public access and park as shown on Figure 6. This proposal includes use of the area below the 15th Street ramp as asphalt-paved parking area. In addition, a constructed wetland with small ponds and "viewpoint" paths would be developed under the ramp. For this redevelopment option, cleanup action would consist of a combination of excavation and treatment of contaminated soils, and isolation by soil cover and pavement cap. Figure 6 depicts the cleanup alternatives for this redevelopment option.

Three feet of overexcavation will be required to maintain a 3-foot soil cover cap thickness below the lowest adjacent grades for the "ponds" and stream area. Depth of overexcavation assumes that the wetlands areas and sidewalks, etc., are planned to coincide with existing grade (See Figure 7).

Soils that appear to be contaminated based on field screening, or soils that have been interpreted to be within the extent of contamination shown on Figure 2, will be stockpiled for testing. If soil quality does not exceed residential cleanup levels it can be reused as fill, if geotechnically suitable. Alternatively, soil will be thermally treated if cPAH and TPH-O are the primary contaminants. Landfilling and/or recycling would be used for debris disposal. If slag is encountered, the soils would be stockpiled separately and handled as discussed previously. Specific elements of the cleanup plan are outlined below.

Site Preparation

Site preparation will consist of removal of asphalt pavement and concrete sidewalk, and possibly removal of slag (if encountered near the waterfront) to accommodate overexcavation and placement the clean fill beneath areas forming the planned stream channels.

Overexcavation and Treatment/Disposal of Contaminated Soils

Overexcavation of surface soils to allow for the placement of 3 feet of clean soil cover cap beneath the lawn, pond, and stream areas would occur. The data to date indicate cPAHs as the primary soil constituent above the residential use cleanup levels. The cPAH-containing soils would be thermally treated. Although slag was not encountered in exploration R15-B01, it was encountered in an adjacent boring (P3-B01) on Parcel 3. In this area of the bank, the potential for encountering slag should be considered in the remedial design plans. Additionally, some debris sorting may be required. All debris and slag (if applicable), will be disposed of in a Class D (lined) landfill. Refer to previous section for discussion of treatment and disposal alternatives.

Placement of a Geosynthetic Liner and Additional Exploration

Placement of a geosynthetic liner beneath the "constructed wetland" area consisting of three small ponds interconnected with stream channels may be needed to prevent future mobilization of contaminants due to the added infiltration from these features and/or the groundwater mounding which may occur. Additional exploration and sampling with installation of monitoring wells may be needed in the specific area of the wetlands to evaluate the soil and groundwater quality, groundwater levels, and provide additional data for subgrade and liner design.

Trench Excavations for Utilities

Limited excavation for utilities is proposed for the 15th Street ROW according to present information; however, at this time it is uncertain whether the existing utilities will be maintained or replaced in this area. Soils would be excavated from utility trenches in accordance with the Consent Decree requirements and this Cleanup Action Plan as previously discussed.

Placement of Soil Cover

Soil cover will be used to isolate deeper contaminants in the lawn areas. In addition, soil cover will be placed beneath the constructed wetlands/streams features following the overexcavation.

Installation of Pavement Cap

Pavement will be used for public access to different areas of the park and to the Esplanade. These areas will provide a barrier to prevent direct contact with underlying contaminated soils. Pavement cap will consist of asphalt walkways or

concrete sidewalks that will either use existing pavement, use existing pavement with asphalt overlays, or include new pavement.

Storm Water Runoff and Site Drainage

Collection and drainage of the storm water from pavement cap and soil cover areas are an integral component of the cleanup action. Storm water will be collected and discharged to the drain lines in Dock Street, to existing lines beneath the 15th Street ROW, or into the constructed wetlands and stream features. All storm water collection and drainage will be designed consistent with the Ecology's Stormwater Management Manual for Puget Sound basin including implementation of applicable BMPs.

During construction, erosion and sedimentation control measures will be implemented to prevent contaminated soils from leaving the site. This also aids in stabilizing exposed soils, and preventing storm water discharge to the waterway. Applicable BMPs from the Stormwater Manual for the Puget Sound Basin will be used during construction.

Compliance Monitoring

Compliance monitoring will be performed to confirm that human health and the environment are protected during the construction, and operation and maintenance, of the cleanup action. Compliance monitoring will also confirm that the cleanup actions have attained the cleanup standards prescribed by the cleanup plan, and confirm the long-term effectiveness of the remedial action. Compliance monitoring will be performed according to the criteria specified in WAC 173-340-410 and -360(8), and the Consent Decree as follows:

- Protection Monitoring will be implemented during construction by ensuring that site workers are appropriately trained in health and safety and that a health and safety and contingency plans for encountering hazardous materials are available during construction. Soils that are obvious waste materials will be stockpiled and covered to prevent contact. Appropriate erosion and sedimentation control, and site drainage control measures will be used to ensure that no discharge occurs to the waterway during earthwork activities.

- Performance Monitoring will be performed during construction on all soils deemed suspect during the utility excavations. Suspect soils will be stockpiled separately and chemically analyzed for the constituents of concern identified in the RI report. Appropriate treatment and/or disposal

will be performed on excavated soils in accordance with applicable facility permits, the Consent Decree, and this cleanup action plan.

- Confirmational monitoring will be performed by collection of groundwater monitoring data during and after completion of the cleanup actions. The groundwater monitoring will ensure that the disturbance of the soil during construction and the various site work will not cause future leaching of contaminants to groundwater. A compliance monitoring plan will be submitted as part of the remedial design documents.

JUSTIFICATION OF CLEANUP ALTERNATIVE

MTCA requires that any alternative selected for site remediation must meet as minimum four threshold criteria: protect human health and the environment; comply with cleanup standards; comply with applicable state and federal laws; and provide for compliance monitoring. In addition, the cleanup action shall use permanent solutions to the maximum extent practicable and consider public concerns. The selected alternative meets these criteria as described below.

Protection of Human Health and the Environment

The cleanup action protects human health and the environment by eliminating the potential for direct contact with subsurface soils. The subsurface soils will be isolated from contact by pavement caps and building foundations in many areas, and by a minimum of 3 feet of soil cover in other areas. Contaminated soils that are excavated will be treated or landfilled, eliminating direct contact concerns for future site use and reducing on-site contaminant volumes. Use of thermal desorption where possible will permanently reduce contaminant volumes.

Groundwater quality at Parcel 3 has not been impacted beyond background levels and the data indicate that Parcel 3 soils are not acting as a source of contamination to groundwater. Confirmation monitoring will ensure that the groundwater continues to be protected. The cleanup action also eliminates the potential for impacts to the waterway by isolation of contaminated soils from surface water runoff.

Compliance with Cleanup Standards

The selected cleanup alternatives comply with the Consent Decree cleanup standards and the reasonable maximum exposure scenario expected with any future site uses.

Compliance with Applicable or Relevant and Appropriate Requirements

Applicable or Relevant and Appropriate Requirements (ARARs) associated with the following laws and regulations apply to the site:

Federal Laws and Regulations

- 33 USC 1251 *et. Seq.* (Clean Water Act) and 40 CFR 230;
- 40 CFR 131 Subpart D (Federally Promulgated Water Quality Standards);
- Subtitles C and D - 42 USC 6921-6949a and 40 CFR Part 268 (Resource Conservation and Recovery Act - RCRA);
- 20 CFR Subpart 1910.120 (Occupational Safety and Health Act); and
- Executive Order 11988 (40 CFR Part 6, Appendix A - Flood Plain Management).

State Laws and Regulations

- Chapter 70.105 RCW (Washington State Hazardous Waste Management Act) and Chapter 173-303 WAC (State Dangerous Waste Regulations);
- Chapter 90.48 RCW (State Water Pollution Control Act);
- Chapter 90.70 RCW (Puget Sound Water Quality Act);
- Chapter 173-201A WAC (Water Quality Standards for Surface Waters of the State of Washington);
- Chapter 173-14 WAC (Shoreline Management Act);
- Chapter 75-20 RCW (State Hydraulic Code) and Chapter 220-11 WAC (Hydraulic Code Rules);
- Chapter 75-20 RCW (Construction Projects in State Waters);
- Chapter 70.95 (Solid Waste Management - Reduction and Recycling);
- Chapter 70.94 RCW (Washington Clean Air Act);
- Chapter 173-160 WAC (Minimum Standards for Construction and Maintenance of Wells);
- Chapter 43.21C RCW (State Environmental Policy Act) and Chapter 197-11 WAC (State Environmental Policy Act Rules); and
- Washington Industrial Safety and Health Act (WISHA).

The selected cleanup plan complies with the ARARs from the laws and regulations listed above. These ARARs include compliance with the specific substantive requirements for project permits. Other administrative approvals and authorizations which are separate from substantive requirements will be complied with as part of the permitting process.

Compliance Monitoring

Compliance monitoring will be provided during and post-construction as described above. Protection monitoring will be implemented during construction, performance monitoring will include implementation of treatment or disposal of obvious waste material that is encountered, and groundwater monitoring will be performed to ensure that groundwater quality remains the same or improves. Establishment of saltmarsh vegetation on the intertidal benches will be monitored as specified in the Habitat Assessment and Mitigation Plan (HAMP; Pentec 1999).

Short-Term Effectiveness

The short-term effectiveness considers how the cleanup action impacts human health and the environment during the construction phase and prior to the attainment of cleanup standards. The primary risk during construction of Parcel 3 and 15th Street ROW development elements is workers coming in direct contact with contaminated soils during excavations and grading, and the potential for contaminant discharges to the waterway. Exposures to contaminated materials that may be encountered during construction can be addressed through a worker health and safety plan; by reducing dust generation during dry construction periods; and by constructing appropriate on-site drainage and erosion control measures.

Long-Term Effectiveness

The long-term effectiveness of the cleanup action is evaluated in terms of the magnitude of residual risk and the adequacy and reliability of the cleanup action. The residual risk will be dramatically reduced, or even eliminated, by removal and treatment of relevant cPAH/TPH-O-contaminated soils and capping or disposal of the lead-containing soils encountered during construction. Risk reduction will be further achieved by implementing treatment and/or disposal options for all excavated materials that are contaminated, including backfill of all utility trenches with clean soils. Where thermal desorption is used, the contaminants are permanently destroyed, eliminating all residual risk.

Permanent Reduction of Toxicity, Mobility, or Volume

This evaluation criterion addresses the preferential implementation of treatment technologies that permanently and significantly reduce toxicity, mobility, and volume of the hazardous substances present. Given the age and nature of the upland fill materials and their general lack of leachable constituents to the groundwater system, a capping alternative is appropriate. Any petroleum-

containing soils, or soils containing cPAHs at concentrations above the risk-based screening levels will be treated using a thermal desorption technology. Thermal desorption reduces the toxicity, mobility, and volume of contaminants in soil permanently. On-site volumes will be also be reduced by the landfill disposal of all excavated material that may not be treatable (e.g., the lead-containing soils and debris).

Implementability/Technical Feasibility

The technologies chosen in the cleanup action have been implemented and used reliably elsewhere to remediate contaminated soil with similar characteristics.

State and Community Acceptance

State and community acceptance was evaluated by subjecting the Draft SCAP to public comment. The SCAP was modified based on the comments received.

Cost

Capping and soil cover is the most appropriate and cost-effective method of risk reduction for Parcel 3 and the 15th Street ROW. Appendix A presents the estimated cleanup costs for each of the SCAP areas and options.

SUBSTANTIVE REQUIREMENTS FOR PERMITS

Persons conducting cleanup under a MTCA Consent Decree are exempt from having to obtain certain state and local permits or approvals. Instead, the substantive requirements of those permit laws must be complied with as a part of the MTCA cleanup. The following are the substantive requirements, identified to date, that must be complied with.

Ecology, Chapter 90.48 RCW, Water Pollution Control

Construction design and implementation shall include measures to prevent any discharge into any waters of the state any organic or inorganic matter that shall cause or tend to cause pollution of such waters according to the determination of Ecology.

33 USC Sections 1341 and 1344 (CWA - Section 401 and Section 404) and 40 CFR Part 230

Discharges of material into navigable waters are regulated under Sections 401 and 404 of the CWA (33 USC Sections 1341 and 1344), 40 CFR Part 230 [Section 404(b)(1) guidelines], 33 CFR Parts 320 (general policies), 323 and 325 (permit requirements), and 328 (definition of waters of the United States). These requirements regulate the discharge of dredged or fill material to waters of the United States, implemented by the U.S. Army Corps of Engineers (Corps). Section 404(b)(1) guidelines, 40 CFR 230.10(b), specify criteria which prohibit discharges that violate various provisions of the CWA. These standards are legally applicable and affect planned sediment removal and fill placement activities (as well as related water quality issues).

The guidelines at 40 CFR 230.10(c) also provide that no discharge will be authorized which contributes to significant degradation of the waters of the United States. Where there is no practicable alternative to a discharge, 40 CFR 230.10(d) requires the use of appropriate mitigation measures to minimize potential adverse impacts of the discharge on the aquatic ecosystem.

The Endangered Species Act, 16 United State Code, Section 1531

The Endangered Species Act (ESA) of 1973, as amended (16 USC § 1531), provides "... a means whereby the ecosystems upon which endangered species depend may be conserved." On May 24, 1999, the National Marine Fisheries Service (NMFS) formalized the listing of Puget Sound chinook salmon *(Oncorhynchus tshawytscha)* as threatened under the Endangered Species Act (ESA). NMFS has designated the coho salmon *(O. kisutch)* as a candidate for listing. The U.S. Fish and Wildlife Service (USFWS) listed bull trout *(Salvelinus confluentus)* in Puget Sound as threatened, effective December 1, 1999. The presence of these species in the Thea Foss Waterway will require the U.S. Army Corps of Engineers (Corps) to engage in a consultation with NMFS and USFWS regarding the effects of their decision for issuing a Nationwide Permit (NWP 38) for the remedial action on chinook, coho, bull trout and their habitat under Section 7 of the ESA. The City of Tacoma is working with the Corps to facilitate the consultation process through preparation of a biological evaluation (BE) with succinct and focused assessment of the potential effects of the remedial action on listed (or proposed) species in the project area.

Memorandum of Agreement between EPA and U.S. Army Corps of Engineers [Mitigation under Clean Water Act Section 404(b)(1)]

The Agreement sets forth policy and procedures for developing mitigation for compliance under Section 404, but does not alter any of the requirements under this section. These guidelines for mitigation include, in order of importance, avoidance, minimization, and compensatory mitigation.

U.S. Fish and Wildlife Mitigation Policy (46FR 7644)

This policy establishes guidance for U.S. Fish and Wildlife personnel involved in making recommendations to protect of conserve fish and wildlife resources.

State of Washington Ecology, Chapter 70.105 RCW, Hazardous Waste Management

Remedial action shall not allow for disposal of dangerous wastes in any manner not in compliance with regulations under Chapter 173-303 WAC.

State Environmental Policy Act (SEPA - Chapter 43.21C RCW) and SEPA Rules (Chapter 197-11 WAC)

Rules on the integration of MTCA and SEPA provided in WAC 197-11-250 through 268 list applicable requirements for the project. Implementation of the site remediation action triggers SEPA environmental review (e.g., SEPA checklist), threshold determination, and public notice. Pursuant to WAC 197-11-060(5) and WAC 197-11-630 a review was done to ensure compliance of the remedial action with SEPA. A Mitigated Determination of Nonsignificance was issued for the site. A public comment period was conducted concurrent with that for the Site-Specific RI and SCAP.

Puget Sound Clean Air Agency, Regulation I of the Puget Sound Clean Air Agency

Remedial action shall be performed so as to not allow the emission of any air contaminates in violation of the visual standard established by Section 9.03 of the regulation. Remedial action shall be performed so as to not allow the emission of particulate matter in violation of Section 9.04 of the regulation.

Remedial action shall be performed so as to not allow the emission of air contaminates in violation of Section 9.11 of the regulation. Remedial action shall be performed so as to not allow the emission of fugitive dust in violation of Section 9.15 of the regulation. Equipment utilized on site for the remedial action

shall be maintained in such a manner as to not be in violation of Section 9.20(b) of the regulation.

Regulation III of the Puget Sound Clean Air Agency

The numerical standards for compliance with air emissions regulations that apply to remedial action on the site are those listed in Appendix A, Acceptable Source Impact Levels, of the regulation.

City of Tacoma, Storm Water Management Manual

Project activities will comply with provisions of the City of Tacoma Storm Water Management Manual and underlying regulations for storm water management in accordance with the National Clean Water Act, the Puget Sound Water Quality Management Plan, and the National Pollutant Discharge Elimination System Storm Water Permit. For environmental cleanup and redevelopment, activities comply with best management practices identified in Section A5 of manual "Construction and Demolition Activities" and Section A6 "Other Activities."

City of Tacoma, Chapter 13.10, Shoreline Regulations

Construction design shall include:

- Measures to minimize erosion during and after construction and for the replanting of the site after construction.
- Measures to minimize the problems of contamination of surface waters, depletion and contamination of groundwater, and the generation of increased surface water runoff.
- Provisions for facilities or appurtenances for disposal of sanitary waste and shall monitor the use of chemicals, fertilizers, and other pollutants in such a manner so as to not degrade existing levels of surface water and groundwater quality. Dust control measures, employing vegetative controls where feasible, shall be taken.
- Signs required for safety and security shall be allowed. All signs shall be of permanent materials.

City of Tacoma, Chapter 70, Uniform Building Code—Excavation and Grading

Grading and excavation requirements include:

- The slope cut surface shall be no steeper than safe for intended use, and shall be no steeper than two horizontal to one vertical. Detrimental amounts of organic material shall not be permitted in fills.
- No rock or similar irreducible material with a maximum dimension greater than 6 inches shall be buried or placed in fills.
- The top cut slopes shall not be made nearer to a site boundary line than one fifth of the vertical height of the cut with a minimum of 2 feet and a maximum of 10 feet. The setback may need to be increased for any required interceptor drains.
- Unless otherwise indicated on the approved grading plan, drainage facilities and terracing shall conform to the provisions of Section 7012 for cut or fill slopes steeper than three horizontal to one vertical.
- The faces of cut and fill slopes shall be prepared and maintained to control against erosion. This control may consist of effective planting. The protection for slopes shall be installed as soon as practicable and prior to calling final approval.

City of Tacoma, Chapter 12.08 City Code

Comply with provisions for acceptance of any water generated by remedial action discharged into the City sewer system.

Tacoma Pierce County Health Department, Waste Disposal Authorization

Comply with provisions for acceptance of any soils to be disposed of at the City of Tacoma Municipal Landfill according to criteria developed for the facility.

Mitigation Analysis

Cleanup of Parcel 3 will eliminate potential sources of contamination to the Thea Foss Waterway. Cleanup of the Parcel 3 shoreline will result in removal of existing derelict overwater structures and a large number of treated wood pilings.

Overall, the cleanup of Parcel 3 will result in minor gains and losses of intertidal habitat area at elevations below MHHW. There will be a negligible change in intertidal habitat area below MHHW (net change less than 25 square feet). The area of productive intertidal habitat will be extended up to the OHW level (about elevation 14.5 feet MLLW; 8.2 feet City of Tacoma datum) through the establishment of benches supporting saltmarsh vegetation along a portion of the SCAP 9 area. Approximately 0.25 acre of new habitat (775 feet by 14 feet) will be added in this fashion. Thus, the remediation of the shoreline in the SCAP 9 area will result in a net increase of approximately 0.25 acre of new habitat below OHW.

SCAP 9 cleanup will have the following additional positive impacts on the nature of marine habitat in the Thea Foss Waterway:

- Removal of several hundred pilings;
- Removal of approximately 0.42 acre of derelict overwater structures;
- Removal or capping of debris;
- Reduction in beach slopes (e.g., Figures 5b and 5c); and
- Provision of more natural substrata.

Collectively, these changes will improve the habitat quality of approximately 0.8 acre of shoreline habitat between MHHW and MLLW along this shoreline. The significant net positive effects on area and quality of marine habitat that will result from completion of the SCAP 9 remediation will offset net losses of low quality habitat in other SCAPs along the southwest shoreline of the Thea Foss Waterway. The net change in marine habitat resulting from shoreline remediation and upland remediation and development along the area between 15th Street and 22nd Street are dealt with in the HAMP (Pentec, 1999a).

SCHEDULE FOR IMPLEMENTATION

The cleanup action shall be completed within a reasonable time frame. Factors to be considered in establishing the cleanup time frame shall be in accordance with WAC 173-340-360(6) and the Consent Decree. Remedial design documents shall be submitted within one year of entry by court of amendment to Area-wide Consent Decree to include the SCAP for this site. The following tasks are planned for implementation of this cleanup action:

TASK 1	Submit to Ecology a Draft Engineering Design Report, construction plans and specifications, maintenance plan, compliance monitoring plan, and financial assurance documents (hereafter "Remedial Design Documents"). Schedule: Within one year of entry by the court of the amendment to the Area-Wide Consent Decree to include the SCAP for this site.
TASK 2	Submit final documents listed in Task 1 that incorporate Ecology's comments on the draft documents. Schedule: Within 30 of receipt of Ecology's comments on the drafts.
TASK 3	Begin implementation of Site-Specific Cleanup Action Plan. Schedule: In accordance with the schedule approved in the Remedial Design documents.
TASK 4	Submit as-built documentation of the cleanup and final financial assurance documents and procedures for periodic adjustment. Schedule: In accordance with the schedule approved in the Remedial Design documents.
TASK 5	Perform long-term monitoring, operation and maintenance. Schedule: In accordance with the schedule approved in the Remedial Design documents.

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Hart Crowser, 1998. Draft Final Parcel 3 and 15th Street ROW Site-Specific Remedial Investigation (RI report), Thea Foss Upland Properties. October 12, 1998.

Pentec Environmental, 1999a. Thea Foss Uplands Remediation Habitat Assessment and Mitigation Plan (HAMP), prepared for the City of Tacoma Public Works Department.

Pentec Environmental, 1999b. Thea Foss Upland Remediation Biological Assessment, Review Draft. Prepared for City of Tacoma, Public Works Department.

State of Washington Department of Ecology, 1994. Consent Decree 94-10917 6 between the State of Washington Department of Ecology and the City of Tacoma and Metropolitan Park District of Tacoma, filed October 7, 1994.

The Robinson Company, 1998. Revised Design Development Cost Estimate for the Thea Foss Waterway, a letter to Architects Reed Reinvald Johnson Willows, August 21, 1998.

Table 1 - Cleanup Standards for Soil and Groundwater

Constituent	Soil Cleanup Level in mg/kg (Method B)	Groundwater Cleanup Level in ug/L
TPH[a]	5,700	1,000
Benzene	34.5	71.0
Toluene	16,000	200,000
Ethylbenzene	8,000	29,000
Xylenes	160,000	16,000
Carcinogenic PAH compounds	0.137	0.031
Antimony	32.0	4,300
Arsenic	1.43 (20[b])	0.14
Cadmium	80.0	8.0
Chromium (VI)	400	50.0
Copper	2,960	2.5
Lead	250[c]	5.8
Mercury	24.0	0.025
Nickel	1,600	7.9
Zinc	24,000	76.6
PCB (Total)	0.13	0.030

Notes:

Table 1 is based on the Thea Foss Area-Wide Consent Decree (see Table 4-1 in the Cleanup Action Plan, 8-24-94). A few modifications are made to account for site-specific characteristics and contemporary cleanup policies.

[a] The TPH cleanup standard of 200 ppm as presented in the Consent Decree may be adjusted to allow for alternatives in setting the standard based on new risk assessment methods adopted by Ecology. In this case we are using 5,700 mg/kg as the residential direct contact cleanup level for TPH in soil based on Parcel 3 data and the current Ecology TPH policy.

[b] Cleanup level based on the Method A cleanup criteria.

[c] Soil cleanup levels for lead are not defined under Method B. Cleanup level is based on the MTCA Method A level.

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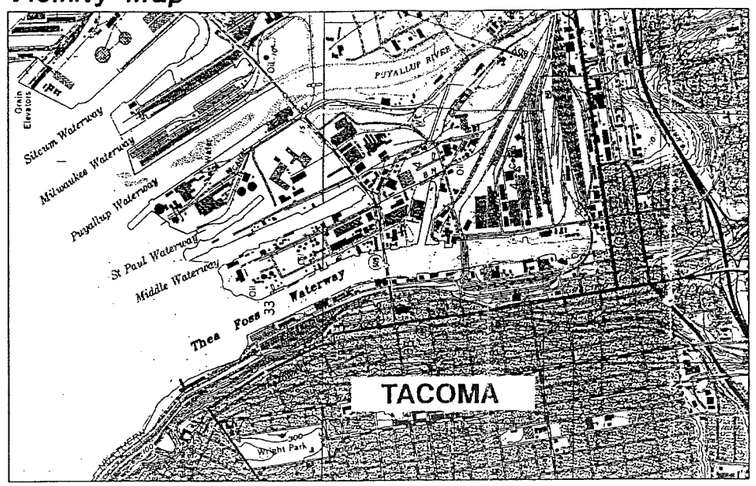
Site 4A-C

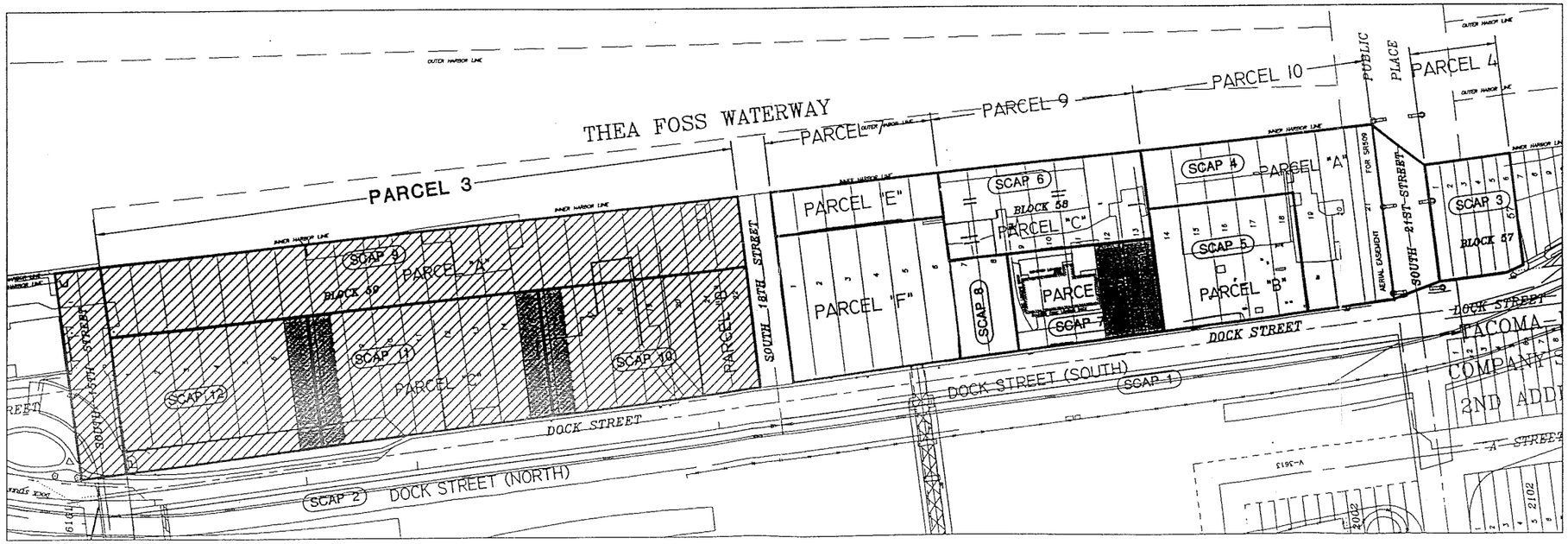
Project Area Map

Site-Specific Cleanup Action Plans

KC 10001B

Vicinity Map





N

0 200 400

Scale in Feet

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Figure 1

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DWG 12/16/98 1=1 xref=base.dwg color.pc2
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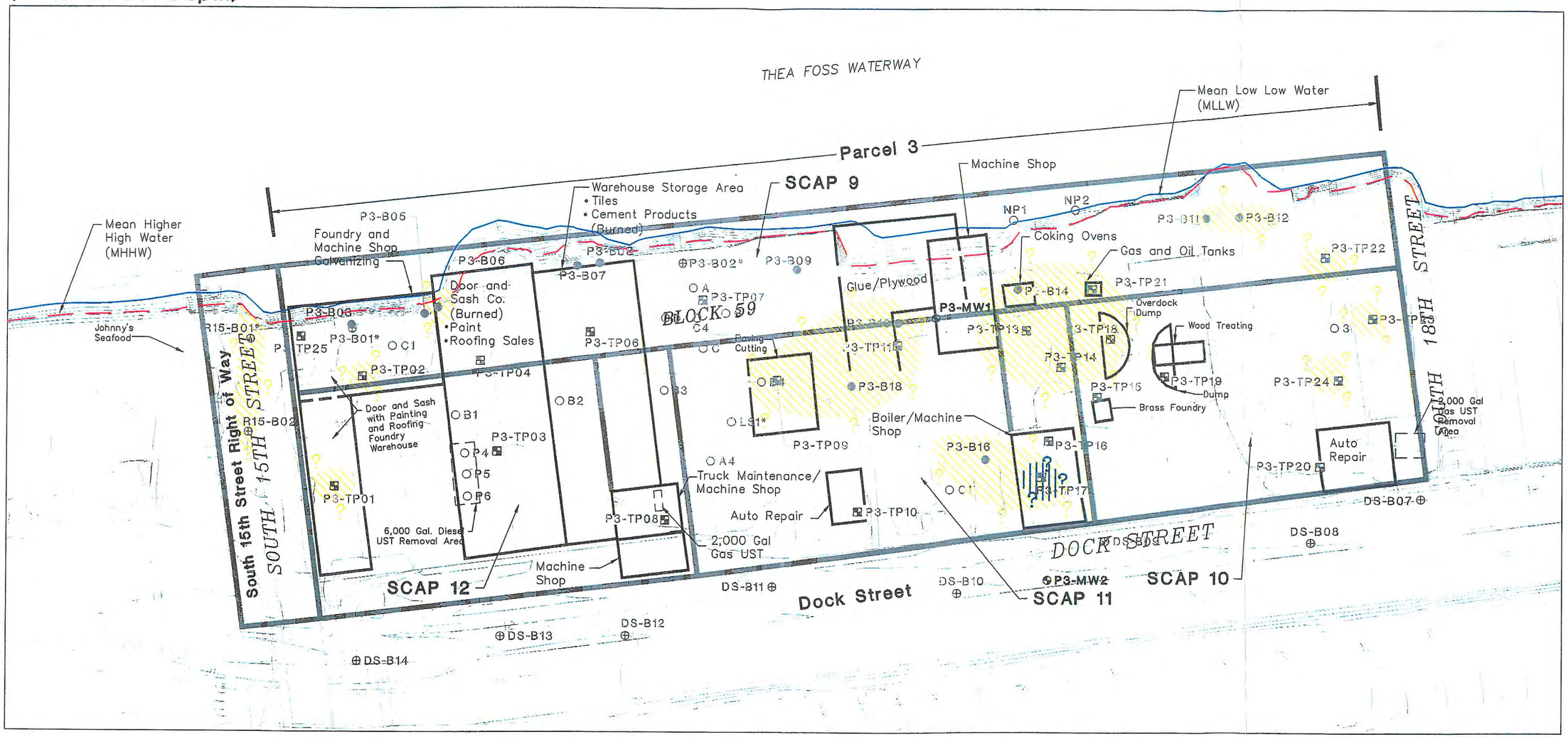
Site 4A-C

Summary of Potential Cleanup Action Areas

Parcel 3 and 15th Street ROW

(0- to 3-Foot Depth)



Exploration Location and Number (Source)

- ⊕ A1 — Soil Boring (Bison, 1990, and E+E, 1990)
- ⊙ PA3 — Abandoned Monitoring Well (WSDOT)
- * — Indicates groundwater grab sample obtained
- P3-TP01 — Test Pit (Current Study)
- ⊕ R15-B01 — Soil Boring (Current Study)
- ● P3-B01 — Strataprobe Boring (Current Study)
- ⊕ P3-MW1 — Monitoring Well (Current Study)

Potential Cleanup Action Areas

- cPAHs
- Lead

N

0 100 200

Scale in Feet

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Figure 2 1/2

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CYD 12/17/98 1=100 xref=BASE and FOSSCONT 1=100 4676color.pc2
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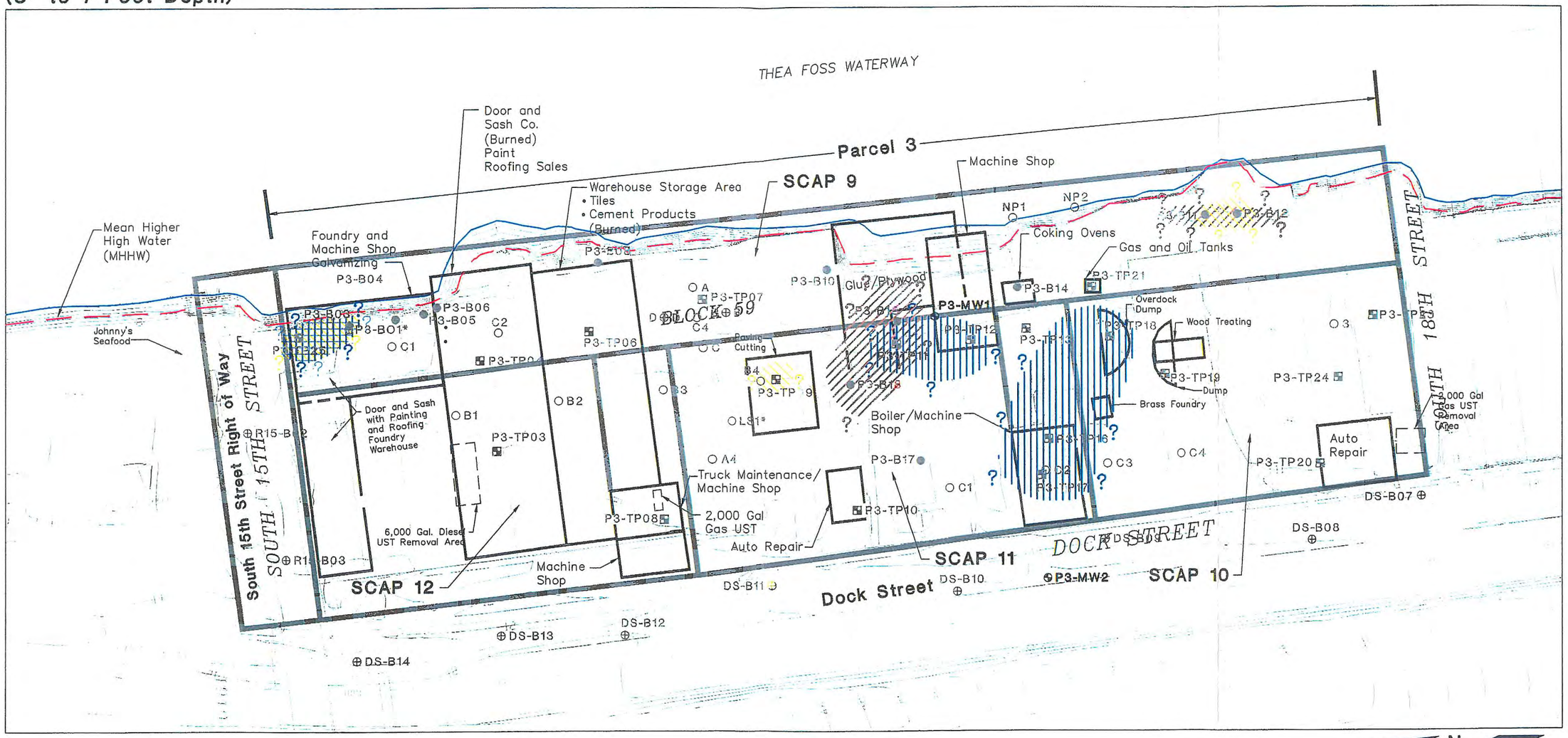
Site 4A-C

Summary of Potential Cleanup Action Areas

Parcel 3 and 15th Street ROW

(3- to 7-Foot Depth)



Exploration Location and Number (Source)

○ B1	Soil Boring (Bison, 1990, and E+E, 1990)	■ P3-TP01	Test Pit (Hart Crowser, 1997)
⊙ PA3	Abandoned Monitoring Well (WSDOT)	⊕ R15-B01	Soil Boring (Hart Crowser, 1997)
*	Indicates groundwater grab sample obtained	● P3-B01	Strataprobe Boring (Current Study)
		⊕ P3-MW1	Monitoring Well (Current Study)

Potential Cleanup Action Areas

- cPAHs
- TPH
- Lead
- Copper

N

0 100 200

Scale in Feet

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Figure 2 2/2

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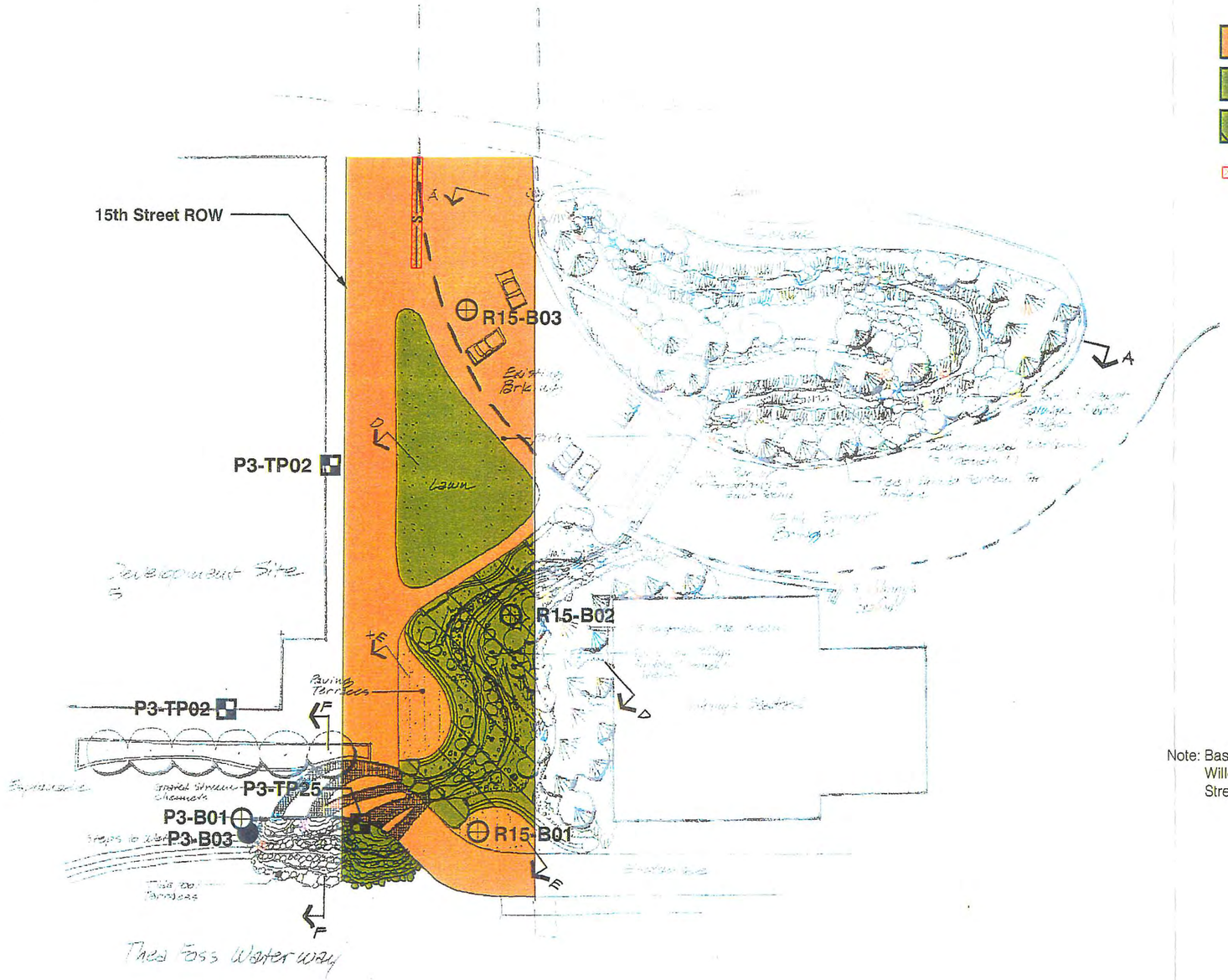
Site 4A-C

Proposed Cleanup Action
15th Street ROW



Pavement Cap

3-Foot Soil Cover Cap

Requires 3 Feet of Overexcavation Including below Stream Beds

Areas of Soil Excavation Required for Utility Construction

N

0 50 100

Scale in Feet

Note: Based on figure by Architects Reed Reinvald Johnson Willows entitled "Schematic Design: 15th Street to 21st Street, Thea Foss Public Esplanade" dated July 1997.

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Figure 6

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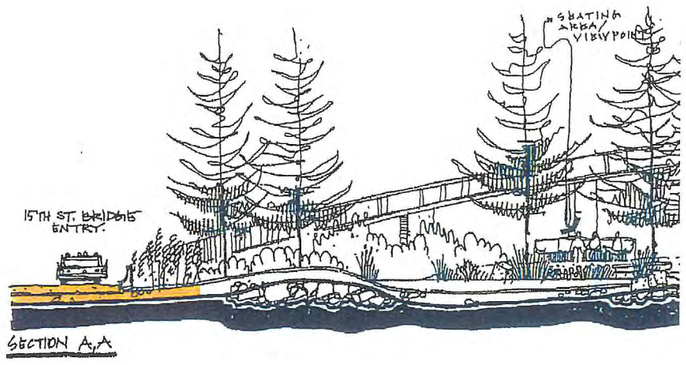
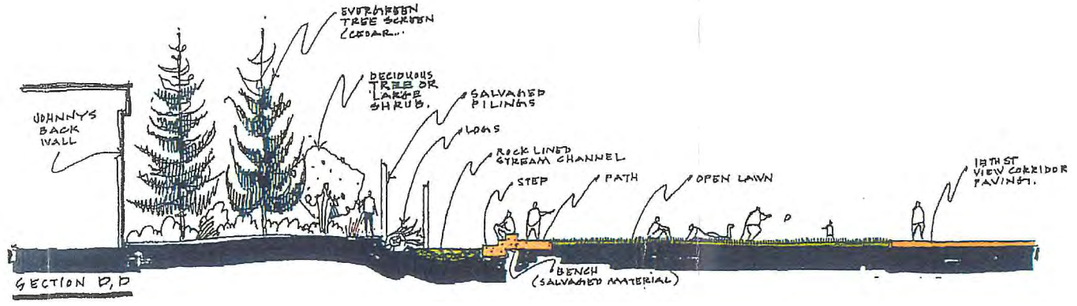
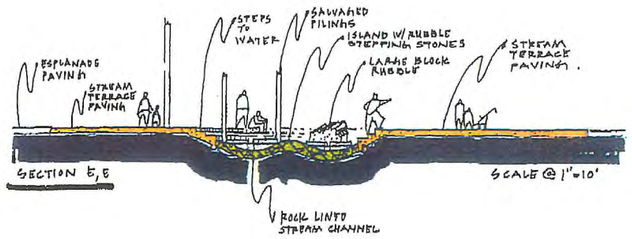
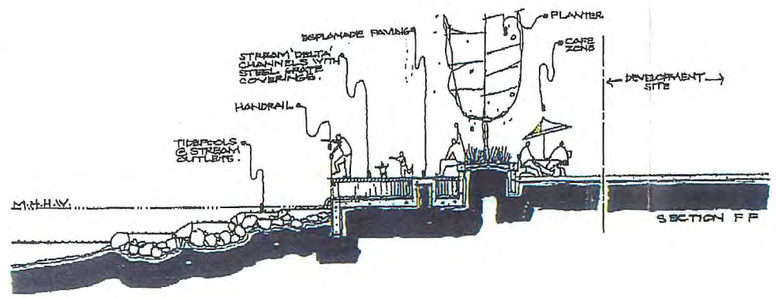
Site 4A-C

Conceptual Cross Sections Showing Cleanup Action Elements
15th Street ROW









Pavement Cap

3 Foot Soil Cover Cap

Requires 3-Feet of Overexcavation Including below Stream Beds

0 50 100

Scale in Feet

Note: Based on figure by Architects Reed Reinvald Johnson Willows entitled "15th Street Corridor Landscape Cross Sections" dated July 1997.

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Figure 7

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4A-D

Draft
Site-Specific Remedial Investigation
Johnny's Seafood Property
Thea Foss Upland Properties
Tacoma, Washington

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Delivering smarter solutions

Prepared for
City of Tacoma

December 6, 2001
4676-71

4A-D

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Chemical Data Quality Review C-1

DRAFT
SITE-SPECIFIC REMEDIAL INVESTIGATION
JOHNNY'S SEAFOOD PROPERTY
THEA FOSS UPLAND PROPERTIES
TACOMA, WASHINGTON

INTRODUCTION

This report addresses the site-specific remedial investigation being conducted for the Johnny's Seafood property. The remedial investigation and any subsequent cleanup activities are being conducted under Consent Decree 94-10917 6 between the Washington State Department of Ecology (Ecology) and the City of Tacoma and Metropolitan Parks District of Tacoma.

The Johnny's Seafood property is located adjacent to and north of South 15th Street (Figure 1). The parcel currently includes a building with a wholesale and retail seafood company and paved parking on the north side. The Johnny's Seafood property is one of four waterfront parcels between Dock Street and the Thea Foss Waterway currently being investigated for the purpose of developing a cleanup action plan under the Consent Decree.

Under the process outlined in the Consent Decree, if a contaminant release has occurred, a site-specific remedial investigation (RI) is performed. The purpose of the site-specific RI is to identify contaminant release(s) on the property that require cleanup and to propose cleanup actions consistent with the Cleanup Action Plan (CAP) defined in the Consent Decree. Site-specific cleanup actions plans (SCAPs) are then developed that are consistent with long-term plans for use of the site.

Future land use for this parcel includes a continuation of the esplanade and public access area along the Thea Foss Waterway. According to conceptual site plans, the existing Johnny's Seafood facility will be upgraded and expanded to the north and east. As currently envisioned, the new facility will include a large retail area with a seafood bar. Parking will continue to be located on the north end of the property.

Scope of Work

The scope of work completed to prepare this report was detailed in the Thea Foss Uplands Site-Specific Remedial Investigation Work Plan (Hart Crowser 2000a). The scope included:

- Excavating three test pits and drilling three Strataprobe™ soil borings and one hand-auger boring to obtain data regarding subsurface physical conditions and soil quality. (Note that the original scope in the Work Plan involved four test pits. However, due to access issues, one of the test pits was replaced with a hand-auger boring. A third Strataprobe™ soil boring was also added to further characterize the site.);

- Collecting three groundwater quality grab samples from the Strataprobe™ borings;

- Comparing the environmental data to Cleanup Levels and Soil Contamination Maximums established in the Consent Decree;

- Evaluating the available data from the investigations to determine whether sources of any detected contamination can be identified; and

- Identifying a cleanup action that is consistent with the Consent Decree Cleanup Action Plan and anticipated future land use of the Johnny's Seafood property.

Historical Land Use

As with the other properties to the north, the Johnny's Seafood parcel was originally tideland. The tideland was filled with dredge material by 1893 as railroad lines developed along the shoreline in this area. Figure 2 presents a site plan outlining potentially significant historical features on the parcel.

One of the first businesses recognized on this parcel was Griffin's Transfer Company, which apparently had a coal operation on Lot 22 in the 1890s. Their facility included a long, narrow coal shed, office, storage, and a railroad spur. By 1901, the property was sold by the Northern Pacific Railway Company to the City of Tacoma for establishing a farmers' market and city dock. The large, segmented building, called City Dock, was used by food wholesalers into the 1960s. Tenants included Northern Fish Products Company, a seafood distributor; Williams Brothers; and West Coast Fruit and Produce Company. City Dock may not have been used only for produce; in 1910, the American Fish Company subleased a portion of their space to Henry Cowell Lime and Cement Company.

In the mid-1960s, the sign shop for the Tacoma Department of Public Works moved into City Dock, initially sharing the building with the Northern Fish Products Company. This lasted until 1970 when a fire occurred causing

substantial damage. A new smaller building for the sign shop was then constructed.

Circa 1975, the sign shop was replaced with a larger building constructed for Johnny's Seafood. In 1977, Johnny's Seafood received a permit to dredge the waterway. Based on a conversation with Gary Gerantis, the owner of Johnny's Seafood since 1977, the dredge material was not placed on site. In the late 1970s, Johnny's Seafood's operations included a gasoline underground storage tank (UST) and pump located on the east side of the building. This UST was used to fuel Johnny's Seafood's trucks. The pump and UST were only used for a few years, as the truck fleet grew beyond the UST's capacity. The tank was closed in place by the Fire Department, who inspected it, pumped out the fuel, and filled it with sand.

Although the long-term use as a City Dock suggests minimal environmental concerns, there are potential concerns associated with former coal storage and associated polycyclic aromatic hydrocarbons (PAHs), residual materials from the City Dock fire which may have released PAHs into the soils, and the occurrence of an UST and attendant soil and groundwater concerns associated with potential petroleum fuel leakage from the tank.

ENVIRONMENTAL INVESTIGATIONS

Summary of Previous Investigations

Several sources of environmental data are available for the Johnny's Seafood and adjacent properties. Investigations were performed adjacent to the Johnny's Seafood property along the Dock Street Right of Way (ROW) to the west of the property (Hart Crowser 2001a) and the South 15th Street ROW, which was investigated in conjunction with Parcel 3 (Hart Crowser 2000b). Two rounds of sediment and bank sampling were performed in the waterway as part of larger waterway investigations (City of Tacoma 1995 and 1996). These data were used in conjunction with historical land use information to interpret environmental site conditions. Collectively, the completed studies provide a preliminary source of environmental data for each parcel. These studies are outlined below.

Dock Street North ROW (2001)

The Dock Street ROW north of South 15th Street is one of the sites currently being investigated under the Consent Decree. Two borings (DSN-B06 and DSN-B07) were drilled in Dock Street adjacent to the Johnny's Seafood property (Figure 3). Arsenic was encountered in one of the borings (DSN-B07) at

concentrations above the Consent Decree cleanup levels (Hart Crowser 2001a). This arsenic occurrence was associated with mixed fill materials placed after the 1890s-era dredge fill.

South 15th Street ROW (2000)

The Remedial Investigation performed at the South 15th Street ROW, immediately south of the Johnny's Seafood property, indicated the presence of metals and carcinogenic PAHs (cPAHs) in soil at concentrations exceeding the Consent Decree cleanup levels (Hart Crowser 2000b). Soils exceeding cleanup levels were in mixed fill materials, similar to those encountered at DSN-B07 in the Dock Street ROW.

Thea Foss Waterway Round 1 and Round 2 Sampling and Analysis

Hart Crowser completed waterway sediment and bank sampling of the Thea Foss Waterway in 1994 as part of the Round 1 Thea Foss Waterway Pre-Remedial Design (City of Tacoma 1995). Two composite sediment samples, RD-B27 and RD-B28, were collected along the shoreline bank near the low tide line at elevations of approximately –4 to –6 feet Tacoma Public Works Datum (TPWD). Sample locations are shown on Figure 3. Chemical analyses included total metals, semivolatile organic compounds (SVOCs), PAHs, polychlorinated biphenyls (PCBs), and pesticides.

During the Round 2 phase of sediment sampling work conducted in 1995 for the Thea Foss Waterway remedial design effort (City of Tacoma 1997), four discrete bank sediment samples, RD2-B01, RD2-B02, RD2-B03, and RD2-B04, were collected from an elevation of approximately –6 feet TPWD. The sampling locations are shown on Figure 3. Chemical analyses were conducted for total metals.

Results from the two sampling rounds suggested the potential for the occurrence of PAHs on the Johnny's Seafood property. Two bank samples, one north and one south of the property (RD-B27 and RD-B28, respectively), contained PAH concentrations, which exceeded the Consent Decree cleanup levels. Both of these samples were associated with brick and wood debris located in the vicinity.

Current Site Investigation

The field investigation was completed by Hart Crowser between March 6 and 20, 2001, to collect site characterization data to support evaluation of any

potential site cleanup needs. The locations of test pits and borings completed for this investigation are shown on Figure 3. Locations of select explorations from previous or ongoing investigations at adjacent sites are also shown on Figure 3. Boring logs and field investigation procedures are presented in Appendix A.

Soil Borings

Three borings (JS-B01, JS-B02, and JS-B04) were completed at the site using a Strataprobe™ direct-push drilling rig on March 20, 2001. A fourth boring (JS-B03) was completed inside the site building on March 13, 2001, using a hand auger. The Strataprobe™ borings were advanced to a depth of 15 feet, and the hand-auger boring was advanced to a depth of 7 feet. Soil samples were collected continuously, beginning at ground surface. At minimum, one shallow and one deep sample were submitted for laboratory analysis per boring, with additional samples submitted if evidence of potential contamination was noted. Typically the shallow sample was collected from within the upper 6 feet and the deep sample from near the water table, below a depth of 6 feet.

The samples were submitted to the City of Tacoma laboratory for analysis of diesel- and oil-range petroleum hydrocarbons, total metals, and PAHs. Soil samples from boring JS-B03 were also submitted for analysis of gasoline-range petroleum hydrocarbons and benzene, toluene, ethylbenzene, and xylene (BTEX) compounds.

Test Pits

Three test pits were excavated at the site using a backhoe on March 6, 2001. Two soil samples from each test pit were submitted for laboratory analysis of diesel- and oil-range petroleum hydrocarbons, total metals, and PAHs. One shallow sample was collected from each test pit from a depth of less than 2 feet. Deeper samples were collected from depths of between 3 and 7 feet.

Groundwater Sampling and Analysis

Groundwater quality samples were collected from borings JS-B01, JS-B02, and JS-B04. The samples were groundwater grabs collected during drilling. The samples were submitted to the City of Tacoma laboratory for analysis of diesel- and oil-range petroleum hydrocarbons, dissolved metals, PAHs, and total suspended solids (TSS).

PHYSICAL SUBSURFACE CONDITIONS

The subsurface soil and groundwater conditions were evaluated to understand the physical setting with respect to contaminant occurrence and migration. In general, the upper fill soils are the most significant with respect to direct contact risk (e.g., to site workers during soil excavation for utilities work). Deeper soils are of more concern with respect to groundwater impact and contaminant migration to the Thea Foss Waterway. A summary of the soil and groundwater conditions is presented in the following sections.

Subsurface Stratigraphy

Our interpretation of subsurface stratigraphy is based on the soil explorations performed for this investigation and knowledge of site history. Exploration logs are presented in Appendix A.

Figure 4 is a cross section running north-south through the site. The entire site is overlain by asphalt parking or the concrete slab of the Johnny's Seafood building with up to 1 foot of sand and gravel structural fill. A Mixed Fill unit, consisting of brown silt or silty fine sand with occasional brick debris and coal fragments was encountered beneath the structural fill. This layer is generally less than 1 foot thick, but may range up to 4 to 5 feet thick at JS-B02 and JS-B04. The Mixed Fill unit increases in thickness to the south and near the waterway. An 8-inch-thick concrete slab from a former structure, likely the old City Dock, was encountered between the structural fill and the Mixed Fill at JS-B01, JS-B04, and JS-TP03. Black sand with varying amounts of shells was encountered beneath the Mixed Fill. The black sand with shells is consistent with 1890s era Dredge Fill and is interpreted as being from this source. When encountered below elevations of approximately –6 feet TPWD, the black sand was interpreted as being native Deltaic and Marine Deposits.

Groundwater Conditions

Groundwater was encountered between depths of 10 and 11 feet in borings at the Johnny's Seafood property (Table 1). No permanent monitoring wells were installed at the site, so water level changes due to tide stage were not measured. Net groundwater flow is expected to be toward the Thea Foss Waterway, with temporary flow reversals during high tide. Based on results from high and low tide water level measurements at the Hicks-Bull property to the north, water level fluctuations through most of the site are expected to be on the order of 1 to 3 feet, decreasing in magnitude toward Dock Street.

NATURE AND EXTENT OF CONTAMINATION

This section describes the nature and extent of constituents identified in soil and groundwater at concentrations above the site cleanup levels. The results of chemical testing on soil and groundwater from the investigations were compared to the cleanup standards for soil and groundwater developed as part of the Consent Decree (Table 2). This table has been modified from the original values developed in the Consent Decree to reflect changes under new MTCA Amendments (Hart Crowser 2001c). The basis of the cleanup levels is as follows:

- Soil cleanup levels are based on the protection of human health under a residential use scenario (MTCA Method B direct contact criteria); and

- Groundwater cleanup levels are based on the protection of marine surface water. Groundwater at the site has been determined by Ecology to not be a current or future source of drinking water based on MTCA criteria. Groundwater cleanup levels include protection of aquatic life (marine chronic criteria; Chapter 173-201A WAC) and the protection of human health from consumption of aquatic organisms (40 CFR 131).

As defined by the Consent Decree Cleanup Action Plan (CAP), groundwater contamination above applicable standards is not expected on the upland properties. Thus, soil quality criteria for groundwater protection is considered if groundwater quality has been impacted such that active remediation is required, or an active source in the soil is encountered.

The Consent Decree CAP was based on the concept that the properties had similar physical characteristics, past land uses, and similar contaminant problems, which allowed for similar cleanup remedies. Given these conditions, a contaminant scenario was developed within which the CAP would be applicable. The contaminant scenario included "Soil Contaminant Maximums" applicable to the CAP contamination scenario. The Soil Contaminant Maximums are presented in Table 2, along with the soil and groundwater cleanup levels. Each site is evaluated relative to the nature and extent of the contaminants identified as well as the Soil Contaminant Maximums to assess applicability of the Consent Decree CAP.

Soil Quality Results

In total, 15 soil samples and one blind duplicate of JS-TP02 S-2 were collected at seven on-site locations. Table 3 presents a summary of the soil chemical

analyses completed by location and depth. A summary of the soil cleanup level exceedences are presented in Table 4.

The shallow sample (0 to 3 feet) at boring JS-B04 is the only location where any analyte was identified in site soils at concentrations exceeding Consent Decree soil cleanup levels. The only analyte to exceed cleanup levels were total cPAHs. Concentrations of analytes in the seven samples were below the Soil Contamination Maximums outlined in the CAP.

The complete results of the soil quality analyses are presented in Tables B-1 through B-5 of Appendix B, which are sorted by chemical groups and exploration location. Appendix C provides laboratory certificates of analysis and a chemical data quality review summary for the current sampling.

Metals

Concentrations of metals analyzed for in Johnny's Seafood soil samples were below the soil cleanup levels presented in Table 2. Complete soil sample metals results are presented in Table B-3. Note that the elevated soil arsenic concentrations (Figure 3; DSN-B07) observed in a boring just southwest of the Johnny's Seafood property during the Dock Street ROW (North) Remedial Investigation (Hart Crowser 2001a) were not encountered on this site.

Organics

Gasoline-range hydrocarbons and BTEX compounds were not detected in the two soil samples submitted from JS-B03 for analysis. Diesel- and oil-range hydrocarbons were detected in one of 16 samples submitted for analysis. In JS-B04 S-1, diesel-range hydrocarbons were detected at a concentration of 24 mg/kg and oil-range at 110 mg/kg—both well below the cleanup levels presented on Table 2. BTEX and hydrocarbon results are presented in Table B-4.

Low concentrations, below MTCA cleanup criteria, of several non-carcinogenic PAHs were detected in samples JS-B03 S-1 and/or JS-B04 S-1. Detected non-carcinogenic compounds included benzo(g,h,i) perylene, acenaphthylene, anthracene, fluoranthene, phenanthrene and pyrene at concentrations ranging between 99 and 2,200 ug/kg (Table B-2).

All six cPAHs analytes were detected in JS-B04 S-1 (0 to 3 feet depth) at concentrations ranging from 160 to 1,600 ug/kg. As indicated in Table 4, the total cPAH concentration for this sample, using the toxicity equivalent methodology presented in WAC 173-340-708(8), equals 1.338 mg/kg (1,338 ug/kg), which is above the cleanup level of 0.137 mg/kg from Table 2.

Carcinogenic PAHs were not detected in any of the other 15 soil samples submitted for analysis (Table B-1).

Groundwater Quality Results

Groundwater grab samples were collected from the three Strataprobe™ borings JS-B01, JS-B02, and JS-B04. A summary of the chemical analyses completed on the groundwater samples from the sampling events and locations is presented in Table 5. The complete results of groundwater chemical analyses are presented by chemical group in Tables B-6 through B-10 of Appendix B. Appendix C provides laboratory certificates of analysis and a chemical data quality review summary for the current sampling.

Table 6 presents the summary of the groundwater quality data, which exceed the groundwater cleanup levels. Dissolved arsenic, copper, and nickel are the only constituents detected at concentrations above Consent Decree groundwater cleanup levels presented in Table 2.

Dissolved Metals

Dissolved arsenic was detected above the cleanup level of 0.14 ug/L in the three Strataprobe™ borings, with concentrations ranging between 9.7 and 21 ug/L. Similarly, dissolved copper was detected above the 3.1 ug/L cleanup level in the three borings at concentrations ranging between 4.5 and 7.3 ug/L. Nickel was detected above the cleanup level of 8.2 ug/L in JS-B01 at a concentration of 14 ug/L.

Other metals (antimony, chromium, lead, and zinc) were detected at one or more locations at concentrations below groundwater cleanup levels (Table B-8).

Metals exceedences in groundwater appear to be representative of area-wide conditions, and are not the result of any identifiable on-site contaminant source. Figure 4 presents arsenic, copper, and nickel concentrations in groundwater from previous and ongoing upland investigations along the waterway. Concentrations of each of these constituents are elevated at the properties north of 15th Street along the west side of the waterway. The detected concentrations at Johnny's Seafood are in the range of those detected at other upland parcels. Soil sample chemical analysis results did not indicate a site source for arsenic, copper, nor nickel in groundwater.

The 0.14 ug/L cleanup level for arsenic is a very conservative criteria for evaluating cleanup and may not be appropriate. This cleanup level is based on protection of human health from consumption of aquatic organisms, assuming

that arsenic is bioaccumulating in fish tissue. Data from fish tissue studies indicate that bioaccumulation of arsenic is not occurring to any significant degree in Commencement Bay or Thea Foss Waterway (Tetra Tech 1985). Based on this finding, a groundwater cleanup level based on protection of human health from consumption of aquatic organisms may be overly conservative. A cleanup level of 36 ug/L, based on the protection of aquatic organisms from the toxic effects of arsenic, may be a more appropriate criteria for groundwater quality entering Thea Foss Waterway.

Organics

Diesel- and oil-range hydrocarbons, non-carcinogenic PAHs, and cPAHs were not detected in the three groundwater samples collected at the Johnny's Seafood site (Tables B-6, B-7, and B-9).

Summary of Subsurface Contaminant Conditions

The only significant contaminant issue identified on the Johnny's Seafood site was an exceedence of the cPAH cleanup level in one soil sample. The cPAH concentration in JS-B04 S-1 was approximately 10 times the cleanup level. Carcinogenic PAHs were not detected in any of the other 15 samples collected at the site. Further, PAHs were not detected in the groundwater sample collected from this boring, nor the other two site Strataprobe™ borings.

A review of the boring and test pit logs presented in Appendix A indicates that "coal" was observed in the 2- to 5-foot-depth interval of JS-B04. The coal was present in the Mixed Fill layer that included individual pieces of brick as well as coal. JS-B04 was drilled in the area of the former coal shed. This area is overlain by the aforementioned parking lot asphalt and the concrete slab. Black sand is situated below this depth in this boring.

It seems likely that the cPAHs detections in JS-B04 S-1 are associated with the coal observed at this sampling location. While the extent of the coal cannot be specifically delineated, it was not observed below a depth of 5 feet in this boring. The coal was also not observed in nearby explorations, including borings JS-B01 and JS-B02, located 40 feet to the north and 100 feet to the south, respectively, and test pit JS-TP03 40 feet to the west. However, it is reasonable to expect it to occur within the Mixed Fill material (Figure 4), particularly around the area of the former coal sheds. Although not specifically observed, burn material may also be expected to contain cPAHs. As the old City Dock burned down in 1970, some residual burn material may occur within the shallow fill material.

The data indicate the Johnny's Seafood site meets the intent of the Consent Decree Cleanup Action Plan with expected contaminant types, land use history, and analyte concentrations. Much of the Johnny's Seafood site appears to contain predominantly relatively clean dredge fill and is likely to have limited contamination. The Mixed Fill unit is the most likely to contain occasional soil material that exceeds cleanup levels; however, the amount of contaminated soil is not expected to be significant given the site history and the findings of this site investigation. The identified contamination is below the maximum soil concentrations allowed in the Consent Decree.

CLEANUP ACTION ANALYSIS

The cleanup action analysis consists of the identification of remedial technologies that conform to the objectives of the Consent Decree, and provides a conceptual understanding of the remedial actions applicable to the site under the terms of the Consent Decree CAP. The CAP identifies Alternative 3 Remediation of Soils Based on Future Land Use Development as the appropriate alternative for site cleanup all along the Thea Foss waterfront based on an Area-Wide Feasibility Study (Black & Veatch 1994).

An analysis of the cleanup action applicable to Johnny's Seafood and the rationale are described herein. Specific technologies will be addressed in greater detail in the site-specific cleanup action plan (SCAP) for future development.

Proposed Cleanup Action for Johnny's Seafood

The development of the Johnny's Seafood SCAP will address the proposed upgrade and expansion of the facility. As currently envisioned, the building footprint will be expanded to the north and east to allow for additional retail area and a seafood bar. An esplanade will run along the Thea Foss Waterway at the west side of the building.

Detected soil contamination occurs beneath the parking lot asphalt and an 8-inch-thick concrete slab, which provides protection of human health and the environment under current conditions. However, isolated contaminated soils could potentially be encountered during construction excavation activities, particularly in shallow soils (upper 2 to 5 feet). From the perspective of protecting human health, soil cleanup levels based on commercial or industrial land use represent appropriate remediation action levels.

If excavation beneath the concrete slab occurs in the vicinity of JS-B04, elevated cPAHs likely associated with coal fragments, could be encountered. In this case,

excavated soils in this area should be segregated and additional testing should be performed to confirm the initial cPAH concentrations and, if possible, confirm its association with/origin from the fragments of coal.

Application of the CAP alternatives are currently envisioned as follows:

- **No Action** is applicable for most of Johnny's Seafood site where no contamination is identified and/or no construction excavation work is planned. Given the relatively low detected constituent concentrations and limited extent of soil exceedences; the existing protection against direct contact with subsurface soils provided by the existing building footprint, asphalt, and subsurface concrete layer; and the lack of groundwater contamination, the subsurface soils at Johnny's Seafood do not appear to pose a threat to human health or the environment if left on site.

- **Isolation by Cap or Cover** is applicable and is provided by the current building footprint, asphalt parking lot, and subsurface concrete slab. Conceptual future site plans suggest that this will continue to be the case in the future.

- **Excavation and Treatment** may be applicable if, during construction excavation activities, isolated areas of contaminated soils are encountered.

Soil Excavation during Construction Work

Excavation in the vicinity of JS-B04 should proceed cautiously until additional soil testing can be performed. If the additional sample analyses indicate there is a cPAH risk, soil recycling through the use of off-site thermal desorption (a preferred destructive technology) is a feasible soil treatment alternative. Cleaned soil could be returned to the site and used as backfill where needed.

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Table 1 - Groundwater Level Data

Location	Date	Approximate Measuring Point Elevation in Feet TPWD[a]	Approximate Depth to Water in Feet[b]	Approximate Groundwater Elevation in Feet TPWD
JS-B01	3/20/2001	12	11	1
JS-B02	3/20/2001	11	10	1
JS-B04	3/20/2001	11	10	1

Notes:
TPWD = Tacoma Public Works Datum, NGVD 1929.
[a]Measuring point elevations for borings are approximate ground surface elevations based on the City's surveyed base map.
[b]Depth to water measurements in borings are at time of drilling (ATD).

Table 2 - Soil and Groundwater Cleanup Levels and Soil Contamination Maximums

Constituent	Soil Cleanup Level in mg/kg	Maximum Soil Concentration in mg/kg	Groundwater Cleanup Level in ug/L
TPH[a]:			
Gasoline-Range Organics (BTEX Restrictions)	**100**	5,000	**1,000**
Gasoline-Range Organics (All other GRO)	**30**	5,000	**800**
Diesel-Range Organics	**2,000**	5,000	**500**
Heavy Oil	**2,000**	5,000	**500**
Benzene	34.5	250	71.0
Toluene	16,000	5,000	200,000
Ethylbenzene	8,000	5,000	29,000
Xylenes	160,000	5,000	16,000
Total cPAHs (as BAP)[d]	**0.137**	10.0	0.031
Antimony	32.0	320	4,300
Arsenic	**0.7** (20[b])	200	0.14[g]
Cadmium	80.0	400	**9.3**[f]
Chromium (VI)[e]	**240**	4,000	50.0
Copper	2,960	29,600	**3.1**[f]
Lead	250[c]	2,500	**8.1**[f]
Mercury	24.0	240	0.025
Nickel	1,600	16,000	**8.2**[f]
Zinc	24,000	240,000	**81**[f]
PCB (Total)	**0.5**	50.0	0.030

Notes:

Bold values have been revised from original Table 1 in the Consent Decree to reflect new MTCA Amendments of February 2001.

[a] TPH cleanup criteria are based on Method A Cleanup Standards. TPH Cleanup levels may be adjusted using site-specific risk assessment procedures outlined in MTCA Method B and C equations.

[b] The arsenic Method B risk-based cleanup standard is 0.7 mg/kg, while the cleanup level based on Washington State background is 20 mg/kg. The arsenic Method B and C soil cleanup criteria no longer use a GI absorption fraction of 0.4.

[c] Soils cleanup levels for lead are not defined under Method B or Method C. The Method A cleanup level is used for the direct contact value.

[d] Total cPAHs calculated using toxicity equivalent methodology presented in WAC 173-340-708(8).

[e] The chromium VI cleanup standards are based on an updated oral reference dose of 0.003 mg/kg/day (previous oral RfD was 0.005 mg/kg/day).

[f] Cleanup standard based on WAC 173-201A Marine Water Chronic.

[g] Cleanup standard based on Federal Ambient Water Quality Criteria (40CFR 131) for human consumption of aquatic organisms.

Table 3 - Soil Chemistry Results Count
Johnny's Seafood

Sample ID	Depth in Feet	Sampling Date	Conven-tionals	Metals, Tot.	PAHs	BTEX	TPH
JS-B01 S-2	3 to 6	3/20/2001	1	9	17		2
JS-B01 S-4	9 to 12	3/20/2001	1	9	17		2
JS-B02 S-2	3 to 6	3/20/2001	1	9	17		2
JS-B02 S-4	9 to 12	3/20/2001	1	9	17		2
JS-B03 S-1	1.5 to 3	3/13/2001	1	9	17	4	3
JS-B03 S-3	5 to 7	3/13/2001	1	9	17	4	3
JS-B04 S-1	2 to 3	3/20/2001	1	9	17		2
JS-B04 S-2	3 to 6	3/20/2001	1	9	17		2
JS-B04 S-3	6 to 9	3/20/2001	1	9	17		2
JS-TP01 S-1	1 to 2	3/6/2001	1	8	17		2
JS-TP01 S-3	6 to 7	3/6/2001	1	8	17		2
JS-TP02 S-1	0.5 to	3/6/2001	1	8	17		2
JS-TP02 S-2	3 to 4	3/6/2001	1	8	17		2
JS-TP03 S-1	1 to 2	3/6/2001	1	8	17		2
JS-TP03 S-3	5 to 6	3/6/2001	1	8	17		2
JS-TPA[a]		3/6/2001	1	8	17		2

Notes:

[a] Duplicate sample from JS-TP02 S-2

Table 4 - Summary of Soil Exceedences
Johnny's Seafood

Analyte Group	Analyte Name	Analyte Value in mg/kg	Depth in Feet	Sampling Date	Sample ID	Cleanup Level Value in mg/kg
PAHs	Total cPAHs (BaP)[a]	1.338	0 to 3	3/20/2001	JS-B04 S-1	0.137

Notes:

[a] Total cPAHs calculated using toxicity equivalent methodology presented in WAC 173-340-708(8).

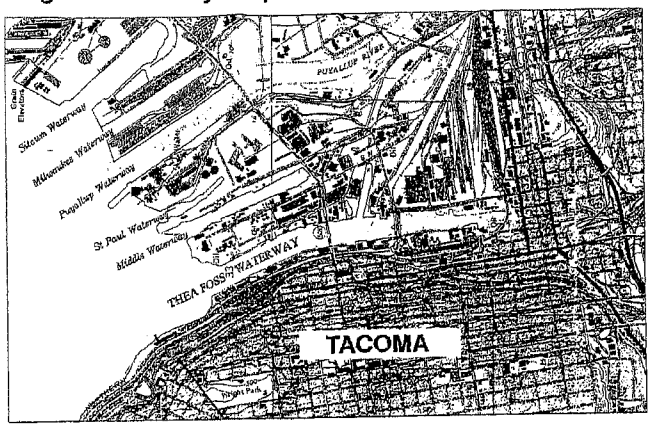
Table 5 - Groundwater Chemistry Results Count
Johnny's Seafood

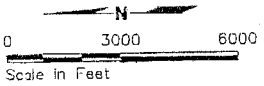
Sample ID	Sampling Date	Conven-tionals	Metals, Dissolved	PAHs	TPH
JS-B01	3/20/2001	1	9	17	2
JS-B02	3/20/2001	1	9	17	2
JS-B04	3/20/2001	1	9	17	2

4A-D

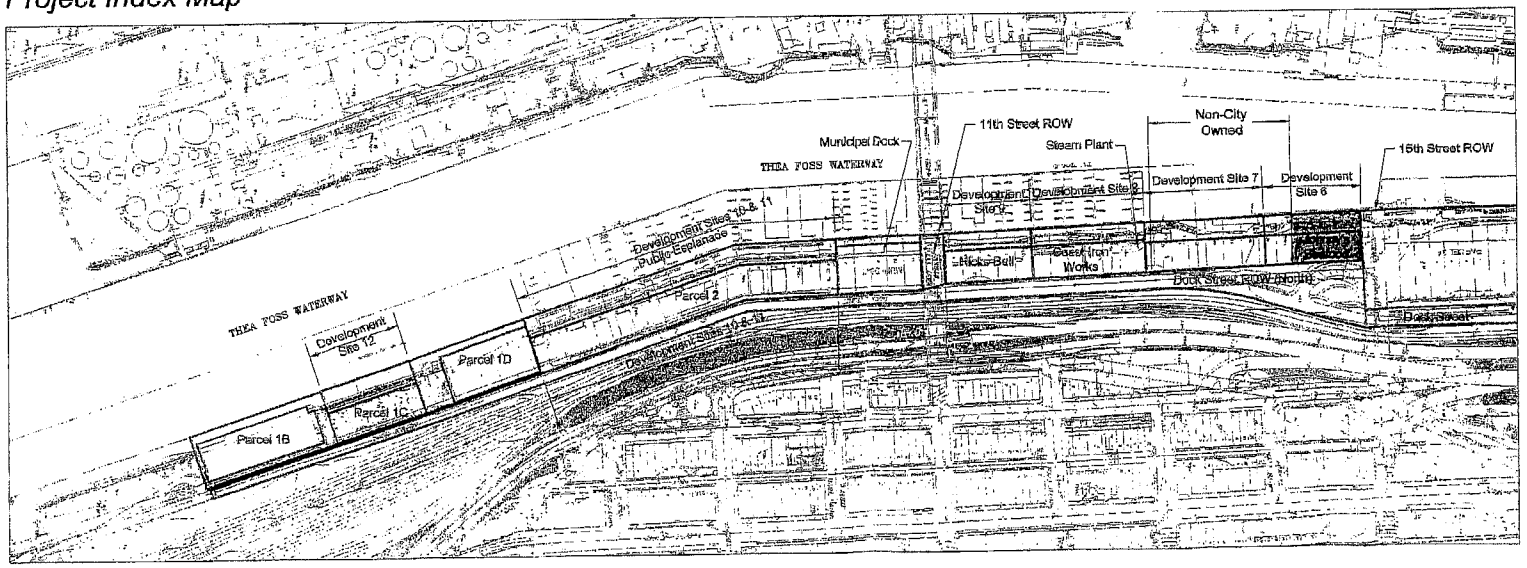
Vicinity Map
Johnny's Seafood Property

Regional Vicinity Map



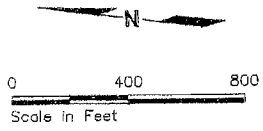


Project Index Map



Remedial Investigation Study Area with Development Site Boundary from City Map X_SAP(12-99).dwg Dated December 1999

Johnny's Seafood Site



HARTCROWSER

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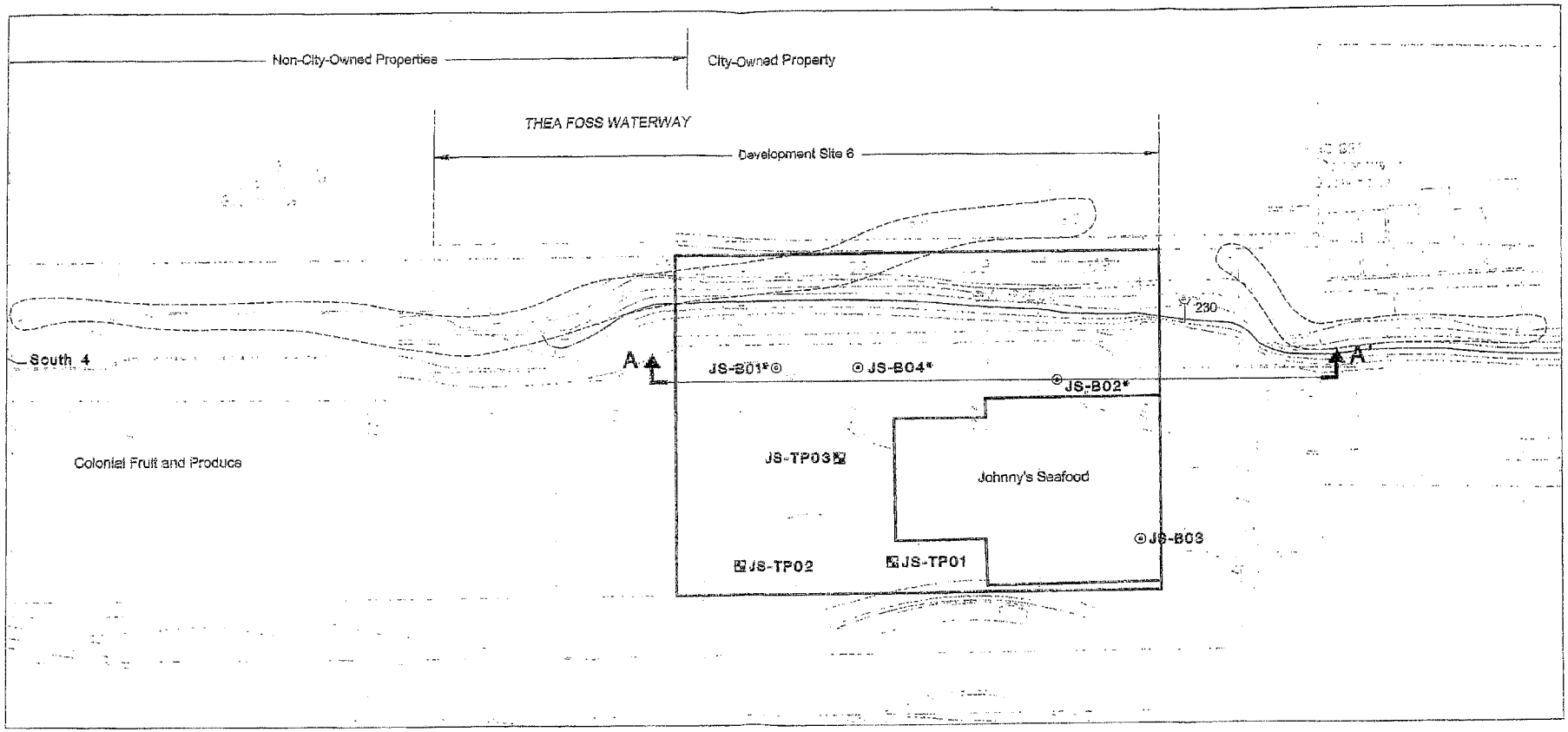
Figure 1

MEL 12/10/01 -1 xref=BASE 13 and Composite color.ctb2
4878/08

Site Exploration Plan
Johnny's Seafood Property



Exploration Location and Number

- JS-TP01 — Test Pit
- JS-B01* — Boring; * Indicates Groundwater Grab Sample Collected

Note: Explorations from previous investigations are shown in gray

- Discrete Bank Sample
- Composite Bank Subsample
- 230 — Stormwater Outfall Location and Number
- A A' — Cross Section Location and Designation

N

0 50 100

Scale in Feet

HARTCROWSER

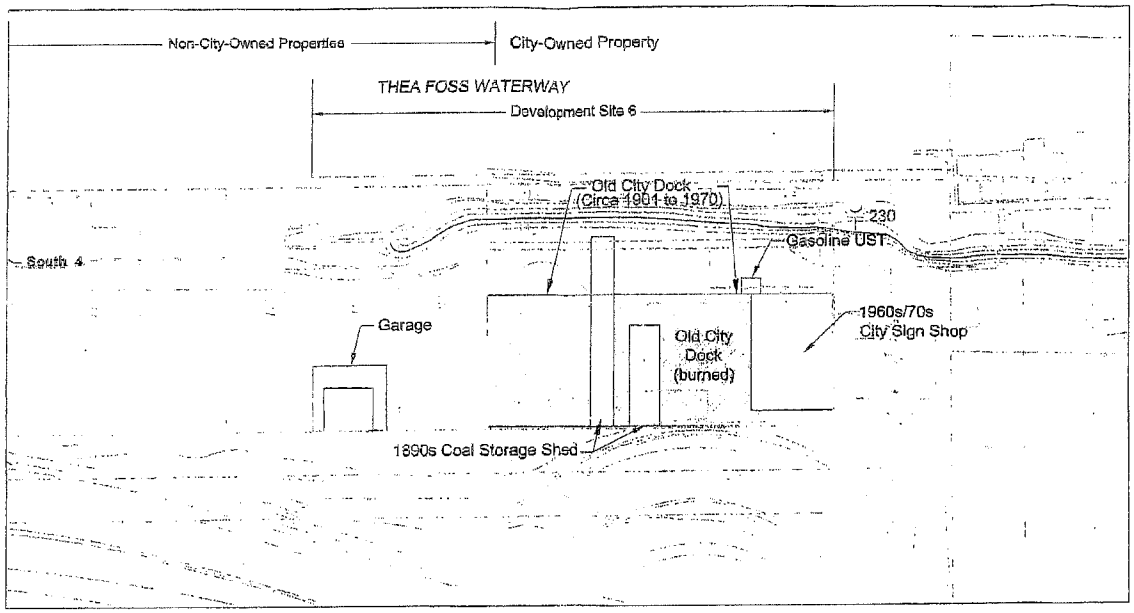
J-4876-71 9/01

Figure 3

4A-D

Significant Historical Features Map

Johnny's Seafood Property



230 Stormwater Outfall Location and Number

Potentially Significant Historical Area

Former Building

Mean Higher High Water Elevation (Tacoma Public Works Datum)

N

0 30 160

Scale in Feet

HARTCROWSER

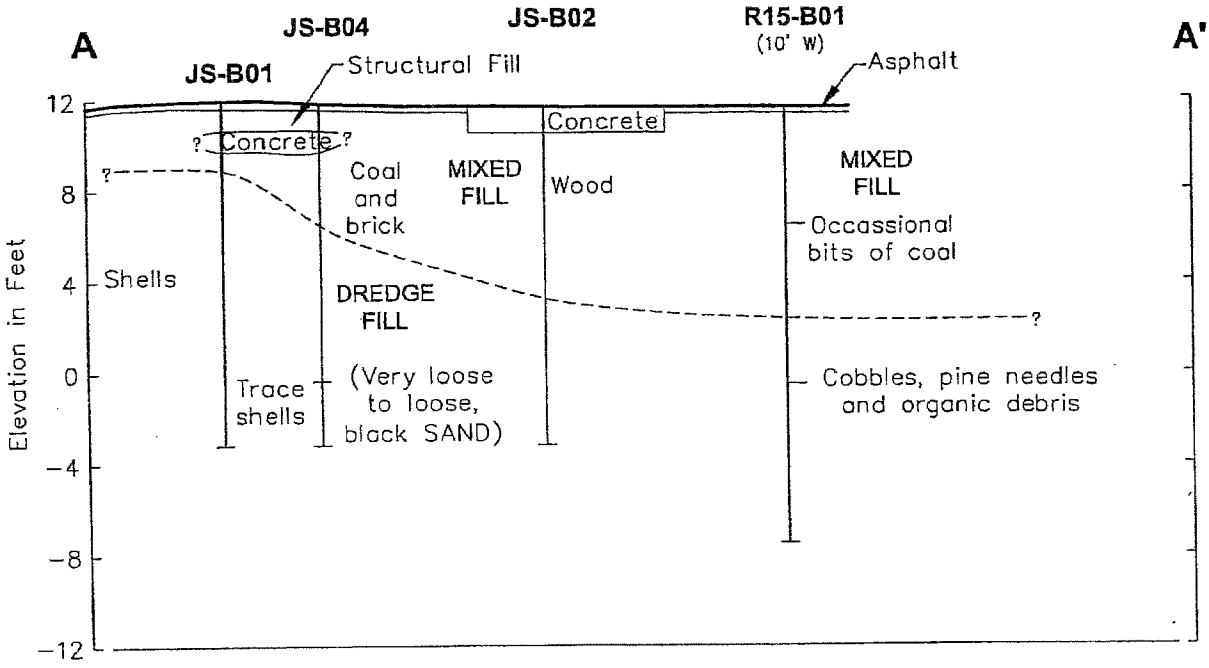
J-4878-71 9/01

Figure 2

4A-D

4A-D

Generalized Subsurface Cross Section A-A'



Horizontal Scale in Feet
0 80 160
0 8 16
Vertical Scale in Feet
Vertical Exaggeration x 10

R15-B01 Exploration Number
(10' W) (Offset Distance and Direction)

Exploration Location

ATD Water Level

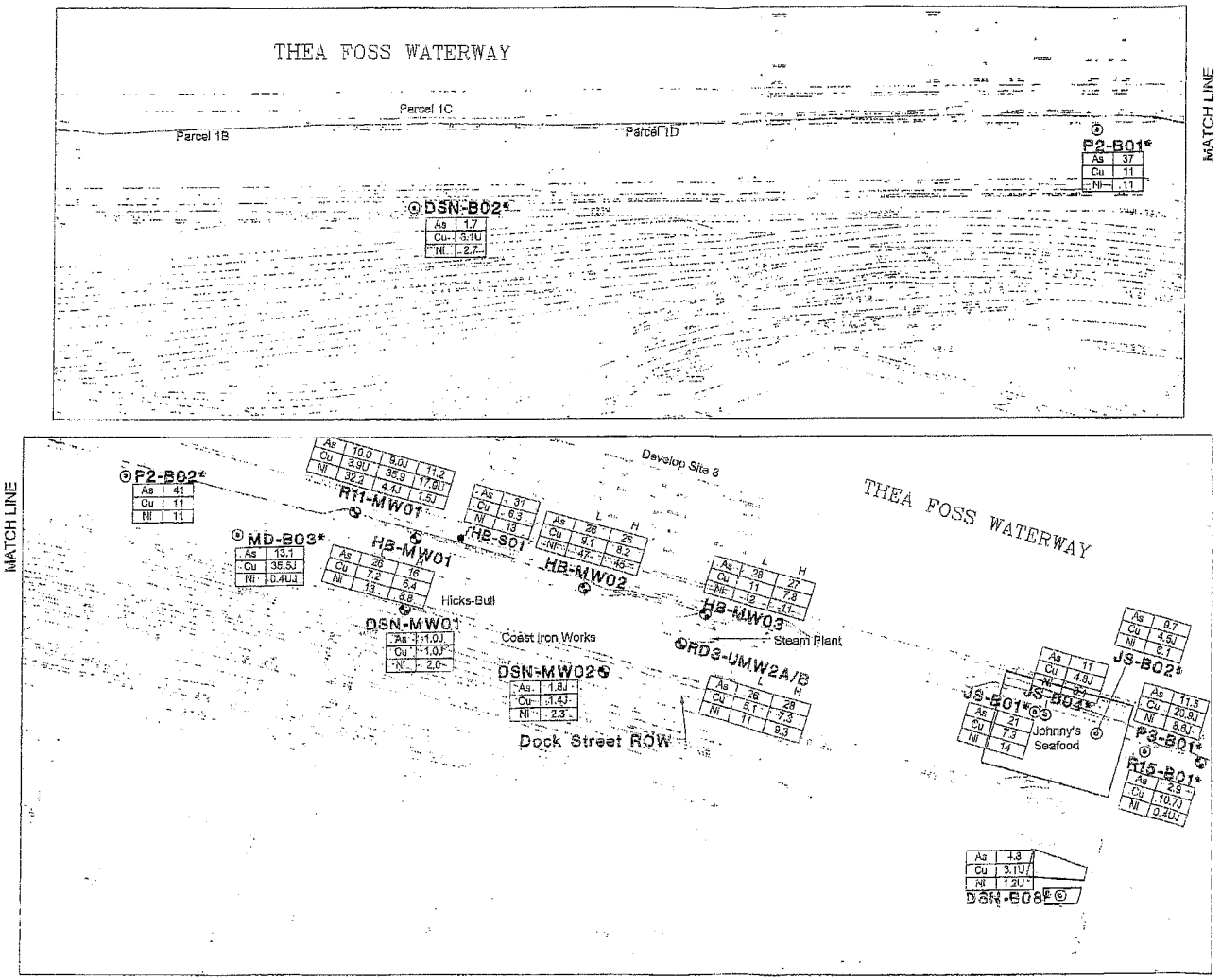
Depth Bottom of Boring

DTN 12/5/01 1=1 charlie.pc2
4676711.0

HARTCROWSER
4676-71 12/01
Figure 4

Area-Wide Concentrations of Arsenic, Copper, and Nickel in Groundwater

Properties North of 15th Street



Mean Higher High Water

Johnny's Seafod Site

Exploration Location and Number

DSN-B01* Boring

Indicates Groundwater Grab Sample Collected

HC-MW01 Monitoring Well

HB-S01 Seep

As Arsenic

Cu Copper

Ni Nickel

Concentrations are in µg/L

N

0 200 400

Scale in Feet

HARTCROWSER

J-4678-71 11/01

Figure 6

4A-D

APPENDIX B
SAMPLE RESULTS SUMMARY TABLES

The following tables provide summaries of the available soil and groundwater quality data collected during the current investigations of the Johnny's Seafood property. The soil quality tables are presented first, followed by the groundwater quality tables. The tables within each of these media are ordered by the following compound groups:

- Carcinogenic PAHs;
- Non-Carcinogenic PAHs;
- Metals;
- Petroleum Hydrocarbons; and
- Conventionals.

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Table B-1 - Carcinogenic PAH Results for Soil Samples
Johnny's Seafood

Sample I.D.	Date Sampled	Units	Benzo(a) anthracene	Benzo(a) pyrene	Total Benzo-fluoranthenes	Chrysene	Dibenz(a,h) anthracene	Indeno (1,2,3-cd)pyrene	Total cPAHs (BaP)
JS-B01 S-2	3/20/2001	µg/kg	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	83.79 U
JS-B01 S-4	3/20/2001	µg/kg	99.0 U	99.0 U	99.0 U	99.0 U	99.0 U	99.0 U	84.65 U
JS-B02 S-2	3/20/2001	µg/kg	93.0 U	93.0 U	93.0 U	93.0 U	93.0 U	93.0 U	79.52 U
JS-B02 S-4	3/20/2001	µg/kg	94.0 U	94.0 U	94.0 U	94.0 U	94.0 U	94.0 U	80.37 U
JS-B03 S-1	3/13/2001	µg/kg	96.0 U	96.0 U	96.0 U	96.0 U	96.0 U	96.0 U	82.08 U
JS-B03 S-3	3/13/2001	µg/kg	79.0 U	79.0 U	79.0 U	79.0 U	79.0 U	79.0 U	67.55 U
JS-B04 S-1	3/20/2001	µg/kg	960.0	960.0	1600.0	1,100.0	160.0	470.0	1,338.0
JS-B04 S-2	3/20/2001	µg/kg	85.0 U	85.0 U	85.0 U	85.0 U	85.0 U	85.0 U	72.68 U
JS-B04 S-3	3/20/2001	µg/kg	95.0 U	95.0 U	95.0 U	95.0 U	95.0 U	95.0 U	81.23 U
JS-TP01 S-1	3/6/2001	µg/kg	100.0 U	100.0 U	100.0 U	100.0 U	100.0 U	100.0 U	85.50 U
JS-TP01 S-3	3/6/2001	µg/kg	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	83.79 U
JS-TP02 S-1	3/6/2001	µg/kg	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	83.79 U
JS-TP02 S-2	3/6/2001	µg/kg	91.0 U	91.0 U	91.0 U	91.0 U	91.0 U	91.0 U	77.81 U
JS-TP03 S-1	3/6/2001	µg/kg	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	83.79 U
JS-TP03 S-3	3/6/2001	µg/kg	99.0 U	99.0 U	99.0 U	99.0 U	99.0 U	99.0 U	84.65 U
JS-TPA	3/6/2001	µg/kg	99.0 U	99.0 U	99.0 U	99.0 U	99.0 U	99.0 U	84.65 U

U - Indicates value was not detected at associated detection limit
J - Indicates value was estimated

4A-D

Table B-2 - Non-Carcinogenic PAH Results for Soil Samples
Johnny's Seafood

Sample I.D.	Date Sampled	Units	2-Methyl-naphthalene	2-Chloro-naphthalene	Benzo(g,h,i) perylene	Acenaph-thene	Acenaph-thylene	Anthra-cene	Fluoran-thene	Fluorene	Naph-thalene	Phenan-threne	Pyrene
JS-B01 S-2	3/20/2001	µg/kg	98.0 U	98.0 U	98 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U
JS-B01 S-4	3/20/2001	µg/kg	99.0 U	99.0 U	99 U	99.0 U	99.0 U	99.0 U	99.0 U	99.0 U	99.0 U	99.0 U	99.0 U
JS-B02 S-2	3/20/2001	µg/kg	93.0 U	93.0 U	93 U	93.0 U	93.0 U	93.0 U	93.0 U	93.0 U	93.0 U	93.0 U	93.0 U
JS-B02 S-4	3/20/2001	µg/kg	94.0 U	94.0 U	94 U	94.0 U	94.0 U	94.0 U	94.0 U	94.0 U	94.0 U	94.0 U	94.0 U
JS-B03 S-1	3/13/2001	µg/kg	96.0 U	96.0 U	96 U	96.0 U	96.0 U	96.0 U	100.0	96.0 U	96.0 U	99.0	130.0
JS-B03 S-3	3/13/2001	µg/kg	79.0 U	79.0 U	79 U	79.0 U	79.0 U	79.0 U	79.0 U	79.0 U	79.0 U	79.0 U	79.0 U
JS-B04 S-1	3/20/2001	µg/kg	99.0 U	99.0 U	520	99.0 U	180.0	150.0	1,600.0	99.0 U	99.0 U	920.0	2,200.00
JS-B04 S-2	3/20/2001	µg/kg	85.0 U	85.0 U	85 U	85.0 U	85.0 U	85.0 U	85.0 U	85.0 U	85.0 U	85.0 U	85.0 U
JS-B04 S-3	3/20/2001	µg/kg	95.0 U	95.0 U	95 U	95.0 U	95.0 U	95.0 U	95.0 U	95.0 U	95.0 U	95.0 U	95.0 U
JS-TP01 S-1	3/6/2001	µg/kg	100.0 U	100.0 U	100 U	100.0 U	100.0 U	100.0 U	100.0 U	100.0 U	100.0 U	100.0 U	100.0 U
JS-TP01 S-3	3/6/2001	µg/kg	98.0 U	98.0 U	98 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U
JS-TP02 S-1	3/6/2001	µg/kg	98.0 U	98.0 U	98 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U
JS-TP02 S-2	3/6/2001	µg/kg	91.0 U	91.0 U	91 U	91.0 U	91.0 U	91.0 U	91.0 U	91.0 U	91.0 U	91.0 U	91.0 U
JS-TP03 S-1	3/6/2001	µg/kg	98.0 U	98.0 U	98 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U	98.0 U
JS-TP03 S-3	3/6/2001	µg/kg	99.0 U	99.0 U	99 U	99.0 U	99.0 U	99.0 U	99.0 U	99.0 U	99.0 U	99.0 U	99.0 U
JS-TPA	3/6/2001	µg/kg	99.0 U	99.0 U	99 U	99.0 U	99.0 U	99.0 U	99.0 U	99.0 U	99.0 U	99.0 U	99.0 U

U - Indicates value was not detected at associated detection limit
J - Indicates value was estimated

4A-D

Table B-3 - Metal Results for Soil Samples
Johnny's Seafood

Sample I.D.	Date Sampled	Basis	Units	Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
JS-B01 S-2	3/20/2001	TOT	mg/kg	0.55 UJ	3.1	0.3 J	10.8	7.81	2.55	0.0073 U	7.96	16.0
JS-B01 S-4	3/20/2001	TOT	mg/kg	0.56 UJ	3.0	0.31 J	13.2	8.48	2.52	0.0127 J	8.99	18.0
JS-B02 S-2	3/20/2001	TOT	mg/kg	0.49 UJ	4.2	0.44 J	24.5	14.7	18.5	0.0942 J	32.3	31.7
JS-B02 S-4	3/20/2001	TOT	mg/kg	0.5 UJ	3.9	0.43 J	24.6	17.0	46.9	0.0918 J	27.8	44.2
JS-B03 S-1	3/13/2001	TOT	mg/kg	0.54 UJ	5.0	0.52 J	29.7	29.2	94.3	0.171	33.5	89.6
JS-B03 S-3	3/13/2001	TOT	mg/kg	0.53 UJ	4.9	0.48 J	30.1	19.4	45.1	0.222	34.0	60.2
JS-B04 S-1	3/20/2001	TOT	mg/kg	0.54 UJ	4.4	2.66	24.0	34.9	123.0	0.0079 U	17.5	310.0
JS-B04 S-2	3/20/2001	TOT	mg/kg	0.53 UJ	2.8	0.45 J	22.3	7.85	5.2	0.373	8.18	130.0
JS-B04 S-3	3/20/2001	TOT	mg/kg	0.56 UJ	2.6	0.37 J	13.3	8.25	2.98	0.0196 J	8.22	76.0
JS-TP01 S-1	3/6/2001	TOT	mg/kg		4.3	0.47 J	48.3	16.9	13.4	0.0763 J	41.5 J	42.7
JS-TP01 S-3	3/6/2001	TOT	mg/kg		2.4	0.25 U	12.1	6.7	3.39	0.0094 J	7.7 J	15.9
JS-TP02 S-1	3/6/2001	TOT	mg/kg		16.9	0.78 J	30.4	16.0	15.8	0.0473 J	35.1 J	145.0
JS-TP02 S-2	3/6/2001	TOT	mg/kg		2.8	0.27 J	9.4	5.4	2.28	0.005 J	5.9 J	78.0
JS-TP03 S-1	3/6/2001	TOT	mg/kg		2.5	0.39 J	17.1	11.3	22.8	0.0402 J	16.2 J	39.3
JS-TP03 S-3	3/6/2001	TOT	mg/kg		2.5	0.24 U	5.91	4.8	1.81	0.0051 J	5.7 J	11.0
JS-TPA	3/6/2001	TOT	mg/kg		2.2	0.25 U	7.04	4.3	1.76	0.0053 J	5.4 J	60.6

U - Indicates value was not detected at associated detection limit
J - Indicates value was estimated
Blank indicates sample not analyzed for specific analyte.

4A-D

Table B-4 - BTEX and TPH Results for Soil Samples
Johnny's Seafood

Sample I.D.	Date Sampled	Units	Benzene	Toluene	Ethylbenzene	Total Xylenes
JS-B03 S-1	3/13/2001	mg/kg	0.19 U	0.19 U	0.19 U	0.19 U
JS-B03 S-3	3/13/2001	mg/kg	0.18 U	0.18 U	0.18 U	0.18 U

Sample I.D.	Date Sampled	Units	Diesel	Gasoline	Heavy Oil
JS-B01 S-2	3/20/2001	mg/kg	20.0 UJ		39.0 U
JS-B01 S-4	3/20/2001	mg/kg	20.0 U		40.0 U
JS-B02 S-2	3/20/2001	mg/kg	19.0 U		37.0 U
JS-B02 S-4	3/20/2001	mg/kg	19.0 U		38.0 U
JS-B03 S-1	3/13/2001	mg/kg	19.0 U	3.8 UJ	38.0 U
JS-B03 S-3	3/13/2001	mg/kg	16.0 U	3.7 UJ	32.0 U
JS-B04 S-1	3/20/2001	mg/kg	24.0		110.0
JS-B04 S-2	3/20/2001	mg/kg	17.0 U		34.0 U
JS-B04 S-3	3/20/2001	mg/kg	19.0 U		38.0 U
JS-TP01 S-1	3/6/2001	mg/kg	20.0 UJ		40.0 UJ
JS-TP01 S-3	3/6/2001	mg/kg	20.0 UJ		39.0 UJ
JS-TP02 S-1	3/6/2001	mg/kg	20.0 UJ		39.0 U
JS-TP02 S-2	3/6/2001	mg/kg	18.0 UJ		36.0 U
JS-TP03 S-1	3/6/2001	mg/kg	20.0 UJ		40.0 U
JS-TP03 S-3	3/6/2001	mg/kg	20.0 UJ		40.0 UJ
JS-TPA	3/6/2001	mg/kg	20.0 UJ		40.0 UJ

U - Indicates value was not detected at associated detection limit
J - Indicates value was estimated
Blank indicates sample not analyzed for specific analyte.

Table B-5 - Conventionals Results for Soil Samples
Johnny's Seafood

Sample I.D.	Date Sampled	Units	Total Solids
JS-B01 S-2	3/20/2001	%	94.9
JS-B01 S-4	3/20/2001	%	87.5
JS-B02 S-2	3/20/2001	%	89.3
JS-B02 S-4	3/20/2001	%	83.3
JS-B03 S-1	3/13/2001	%	80.9
JS-B03 S-3	3/13/2001	%	88.7
JS-B04 S-1	3/20/2001	%	84.3
JS-B04 S-2	3/20/2001	%	93.5
JS-B04 S-3	3/20/2001	%	93.5
JS-TP01 S-1	3/6/2001	%	83.7
JS-TP01 S-3	3/6/2001	%	94.3
JS-TP02 S-1	3/6/2001	%	88.9
JS-TP02 S-2	3/6/2001	%	95.5
JS-TP03 S-1	3/6/2001	%	89.8
JS-TP03 S-3	3/6/2001	%	93.0
JS-TPA	3/6/2001	%	95.4

Table B-6 - Carcinogenic PAH Results for Groundwater Samples
Johnny's Seafood

Sample I.D.	Date Sampled	Units	Benzo(a) anthracene	Benzo(a) pyrene	Total Benzo-fluoranthenes	Chrysene	Dibenz(ah) anthracene	Indeno (1,2,3-cd)pyrene
JS-B01	3/20/2001	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
JS-B02	3/20/2001	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
JS-B04	3/20/2001	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

U - Indicates value was not detected at associated detection limit

4A-D

Table B-7 - Non-Carcinogenic PAH Results for Groundwater Samples
Johnny's Seafood

Sample I.D.	Date Sampled	Units	2-Methyl-naphthalene	2-Chloro-naphthalene	Benzo(g,h,i) perylene	Acenaph-thene	Acenaph-thylene	Anthra-cene	Fluoran-thene	Fluorene	Naph-thalene	Phenan-threne	Pyrene
JS-B01	3/20/2001	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
JS-B02	3/20/2001	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
JS-B04	3/20/2001	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

U - Indicates value was not detected at associated detection limit

4A-D

Table B-8 - Metal Results for Groundwater Samples
Johnny's Seafood

Sample I.D.	Date Sampled	Basis	Units	Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
JS-B01	3/20/2001	DIS	µg/L	0.79 J	21.0	0.083 U	8.9	7.3	0.089 J	0.05 U	14.0	6.3
JS-B02	3/20/2001	DIS	µg/L	1.4 J	9.7	0.083 U	8.2	4.5 J	0.24 J	0.05 U	6.1	11.0
JS-B04	3/20/2001	DIS	µg/L	0.38 J	11.0	0.083 U	13.0	4.8 J	0.13 J	0.05 U	8.1	13.0

U - Indicates value was not detected at associated detection limit
J - Indicates value was estimated

4A-D

Table B-9 - TPH Results for Groundwater Samples
Johnny's Seafood

Sample I.D.	Date Sampled	Units	Diesel	Heavy Oil
JS-B01	3/20/2001	mg/L	0.25 UJ	0.5 UJ
JS-B02	3/20/2001	mg/L	0.25 UJ	0.5 UJ
JS-B04	3/20/2001	mg/L	0.25 U	0.5 U

U - Indicates value was not detected at associated detection limit
J - Indicates value was estimated

Table B-10 - Conventionals Results for Groundwater Samples
Johnny's Seafood

Sample I.D.	Date Sampled	Total Suspended Solids in mg/L
JS-B01	3/20/2001	40.4
JS-B02	3/20/2001	426.0
JS-B04	3/20/2001	46.1

Site 4A-E and 4B-C

THEA FOSS AND WHEELER-OSGOOD WATERWAYS REMEDIATION PROJECT

REMEDIAL ACTION CONSTRUCTION REPORT

SEPTEMBER 2006

Prepared for:

U.S. ENVIRONMENTAL PROTECTION AGENCY

Prepared by:

CITY OF TACOMA
KPFF CONSULTING ENGINEERS
FLOYD|SNIDER

3.1.6 REMEDIAL AREA 8

Remedial Area 8 (RA 8) is comprised of the western bank of the Thea Foss Waterway from Station 52+34 on its southern boundary to Station 34+91 on the north (Figure 2). The area extends from elevation +13 feet MLLW on the shoreline slope to the pierhead/bulkhead line along the west side of the Thea Foss Waterway.

The remedial design for RA 8 consisted of slope dredging to support slope capping. Slope dredging was performed to achieve a 2H:1V slope. Capping consisted of constructing a thick slope cap. Facilities in or adjacent to RA 8 include: Johnny's Seafood and the seaplane float, Colonial Fruit, Foss Waterway Marina, and a pile supported esplanade.

3.1.6.1 SUMMARY OF CONSTRUCTION

Construction performed in RA 8 includes:

- Debris and piling removal;
- Removal and replacement of the seaplane float;
- Dredging and thick slope cap placement;
- Habitat enhancement;
- Surveying; and
- Water quality monitoring.

3.1.6.2 DESIGN MODIFICATIONS

Several design modifications were made following or in conjunction with agency approval of the Remedial Design on November 10, 2003, and prior to the beginning of work in RA 8. These changes were incorporated into revised drawings and submitted to EPA for approval. The changes listed below were approved by EPA:

- The top elevation of the slope cap in front of the sheetpile wall at Johnny's Seafood was revised from +12 feet MLLW to +10 feet MLLW. This change was necessary to prevent the reinstalled seaplane float from future grounding on the slope cap. Additionally, the two-foot bench at the top of the slope was eliminated to resolve the grounding issue. The slope was maintained at 2H:1V, and the capping requirements were not changed.
- More large woody debris (LWD) was added to the habitat bench between Stations 52+24 and 50+90.
- An abandoned concrete vault at the north side of Colonial Fruit was identified to be demolished and a log step habitat area constructed in its place.
- The piling used for reinstallation of the seaplane float was changed from treated timber to galvanized steel pipe.

The following minor change was transmitted to and approved by EPA via email:

- The cap material for a small area under Colonial Fruit was changed from quarry spalls to habitat mix to be consistent with the adjacent area under the warehouse and to facilitate placement of the cap material.

One additional minor change was made to fit field conditions:

- The quarry spall and habitat mix slope cap in the vicinity of Outfall 230 was extended above the elevation shown on the plans to provide erosion protection in an area of existing trees on the upper bank. Had the bank been left in its existing condition, the City felt the trees could be lost. As this change was an addition to prevent bank erosion and loss of vegetation and did not change the remedial design, a field modification was made in this area.

3.1.6.3 PREPARATION FOR CONSTRUCTION

Several meetings were held on-site to discuss various aspects of the work such as the method for grading the slopes at the sheetpile wall at Johnny's Seafood; method of constructing the splash pad at Outfall 230; construction of the habitat bench at the south end of the RA; removal of creosote piling located within the dredge prism in proximity of the sheetpile wall; and placement of cap and habitat material under the pile supported portions of the Esplanade.

Additionally, the preparation for dredging was accomplished in a pre-construction meeting on July 14, 2004. Representatives of the City, KPFF, Floyd|Snider and Manson were in attendance.

Topics discussed included:

- Health and safety requirements;
- Pre and post-dredge survey requirements;
- Reporting requirements;
- Dredge tolerances;
- Water quality monitoring requirements; and
- Containment booms at the site of dredge and other environmental BMPs.

3.1.6.4 SEAPLANE FLOAT

The seaplane float was removed to allow for the dredging and slope capping to be completed in front of the sheetpile wall at Johnny's Seafood. Derrick 3 initially removed and stored the gangway and then used a vibratory hammer to extract six timber guide piles along the float. When the dredging and capping were completed, the float was reinstalled using 12-inch diameter galvanized steel piling at the same locations where the pre-existing timber piling had been removed.

3.1.6.5 DREDGING

Dredging in RA 8 commenced on December 28, 2004, with the derrick Andrew loading dredge material into the dump scows for transport and disposal of the material into the CDF. The initial dredging between approximate Stations 52+34 to 44+50 proceeded continuously until January 31, 2005, with one additional day of dredging on February 11, 2005. The dredging and capping to elevation -31 feet MLLW in a portion of this area actually crosses the line between RA 8 and RA 6.

On three separate occasions, a backhoe on a flat deck barge was used at night during low tides to excavate the upper slope along the sheetpile wall at Johnny's Seafood, for the excavation at the base of Outfall 230, and under the walkway access for the seaplane float where it was impracticable to try to use the clamshell dredge.

Dredging in RA 8 resumed on November 14, 2005, with the derrick Andrew cutting the slope riprap keyway between Stations 38+75 to 37+25. This dredging was completed on November 15, 2005, and was the final dredging in RA 8. This material was loaded into a dump scow and then transferred to lined trucks for haul and disposal into the CDF.

Approximately 43,434 CY of material was dredged from the slopes of RA 8 between Stations 52+34 and 37+25. Although some of the material from the lower portions of the slope and the toe trench was actually within the boundaries of RA 6, it is included in the dredging volumes for RA 8 as it was done in support of the slope capping in RA 8.

3.1.6.6 CAPPING / BACKFILLING

The emphasis for slope capping during the 2004-2005 construction season was to complete the slope in the area of the seaplane float and sheetpile wall at Johnny's Seafood to allow for reinstallation of the float and to restore the stability of the slope at the sheetpile wall. Following dredging of the slope, the work proceeded first with the placement of the riprap toe berm, then placement of an 18-inch lift of slope cap filter material. This was followed by placement of an 18-inch lift of riprap, and finally a covering of habitat mix at a rate of 25 tons per 1,000 SF. The Andrew placed the filter material and riprap while Derrick 3 was used to place habitat mix. A backhoe on a flat deck barge was used to place cap material around Outfall 230 and under the seaplane float approach pier.

Slope capping began January 26, 2005, and proceeded through February 15, 2005. During that period of time, the activity switched back and forth between toe berm construction and the placement of thick slope cap materials. Slope capping was completed from Outfall 230 through the northern end of the seaplane float. The riprap toe berm was completed from that point north to approximate Station 44+50. In all, approximately 3,925 tons of slope cap filter material, 5,600 tons of riprap, and 115 tons of habitat mix were placed on the RA 8 slopes during the 2004-2005 construction season.

Capping resumed on July 18, 2005, at approximate Station 47+00 following agency approval of an early start of the in-water construction season for the placement of clean cap material. On July 21-22, 2005, a conveyor belt was used to place habitat mix under Colonial Fruit at a rate of 25 tons per 1,000 SF. Capping continued intermittently in various areas of RA 8 through August 19, 2005, when capping was completed to the southern end of the Foss Waterway Marina.

Capping resumed in the area of the Foss Waterway Marina on November 17, 2005. At the south end of the marina, in the area under the pile supported concrete section of the Esplanade, an extendable boom bucket loader was used to place slope cap filter

material and riprap during night time low tides. Approximately 150 feet of thick slope cap between the pile supported timber portion of the Esplanade and the pile supported concrete portion of the Esplanade was steepened from 2V:1H to approximately 1.5V:1H to prevent grounding of the adjacent marina marginal walkway float. A derrick with a clamshell bucket was used to place slope cap material in the open areas of the slope.

At the north end of RA 8, a combination of Telebelt and bucket loader placement through the deck was used to cap under the timber pile supported portion of the Esplanade. The derrick was used where possible to complete capping on this slope.

Final capping in RA 8 was completed on December 7, 2005. Approximate material quantities for capping included 13,588 tons of slope cap filter material, 26,616 tons of light loose riprap, 2,690 tons of quarry spalls, and 1,362 tons of habitat mix.

3.1.6.7 STORMWATER OUTFALLS

Riprap splash pads were constructed for Stormwater Outfalls 225 and 230 to prevent erosion. Neither pipe required extension.

3.1.6.8 HABITAT ENHANCEMENTS

Two habitat enhancement areas were created in RA 8. At the south end of RA 8 between approximate Stations 52+24 and 50+90 a bench was created at the top of the shoreline slope at elevation +13 feet MLLW and six pieces of LWD were placed (Figure 3). At approximate Station 44+00, a log step with a benched planting area was installed in the slope at elevation +11 feet MLLW to +13 feet MLLW.

3.1.6.9 SURVEYING

Hydrographic surveys were conducted in RA 8 after dredging to confirm dredge depths and limits. Hydrographic surveys were also performed following placement of the toe berm riprap, slope cap filter material, and thick slope riprap layer. Surveys were reviewed and approved by the CM Team prior to the placement of the next lift of cap material.

A combination of topographic surveys and onsite continuous inspection were used to confirm placement of cap material above elevation +5 feet MLLW. Inspectors confirmed the placement of the 18-inch layer of slope cap filter material through visual observation and computation of tonnage of material placed over a known area. Topographic surveys were performed following placement of riprap and compared with the post-dredge slope to verify a minimum three-foot final cap thickness.

Dredging and capping surveys were reviewed by the CM Team and the Corps at the time of the Pre-Final Inspection with no issues noted. Figure 5 presents the post-construction conditions in RA 8.

3.1.6.10 DEMOLITION AND DISPOSAL

3.1.6.10.1 Johnny's Seafood

Removal and disposal of treated timber piling associated with the seaplane float was performed adjacent to Johnny's Seafood in preparation for dredging in RA 8. Piling removal consisted of placing containment and absorbent booms around the work areas to contain floating debris and any possible petroleum sheen, using a derrick and vibratory hammer to fully extract six individual treated timber piling; placing the piling onto a plastic lined barge; and transferring the piling (approximately 15 tons) from the barge into containers at the Middle Waterway Peninsula for transport and disposal at the Rabanco Landfill. These piling removed from the seaplane float were combined with piling removed from other portions of the Thea Foss Waterway and disposed of (Table C-2).

Removal of the seaplane float piling was performed by Manson from January 3-5, 2005. Transfer, transport, and disposal of the debris were performed by Rhine on March 14, 2005.

Additionally, during dredging of the slope at Johnny's Seafood on January 21, 2005 (approximate Stations 47+50 to 50+00), a row of non-treated piling was discovered below the mudline at approximate elevation +7 feet MLLW. Piling removal consisted of breaking the piling off at the mudline with an excavator, placing the piling onto a barge, and transferring the piling from the barge into containers at the Middle Waterway Peninsula for transport to the Rabanco Landfill for disposal (Table C-2). Transfer, transport and disposal were performed by Rhine on March 14, 2005.

3.1.6.10.2 Colonial Fruit

Removal and disposal of timber piling was performed adjacent to Colonial Fruit in preparation for remediation in RA 8. Piling removal consisted of placing debris and absorbent booms around the work areas to contain floating debris and any possible petroleum sheen; using a derrick to extract approximately 30 individual treated timber piling; placing the piling onto plastic lined barges; and transferring the piling (approximately 68 tons) from the barge into containers at the Middle Waterway Peninsula for transport to the Rabanco Landfill for disposal (Table C-3).

Removal of the piling was performed by Manson from July 7-13, 2005. All piling were extracted using a vibratory hammer. Transfer, transport, and disposal of the piling were performed by Rhine from July 11-15, 2005.

3.1.6.10.3 Log Step

Just north of Colonial Fruit a concrete vault was demolished on August 1-2, 2005, in preparation for the creation of a log step habitat enhancement area. The concrete vault was demolished using small tools and a trackhoe with a breaker operating from the upland. The demolished concrete vault and surrounding sediment was excavated by the trackhoe and loaded into lined trucks and transported to the CDF for disposal. Approximately 200 tons of concrete and sediment were transported to the CDF for disposal from the log step habitat area.

3.1.6.10.4 Foss Waterway Marina

Several debris piles were removed from beneath the Esplanade at the Foss Waterway Marina on August 30-31, 2005 and October 13-14, 2005. The debris piles were excavated by hand and placed into steel containers. The steel containers were lifted with a crane and the debris within the containers was transferred into lined trucks. Approximately 14 cubic yards of debris was transported by truck to the CDF for disposal.

3.1.6.11 Cap Verification Sampling and Analysis

The CQAP identified the collection of cap boundary verification samples at four locations in RA 6 following completion of slope capping in RA 8. The intent of the samples was to monitor potential impacts of cap placement in RA 8 on dredged surfaces in RA 6.

The cap boundary verification samples were not collected as the components of capping in RA 8 (i.e., dredging, placement of key rock, filter material, and riprap) occurred prior to completion of dredging in the adjacent portion of RA 6. This modification to the CQAP for cap verification sampling was transmitted to EPA in a letter dated September 16, 2005. The approval for the CQAP modification was received in an email from EPA dated October 4, 2005.

3.1.6.12 Water Quality Monitoring

Visual and in-situ water quality monitoring was performed during piling and marina float removal, dredging, capping, and pile driving and float installation activities in RA 8. Water quality monitoring was performed in accordance with the EPA approved Final Design CQAP, Water Quality FSP, project plans and specifications, and Interim No. 4 and Interim No. 5 WQC. Daily and monthly water quality monitoring reports were submitted to EPA documenting the monitoring results.

Visual water quality monitoring was performed to monitor compliance with construction and environmental BMPs (i.e., dredge speed, containment by debris and absorbent booms, etc.). In-situ water quality monitoring was performed to measure temperature, turbidity, and DO. Samples were also collected for DO, TSS, and metals (i.e., copper and silver) analyses in accordance with the project plans and WQCs.

The results of in-situ monitoring for temperature and DO consistently met water quality standards specified in the project WQCs. Turbidity infrequently exceeded the criteria (i.e., ambient turbidity plus 10 NTUs) during dredging activities. Turbidity exceedences were generally less than 10 NTUs above the criteria.

Turbidity exceedences occurred on three occasions in the 2004-2005 construction season when dredging first began in RA 8. The elevated turbidity was predominantly measured at one monitoring station located at the boundary of the construction zone (i.e., mixing zone). It was speculated that localized bathymetry / topography (the bulge into the waterway created by the volleyball court) was concentrating turbidity at the monitoring station. In response to the elevated measurements, the contractor

relocated the construction zone further to the north. Once the construction zone was relocated, no further turbidity exceedences occurred during dredging in RA 8. EPA was notified of the turbidity exceedences and the contractor's response to reduce turbidity.

Sheen was intermittently observed to occur as a result of dredging in RA 8. Debris and absorbent booms were deployed to contain sheen during remedial activities in RA 8 in accordance with project BMPs.

Dissolved silver was not detected in water quality samples. The dissolved copper concentrations detected in construction area samples are consistently comparable to concentrations at the up-current ambient monitoring locations. Copper concentrations in construction area samples ranged from 8.8 to 50.7 µg/L. Ambient concentrations ranged between 14 and 51.6 µg/L. The results of samples collected in the construction area and ambient locations identify that elevated copper concentrations are the result of ambient conditions and that remedial construction activities are not causing further increases in the copper concentration.

3.1.6.13 Fish Monitoring Activities

An extension to the in-water work period was requested to continue work beyond February 14, 2005. Work to be performed in the extension period consisted of reinstallation of the seaplane floats in RA 8 using a vibratory hammer. EPA granted a work extension to March 15, 2005, and the City continued until work was completed on March 3, 2005. During the work extension period, specified BMPs and monitoring were required for in-water construction activities.

Fish monitoring consisted of visual observations within and adjacent to work areas and seining at designated locations to evaluate fish presence. Visual monitoring was performed at each in-water construction location. Seining for fish was performed at the following locations during the work extension period:

- Mouth of the Wheeler-Osgood Waterway;
- Volleyball Court in RA 19A;
- Simpson Peninsula;
- OVRA Site; and
- North Beach Habitat.

Seining was performed at a specific location contingent upon the location of in-water construction activities.

Visual monitoring for the presence of fish was required and performed for piling installation using a vibratory hammer to reinstall the seaplane float in RA 8 during the work extension period. Additionally, seining was performed at the Volleyball Court site in RA 19A during the time period when work was performed in RA 8 during the work extension period (February 16-17, 2005). No salmonids were captured in two seine sets performed at the Volleyball Court site.

comprised of three feet of channel sand cap material was placed in the grid area in response to the exceedences.

The OMMP requirements for cap integrity and recontamination monitoring will be reviewed for RA 6. No other modifications to the requirements outlined in the OMMP are necessary as a result of remedial actions performed in the remaining portion of RA 6.

7.1.5 REMEDIAL AREAS 7 AND 7A

Similar to RAs 5 and 6, the remedial actions performed in RA 7 were modified due to the presence of utilities crossing the waterway. Additional sediment sampling and analysis was performed to characterize sediment in the northern portions of RAs 5, 6, and 7, to evaluate the potential for modification of remedial actions in the area of the utility crossings.

The detected chemical concentrations were less than the SQOs in the sample collected from the northernmost portion of RA 7 between Stations 35+00 and 36+30 (Section 3.1.5.8.1). The detected concentration of a pesticide was greater than the SQO but less than the 2nd Lowest Apparent Effects Threshold (2LAET) criteria in the sample collected between Stations 36+30 and 37+10.

Based on the location of the utility crossings and the results of sediment sampling and analysis, the remedial actions in the northern portion of RA 7 were modified. In the area north of Station 36+30, the remedial action was modified from enhanced natural recovery to natural recovery. The remedial actions were not modified in the area south of Station 36+30.

The OMMP requirements for natural recovery monitoring will be reviewed for the northern portion of RA 7 based on the modifications to the remedial design. No other modifications to the requirements outlined in the OMMP are necessary as a result of remedial actions performed in the remaining portion of RAs 7 and 7A.

7.1.6 REMEDIAL AREA 8

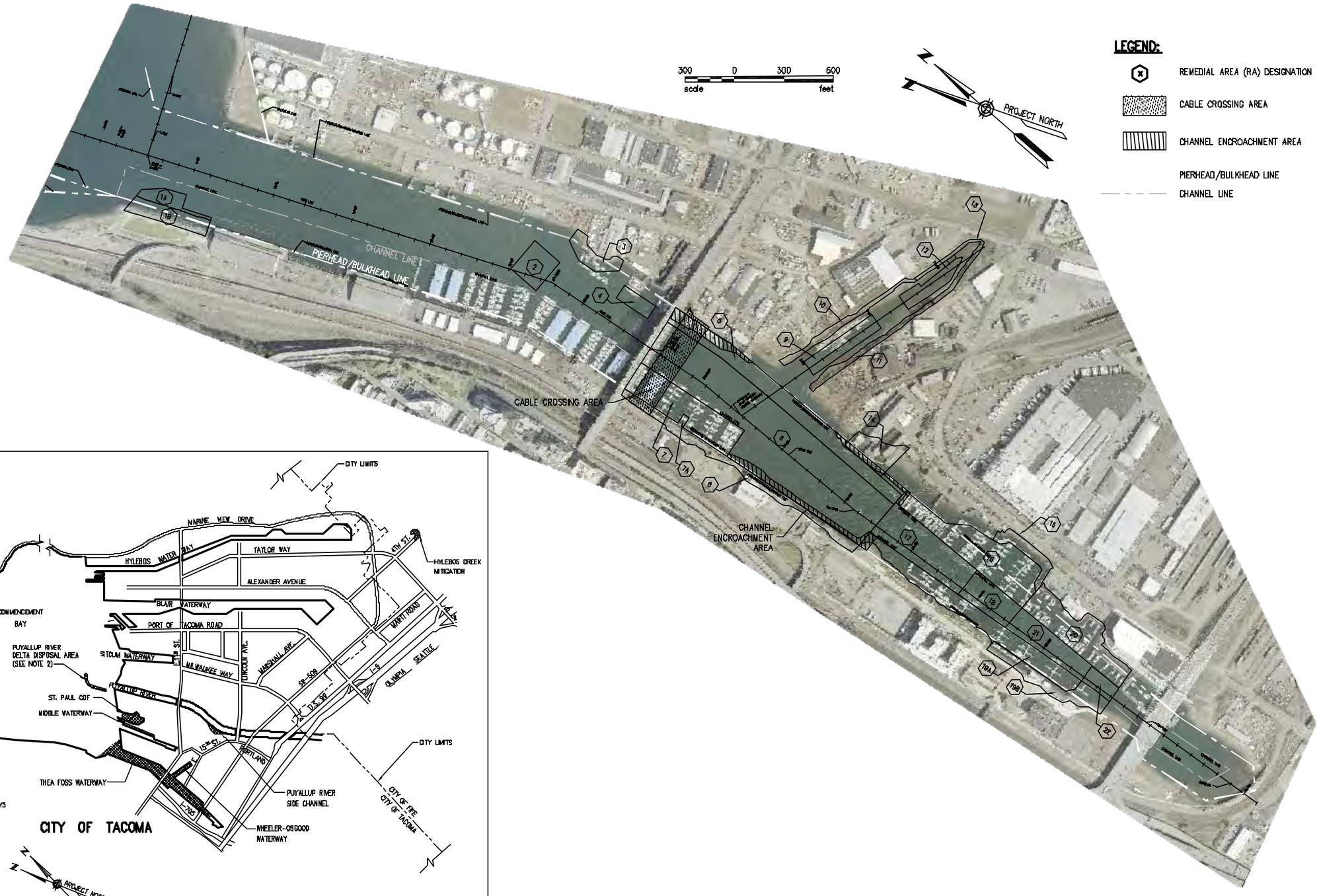
Remedial actions performed in RA 8 included habitat enhancement in two areas that were not originally included in the remedial design. These habitat enhancement elements were added as part of the final design approval for the project. A benched habitat area was built in the central portion of RA 8. In addition, large woody debris (LWD) was added to an area of the southern portion of RA 8.

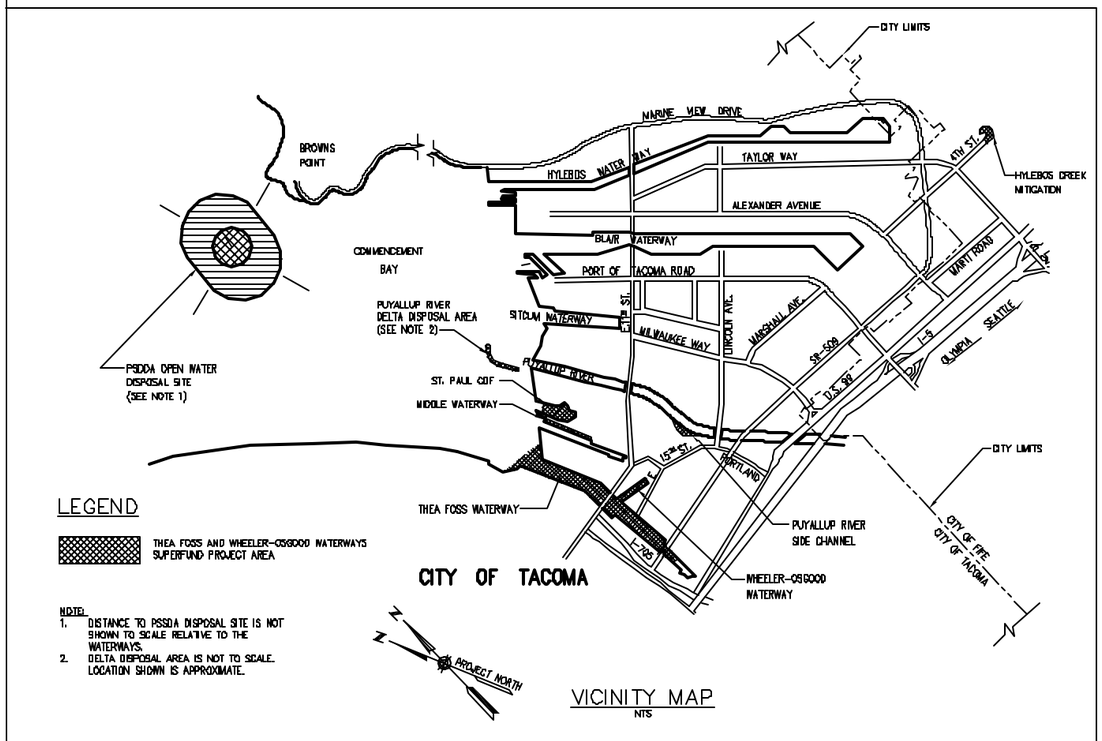
The OMMP requirements for mitigation / restoration site monitoring will be reviewed based on the construction of these habitat enhancement areas in RA 8. No other modifications to the requirements outlined in the OMMP are necessary as a result of remedial actions performed in the remaining portion of RA 8.

7.1.7 REMEDIAL AREA 9

The remedial design identified RA 9 as a dredge and backfill area. Post-dredge sample results indicated that the average chemical concentrations were greater than the SQOs

Site 4A-E and 4B-C





VICINITY MAP
NTS

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DATE: 9/7/06

Thea Foss and Wheeler-Osgood Waterways Remediation Project

Figure 1

Vicinity Map

CDF CONTAINMENT BERM
TACOMA KRAFT MILL
(SIMPSON TACOMA KRAFT COMPANY)
ST. PAUL CDF OFFSET BERM
ST. PAUL CDF SITE
SIMPSON FUEL DOCK
STORM WATER COLLECTION
TACOMA SAW MILL
(SIMPSON TIMBER COMPANY)
ST. PAUL BEACH HABITAT **
SIMPSON LOG HAUL ROAD
ST. PAUL HABITAT BERM
PENINSULA HABITAT **
MIDDLE WATERWAY
CORRIDOR HABITAT
STORM WATER
DISCHARGE
MIDDLE WATERWAY
TIDEFLAT HABITAT
SIMPSON LOG HAUL OUT
MIDDLE WATERWAY
SHEEN SOURCE REMOVAL AREA

** NOTE:
PENINSULA HABITAT AND ST. PAUL BEACH HABITAT ARE COLLECTIVELY KNOWN AS THE NORTH BEACH HABITAT

PROJECT NORTH

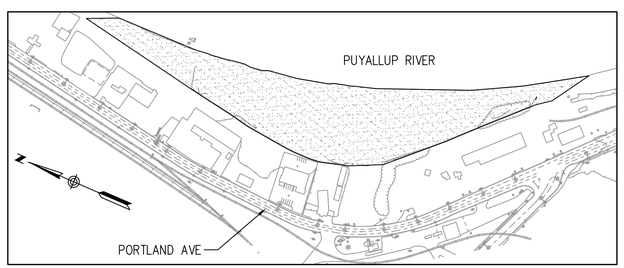
COMMENCEMENT BAY
THEA FOSS WATERWAY
WHEELER-OSGOOD WATERWAY
FOSS WATERWAY MARINA
CITY MARINA / DELIN DOCKS
JOHNNY'S DOCK MARINA NORTH
JOHNNY'S DOCK MARINA SOUTH
FOSS LANDING MARINA
17TH ST. MARINA *
CITY VIEW MARINA *
ALBER'S WHARF MARINA *

* NOTE:
17TH STREET, CITY VIEW, AND ALBER'S WHARF MARINAS ARE COLLECTIVELY KNOWN AS DOCK STREET MARINA.

REMEDIAL AREA
BY OTHERS

LEGEND:
- X — REMEDIAL AREA (RA) DESIGNATION
- REMEDIAL WORK PREVIOUSLY COMPLETED UNDER SEPARATE CONTRACT
- REMEDIAL WORK ACCOMPLISHED BY UTILITIES

300 0 300 600
scale feet



PUYALLUP RIVER SIDE CHANNEL
SCALE: 1"=300'

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DATE: 6/2/06

Thea Foss and Wheeler-Osgood Waterways Remediation Project

Figure 2

Project Site Plan

Site 4A-E and 4B-C

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Thea Foss and Wheeler-Osgood Waterways Remediation Project

Figure 3 (2 of 2)
Completed Remedial Actions

DATE: 6/22/2006 4:54:59 PM
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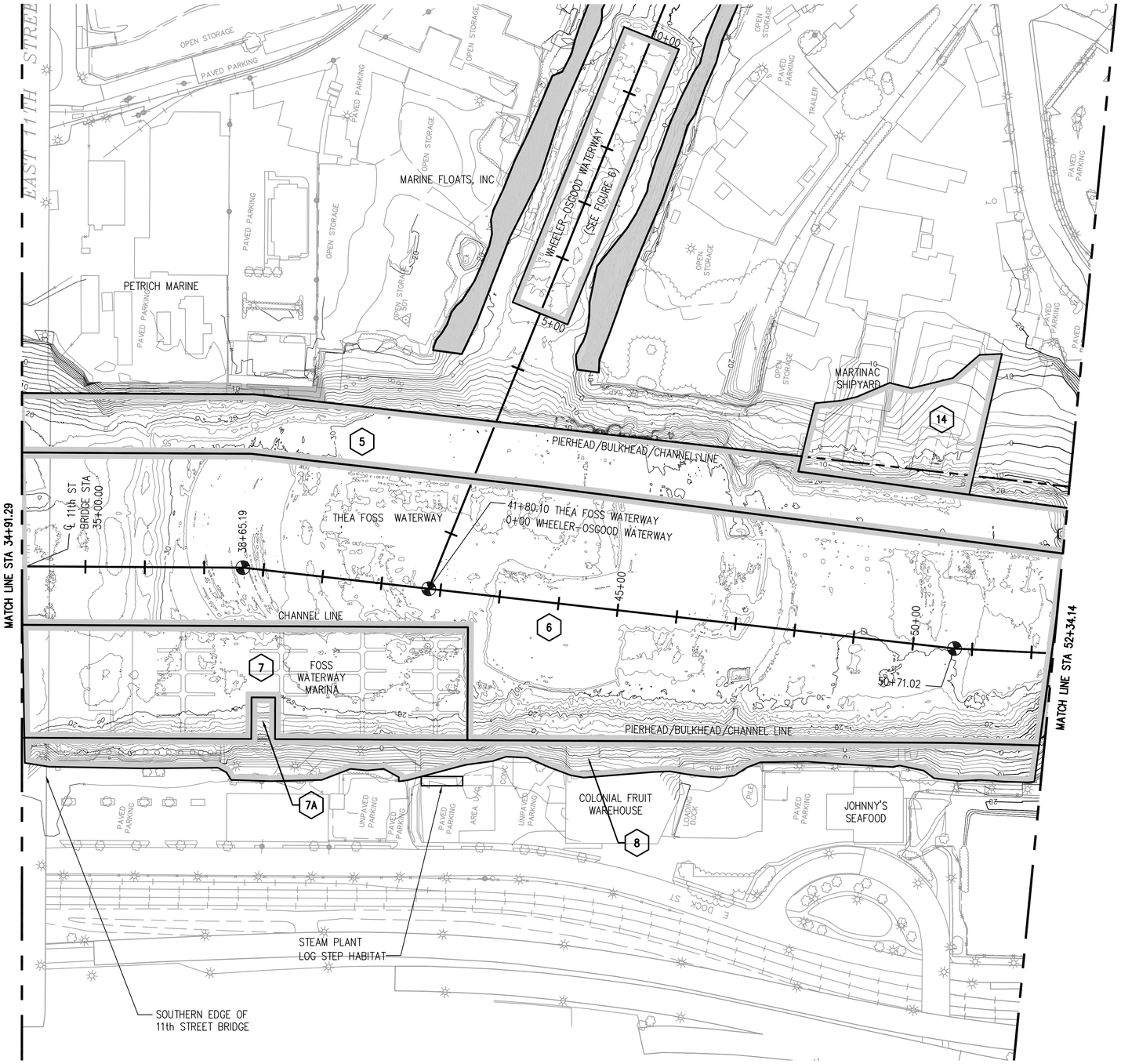
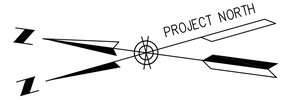
Site 4A-E and 4B-C

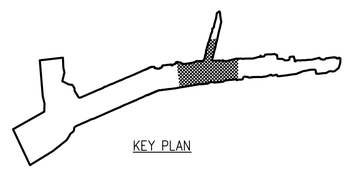




SCALE: 1"= 100'

LEGEND:

- BOUNDARY OF REMEDIAL AREA
- (X) REMEDIAL AREA (RA) DESIGNATION
- REMEDIAL WORK PREVIOUSLY COMPLETED UNDER SEPARATE CONTRACT
- -xx- FINAL SURVEY CONTOUR



KEY PLAN

100 0 100 200
scale feet

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DATE: 6/2/06

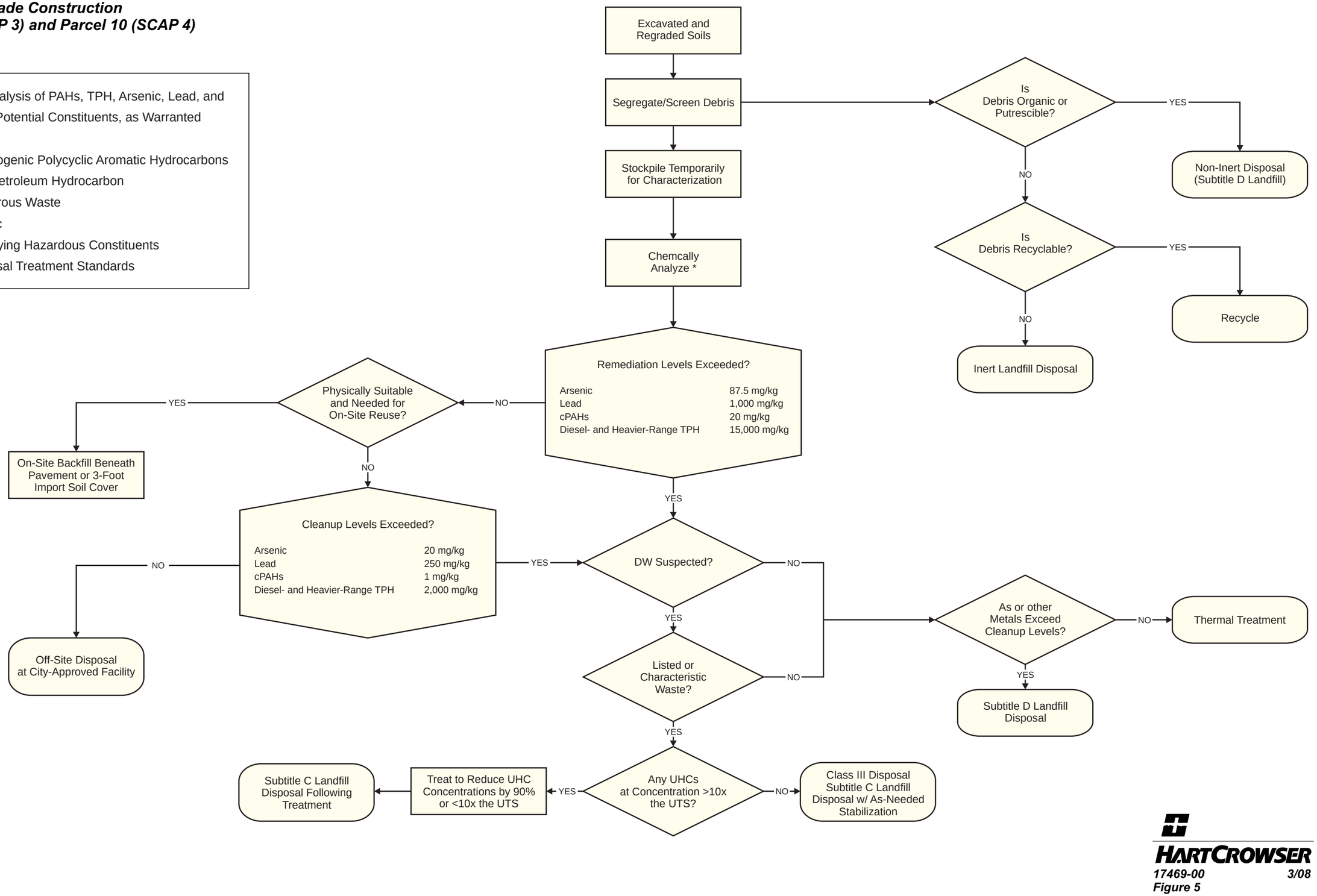
Thea Foss and Wheeler-Osgood Waterways Remediation Project

Figure 5

RA5, RA6, RA7, RA7A, RA8, and RA14

Soil and Debris Handling Decision Tree for Excavated Materials and Debris
Public Esplanade Construction
Parcel 4 (SCAP 3) and Parcel 10 (SCAP 4)

*	Lab Analysis of PAHs, TPH, Arsenic, Lead, and Other Potential Constituents, as Warranted
cPAH	Carcinogenic Polycyclic Aromatic Hydrocarbons
TPH	Total Petroleum Hydrocarbon
DW	Dangerous Waste
As	Arsenic
UHC	Underlying Hazardous Constituents
UTS	Universal Treatment Standards



17469-00-AA.cdr EAL 03/04/08

HARTCROWSER

17469-00 *3/08*

Figure 5

SECTION 4B. SECTION 4B: I-705/BNSF/DOCK STREET/1147 DOCK STREET (CUT AND COVER AND TRENCHLESS)

Geotechnical

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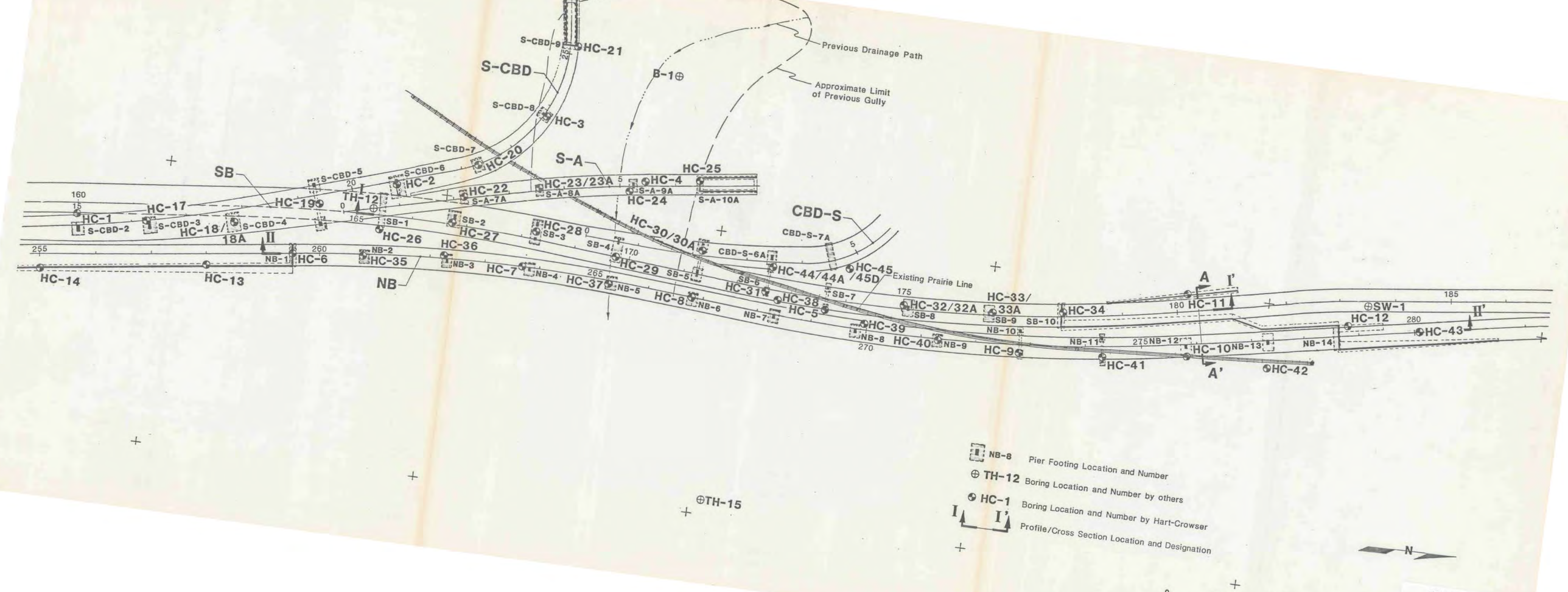
Geotechnical Reference Material


S-CBD-9
HC-21
S-CBD
S-CBD-8
HC-3
S-CBD-7
HC-20
S-A
HC-25
SB
S-CBD-5
S-CBD-6
HC-2
HC-22
S-A-7A
HC-23/23A
S-A-8A
HC-4
S-A-9A
HC-24
S-A-10A
HC-17
HC-19
TH-12
HC-1
S-CBD-2
S-CBD-3
HC-18/18A
S-CBD-4
SB-1
SB-2
HC-26
HC-27
HC-28
SB-3
SB-4
HC-30/30A
CBD-S
CBD-S-7A
CBD-S-6A
HC-44/44A
HC-45/45D
Existing Prairie Line
HC-14
HC-13
NB-1
HC-6
NB-2
HC-35
HC-36
NB-3
HC-7
NB-4
HC-37
NB-5
HC-8
HC-29
SB-5
SB-6
HC-31
HC-38
HC-5
NB-6
NB-7
SB-7
HC-32/32A
SB-8
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HC-34
HC-39
NB-8
HC-40
NB-9
HC-9
NB-10
NB-11
NB-12
HC-10
NB-13
NB-14
HC-11
HC-12
SW-1
HC-43
HC-41
HC-42
NB
A
A'
I
I'
II
II'
B-1
Previous Drainage Path
Approximate Limit of Previous Gully
TH-15
NB-8 Pier Footing Location and Number
TH-12 Boring Location and Number by others
HC-1 Boring Location and Number by Hart-Crowser
Profile/Cross Section Location and Designation
N

Boring Log HC-40 (Pier NB-9)

SOIL INTERPRETATION

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY TESTS

Approximate Ground Surface Elevation in Feet 21.6

Depth Feet

Sample

▲ Blows per Foot

Depth Feet	Soil Interpretation
0	Loose, damp, black, gravelly, silty SAND (FILL).
5	Medium dense, moist, brown, trace gravelly, silty, fine SAND.
10	Very dense, moist, brown, silty, sandy GRAVEL.
15	Gray color.
20	Very dense, saturated, brown, slightly silty, gravelly SAND.
25	Very dense, wet, brown, SAND.
30	
35	Very dense, saturated, brown, slightly silty, gravelly, medium to coarse SAND.
40	
45	Bottom of Boring at 42.8 Feet. Completed 5/4/83.
50	

ATD

Sample	Blows per Foot	Laboratory Tests
S-1		
S-1		
S-3		GS
S-4	85/10"	
S-5		GS
S-6	50/4"	GS
S-7	55/6"	
S-8	50/4"	
S-9	50/4"	

1 5 10 20 50 100

1 2 5 10 20 50 100

● Natural Water Content (%)

Groundwater Level

Bentonite Seal

Downhole Seal

2/4/83 ATD

Water Level (Date) At Time of Drilling

Observation Well Tip or Slotted Section

Sampling

2" O.D. Split Spoon Sample

3" O.D. Shelby Tube Sample

Cutting Sample

* No Sample Recovery

Laboratory Tests

GS	Grain Size Analysis
CN	Consolidation Test
K	Permeability Test
DS	Direct Shear
QU	Unconfined Compression, tsf
TV	Torvane, tsf
PP	Pocket Penetrometer, tsf
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained

Water Content (%)

Plastic Limit — Natural Water Content — Liquid Limit

Notes

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level, if indicated, is for the date specified and may vary with the time of year.
3. Water contents not determined for gravelly or very small samples.

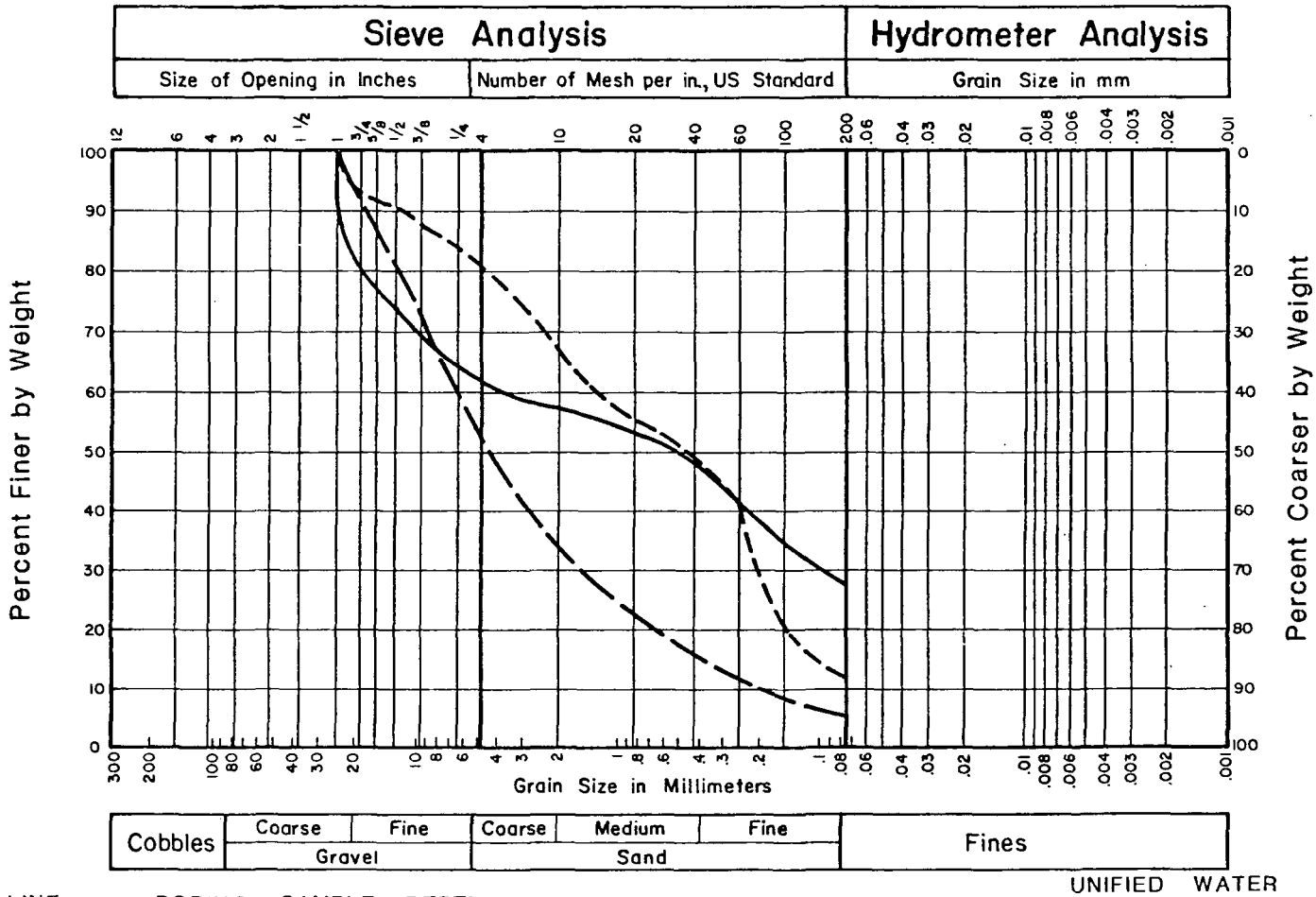
J-1210-02 June 1983

HART-CROWSER & associates inc.

Figure A-23

27009886
TF GeoT

Grain Size Classification

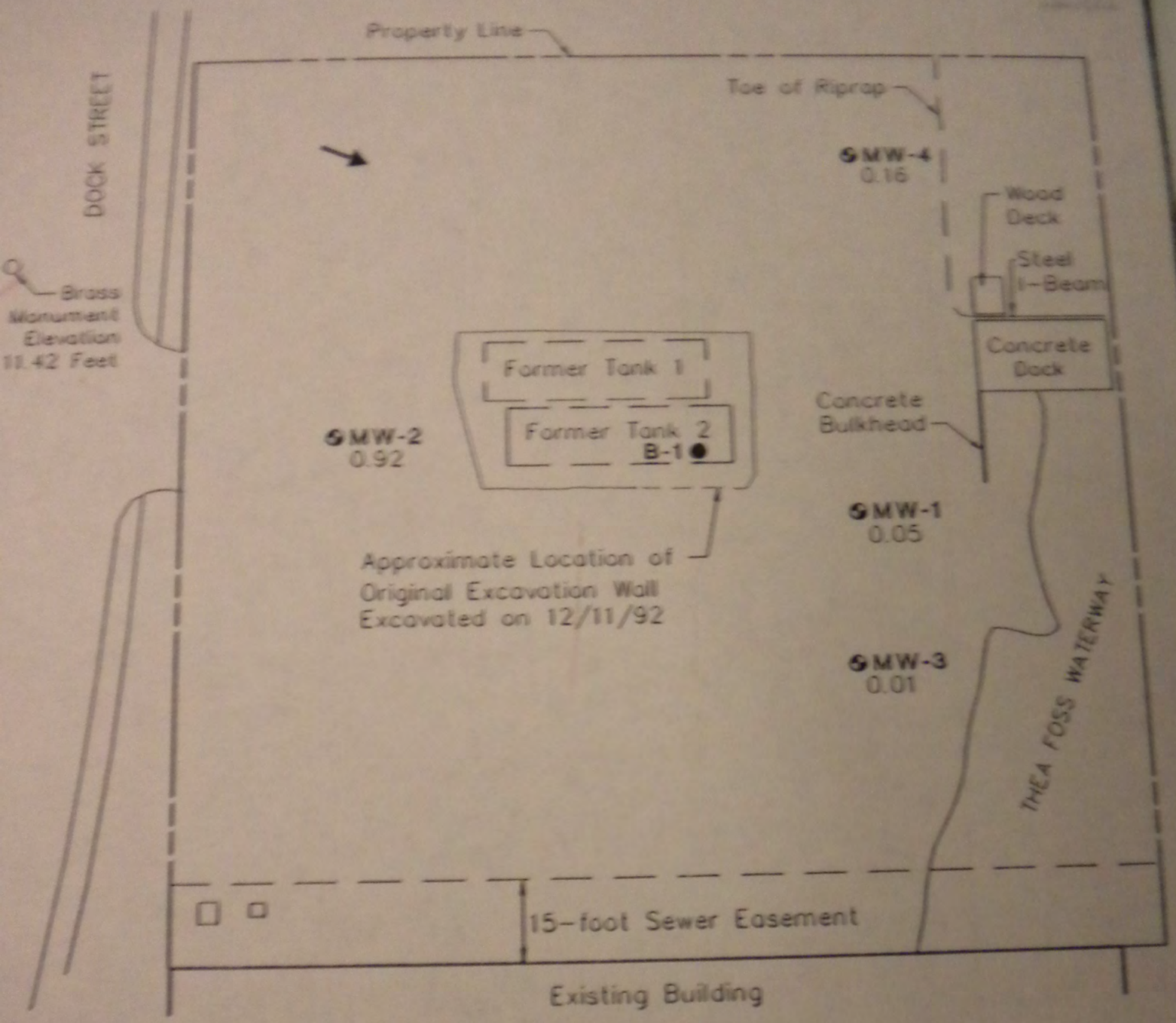


LINE SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH IN FEET	CLASSIFICATION	UNIFIED SOIL CLASS.	WATER CONTENT PERCENT
———	HC-40	S-3	12.5-14.0	Silty, sandy GRAVEL	GM	9.
— —	HC-40	S-5	22.5-24.0	Slightly silty, gravelly SAND	SM-SP	6.
– – – –	HC-40	S-6	27.5-28.3	Silty, gravelly SAND	SM	8.

27009905
TF GeoT

J-1210-02 June 1983
HART-CROWSER & associates, inc.
Figure B-11

Site and Exploration Plan



B-1 Boring Location and Number

MW-1 Monitoring Well Location and Number

0.05 Groundwater Elevation in Feet

→ Groundwater Flow Direction

Note: Water level measurements collected September 15, 1994.

N

0 30 60

Scale in Feet

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Figure 2

Key to Exploration Logs

Sample Description

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual-manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:
Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT, additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance.
Soil density/consistency in test pits is estimated based on visual observation and is presented parenthetically on the test pit logs.

SAND or GRAVEL Density	Standard Penetration Resistance (N) in Blows/Foot	SILT or CLAY Consistency	Standard Penetration Resistance (N) in Blows/Foot	Approximate Shear Strength in TSF
Very loose	0 - 4	Very soft	0 - 2	<0.125
Loose	4 - 10	Soft	2 - 4	0.125 - 0.25
Medium dense	10 - 30	Medium stiff	4 - 8	0.25 - 0.5
Dense	30 - 50	Stiff	8 - 15	0.5 - 1.0
Very dense	>50	Very stiff	15 - 30	1.0 - 2.0
		Hard	>30	>2.0

Moisture

Dry	Little perceptable moisture
Damp	Some perceptable moisture, probably below optimum
Moist	Probably near optimum moisture content
Wet	Much perceptable moisture, probably above optimum

Minor Constituents

	Estimated Percentage
Not identified in description	0 - 5
Slightly (clayey, silty, etc.)	5 - 12
Clayey, silty, sandy, gravelly	12 - 30
Very (clayey, silty, etc.)	30 - 50

Legends

Sampling Test Symbols

BORING SAMPLES		TEST PIT SAMPLES	
⊠	Split Spoon	⊠	Grab (Jar)
⧅	Shelby Tube	⧄	Bag
▥	Cuttings	⧅	Shelby Tube
▯▯	Core Run		
*	No Sample Recovery		
P	Tube Pushed, Not Driven		

Test Symbols

GS	Grain Size Classification
CN	Consolidation
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained
QU	QU
DS	Direct Shear
K	Permeability
PP	Pocket Penetrometer Approximate Compressive Strength in TSF
TV	Torvane Approximate Shear Strength in TSF
CBR	California Bearing Ratio
MD	Moisture Density Relationship
AL	Atterberg Limits
	Water Content in Percent Liquid Limit Natural Plastic Limit
PID	Photoionization Reading
CA	Chemical Analysis

Groundwater Observations

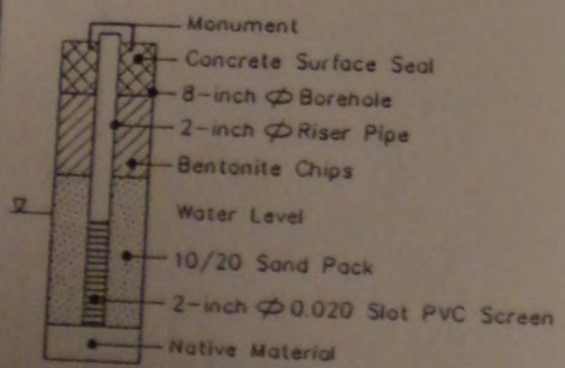

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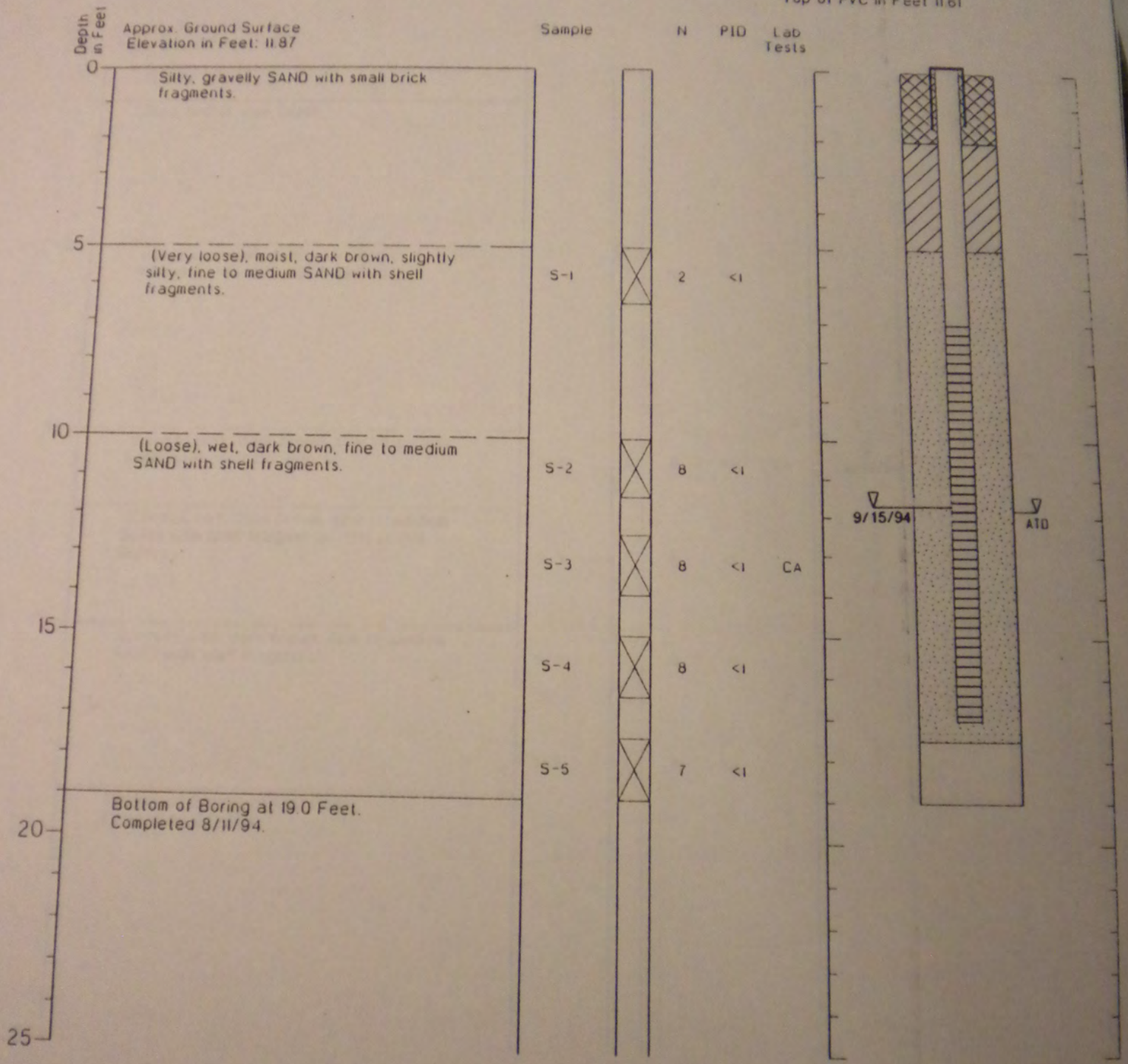
Figure A-1

Boring Log and Construction Data for Monitoring Well MW-3



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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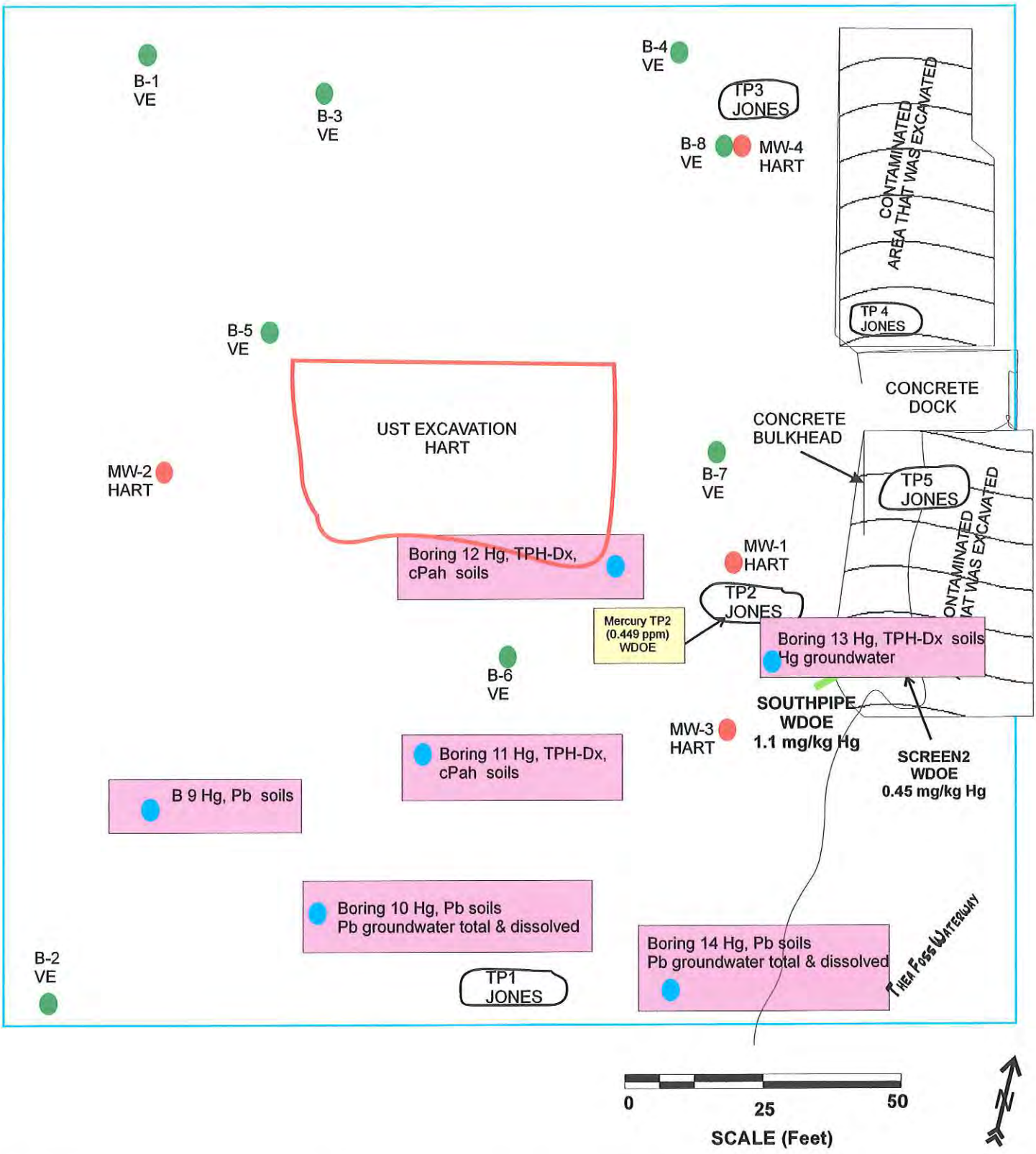
Figure A-5



Environmental	Subsurface Soil/Groundwater Conditions SE Quadrant and SE Corner of Former UST May 21, 2007 VE Project Number: 213-4 Drawn by: Verna Lee Curry	**FIGURE 1** **Proposed Borehole Locations** 1147 Dock Street Tacoma, Washington

LOG OF BOREHOLE

Project No.: 205-025-01
Project: Investco/Looney Client:V Environmental
Location: Tacoma
Drilling Method: Geoprobe Driller: ESN
Sampling Method: probe

Borehole No.: B-9
Date: 7/10/07
Logged By: DRP
Reference Elevation: Ground Surface
Groundwater Level:

DEPTH (ft)	TIME	SAMPLE	SAMPLE No.	Blow Count (blows per foot)	Graphic Log/	GEOLOGICAL DESCRIPTION AND CLASSIFICATION	ODOR	OVA (ppm)
					GM	Surface 3/8 minus gravel		
					SP	Brown Gravelly Sand (Gravel to 1/2' Dia) (dry)	none	
						Gray Fine to Medium Sand with Shell Fragments (dry)		
5					SP			
10								
					ML	Two 1/2" thick layers 4" apart Brown Silt (moist)		
					SP	Gray find to Medium Sand with Shell Fragments (dry)		
				▼		Water at 13 1/2 '		
15					ML	Gray Clayey Silt (soft) (wet)		
						Boring Terminated at 16' and Backfilled with 3/8" Holeplug Bentonite Chips		
20								
25								

LOG OF BOREHOLE

Project No.: 205-025-01
Project: Investco/Looney Client:V Environmental
Location: Tacoma
Drilling Method: Geoprobe Driller: ESN
Sampling Method: probe

Borehole No.: B-10
Date: 7/10/07
Logged By: DRP
Reference Elevation: Ground Surface
Groundwater Level:

DEPTH (ft)	TIME	SAMPLE	SAMPLE No.	Blow Count (blows per foot)	Graphic Log/	GEOLOGICAL DESCRIPTION AND CLASSIFICATION	ODOR	OVA (ppm)
					GM	Surface Light Brown Sandy Gravel	None	
					SP	Light Brown Gravelly Sand (Gravel to 1/2' Dia) (dry)		
						Gray Fine to Medium Sand with Wood Debris & Shell Fragments (moist)		
5					SP			
10								
					ML	2" Thick Dark Gray Fine to Medium Sandy Silt		
						Gray Fine to Medium Sand with Wood Debris & Shell Fragments (moist)		
				▼	SP	Water at 13'		
15					ML	Gray Clayey Silt (soft) (wet)		
						Boring Terminated at 16' and 3/4" Diameter, 5' long		
						Temporary Screen Installed		
						Screen Removed after Sampling & Boring Backfilled with		
						3/8" Holeplug Bentonite Chips		
20								
25								

LOG OF BOREHOLE

Project No.: 205-025-01
Project: Investco/Looney Client:V Environmental
Location: Tacoma
Drilling Method: Geoprobe Driller: ESN
Sampling Method: probe

Borehole No.: B-14
Date: 7/10/07
Logged By: DRP
Reference Elevation: Ground Surface
Groundwater Level:

DEPTH (ft)	TIME	SAMPLE	SAMPLE No.	Blow Count (blows per foot)	Graphic Log/	GEOLOGICAL DESCRIPTION AND CLASSIFICATION	ODOR	OVA (ppm)
					GM	Surface Backberries with Light Gray Fine Sandy Gravel (Gravel to 1/2" Dia.)	none	
					SP	Light Brown Fine Silty Sand (some Gravel) (dry)		
5					SP	Dark Gray Fine to Medium Sand with Shell Fragments (moist)		
					SP	Light Brown Silty Sand (no Shells) (moist)		
10					SP	Dark Gray Fine to Medium Sand (No Shell Fragments) (moist)		
				▼		Water at 13'		
15					ML	Gray Clayey Silt (Some Fine Sand) (Wet)		
						Boring Terminated at 16' and 3/4" Diameter, 5' long Temporary Screen Installed Screen Removed after Sampling & Boring Backfilled with 3/8" Holeplug Bentonite Chips		
20								
25								

Site 4B-B

HARTCROWSER

Earth and Environmental Technologies

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102
FAX 206.328.5581
206.324.9530

J-3641

May 4, 1993

Mr. Michael Corliss
Investco Financial Corporation
P.O. Box 1117
Tacoma, Washington 98401

Re: Bunker C Oil Underground Storage Tank (UST)
Removal and Closure Assessment
Former Tacoma Steam Plant
Tacoma, Washington

Dear Mr. Corliss:

This letter report presents the results of our work associated with the removal and closure of two Bunker C Oil USTs, previously located at the former Tacoma Steam Plant in Tacoma, Washington, and an interim cleanup action. This work was performed for you according to our September 9, 1992, contract and November 2, 1992, addendum. The USTs had contained Bunker C, a fuel source for the old steam plant. The vicinity map is shown on Figure 1 and a generalized site plan on Figure 2. This assessment was performed in general accordance with Chapter 173-160 WAC and Chapter 173-340 WAC.

Site 4B-B

EXECUTIVE SUMMARY

During the period October 20 to 23, 1992, Hart Crowser excavated approximately 120 cubic yards of soil and removed two 35,000-gallon Bunker C Oil USTs at the site. We collected soil samples from excavation side walls and from beneath the former tank bottom and submitted them for chemical analyses, representative of the previous contents of the UST (Bunker C Oil). Results of the tank excavation verification soil sample chemical analyses indicated Total Petroleum Hydrocarbon (TPH) and carcinogenic polyaromatic hydrocarbons (cPAHs) above the Washington State Department of Ecology Model Toxics Control Act (MTCA) Method A soil cleanup levels in the tank excavation. Groundwater was encountered in the excavation at a depth of 11 feet.

Additional excavation was completed on December 11, 1992, to remove soil with TPH concentrations over 200 mg/kg. Also, suspected hot spots were "dredged" from below groundwater until the remaining soil was visibly clean. Approximately 50 cubic yards were excavated and placed in a lined area. After excavation, two side wall samples were collected and analyzed for TPH. Results from the chemical analyses indicated TPH concentrations below the MTCA Method A soil cleanup level.

On December 14 and 15, 1992, the UST excavation was backfilled to original surface level using imported pit run and the original 120 cubic yards of soil.

Based on the initial tank excavation and the additional limited excavation chemical results, the lateral extent of soil contamination has been defined. The final excavation side wall verification soil sample concentrations were below MTCA Method A soil cleanup level of 200 mg/kg for TPH except for N-Wall (210 mg/kg). We recommend that one soil boring be drilled beneath the former south tank bottom and three groundwater monitoring wells installed to further evaluate the subsurface conditions and assess if TPH and cPAHs are still present in the soil and if groundwater at the site has been affected.

Site 4B-B

SCOPE OF WORK

Hart Crowser's scope of work for this project included:

- Obtaining necessary permits from the Tacoma-Pierce County Health Department and Tacoma Fire Department;
- Observing product pumping activities associated with the two USTs;
- Inerting, excavating, and removing two Bunker C Oil USTs and associated product lines and additional excavation of contaminated soil;
- Sampling soil from the side walls, beneath the former tank bottoms, and from associated soil stockpile;
- Assigning laboratory chemical analyses and summarizing these test results;
- Providing recommendations for further work; and
- Preparing this letter report.

Hart Crowser decommissioned and excavated the USTs. Hart Crowser's Washington State-registered Site Assessor observed the removal of the UST and sampled soil in general accordance with Chapter 173-360 WAC and *Guidance for Site Checks and Site Assessments for Underground Storage Tanks* (Ecology, 1991). A copy of the Tacoma-Pierce County Health Department permit and Tacoma Fire Department permit is included in Appendix D

The UST 30-Day Notice of Intent to Close/Decommission Tanks was submitted to Ecology prior to the excavation. Ecology returned the notification enclosed with a reply letter stating the USTs met the requirements for exempt status. The only further reporting required by Ecology was to report discovery of contamination at the site during the tank removal. A copy of the letter is included in Appendix D.

Site 4B-B

UST EXCAVATION AND SOIL SAMPLING

On October 20 and 21, 1992, we removed the concrete slab located directly over the two USTs and excavated soils surrounding the tanks. Approximately 120 cubic yards of soil were excavated in order to remove the USTs and placed in a visqueen-lined and covered area south of the tank excavation.

On October 22, 1992, remaining Bunker C Oil contained in the USTs was pumped out. Approximately 4,300 gallons of product were removed from the tanks and transported to a waste oil disposal facility. The bill of lading is presented in Appendix D.

Both USTs were inerted and removed on October 23, 1992, and shipped to a disposal facility. The tanks, residual fluids, and sludges were disposed of in accordance with all applicable local, state, and federal regulations. The disposal certifications are presented in Appendix D.

The asphalt-coated single-wall steel tanks were 11.5 feet in diameter and 42 feet long, approximately 35,000 gallons. The USTs had evidence of corrosion with severe pitting but no holes were evident. No existing piping was found during the excavation.

Each UST was bedded (6 to 12 inches below bottom of tank) and surrounded by pea gravel (0 to 12 inches) which extended to slightly below the concrete slab. Soil units encountered in the excavation generally consisted of:

- Concrete slab from surface to a depth of about 1.5 feet;
- Loose, moist, fine brown to black, slightly silty sand with trace organics from a depth of about 1.5 to 11 feet; and
- Loose, wet, fine to black, slightly silty sand with trace organics from about 11 to 13.5 feet (the bottom of each UST was approximately 13.5 feet below existing grade). At the time of UST removal, groundwater was approximately 12.0 feet below existing grade.

Site 4B-B

Visible contamination was noted on the bottom of Tank 2 and in the southeast corner of the excavation from a depth of 9 feet to the groundwater level just after Tank 2 was removed.

The UST excavation verification soil samples and soil stockpile characterization samples were collected on November 4, 1992, and submitted to the Hart Crowser *FAST* Laboratory for TPH (WTPH - 418.1). The UST excavation and stockpile soil sampling procedures are discussed in Appendix B.

We collected six side wall soil samples just above the groundwater (estimated depth of 11 feet below existing grade) at locations shown on Figure 2. In addition, we collected one soil sample from between the former tanks (B/W-Tank), one soil sample from the former Tank 2 bottom beneath the groundwater (Bottom), and one soil sample 1 foot south of SW-Wall (SW-Wall-2).

One split soil sample from the excavation (SE-Wall) was submitted to Analytical Technologies, Inc., laboratory for the following analyses:

- PAHs (EPA Method 8310);
- Priority Pollutant Metals;
- PCBs (EPA Method 8080); and
- Volatile Organics (EPA Method 8240).

It was noted during sampling that there was from 0 to 2.5 feet of groundwater (11 feet from surface) in the bottom of the excavation. A layer of oily foam and sheen was floating on top of the groundwater. The oily foam was removed from the excavation using a pump truck and absorbent materials. Floating absorbent material was left in the excavation to capture any remaining hydrocarbons. Approximately 850 gallons of oily foam and water were pumped from the excavation and transported to a permitted disposal facility. The bill of lading is presented in Appendix D.

UST EXCAVATION SOIL AND STOCKPILED SOIL ANALYTICAL RESULTS

Table 1 summarizes the detected concentrations of TPH in the tank excavation verification soil samples and stockpiled soil characterization samples. Analytical results indicated concentrations above the MTCA Method A TPH cleanup level of 200 mg/kg were detected in the following soil samples:

- Between the tanks (B/W-Tank) - 10,000 mg/kg;
- Southeast excavation wall (SE-Wall) - 10,000 mg/kg;
- Beneath Tank 2 (Bottom) - 3,500 mg/kg; and
- North excavation wall (N-Wall) - 210 mg/kg.

The remaining four excavation soil samples (S-M-Wall, SE-Wall-2, W-Wall, and E-Wall) and four stockpile soil samples (SP-1, SP-2, SP-3, and SP-4) had detected concentrations or detected TPH concentrations below 200 mg/kg.

The split sample (SE-Wall) detected analytes are summarized in Table 2. Analytical results indicated the presence of PAHs with total concentrations of cPAHs above MTCA Method A cleanup level of 1 mg/kg.

Low concentrations of ethylbenzene and total xylenes were detected but are below MTCA Method A cleanup levels of 20 mg/kg for each.

Six Priority Pollutant Metals were detected at the following concentrations:

- Arsenic - 2.7 mg/kg;
- Chromium - 8.5 mg/kg;
- Copper - 8.8 mg/kg;
- Lead - 2.2 mg/kg;
- Nickel - 7.4 mg/kg; and
- Zinc - 13.8 mg/kg.

Site 4B-B

The detected Priority Pollutant Metals were within background concentrations presented in a separate Bison Engineering, Inc. document entitled *Addendum #1, Phase II Environmental Site Assessment, Thea Foss Waterway, Tacoma, Washington,* dated December 17, 1990.

No PCBs were detected.

The laboratory certificates of analysis from Analytical Technologies, Inc., and Hart Crowser *FAST* Laboratory are presented in Appendix C.

ADDITIONAL EXCAVATION, SOIL SAMPLING, AND ANALYTICAL RESULTS

Additional excavation was conducted on December 11, 1992, to remove soils with TPH concentrations above 200 mg/kg. Suspected hot spots below the groundwater were also "dredged" until the remaining soil was visibly clean. The soil was placed in two visqueen-lined areas, bordered with bales and covered with visqueen. The soil from the additional excavation will be sent to a permitted disposal facility.

Two verification soil samples (RS-1 and RS-2) were collected from the south wall as shown on Figure 2. Analytical results indicated detected concentrations below 200 mg/kg as shown in Table 1. The Hart Crowser Chemistry Laboratory Certificate of Analysis is presented in Appendix C.

Prior to the additional excavation, no oily foam or sheen was noted on the groundwater in the excavation. After the "dredging", there was a layer of oily foam and sheen floating on the water. The oily foam was removed with adsorbent materials and a pump truck and the resulting 250 gallons of oily water were taken to a permitted disposal facility. A bill of lading for the oily water is presented in Appendix D.

Site 4B-B

BACKFILLING UST EXCAVATION

The excavation was backfilled on December 14 and 15, 1992. Import pit run was initially placed in the excavation to two feet above groundwater without compaction. The 120 cubic yards of soil from the original UST tank excavation were then placed in the excavation. Once the backfill in the excavation was two feet above the groundwater, the soil was placed in layers in 10- to 12-inch lifts and compacted to a moderately dense, non-yielding condition with a vibratory roller compactor. The remainder of the excavation was backfilled with import pit run and compacted as described above.

RECOMMENDATIONS FOR ADDITIONAL WORK

With the presence of groundwater in the excavation, it was difficult to estimate if sufficient contamination still exists to be of risk to the environment. To better define the existing conditions, we recommend drilling one boring beneath the former south tank bottom and installing three monitoring wells.

We recommend that one soil sample be collected per boring/monitoring well and analyzed for TPH quantified as heavier than diesel (Ecology's WTPH-418.1) and PAHs (EPA Method 8310) if TPH is detected. Also, one groundwater sample should be collected from each monitoring well (after it has been developed and purged) and analyzed for TPH quantified as heavier than diesel (Ecology's WTPH - 418.1) and PAHs (EPA Method 610) if TPH is detected.

These explorations and chemical analyses will assist in further assessing if contaminated soil above the MTCA cleanup levels for TPH and cPAHs is currently present at the site and if the groundwater has been impacted. If contaminated soil and/or groundwater is present, it will help define the extent of contamination and also aid in identifying possible practical and feasible methods of soil and/or groundwater remediation at the site.

Site 4B-B

LIMITATIONS

Work for this project was performed, and this letter report prepared, in accordance with generally accepted professional practices for the nature and conditions of the work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of Investco Financial Corporation for specific application to the referenced property. This report is not meant to represent a legal opinion. No other warranty, express or implied, is made.

All MTCA cleanup levels included in this report are provided for comparison purposes only and are based on our understanding of cleanup levels required by Ecology for similar projects. They do not represent MTCA interpretations. By using them for comparison purposes, we are not implying that remedial actions at this site are required under MTCA. Specific MTCA interpretations may involve separate calculations and determinations upon which a range of cleanup standards may be established by Ecology.

Site 4B-B

Please contact James Hest or Julie Wukelic at (206)324-9530 if you have any questions concerning the content of this document, or if we can provide additional services. We trust this letter meets your needs.

Sincerely,

HART CROWSER, INC.

JAMES A. HEST
Project Engineer

JULIE K.W. WUKELIC
Associate Engineer

JAH\JKWW:cen
BUNKERC.ltr

Attachments:
References
Table 1 - Excavation and Stockpile Soil Sample Test Results
Table 2 - Split Soil Sample (Southeast Wall) Test Results
Figure 1 - Vicinity Map
Figure 2 - Site and Soil Sampling Location Plan
Appendix A - Soil Description Key
Appendix B - Soil Sampling Procedures
Appendix C - Certificates of Analysis
Hart Crowser *FAST* Laboratory,
Hart Crowser Chemistry Laboratory, and
Analytical Technologies, Inc.
Appendix D - Washington State Department of Ecology Letter
Bill of Lading for Disposal of Product
Bill of Lading for Disposal of Oily Groundwater
UST Certificates of Disposal

cc: (w/Attachments)
Underground Storage Tank Section; Dept. of Ecology, Olympia.
Leaky Underground Storage Tank Section; Dept. of Ecology, SWRO.
Tacoma-Pierce County Health Department; Tacoma

REFERENCES

Bison Engineering, Inc., 1990, *Addendum #1, Phase II Environmental Site Assessment, Thea Foss Waterway, Tacoma, Washington*, Bison Engineering, Inc., December 17, 1990.

Ecology, 1991. *Guidance for Site Checks and Site Assessments for Underground Storage Tanks*, Ecology, February, 1991.

Table 1 - Excavation and Stockpile Soil Sample Test Results

Sample ID	Sample Date	TPH Concentration in mg/kg
SP-1	11/5/92	130
SP-2	11/5/92	140
SP-3	11/5/92	99
SP-4	11/5/92	120
S-M-Wall	11/5/92	25U
SE-Wall*	11/5/92	10,000
SE-Wall-2	11/5/92	27
W-Wall	11/5/92	25U
N-Wall	11/5/92	210
E-Wall	11/5/92	25U
B/W Tank*	11/5/92	10,000
Bottom*	11/5/92	3,500
RS-1	12/11/92	50U
RS-2	12/11/92	82

U not detected at detection limit indicated.
* Subsequently removed during overexcavation.

BUNKERC.lr

Table 2 - Split Soil Sample (Southeast Wall) Test Results

Detected Analyte	Concentration in mg/kg
EPA Method 8240	
Volatile Organics	
Ethylbenzene	0.46
Total Xylenes	0.46
EPA Method 8310	
PAHs	
Fluorene	7.8
Phenanthrene	11.0
Fluoranthene	14.0
Pyrene	8.3
*Benzo(A)Anthracene	33.0
*Chrysene	23.0
*Benzo(B)Fluoranthene	13.0
*Dibenzo(A,H)Anthracene	6.0
Benzo(G,H,I)Perylene	10.0
Priority Pollutant Metals	
Antimony	3.4U
Arsenic	2.7
Beryllium	0.57U
Cadmium	0.57U
Chromium	8.5
Copper	8.8
Lead	2.2
Mercury	0.29U
Nickel	7.4
Selenium	1.1U
Silver	1.1U
Thallium	1.1U
Zinc	13.8

* cPAHs

U not detected at detection limit indicated.

Site 4B-B

Vicinity Map

0 2000 4000

Scale in Feet

N

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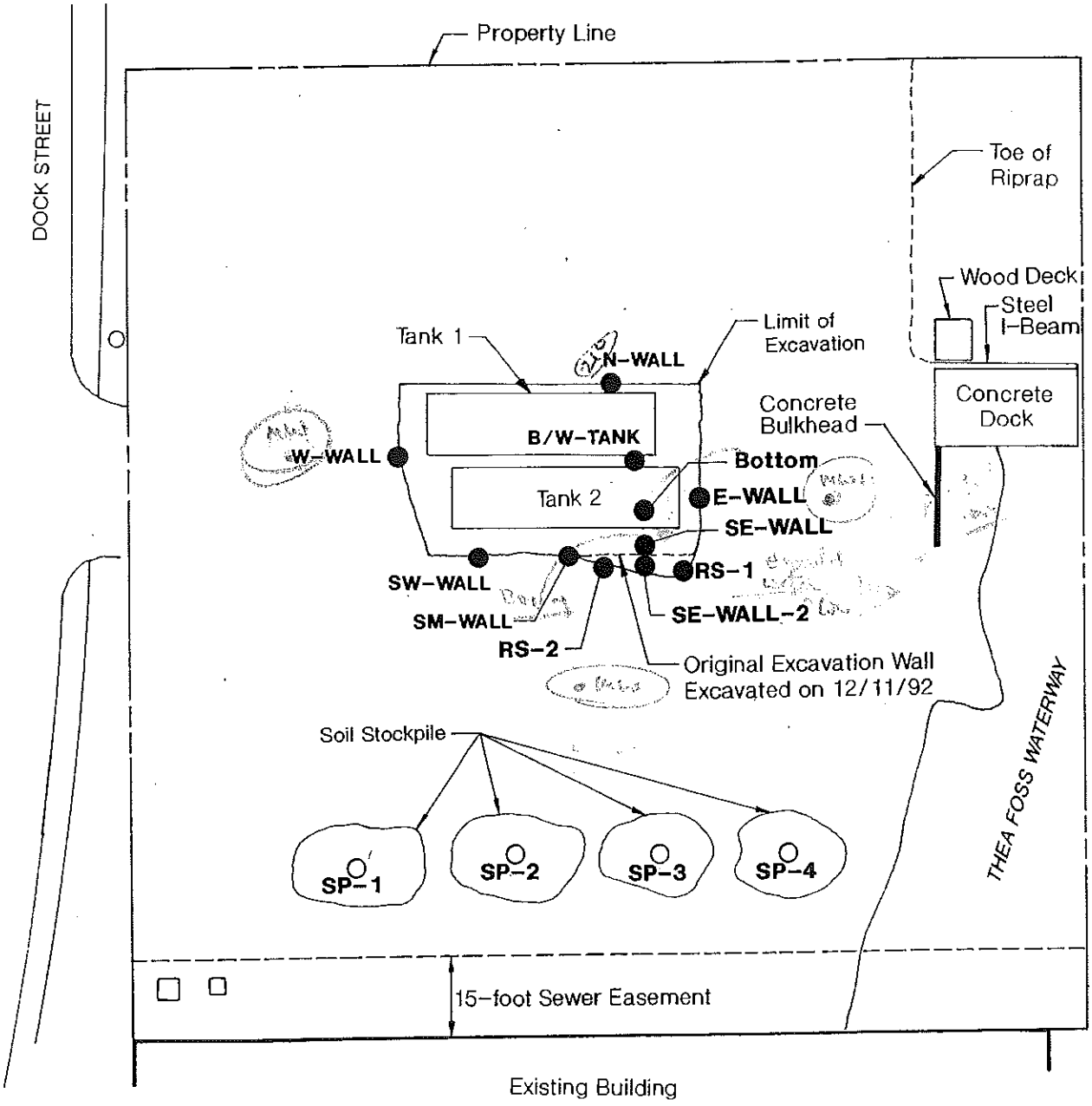
Figure 1

Site 4B-B

Site and Soil Sampling Location Plan



● **N-WALL** Verification Soil Sample Location and Number

○ **SP-1** Stockpile Characterization Soil Sample Location and Number

N

0 30 60

Scale in Feet

HARTCROWSER

J-3641 5/93

Figure 2

Site 4B-B

SUBSURFACE SOIL INVESTIGATION REPORT
FOLLOW-UP TO SITE SUMMARY REPORT
DATED FEBRUARY 15, 2007

Investco/Looney Site
1147 Dock Street
Tacoma, Washington

September 14, 2007

Prepared for:

Federal Asset Recovery, Inc.
PO Box 1435
Tacoma, Washington 98401

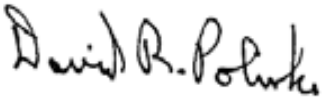
Prepared by:

V Environmental LLC
PO Box 13513
Des Moines, Washington 98198

Prepared by:

Verna Lee Curry, MSES
Principal Project Scientist

Reviewed by:



David R. Polivka P.G./P.H.G.
Environmental Services Manager

V Environmental

Site 4B-B

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FIGURES

Figure 1 Site Location Map
Figure 2 Site Plan
Figure 3 Locations of Borings 9 through 14
Figure 7 Compilation of Location of Investigations

TABLES

Table 1. Upland Soil Samples from Borings – Metals and TPH
Table 2. Upland Groundwater Samples – Total and Dissolved Lead
Table 3. Upland Soil Samples - cPAHs (Method 8270C)

APPENDICES

Appendix A Laboratory Analytical Results and Chain of Custody
Appendix B Boring Logs

EXECUTIVE SUMMARY

V Environmental LLC (V Environmental) conducted this second Phase II Environmental Site Assessment (ESA) of the soils and groundwater at the Property located at 1147 Dock Street as a follow-up to the Site Summary Report that was completed in April 2007.

The Property is situated east of the downtown area of the City of Tacoma on the Thea Foss Waterway. A review of historical records including historical aerial photographs, historical city directories, and information contained in previous reports, indicated that the Property was occupied by the Consumer Central Heating Plant from 1920 to 1980. The Property building was vacant by 1980 and demolished in 1985. The Property has remained unused except for parking since 1985. The south half of the Property is vacant, unpaved land and the northern half of the Property currently contains several old foundation walls and slabs. The Property is adjacent to the Thea Foss Waterway, which is part of the Federal Commencement Bay Nearshore/Tideflats Superfund site.

Several environmental investigations have been conducted at the Property including UST decommissioning activities and groundwater investigation (1992), Area-Wide Investigation (Washington Department of Ecology (WDOE), limited subsurface soil and sediment investigation (1996), Preliminary Sediment Investigation and Interim Action (1997), and Phase II Environmental Site Assessment and Site Investigation (2005).

In February 2007, V Environmental published a Site Summary Report that summarized the previous investigations and remediations. The Site Summary Report identified the presence of lead in groundwater at Boring 2 in a concentration of 24 milligram per kilogram (mg/kg), which is greater than the Model Toxics Cleanup Act (MTCA) Method A Cleanup Level of 15 mg/kg. Lead was detected in the groundwater samples from all borings, but the concentration of lead did not exceed MTCA Method A Cleanup Levels except in Boring 2. Mercury was identified as present in one bank soil sample (SSIDEWALL) at a concentration of 4.2 mg/kg, which is above the MTCA Method A Cleanup Level of 2.0 mg/kg. Mercury was identified in other samples along the bank but at concentrations less than the MTCA Method A Cleanup level.

This investigation was conducted in accordance to the WDOE response letter to the Site Summary Report and the Work Plan for this investigation. The contaminants of concern for this investigation included total and dissolved lead in groundwater, mercury in soils, and heavy oil and c-polycyclic aromatic hydrocarbons (cPAH) in the vicinity of former USTs at the site. The boring locations and laboratory analyses for this investigation were selected based on conversations with the Washington State Department of Ecology (WDOE).

On July 10, 2007, V Environmental advanced six borings at the Property to assess subsurface soil and groundwater conditions in the southern half of the Property. Three borings were spaced across the southern Property boundary, one boring was advanced downgradient of the former USTs, one boring upland of the SSIDEWALL sample collected by WDOE (March 1997), and one boring was placed in the south central area of the Property. Laboratory analyses included mercury in all soil samples, diesel-range hydrocarbons and polycyclic aromatic hydrocarbons (PAHs) in the borings downgradient to the former USTs, and lead in soil and total and dissolved lead in groundwater in three borings, Laboratory analyses did not detect the presence of mercury, lead or PAHs in soil or dissolved lead in groundwater. Total lead was detected in groundwater in Boring 13 and Boring 14 at concentrations of 2.5 and 9.8 mg/kg respectively, which is less than the MTCA Method A Cleanup level of 15 mg/kg. Diesel-range hydrocarbons were detected at a concentration

of 151 mg/kg at 14 feet below ground surface in Boring 11. The MTCA Method A Cleanup level for diesel-range hydrocarbons in soil is 2,000 mg/kg.

This Executive Summary is presented solely for introductory purposes and the information contained in this section should be used only in conjunction with the full text of this report. A complete description of the project, Site conditions, scope of work, investigative methods, and findings are contained in the following sections of this report.

1.0 INTRODUCTION

V Environmental LLC has completed a follow-up subsurface soil investigation of the parcel located at 1147 Dock Street in Tacoma, Tax Parcel Number 8950001971, County of Pierce, Washington, the Property. Figure 1 shows the location of the Property. This subsurface soil and groundwater investigation was conducted as a follow-up to WDOE comments to the Site Summary Report that was completed in general accordance with Section VII (A) of Agreed Order DE3373 between Federal Asset Recovery, Inc. and WDOE, signed November 17, 2006.

The Round 2 Data Evaluation Report for the Thea Foss Waterway (HartCrowser, January 17, 1997) indicated the presence of mercury in concentrations greater than Sediment Quality Objectives (SQO) in intertidal and subsurface sediments in the waterway offshore of the Property. During an area-wide investigation conducted by the Washington State Department of Ecology (WDOE), laboratory analytical results of soil samples indicated that fill material present on the embankment of the Property contained mercury in concentrations greater than Model Toxic Cleanup Act (MTCA) Method A Soil Cleanup levels. Based on chemical analyses of soil samples collected during subsurface soil and sediment investigations between the years 1992 and 1997, WDOE determined that the Property represented a source of mercury to the Thea Foss Waterway.

Three site investigations and three remediation by excavation activities were conducted at the Property between the years 1992 and 2005 and include the following:

- HartCrowser, September 1992, Bunker C Oil Underground Storage Tank Removal and Closure Assessment and subsequent groundwater monitoring. Hart Crower decommissioned two 35,000 underground storage tanks (UST) by excavation and overexcavated petroleum-containing soils. Subsequent to and as part of the recommendations of the UST activity, Hart Crowser advanced one soil boring and installed four groundwater monitoring wells in the upland area of the Property;

- Washington State Department of Ecology, 1993, Area-Wide Investigation. The Washington Department of Ecology (WDOE) conducted an Area-Wide Investigation of the properties along the Thea Foss that included observations and soil and sediment samples;

- JS Jones, 1996, Limited Subsurface Investigation. JS Jones conducted a limited subsurface soil and sediment investigation for Federal Asset Recovery as a response to WDOE's Area-Wide Investigation;

- The Washington Department of Ecology (WDOE), 1997, Preliminary Sediment Investigation. WDOE conducted a preliminary sediment investigation based on findings from Area-Wide Investigation;

- Washington State Department of Ecology, 1998, Interim Action Cleanup Report The WDOE Interim Action (1997). WDOE excavated sediments from the bank and below the waterline and installed a geotextile membrane that would act as a barrier to control the source of mercury to the Thea Foss Waterway;

- V Environmental, October 2005, Phase II Environmental Site Assessment (ESA). V Environmental LLC (V Environmental) conducted a Phase II Environmental Site

Assessment and Site Investigation (2005) of the subsurface soils and groundwater in the upland area of the Property; and

- V Environmental, December 2005, Site Investigation. V Environmental investigated two borings that showed concentrations of mercury above MTCA Method A cleanup levels for soil.

1.1 PROJECT OBJECTIVES

In V Environmental's previous investigation, laboratory analytical results identified lead in groundwater at a concentration of 24 µg/L (microgram per liter), which is greater than the MTCA Method A cleanup level of 15 µg/L, and mercury in the soils along the south end of the bank in a concentration of 4.5 mg/kg (milligram per kilogram), which is greater than the MTCA Method A Cleanup levels of 2.0 mg/kg. The scope of this second Phase II ESA was to further understand the subsurface conditions at the Property to determine if lead and mercury were present in soils and groundwater. The boring placements were based on the locations of previous borings and investigations, conversations with WDOE, and to provide a more thorough coverage of the entire Property.

1.2 SCOPE OF WORK

The scope of work for this investigation was developed through discussions with Ms. Joyce Mercuri (WDOE) and a review of previous investigations and background information.

Work on the project included the following general tasks:

- Advance six (6) boreholes using a Geoprobe direct-push drilling method;
- Collect and submit selected soil and groundwater samples for laboratory analysis;
- Document observations in field notes and borehole logs; and
- Prepare a report that incorporates corrections to the *Site Summary Report* (April 2007).

A detailed description of VE field procedures is presented In Appendix C.

2.0 INVESTIGATION METHODS AND OBSERVATIONS

This section provides a summary of project field methods and observations made during the subsurface investigation of the Site. Additional detail on general project methodologies is provided in Appendix B.

2.1 SOIL BORING AND SAMPLING

On July 10, 2007, six boreholes (B-9 through B-14) were advanced by a Washington State licensed driller, ESN, using a direct push drilling unit. The boreholes were drilled at the following locations: in the southeast corner of the Property, near the southwest corner of the existing concrete slab, at the southeast corner (downgradient) of the former UST excavation, one location near the west edge of the existing driveway and one location near the west/southwest corner of the Property (Figure 1). Borehole locations were selected based on the locations of previous investigations to provide a more thorough coverage of the Property and determine if lead and mercury were a source of contamination to the Thea Foss Waterway. Boreholes 11, 12 and 13 locations were selected based on their proximity

and topographic position relative to the former UST location. The location for Boring 13 was selected based on its proximity to the SSIDEWALL sample collected by WDOE in 1997.

A Washington State Licensed Hydrogeologist was present on the Site to direct drilling and sampling, and to visually classify soils in accordance with the Unified Soil Classification System (USCS). All boreholes were logged and soil cores assessed for chemical odors and staining. Observations, along with other relevant geologic and hydrologic conditions encountered during drilling, were recorded on borehole logs, copies of which are presented in Appendix B.

Soil samples collected from sampling sleeves at four foot intervals were placed in laboratory-prepared glass jars labeled with borehole number, sample interval, time, date, VE project number, and required analyses. Filled sample containers were placed immediately in a chilled ice chest and stored there until delivered to the project laboratory.

2.2 GROUNDWATER SAMPLING

Groundwater samples were collected from three of the direct-push borings by advancing the sampling probe to the desired depth and installing a temporary well. The wells were constructed with a 5 foot long section of PVC screen placed at the bottom or the boring. The screen had a slot size of 0.010 inches. The wells were allowed to settle for approximately 1½ hours before they were purged and sampled. A peristaltic pump was then used to purge and sample the well using low flow sampling techniques. The well was purged at flow of less than 1 liter per minute until field parameters of temperature, conductivity, pH, dissolved oxygen and turbidity stabilized over three consecutive readings. The sample was collected using a peristaltic pump. The sample containers were then filled from the discharge of the peristaltic pump. Samples for dissolved metals were not filtered in the field but were filtered in the laboratory within 24 hours of collection. Each sample was labeled with a unique alphanumeric sample number.

2.3 LABORATORY ANALYSIS

Selected soil samples were submitted under chain-of-custody protocol to Libby Environmental in Olympia, Washington, for chemical analysis. A total of 16 soil and 3 groundwater samples were selected for analysis for diesel-range petroleum hydrocarbons, PAHs, lead and mercury. Not all samples were analyzed for all constituents. Soils from Borings 11, 12 and 13 were analyzed for diesel (TPH-Dx) and CPAHs because of their proximity to the former UST location. Groundwater from Borings 10, 13 and 14 was analyzed for total and dissolved lead to determine if lead in groundwater was an issue at the Property. All soil samples were analyzed for mercury. The analyses on each sample were determined based on a discussion with WDOE. A copy of the chain-of-custody form and laboratory-prepared analytical reports are provided in Appendix A.

3.0 INVESTIGATION OBSERVATIONS AND RESULTS

3.1 FIELD OBSERVATIONS

Subsurface soils did not appear to be native. The soils were similar to the soils identified during the initial Phase II (September 2005) and were dark brown, fine to medium sand with shell fragments infrequently intermixed with embedded lenses of silt. The ground

surface at each boring consisted primarily of sandy gravel. Borehole logs are presented in Appendix B.

3.2 ANALYTICAL RESULTS

Analytical results are summarized in Table 1, 2 and 3. A copy of the laboratory report is presented in Appendix A.

Boring locations and laboratory analytes were selected based on discussions with WDOE and on previous environmental investigations. To conform to Ecology regulations for properties located on the Thea Foss, laboratory analyses for soil and groundwater were based on Table 830-1 in the Model Toxics Control Act Cleanup Regulation Chapter 173-340 WAC amended February 12, 2001 and included selected metals.

Table 1. Upland Soil Samples from Borings – Metals and TPH

Sample ID	Date Collected	Lead	Mercury	Diesel
B9-8	7/10/07	<5.0	<0,5	
B9-12	7/10/07	<5.0	<0,5	
B9-14	7/10/07	<5.0	<0,5	
B10-8	7/10/07	<5.0	<0,5	
B10-12	7/10/07	<5.0	<0,5	
B10-14	7/10/07	<5.0	<0,5	
B11-8	7/10/07	na	<0,5	<25
B11-10	7/10/07	na	<0,5	<25
B11-14	7/10/07	na	<0,5	151
B12-5	7/10/07	na	<0,5	<25
B12-8	7/10/07	na	<0,5	<25
B12-13	7/10/07	na	<0,5	<25
B13-8	7/10/07	<5.0	<0,5	na
B13-12	7/10/07	na	<0,5	<25
B13-12 dup	7/10/07	na	<0,5	<25
B14-7	7/10/07	<5.0	<0,5	
B14-10	7/10/07	na	<0,5	
MTCA A (mg/kg)		250	2.0	2,000

na: not analyzed; * MTCA Method A standards not available and MTCA Method B standards used.

Table 2. Upland Groundwater Samples – Total and Dissolved Lead

		MTCA A µg/L	Date	B-10	B-13	B-14
Metals	Total Lead	15	7/10/07	<2.5	2.5	9.8
TPH	Dissolved Lead	15	7/10/07	<2.5	<2.5	<2.5

Site 4B-B

Table 3. Upland Soil Samples - cPAHs (Method 8270C) revised 11/21/07

Sample Name	Date	Benzo(a) Anthracene	Chrysene	Denzo(b) fluoranthene	Benzo-Fluoranthene	Benzo(a) Pyrene	Indeno (123cd) Pyrene	Dibenzo(ah) Anthracene
B9-8	7/10/07	na	na	na	na	na	na	na
B9-12	7/10/07	na	na	na	na	na	na	na
B9-14	7/10/07	na	na	na	na	na	na	na
B10-8	7/10/07	na	na	na	na	na	na	na
B10-12	7/10/07	na	na	na	na	na	na	na
B10-14	7/10/07	na	na	na	na	na	na	na
B11-8	7/10/07	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
B11-10	7/10/07	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
B11-14	7/10/07	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
B12-5	7/10/07	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
B12-8	7/10/07	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
B12-13	7/10/07	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
B13-8	7/10/07	na	na	na	na	na	na	na
B13-12	7/10/07	na	na	na	na	na	na	na
B14-7	7/10/07	na	na	na	na	na	na	na
B14-10	7/10/07	na	na	na	na	na	na	na
MTCA B (µg/kg)		0.137	0.137	0.137	0.137	0.137	0.137	0.137

3.3 FINDINGS

Soils at approximately 14 feet below ground surface (bgs) in Borehole 11 contained diesel in a concentration of 151 milligrams per kilogram (mg/kg), which is below the current MTCA Method A Soil Cleanup level of 2,000 mg/kg (Table 1). This boring was placed downgradient of the former USTs. Soils in this boring were also sampled for cPAH. Laboratory analyses did not detect the presence of cPAHs in site soils. Lead was not detected in the soils from Borings 9, 10, 13 or 14. Groundwater from Borings 10, 13, and 14 were submitted for laboratory analysis for total and dissolved lead. Laboratory analyses did not detect the presence of dissolved lead in the groundwater from these borings. Total lead was indicated in Borings 13 and 14 at concentrations of 9.8 and 2.5 µg/L respectively, which is below the current MTCA Method A cleanup level for lead (15 µg/L).

No other analytes were identified as present in the soil or groundwater samples from the Site during this investigation.

4.0 CONCLUSIONS

Laboratory analyses of soil and groundwater samples collected during this investigation did not detect the presence of mercury, petroleum hydrocarbons, lead or cPAHs at concentrations greater than MTCA Method A cleanup levels for unrestricted use.

Based on the results of this investigation and on the results of previous investigations and activities at the Property, it is the opinion of V Environmental that the Property represents a low threat to the Thea Foss Waterway and no further action is recommended at this time. However should additional information become available to indicate that there is additional soil or groundwater contamination at the site, additional work may be warranted.

Because there are contaminants remaining at the site under a geotextile membrane, the site should have institutional controls put into place. The institutional controls should include provisions for maintaining and not disturbing the geotextile membrane and underlying sediments.

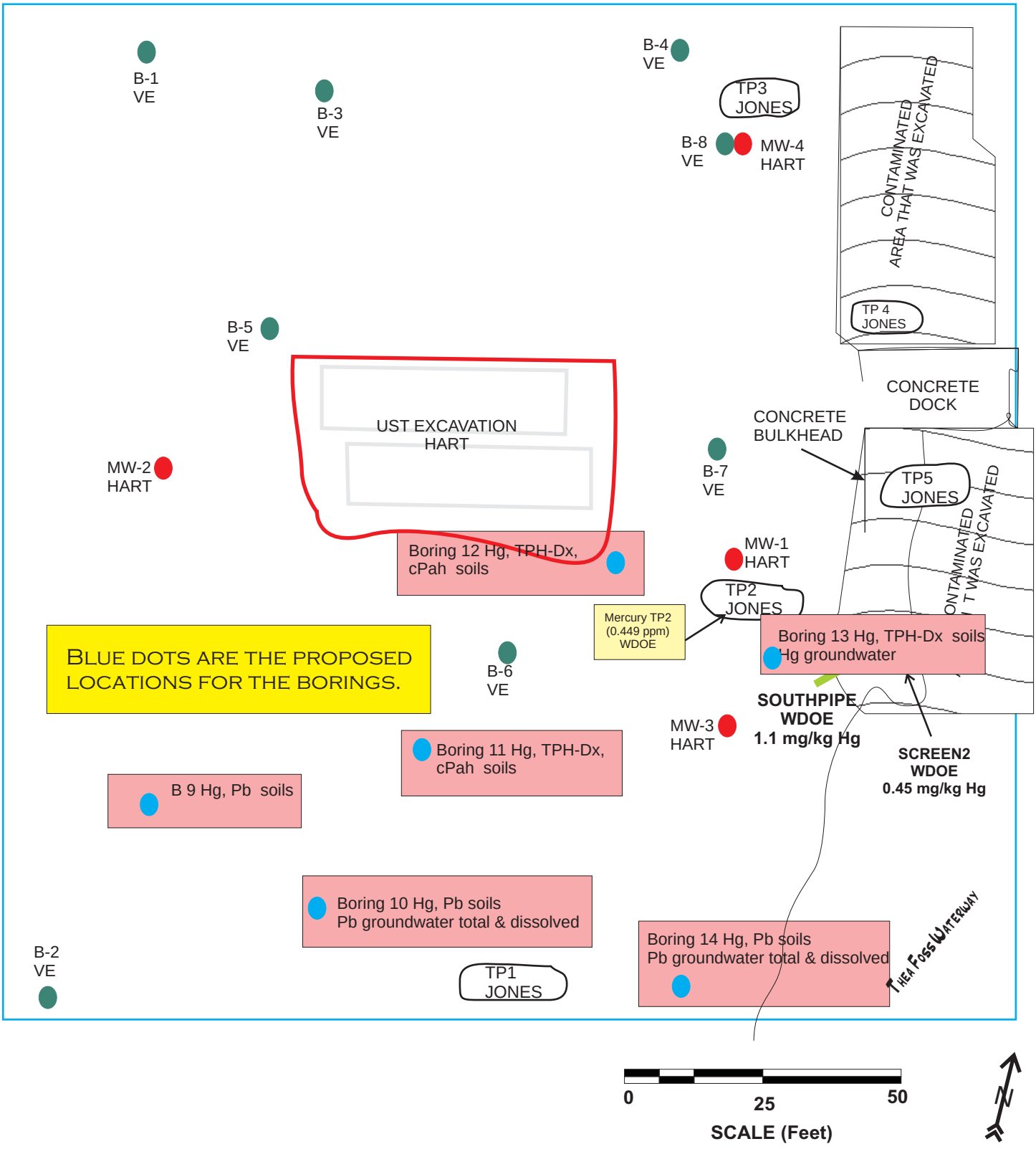
Further investigation may be warranted if greater confidence is required regarding the current condition of soil or groundwater on the subject property. Decision-making authority with regard to further environmental investigations is the sole decision of Federal Asset Recovery and is dependent on the risk tolerance of Federal Asset Recovery.

5.0 STANDARD LIMITATIONS

The findings and conclusions documented in this report have been prepared for the specific application to this project and have been developed in a manner consistent with that level of care and skill normally exercised by members of the environmental science profession currently practicing under similar conditions in the area. A potential always remains for the presence of unknown, unidentified, or unforeseen subsurface contamination on portions of the property not sampled, such as under the building. No warranty, expressed or implied, is made. This report is for the exclusive use of Federal Asset Recovery and their representatives.

If new information is developed in future Site work (which may include excavations, additional borings, or other studies), VE should be contracted to reevaluate the interpretations in this report, and to provide amendments as required.

Site 4B-B



Environmental	Subsurface Soil/Groundwater Conditions SE Quadrant and SE Corner of Former UST May 21, 2007 VE Project Number: 213-4 Drawn by: Verna Lee Curry	**FIGURE 1** **Proposed Borehole Locations** 1147 Dock Street Tacoma, Washington

Site 4B-B

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300

January 16, 2013

Mr. Jay Miller, Principal/Managing Broker
Alchemy Real Estate Group
Keller Williams Realty
4800 Stone Way North
Seattle, WA 98103

Re: Notice of Periodic Review Conducted at the following Hazardous Waste Site:

- Name: 1147 Dock Street Tacoma.
- Address: 1147 Dock Street, Tacoma, Washington 98402.
- Facility/Site Number: 1359.

Dear Mr. Miller:

Under the Model Toxics Control Act (MTCA), Chapter 70.105D RCW, which governs the cleanup of hazardous waste sites in Washington State, the Department of Ecology (Ecology) must conduct a periodic review of all sites with institutional controls and Environmental Covenants every five years. This letter serves to inform you that a periodic review has been conducted at the 1147 Dock street Tacoma Site.

The periodic review process includes the following steps:

- Confirmation that the Environmental Covenant is still active and recorded with the Title to the property.
- A review of any monitoring data collected since the cleanup was completed or since the last review was conducted.
- A Site visit to confirm the institutional controls and conditions of the Environmental Covenant are being followed.
- A 30-day public comment period on the draft periodic review report.

Based on the information collected during this periodic review, the 1147 Dock Street Tacoma Site appears to meet the requirements of Chapter 173-340 WAC, and the selected remedy

Site 4B-B

continues to be protective of human health and the environment. The 30-day public comment period on the draft periodic review report was ended on January 14, 2013. We received one public comment on the draft periodic review report. Enclosed is a copy of the final periodic review report and the public comment including our responses for your information.

A periodic review will continue to be required every five years as long as institutional controls and/or an environmental covenant are required to protect human health and the environment. The next periodic review will be due in January 2018.

If you have any questions regarding this letter or if you would like additional information regarding the cleanup of hazardous waste sites, please call me at (360) 407-6335. Thank you for your cooperation.

Sincerely,

Panjini Balaraju
Toxics Cleanup Program
Southwest Regional Office

Enclosure: 2

By certified mail: (7012 1010 0003 0195 1597)

cc: Su Dowie, Foss Waterway Development Authority
Central Files

Site 4B-B

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Mr. Jay Miller, Principal/Managing Broker
Alchemy Real Estate Group
Keller Williams Realty
4800 Stone Way North
Seattle, WA 98103

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X [signature] ☐ Agent ☐ Addressee

B. Received by (Printed Name) | C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number (Transfer from servic) 7012 1010 0003 0195 1597

PS Form 3811, February 2004 Domestic Return Receipt Paanjini Balasubramanian 102595-02-M-1540

SITE: 1147 DOCK STREET TACOMA

FSID#: 1359

COUNTY: PIERCE

CITY: TACOMA

Periodic Review Report mailing.

Site 4B-B

Bergman, Michael (ECY)

From: Balaraju, Panjini (ECY)
Sent: Monday, January 07, 2013 11:14 AM
To: Bergman, Michael (ECY)
Subject: FW: 1147 Dock Street, Tacoma, WA

FYI.

From: Balaraju, Panjini (ECY)
Sent: Monday, January 07, 2013 11:13 AM
To: Leslie Ann Rose
Cc: Balaraju, Panjini (ECY)
Subject: RE: 1147 Dock Street, Tacoma, WA

Good morning Ms. Rose,

We appreciate you taking the time to review the periodic review report for the 1147 Dock Street Site. Our response to your comment is as follows:

> **Comment: Restrictive Covenants**
> The site restrictive covenant is a legal tool that details the limitations and land management requirements that run concurrently with the property. Several local past incidents have demonstrated that the document alone may not be sufficient to ensure protection of public health and the environment. For example, requirements under a restrictive covenant are not readily available in the event that a land use permit application is submitted to the local permitting entity. The site location and specifics also need to be entered into the local land use database to alert staff to site restrictions as the permit application is considered.
>
> **Ecology Response:** This Site is in Tacoma. Based on your earlier comments on other sites, I coordinated with Shirley Schultz of the City of Tacoma (Principal Planner, Building and Land Use Services) regarding this matter. We established a procedure to deal with this issue. After the public comment period is completed, I e-mail her a copy of the Site/Property figure including the parcel number and a copy of the Restrictive Covenant (RC). They link the RC to the Parcel Number/Property in their GIS system. When they click the parcel number as a part of any permit application, the RC will pop-up on their GIS system indicating the restrictions on the property. So far this procedure is going smooth.

Again I thank you for taking the time to comment on the draft report. If you have any other questions on this site, please call me at (360) 407-6335 or send me an e-mail.

Panjini Balaraju.

From: Leslie Ann Rose [mailto:larose@healthybay.org]
Sent: Friday, January 04, 2013 4:06 PM
To: Balaraju, Panjini (ECY)
Cc: 'Su Dowie'
Subject: 1147 Dock Street, Tacoma, WA

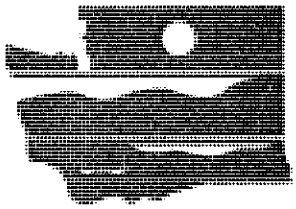
Thank you for your consideration of the attached comments.

Site 4B-B

Leslie Ann Rose
Senior Policy Analyst
Citizens for a Healthy Bay
535 Dock Street, Suite 213
Tacoma, WA 98402
(253) 383 2429 - phone
(253) 383 2446 - fax
(253) 312 7034 - cell
www.healthybay.org

Sound Water. Sound Action.
><))))*>

Site 4B-B



PERIODIC REVIEW
FINAL

1147 Dock Street Tacoma
Facility Site ID#: 1359

1147 Dock Street
Tacoma, Washington 98402

Southwest Region Office

TOXICS CLEANUP PROGRAM

January 2013

Site 4B-B

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1.0 INTRODUCTION

This document is a review by the Washington State Department of Ecology (Ecology) of post-cleanup conditions and monitoring data to ensure that human health and the environment are being protected at the 1147 Dock Street Property (Site). Cleanup at this Site was implemented under the Model Toxics Control Act (MTCA) regulations, Chapter 173-340 Washington Administrative Code (WAC).

A number of independent Site investigations and/or interim actions were conducted at the Site between 1992 through 2005. The final remedial actions were conducted under an Agreed Order Number DE 3373 signed on November 17, 2006 between Federal Asset Recovery Inc. (FAR) and the Department of Ecology (Ecology). In 2008, Ecology issued a notice of satisfaction of Agreed Order. The cleanup actions resulted in concentrations of mercury remaining at the Site in soil/sediment that exceeds MTCA Method A cleanup levels. The MTCA Method A cleanup levels for soil are established under WAC 173-340-740(2). WAC 173-340-420 (2) requires that Ecology conduct a periodic review of a site every five years under the following conditions:

- Whenever the department conducts a cleanup action.
- Whenever the department approves a cleanup action under an order, agreed order or consent decree.
- Or, as resources permit, whenever the department issues a no further action (NFA) opinion.
- And one of the following conditions exists:
  - (a) Institutional controls or financial assurance are required as part of the cleanup.
  - (b) Where the cleanup level is based on a practical quantitation limit.
  - (c) Where, in the department's judgment, modifications to the default equations or assumptions using site-specific information would significantly increase the concentration of hazardous substances remaining at the site after cleanup or the uncertainty in the ecological evaluation or the reliability of the cleanup action is such that additional review is necessary to assure long-term protection of human health and the environment.

When evaluating whether human health and the environment are being protected, the factors the department shall consider include [WAC 173-340-420(4)]:

(a) The effectiveness of ongoing or completed cleanup actions, including the effectiveness of engineered controls and institutional controls in limiting exposure to hazardous substances remaining at the Site.
(b) New scientific information for individual hazardous substances of mixtures present at the Site.
(c) New applicable state and federal laws for hazardous substances present at the Site.
(d) Current and projected Site use.
(e) Availability and practicability of higher preference technologies.
(f) The availability of improved analytical techniques to evaluate compliance with cleanup levels.

The department shall publish a notice of all periodic reviews in the Site Register and provide an opportunity for public comment.

2.0 SUMMARY OF SITE CONDITIONS

2.1 Site History

The 1147 Dock Street property is located in the City of Tacoma in Pierce County, Washington. The Property is situated east of the downtown area of the City of Tacoma on the Thea Foss Waterway, which is a part of the Federal Commencement Bay Nearshore/Tideflats (CBN/T) Superfund site. Dock Street borders the property to the east, a pay parking lot to the north, the Thea Foss Waterway to the east, and an industrial building to the south. A vicinity map is available as Appendix 6.1 and a Site Plan is available as Appendix 6.2.

The Property was occupied by the Consumer Central Heating Plant from 1920 to 1980, which was demolished in 1985. The plant had a 200-foot high smokestack and a conveyor system to accept refuse or hog fuel from barges. The plant used three 750-horsepower boilers to supply heat to Tacoma businesses. The plant burned mill tailings/sawdust from local woodworking mills until 1965 when it began using Bunker C oil. Following demolition of the plant in 1980, the Property remained unused except for parking since 1985.

2.2 Site Investigations and Remedial Actions

2.2.1 1992 UST Removal and Closure

During the period October 20 to 23, 1992, Hart Crowser decommissioned and removed by excavation two 35,000-gallon Bunker C Oil underground storage tanks (USTs).

Visible contamination was noted on the bottom of the southern tank and in the southeast corner of the excavation from a depth of 9 feet below ground surface (bgs) to the groundwater level (approximately 11 feet bgs). Six sidewall soil samples were collected from just above the groundwater table. Additionally, one soil sample was collected from between the former tanks, one soil sample from the former Tank 2 bottom beneath the groundwater, and one soil sample one foot south of the southwest sidewall.

During sampling, Hart Crowser noted that there was approximately 2.5 feet of groundwater (at 11 feet bgs) in the bottom of the excavation hole. A layer of emulsion and sheen was floating on top of the groundwater. The emulsion was removed from the excavation using a vacuum pump truck and absorbent materials. Floating absorbent material was left in the excavation to capture any remaining hydrocarbons. Approximately 850 gallons of emulsion and water were pumped from the excavation and transported to a permitted disposal facility.

Analytical results indicated that total petroleum hydrocarbon (TPH) concentrations exceeded MTCA Method A cleanup levels in four of fourteen samples collected during the tank removal. Contamination was present in the southeast excavation wall [10,000 milligrams per kilogram (mg/Kg)], the north excavation wall (210 mg/Kg), on the floor between the tanks (10,000 mg/Kg), and beneath tank 2 (3,500 mg/Kg).

Additional excavation was conducted on December 11, 1992 to remove soils with TPH concentrations above 200 mg/Kg. Suspected hotspots below the groundwater were also excavated until the remaining soil was visibly clean. Approximately a total of 120 cubic yards of contaminated soils were excavated. The soil was placed in two visqueen-lined areas, bordered with bales and covered with visqueen. According to the Ecology Interim Action, these soils were transported off-Site for disposal during the early stages of the 1997 Interim Action.

Two verification soil samples were collected from the south wall. Analytical results indicated detected concentrations of TPH below 200 mg/Kg.

Prior to the additional excavation, no emulsion or sheen was noted on the groundwater in the excavation. After the excavation, there was a layer of emulsion and sheen floating on the water. The emulsion was removed with adsorbent materials and a vacuum pump truck and the resulting 250 gallons of oily water were taken to a permitted disposal facility.

With the presence of groundwater in the excavation, Hart Crowser recommended drilling one boring beneath the former south tank bottom and installing three monitoring wells. In 1994, Hart Crowser installed four monitoring wells (MW-1, MW-2, MW-3, and MW-4) and one soil boring (B-1) on the Property. Soil samples from each of the wells and the boring were tested for TPH. The samples were obtained from the bottom of the borings 10 to 16 feet bgs. TPH was not detected in soil from the monitoring well borings.

Petroleum hydrocarbons were not detected in any of the monitoring well water samples, but the detection limit was equal to the MTCA Method A groundwater standard of 1 mg/L. However, if groundwater cleanup standards were to be set for the Site, they would likely be for protection of the adjacent surface water, which has typically been set at 10 mg/L for similar sites.

2.2.2 1993 Ecology Area-Wide Investigation

In 1993, during an area-wide investigation as a part of its source control responsibilities for the CBN/T Superfund project, Ecology discovered a man-made fill material along the banks of the Property. Ecology tentatively identified the fill material as consolidated ash and boiler wastes.

No fill was observed beneath the concrete pier, but was found north and south of the pier. Along the north 50 to 60 feet shoreline of the Site (north of the concrete pier), a foundation wall was noted parallel to the shoreline. Clean sandy soils behind the foundation wall were observed through breaks in the wall. Clean sandy soils were also observed beneath the slab in the middle of the shoreline area. Based on these observations, Ecology determined that the contamination did not penetrate into the Site uplands. The fill observed south of the concrete pier appeared to have been dumped over the edge of the bank, resulting in a steep bluff made of fill. The southern third of the shoreline did not contain any visible fill.

Ecology staff obtained samples from the surface by compositing spoonfuls of the material from the top 0 to 2 inches over an approximate four square feet for each sample. Four of the six Ecology samples tested for metals contained mercury above the Commencement Bay Sediment

Quality Objective (SQO) of 0.59 mg/Kg. The highest concentration was 38.3 mg/Kg mercury.

Ecology characterized the material for waste disposal by testing for Toxicity Characteristic Leaching Procedure (TCLP) for metals. There were no exceedances of TCLP metals criteria. One sample was tested for TCLP mercury only and submitted to a 96-hour static acute bioassay using rainbow trout. The bioassay resulted in 100 percent survival. Based on the TCLP and bioassay results, Ecology determined the material was not a hazardous waste.

2.2.3 1996 Limited Subsurface Investigation

In December 1995, Ecology issued Enforcement Order (EO) No. DE 95 TC-S408 to Pacific Trustee, Ltd. (PTL). This EO required PTL to investigate the distribution of fill material at the Site, develop an Interim Action Plan for removal of contaminated fill, implement the activities in the plan, and sample groundwater for at least four consecutive quarters. None of these activities were completed by the PTL.

In May 1996, Ecology issued EO No. DE 96TC-S119 requiring the new property owner, Dock Street Development, Inc. (DSD) to remove contaminated fill material at the Site. DSD was required to conduct further visual observations of the shoreline through the use of hand augers or test pits to determine the distribution of the fill prior to excavation activities. Following the investigation, all contaminated material was to be removed from contact with the Thea Foss Waterway.

JS Jones & Associates (JS Jones) initiated the investigation by excavating five test pits in June 1996. One test pit was located just south of the concrete pier and a second test pit was located just north of the concrete pier. Underneath the surface layer of a gray ashy substance, the soils north of the concrete pier contained a mass of black sludgy sediment mixed with small wood splinters. This material did not have a petroleum odor and contained 14.3 mg/Kg mercury and 2,720 mg/Kg of petroleum hydrocarbons. A composite sample of the ashy matrix (not including the black sediment) was obtained from both test pits. This sample contained 3.64 mg/Kg of mercury and TPH was not detected. A sample of what appeared to be made of sediments in the bottom of the south test pit contained 1.29 mg/Kg mercury. Based on the configuration of the fill, it appeared to have been dumped over the bank after the pier was constructed, which was at least as early as 1930 according to Sanborn Fire Insurance Maps.

JS Jones collected a composite sample from the three upland test pits. Mercury, cadmium, lead and TPH were not detected above laboratory detection limits. Copper, zinc and polycyclic aromatic hydrocarbons (PAHs) were detected at levels below the MTCA cleanup levels.

Ecology collected one soil sample from one of the JS Jones upland test pits located upland of the fill area just south of the concrete slab foundation. The pit contained materials similar in appearance to some of the fill observed on the bank. The sample was collected from a light brown grainy soil that looked as though it could be boiler residue or mixed with boiler residue. Laboratory analyses indicated the soils contained mercury at a concentration of 0.449 mg/Kg,

which is below MTCA Method A soil cleanup criteria (2.0 mg/Kg) and below SQOs for mercury (0.59 mg/Kg).

No excavation or other remedial activities were completed by DSD.

2.2.4 1998 Ecology Interim Action

Ecology determined, based on investigations conducted by JS Jones, Hart Crowser and Ecology, that the north shoreline fill samples consistently contained elevated levels of mercury above both the SQO and MTCA Method A cleanup criteria. Ecology determined that the contaminated fill in the intertidal area was a source of mercury to the Thea Foss Waterway. Ecology's remedial action consisted of removal and disposal of contaminated fill material from along the northern 120 feet of shoreline. The contaminated fill was present from the top of bank to below the mean lower low water level (MLLW).

Ecology determined that it was necessary to move forward with a cleanup using Ecology funds due to the continued lack of cooperation from the Site owners and the need to control the contaminant source prior to the start of Superfund cleanup efforts which were slated to begin in 1999.

The interim action included removing contaminated material to the extent possible working within the constraints of the tides. Work was scheduled during a period of low tides to enable the removal of contaminants to the MLLW level, which is equal to approximately -6.3 feet mean sea level (msl). The exposed surface was covered with a geotextile fabric sufficient to prevent passage of fine sediments and covered with quarry spalls and rip-rap. Treated wood pilings within the construction area were to be cut off at the excavated grade but, due to Site conditions, were broken off with an excavator.

Construction began on August 13, 1997. As the excavation approached the MLLW, the material became very difficult to remove due to saturation and when the approximate +1 foot tidal elevation was reached, Ecology determined it was not possible to continue excavating due to the extreme saturation. In addition to the material being difficult to excavate, the time needed to lay the geotextile and begin backfilling the excavation was limited due to the change in tides.

On August 19, 1997 confirmation samples were collected, the excavation area was covered with geotextile fabric, and backfilling began. Confirmation samples were collected from the bottom and south sidewall of the excavation. As tide conditions allowed, samples from the eastern half and from the western half of the excavated area were taken approximately every 10-15 feet along the shoreline. Only one sample was obtained at each location due to the incoming tide. Two additional confirmation samples were obtained on August 21.

Confirmation samples from the bottom of the excavation (1W through 7EW) contained mercury ranging from 0.35 mg/Kg under the former concrete pier to 29 mg/Kg at sample 4E. One sample, 5W, slightly exceeded the SQO (460 mg/Kg) for zinc. Sample 1W contained 8,340 micrograms per kilogram (µg/Kg) Low Molecular Weight PAHs (LPAH) and 41,045 µg/Kg

High Molecular Weight PAHs (HPAH) compared to the SQO of 5,200 µg/Kg and 17,000 µg/Kg, respectively. No other samples contained total HPAH or LPAH above the SQO. A few individual HPAH exceeded the SQO; however, based on the fact that the initial characterization samples of the fill did not contain PAH above the SQO, Ecology determined that these exceedances in the sample were the result of isolated contamination from removal of the treated wood pilings and were not indicative of PAH contamination in the remaining sediments.

Confirmation samples obtained at the south end of the excavation contained mercury up to 1.1 mg/Kg. At the final lateral and vertical extent of excavation, a composite sample of sediments at the 0-1 foot MLLW level along the final base of the south side wall contained 4.2 mg/Kg of mercury and 410 mg/Kg of zinc. These are above the SQO sediment cleanup standard of 0.59 mg/Kg.

On September 15, 1997, approximately one month after the cleanup was completed; Ecology obtained a seep sample from the Site. This sample was analyzed for mercury and semi-volatile organics. Mercury was not detected above the detection limit of 0.2 µg/L. The shoreline reconstruction, confirmation sampling locations and results are included as Appendix 6.3.

2.2.5 2005 Phase II Environmental Site Assessment

The purpose of the Phase II Environmental Site Assessment (ESA) was to facilitate a property transaction through a better understanding of subsurface conditions. Work on the project included the following tasks:

- Advance eight (8) boreholes using direct-push drilling methods.
- Collect and submit soil and groundwater samples for laboratory analysis for gasoline- and diesel-range petroleum hydrocarbons, benzene, toluene, ethylbenzene and xylenes (BTEX), polychlorinated biphenyls (PCBs), PAHs, semi-volatile organic compounds (SVOCs) and Resource Conservation Recovery Act (RCRA) 8 metals (lead, chromium, cadmium, barium, silver, arsenic, selenium, and mercury).
- Incorporate previous environmental investigation data into a more detailed Site map.

On September 12, 2005, eight boreholes (B-1 through B-8) were advanced by a Washington State licensed driller, ESN, using a direct push drilling unit. The boreholes were drilled in accessible locations in the vicinity of the removed UST, near the corners and center of the Site, and along the edge of the bank overlooking the Thea Foss Waterway. With the exception of boring B-8, groundwater samples were collected from the direct push borings by advancing the sampling probe to the desired depth and the sampling ports opened.

Soils at approximately 7 feet bgs in Boreholes B-4 and B-8 contained mercury in concentrations slightly greater than MTCA Method A Soil Cleanup levels (2.9 mg/Kg and 2.1 mg/Kg respectively). These borings are located on the northeast corner of the Site near the edge of the bank leading down to the Thea Foss Waterway. No other contaminants were detected at concentrations exceeding MTCA Method A cleanup levels.

In groundwater, lead was detected in all samples from the Site. Except for Boring 2 in the southwest corner of the Property, all lead concentrations in groundwater were below the MTCA Method A groundwater cleanup levels of 15 µg/L.

No other analytes were identified at concentrations exceeding MTCA Method A cleanup levels in the soil or groundwater samples from the Site during this investigation.

2.2.6 2005 Site Investigation

On December 5, 2005, V Environmental completed a Supplemental Site Investigation at the Property. The investigation comprised excavating two test pits; collecting and analyzing soil samples suspected to be contaminated with mercury, and evaluation of analytical data.

V Environmental located former Borings B-4 and B-8 and an operator from Environmental Tank Services used a backhoe to excavate two test pits (TP-1 and TP-2) at these locations. A total of 10 soil samples were selected for analysis for mercury. Laboratory analysis indicated that none of the samples contained mercury at concentrations exceeding MTCA Method A cleanup levels.

2.2.7 2006 Agreed Order

In November 2006, the current property owner, Federal Asset Recovery (FAR), entered into Agreed Order (AO) No. DE 3373 with Ecology. This AO required FAR to create a Site summary report to determine whether the interim remedial action completed at the Site met the minimum requirements for cleanup actions under WAC 173-240-360 and whether additional remedial action was necessary for the Site. Additionally, FAR agreed to pay $300,000 to Ecology toward costs incurred during the interim action and project oversight.

If Ecology determined that the interim remedial action did not meet the requirements of a final cleanup action, FAR was required to complete an RI/FS and develop a cleanup action plan. Based on Ecology comments on the draft Site Summary Report, a limited supplemental soil and groundwater investigation was conducted by drilling six borings. Results of all the soil and groundwater samples were all either non-detects or below MTCA Method A or Method B cleanup levels. Boring locations and results are included as Appendix 6.4.

On March 25, 2008, Ecology issued a notice of satisfaction of the Agreed Order. It was determined that the interim action met the sustentative requirements of a final cleanup action under MTCA, Ecology received payment from FAR, a restrictive covenant (RC) was recorded for the property, and no further remedial actions were required at the Site.

2.3 Cleanup Levels and Points of Compliance

2.3.1 Groundwater

The chemical of potential concern for groundwater at this Site was lead. No other constituents, including mercury, were detected in groundwater at levels approaching MTCA groundwater

cleanup levels or water quality criteria for protection of marine waters. The groundwater cleanup levels for lead that apply to this Site are the MTCA, Method A Cleanup Level for Groundwater of 15 µg/L and the Washington State Marine Water Quality Chronic Exposure Criteria for protection of aquatic life of 8.1 µg/L.

The EPA has not promulgated a Water Quality Criteria for lead, for protection of human health. The point of compliance is groundwater throughout the Site. Groundwater results for lead from the 2007 investigation confirmed that elevated lead in initial groundwater samples was due to highly turbid conditions from the sampling method, and that lead in groundwater meets the relevant cleanup levels.

2.3.2 Soils

The chemicals at levels of potential concern that were identified in the soils of this Site include mercury, diesel/heavy oil, and carcinogenic PAHs. The point of compliance for soils is the soils throughout the Site, to a depth of 15 feet bgs.

The MTCA Method A soil cleanup level for mercury is 2.0 mg/Kg. The MTCA Method A soil cleanup level for mercury is based on protection of groundwater from potential leaching of soil contaminants. No mercury was detected in groundwater samples from this Site; therefore it is appropriate to compare the soil mercury concentrations to the human health risk criteria. The MTCA Method B calculated concentration of mercury for protecting human health from ingestion of contaminated soil is 24 mg/Kg.

Cleanup levels applicable for the contaminants of concern for the Site are available in the table below:

Analyte	1991 MTCA Method A Soil Cleanup Level (mg/Kg)	2001 MTCA Method A Soil Cleanup Level (mg/Kg)	1991 MTCA Method A Ground water Cleanup level (µg/L)	2001 MTCA Method A Ground water Cleanup Level (µg/L)
cPAHs	0.1	0.1	0.1	0.1
Lead	250	250	5	15
Mercury	2	2	2	2
TPH-Diesel	200	2000	NL	500
TPH-Oil	200	2000	NL	500
NL = None listed				

2.3.3 Sediments

The chemical of potential concern for sediments at this Site is mercury. The cleanup level for mercury in Thea Foss Waterway is 0.59 mg/Kg. The point of compliance for the sediments is within the top 0 - 10 centimeters of surface sediments, and for deeper sediments that could

become exposed through erosion or could cause the surface sediments to become contaminated through leaching.

2.4 Restrictive Covenant

Following remediation activities, a RC was recorded for the Site on October 6, 2006. Only the area along the shoreline shown on the map (Appendix 6.5, page 28) is subject to this RC. The RC imposes the following limitations:

1. Remedial actions undertaken on the Property consist of: a slope cap (i.e., placement of capping material on the slope of the bank).
2. The Grantor shall not conduct, or allow to be conducted any activity on the Property that may result in the release or exposure to the environment of contaminated sediment that is confined by the remedy, or creates a new exposure pathway, unless the proponent of the activity obtains the prior written authorization from EPA and secures all necessary local, state, and federal permits and approvals. Activities prohibited unless otherwise approved include, but are not limited to:
   - Any activity that alters, modifies, or removes remedial actions undertaken on the Property.
   - Piling removal and installation.
   - Dredging and excavation.
3. Any other activity on the Property that may interfere with the Remedial Action, including Operation and Maintenance activities, is prohibited without prior notice to and approval of EPA.
4. The Grantor shall give thirty (30) days advance written notice to EPA of the Grantor's intent to convey any interest in the Property. No conveyance of title, easement, lease or other interest in the Property shall be consummated by the Grantor without adequate and complete provision for the continued compliance with all required institutional controls, including this RC.
5. The Grantor shall notify and obtain approval from EPA, or its successor agency, before any use of the Property that is inconsistent with the terms of the RC, or the Decree. EPA or its successor agency may approve any inconsistent use only after public notice and comment.
6. The Grantor shall allow authorized representatives of EPA or its successor agency and the City of Tacoma the right to enter the Property at reasonable times for the purpose of evaluating compliance with the Consent Decree and other required plans, including the right to undertake Operation and Maintenance activities required under the Consent Decree, which includes gathering samples on the Property, and to confirm compliance with this RC.
7. The Grantor shall restrict leases of the Property to uses and activities consistent with this RC and shall notify all lessees of the restrictions on the use of the Property. The Grantor shall include a copy of this RC in any instrument conveying any interest in any portion of the Property, including conveyance of title, a lease, a license, an easement or other use authorizations.
8. Within ten (10) days of the date this RC is fully executed, the Grantor shall record this RC with the Auditor's Office, Pierce County, State of Washington. Conformed copies of such recordings shall be forwarded to EPA, Region 10, Office of Regional Counsel at 1200 Sixth

Avenue, ORC-1S8, Seattle, Washington 98101. The Grantor shall include a copy of this RC in any instrument conveying any interest in any portion of the Property.

9. If requested by EPA, the Grantor shall allow, at no cost, the placement and maintenance of signs on the Property regarding prohibited activities, vessel size and speed, and Waterway navigational buoys, markers and visual aids, to the extent such activities do not unreasonably interfere with the public's use and enjoyment of the Property.
10. The Grantor reserves the right under WAC 173-340-440 to record an instrument that provides that this RC shall no longer limit the use of the Property or be of any further force or effect. However, such an instrument may be recorded only if EPA, after public notice and opportunity to comment, concurs.
11. The Grantor hereby confirms that this RC is enforceable at law by EPA.
12. The parties that must be notified by the terms of this RC are:

    Environmental Protection Agency
    Office of Environmental Cleanup

    Joyce Mercuri
    Department of Ecology

    If a proposed activity is within state-owned aquatic lands, then the Grantor shall also notify:

    State of Washington
    Department of Natural Resources
    Aquatic Resources Program

The RC is available as Appendix 6.5.

3.0 PERIODIC REVIEW

3.1 Effectiveness of completed cleanup actions

Based upon the Site visit conducted on April 13, 2012, the Site remains vacant as described in the interim action and Site summary reports. It is not used for vehicle parking, as is apparent in some historical aerial photos and reports. The Site surface consists of compacted gravel and concrete slabs. The Site is bordered to the north by a pay parking area, to the south by an industrial building, to the west by Dock Street and to the east by the Thea Foss Waterway. The property use and Site surface continue to eliminate direct exposure pathways (ingestion, contact) to contaminated soils that remain capped beneath the Site. A photo log is available as Appendix 6.6.

Approximately 1000 tons of fill material with elevated mercury was removed from the Site shoreline, which was then covered with geotextile fabric and several feet of quarry spalls and rip-rap. The shoreline remediation is protected from future disturbance by the placement of a RC on this portion of the property. The shoreline sediments meet the cleanup standard at the point of compliance.

After removal of upland soils from the northeast corner of the Site, all soil samples results are below the mercury Method A soil cleanup level of 2 mg/Kg as well as the Method B cleanup level of 24 mg/Kg.

CPAHs were identified in one sample beneath the footprint of the tank excavation in 1994 at a depth of 16 feet. PAHs were not detected in any of the samples from the 2005 and 2006 investigations, and Ecology believes PAHs are not a chemical of concern at the Site.

The RC for the Site was recorded and is in place. This RC prohibits activities that will result in the release of contaminants contained as part of the cleanup without Ecology's approval, and prohibits any use of the property that is inconsistent with the Covenant.

3.2 New scientific information for individual hazardous substances for mixtures present at the Site

Cleanup levels at the Site were based on regulatory standards rather than calculated risk for chemicals and/or media. These standards are sufficient to be protective of Site-specific conditions.

3.3 New applicable state and federal laws for hazardous substances present at the Site

MTCA Method A and Method B Cleanup levels for contaminants of concern at the Site have not changed since Ecology issued a notice of satisfaction for the Agreed Order at the Site and determined that no further remedial action was necessary. .

3.4 Current and projected Site use

The Site is currently vacant and for sale. The City of Tacoma Department of Community and Economic Development have zoned the property Commercial and Thea Foss Waterway Shoreline. Future uses of the property will likely be commercial or industrial, but uses along the shoreline below the top of the bank will be restricted by the conditions of the RC. These futures uses do not have a negative impact on the risk posed by hazardous substances contained at the Site.

3.5 Availability and practicability of higher preference technologies

The remedy implemented included containment of hazardous substances, and it continues to be protective of human health and the environment. While higher preference cleanup technologies may be available, they are still not practicable at this Site.

3.6 Availability of improved analytical techniques to evaluate compliance with cleanup levels

The analytical methods used at the time of the remedial action were capable of detection below MTCA Method A and Method B cleanup levels. The presence of improved analytical techniques would not affect decisions or recommendations made for the Site.

4.0 CONCLUSIONS

- The sediment cleanup level has not been met for mercury below the MLLW along the shoreline at the standard points of compliance for the Site; however, the cleanup action has been determined to comply with cleanup standards since the long-term integrity of the containment system is ensured, and the requirements of the cleanup action decision under the Sediment Management Standards [WAC 173-204-580(2)] are being met.

- The cleanup actions completed at the Site effectively contain the hazardous materials remaining below the MLLW along the shoreline of the Site. These cleanup actions continue to be protective of human health and the environment.

- The RC for the property is in place and continues to be effective in protecting public health and the environment from exposure to hazardous substances and protecting the integrity of the cleanup action.

Based on this periodic review, Ecology has determined that the remedial action at the Site is continues to be protective of human health and the environment. The requirements of the RC are being met satisfactorily and additional remedial actions are not required for the Site at this time. It is the property owner's responsibility to continue to inspect the Site to assure that the integrity of the cap maintained.

4.1 Next Review

The next review for the Site will be scheduled five years from the date of this periodic review. In the event that additional cleanup actions or institutional controls are required, the next periodic review will be scheduled five years from the completion of those activities.

5.0 REFERENCES

Hart Crowser. *Bunker C Oil Underground Storage Tank Removal and Closure Assessment.* May 4, 1993.

Ecology. *Interim Action Cleanup Report.* March 30, 1998.

Ecology. *Restrictive Covenant.* October 6, 2006.

Ecology. *Agreed Order No. DE 3373.* November 17, 2006.

V Environmental LLC. *Site Summary Report.* February 14, 2007.

V Environmental LLC. *Subsurface Soil Investigation Report.* October 11, 2007.

V Environmental LLC. *Letter Report of Contaminated Soil.* December 6, 2007.

Ecology. *Cleanup Report for Removal From Hazardous Sites List.* December 10, 2007.

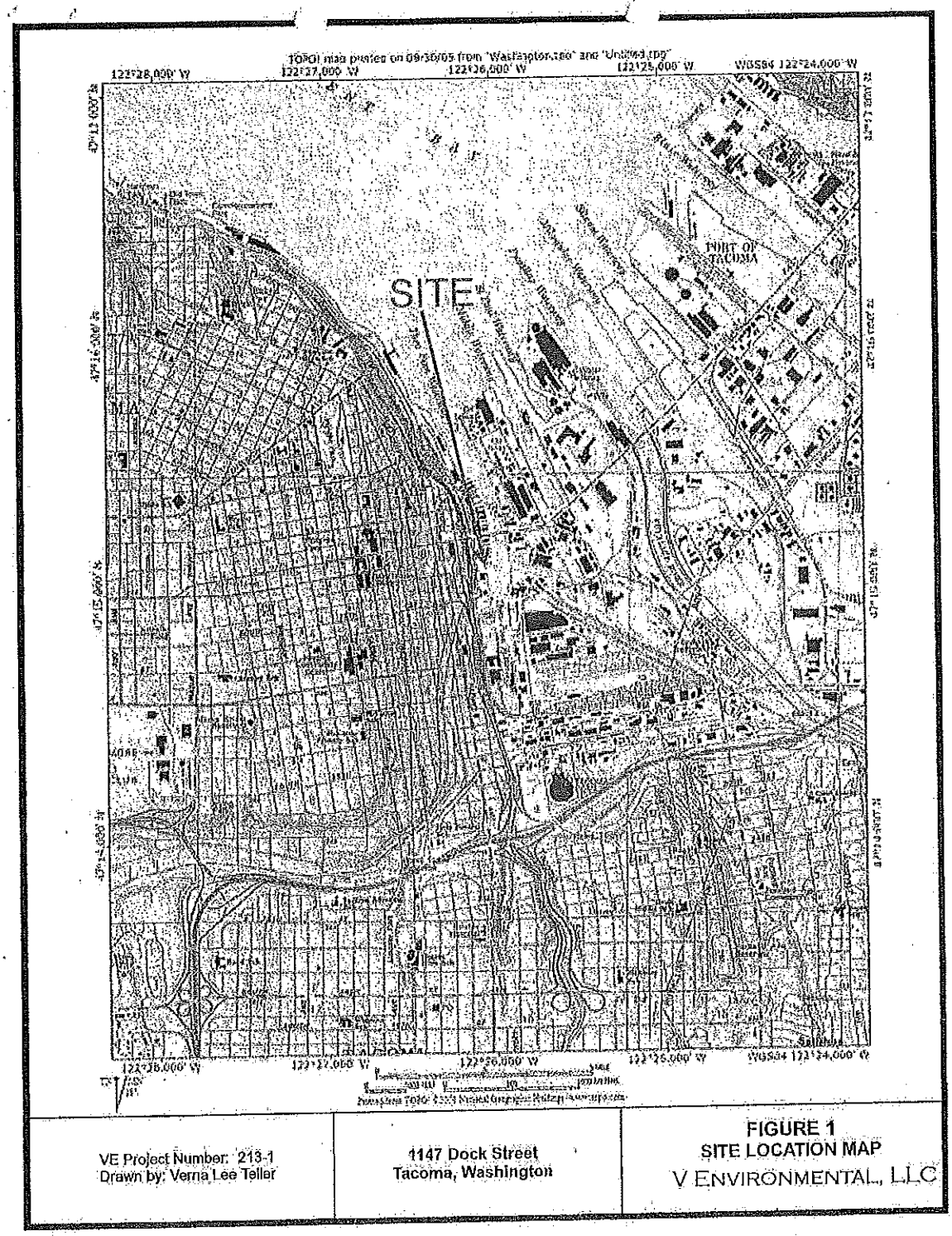
Ecology. *Notice of Satisfaction of Agreed Order No. DE 3373.* March 25, 2008.

Ecology. *Site Visit. April 13*, 2012.

6.0 APPENDICES

Site 4B-B

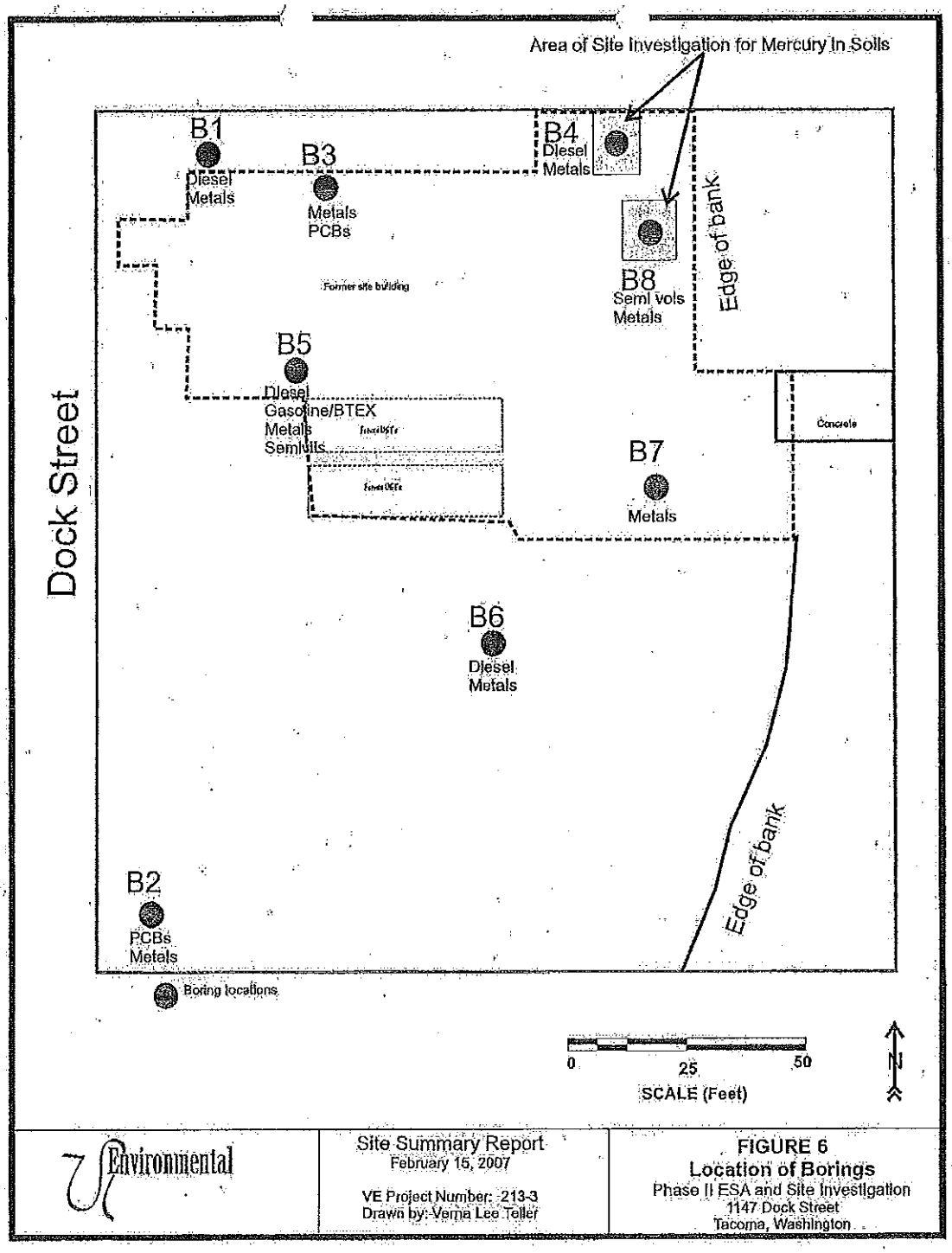
6.1 Vicinity Map



VE Project Number: 213-1 Drawn by: Verna Lee Teller	1147 Dock Street Tacoma, Washington	FIGURE 1 SITE LOCATION MAP V ENVIRONMENTAL, LLC

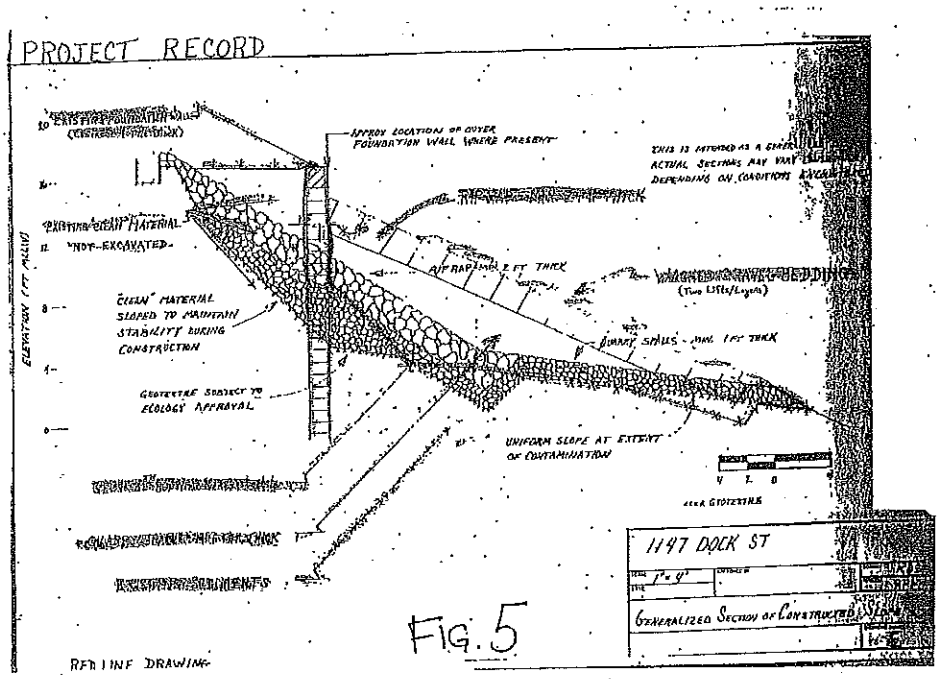
Site 4B-B

6.2 Site Plan



Site 4B-B

6.3 Shoreline Reconstruction, Sediment Confirmation Sampling Locations and Results



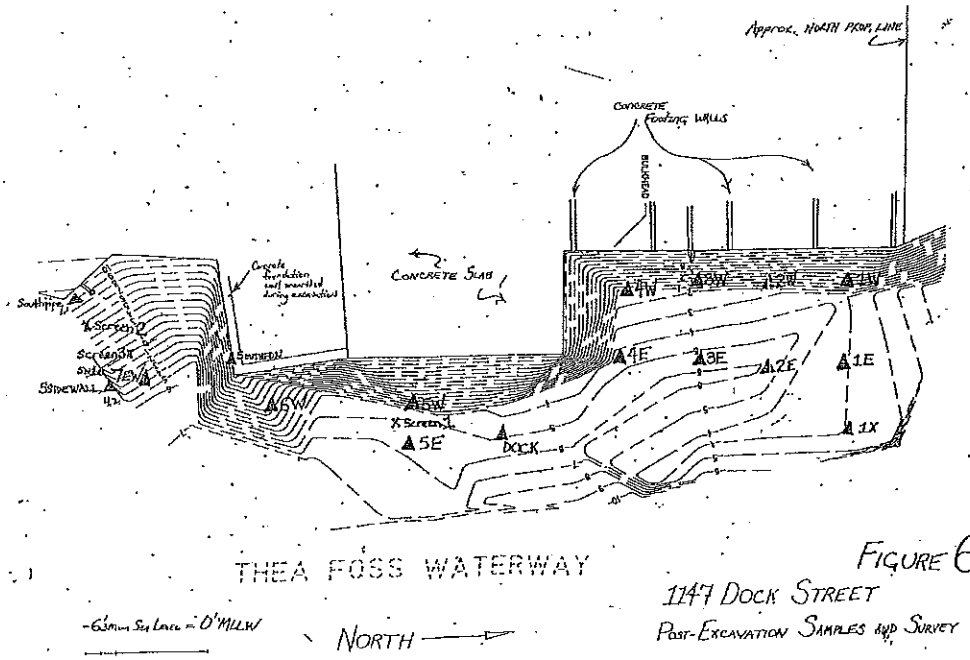


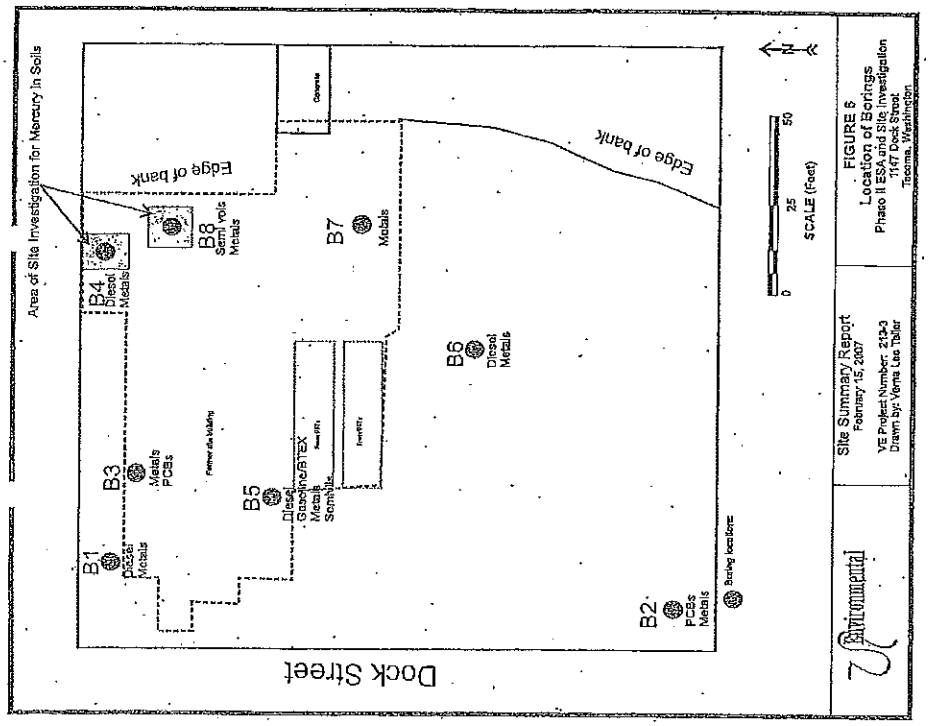
FIGURE 6

TABLE 11
CONFIRMATION SAMPLES - METALS
1147 DOCK STREET

	1	2	3	4	5	6	7
1	DATE	Sample Name	Sample #	Lead mg/kg	Mercury mg/kg	Zinc mg/kg	Comments
2	Screening samples						
3	8/17/97	SS1	66801-01		20		Composited of black silty/woody mud from disposal pile
4	8/17/97	Screen1			0.12		Brown silty sand about 10' from foundation wall edge. later overexcavated.
5	8/17/97	Screen2	66801-03		0.45		From south sidewall of partial excavation, about 4' bgs. Area was later excavated deeper. Sample is representative of upper soils at south wall of excavation.
6	8/17/97	Screen3	66801-04		2.8		From bottom of excavation on 8/17. Later overexcavated & 7EW sample obtained.
7	Post-excavation confirmation samples						
8	8/19/97	1W	66842-01	82	0.82	170	
9	8/19/97	1E	66842-02	na	1.2	na	
10	8/19/97	1X	66842-03	na	1.3	na	
11	8/19/97	2W	66842-04	na	2.8	na	
12	8/19/97	2E	66842-05	120	4.4	230	
13	8/19/97	3W	66842-06	37	1.7	78	
14	8/19/97	3E	66842-07	na	8	na	
15	8/19/97	4W	66842-08	na	1.8	na	
16	8/19/97	4E	66842-09	120	29	260	
17	8/19/97	5W	66842-10	170	26	460	
18	8/19/97	5E	66842-11	na	2.5	na	
19	8/19/97	6W	66842-12	92	18	280	
20	8/19/97	7EW	66842-13	330	2.5	380	
21	8/19/97	Dock	66842-14		0.35		below former concrete pier
22	8/19/97	SSidewall	66842-15	290	4.2	410	0-1 foot MLLW on south sidewall
23	8/19/97	SW1	66842-16		0.22		white/tan sand low on south sidewall near SSIDEWALL
24	8/21/97	Southfdn	66992-01		<.16		ash material within concrete box foundation adjacent to south edge of concrete slab
25	8/21/97	Southpipe	66992-02	51	1.1	60	3' below top of bank near metal pipe at south end of excavation.

Site 4B-B

6.4 2007 Upland Soil Sampling Locations and Results



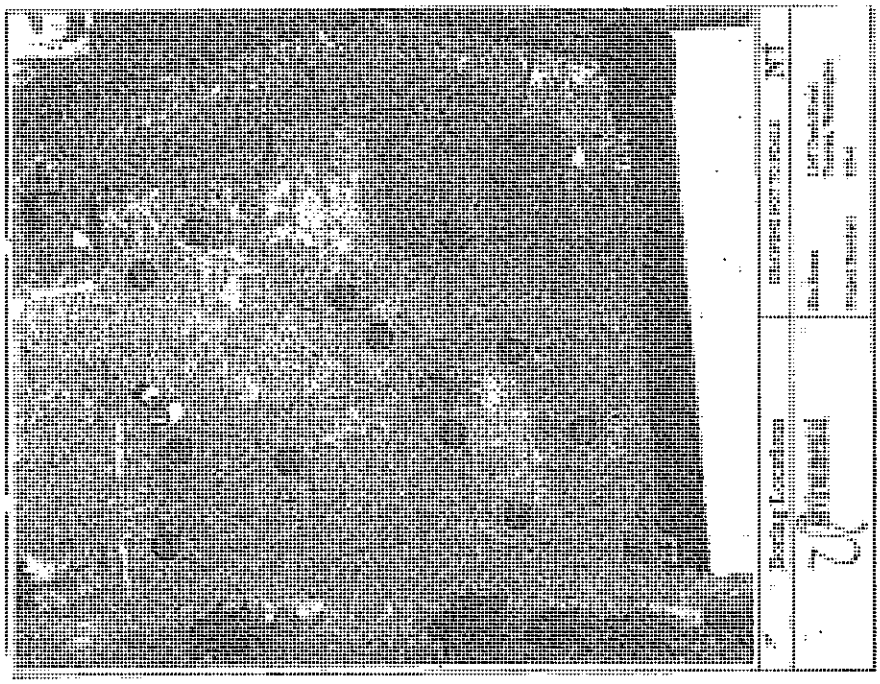


Table 1. Upland Soil Samples from Borings – Metals and TPH

Sample ID	Date Collected	Lead	Mercury	Diesel
B9-8	7/10/07	<5.0	<0.5	
B9-12	7/10/07	<5.0	<0.5	
B9-14	7/10/07	<5.0	<0.5	
B10-8	7/10/07	<5.0	<0.5	
B10-12	7/10/07	<5.0	<0.5	
B10-14	7/10/07	<5.0	<0.5	
B11-8	7/10/07	na	<0.5	<25
B11-10	7/10/07	na	<0.5	<25
B11-14	7/10/07	na	<0.5	151
B12-5	7/10/07	na	<0.5	<25
B12-8	7/10/07	na	<0.5	<25
B12-13	7/10/07	na	<0.5	<25
B13-8	7/10/07	<5.0	<0.5	na
B13-12	7/10/07	na	<0.5	<25
B13-12 dup	7/10/07	na	<0.5	<25
B14-7	7/10/07	<5.0	<0.5	
B14-10	7/10/07	na	<0.5	
MTCA A (mg/kg)		250	2.0	2,000

na: not analyzed; * MTCA Method A standards not available and MTCA Method B standards used.

Table 2. Upland Groundwater Samples – Total and Dissolved Lead

		MTCA A µg/L	Date	B-10	B-13	B-14
Metals	Total Lead	15	7/10/07	<2.5	2.5	9.8
TPH	Dissolved Lead	15	7/10/07	<2.5	<2.5	<2.5

Table 3. Upland Soil Samples - cPAHs (Method 8270C) revised 11/21/0.

Sample Name	Date	Benzo(a) Anthracene	Chrysene	Benzo(b) fluoranthene	Benzo-Fluoranthene	Benzo(a) Pyrene	Indeno (123cd) Pyrene	Dibenzo(ah) Anthracene
B9-8	7/10/07	na	na	na	na	na	na	na
B9-12	7/10/07	na	na	na	na	na	na	na
B9-14	7/10/07	na	na	na	na	na	na	na
B10-8	7/10/07	na	na	na	na	na	na	na
B10-12	7/10/07	na	na	na	na	na	na	na
B10-14	7/10/07	na	na	na	na	na	na	na
B11-8	7/10/07	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
B11-10	7/10/07	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
B11-14	7/10/07	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
B12-5	7/10/07	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
B12-8	7/10/07	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
B12-13	7/10/07	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
B13-8	7/10/07	na	na	na	na	na	na	na
B13-12	7/10/07	na	na	na	na	na	na	na
B14-7	7/10/07	na	na	na	na	na	na	na
B14-10	7/10/07	na	na	na	na	na	na	na
MTCA B (µg/kg)		0.137	0.137	0.137	0.137	0.137	0.137	0.137

6.5 Restrictive Covenant

COPY

When Recorded, Return To:
Kelly Cole
Office of Regional Counsel
U.S. EPA, Region 10
1200 Sixth Ave. ORC-158
Seattle, WA 98101

200610060691 8 PGS
10/06/2006 3:06pm $39.00
PIERCE COUNTY, WASHINGTON

OCT 10 2006

Washington State
Department of Ecology

Document Title:	**Restrictive Covenant**
Grantor:	**Federal Asset Recovery, Inc.**
Grantee:	**WA DEPARTMENT OF ECOLOGY**
Legal Description:	**S ½ lot 12, all lots 13 and 14, N ½ lot 15, Blk 62 map of Tacoma Tidelands according to plat filed September 14, 1895.**
Additional Legal Description:	**SEE ATTACHMENT 1 FOR FULL LEGAL DESCRIPTION**
Assessor's Tax Parcel Number:	**8950001971**

RESTRICTIVE COVENANT

This Restrictive Covenant is made this 5th day of October, 2006, pursuant to RCW 70.105D.030(1)(f), and WAC 173-340-440(9) by Federal Asset Recovery, Inc and its successors and assigns (hereinafter "Grantor"), and the State of Washington, Department of Ecology ("Ecology"), and its successors and assigns (hereinafter "Grantee") for the benefit of the United States Environmental Protection Agency, its successors and assigns, ("EPA").

A portion of the property referenced above is subject to this Restrictive Covenant because Remedial Actions have been undertaken on the property pursuant to the Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA"), 42 U.S.C. § 9601, et. seq., under a Consent Decree entered on May 9, 2003, titled the *United States v. Atlantic Richfield Company, et al.*, in the United States District Court for the Western District of Washington, Civil Action No. C03-5117 RJB, ("Consent Decree"). The objective of the remedial actions undertaken on the property is to protect human health and the environment.

The Consent Decree is part of an integrated settlement that includes two other consent decrees. One is between the EPA and Puget Sound Energy, Advance Ross Sub Company and PacifiCorp; ("Utilities"), and was entered by the federal District Court on May 9, 2003. The other consent decree is between EPA and the state Department of Natural Resources, which was entered by the federal District Court on December 17, 2003.

The property subject to this Restrictive Covenant is the portion of Tax Parcel 8950001971 that is located at 1147 East Dock Street, Tacoma, WA (hereafter, the "Property"), which is generally depicted as the cross-hatched area in the map attached as Attachment 2. This Restrictive Covenant is required because part of the Remedial Action capped and/or left residual contamination in place. The purpose of this Restrictive Covenant is to reduce potential exposure of marine organisms to contaminated sediments confined by capping, and to reduce potential exposure of marine organisms to contaminated sediments left in place in the Thea Foss and Wheeler Osgood Waterways.

The Grantor holds legal title to certain real property in the County of Pierce, State of Washington that is subject to this Restrictive Covenant. The parcel is legally described in Attachment 1, which is incorporated by reference into this Restrictive Covenant. The Grantor, as holder of legal title, does hereby declare that it has authority to enter into this Restrictive Covenant.

Grantor makes the following declarations as to limitations, restrictions, and uses on the Property. Furthermore, it is the intent of the Grantor that such declarations shall constitute covenants that run with the land, as provided by law, and be binding on all parties and all persons claiming under them, including all current and future owners of any portion of or interest in the property.

Section 1. Remedial actions undertaken on the Property consist of: a slope cap (i.e., placement of capping material on the slope of the bank).

Section 2. The Grantor shall not conduct, or allow to be conducted any activity on the Property that may result in the release or exposure to the environment of contaminated sediment that is confined by the remedy, or creates a new exposure pathway, unless the proponent of the activity obtains the prior written authorization from EPA and secures all necessary local, state, and federal permits and approvals. Activities prohibited unless otherwise approved include, but are not limited to:

2.1 Any activity that alters, modifies, or removes remedial actions undertaken on the Property.

2.2 Piling removal and installation.

2.3 Dredging and excavation.

Section 3. Any other activity on the Property that may interfere with the Remedial Action, including Operation and Maintenance activities, is prohibited without prior notice to and approval of EPA.

Section 4. The Grantor shall give thirty (30) days advance written notice to EPA of the Grantor's intent to convey any interest in the Property. No conveyance of title, easement, lease or other interest in the Property shall be consummated by the Grantor without adequate and complete provision for the continued compliance with all required institutional controls, including this Restrictive Covenant.

Section 5. The Grantor shall notify and obtain approval from EPA, or its successor agency, before any use of the Property that is inconsistent with the terms of the Restrictive Covenant, or the Decree. EPA or its successor agency may approve any inconsistent use only after public notice and comment.

Section 6. The Grantor shall allow authorized representatives of EPA or its successor agency and the City of Tacoma the right to enter the Property at reasonable times for the purpose of evaluating compliance with the Consent Decree and other required plans, including the right to undertake Operation and Maintenance activities required under the Consent Decree, which includes gathering samples on the Property, and to confirm compliance with this Restrictive Covenant.

Section 7. The Grantor shall restrict leases of the Property to uses and activities consistent with this Restrictive Covenant and shall notify all lessees of the restrictions on the use of the Property. The Grantor shall include a copy of this Restrictive Covenant in any instrument conveying any interest in any portion of the Property, including conveyance of title, a lease, a license, an easement or other use authorizations.

Section 8. Within ten (10) days of the date this Restrictive Covenant is fully executed, the Grantor shall record this Restrictive Covenant with the Auditor's Office, Pierce County, State of Washington. Conformed copies of such recordings shall be forwarded to EPA, Region 10, Office of Regional Counsel at 1200 Sixth Avenue, ORC-158, Seattle, Washington 98101. The Grantor shall include a copy of this Restrictive Covenant in any instrument conveying any interest in any portion of the Property.

Section 9. If requested by EPA, the Grantor shall allow, at no cost, the placement and maintenance of signs on the Property regarding prohibited activities, vessel size and speed, and Waterway navigational buoys, markers and visual aids, to the extent such activities do not unreasonably interfere with the public's use and enjoyment of the Property.

Section 10. The Grantor reserves the right under WAC 173-340-440 to record an instrument that provides that this Restrictive Covenant shall no longer limit the use of the Property or be of any further force or effect. However, such an instrument may be recorded only if EPA, after public notice and opportunity to comment, concurs.

Section 11. The Grantor hereby confirms that this Restrictive Covenant is enforceable at law by EPA.

Section 12. The parties that must be notified by the terms of this Restrictive Covenant are:

Environmental Protection Agency
Office of Environmental Cleanup
1200 Sixth Avenue, ECL-111
Seattle, WA 98101

Joyce Mercuri
Department of Ecology
Southwest Regional Office
Toxics Cleanup Program
300 Desmond Drive
Lacey, WA 98503

If a proposed activity is within state-owned aquatic lands, then the Grantor shall also notify:

State of Washington
Department of Natural Resources
Aquatic Resources Program
1111 Washington St. SE
PO Box 47027
Olympia, WA 98504-7027

This Restrictive Covenant is executed by;

Federal Asset Recovery, Inc

William A. Looney

By: William A. Looney
Its: President

LINDSAY T. KEETON NOTARY PUBLIC STATE OF WASHINGTON COMMISSION EXPIRES 12-8-07

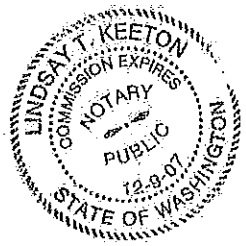
STATE OF WASHINGTON)
)ss
COUNTY OF PIERCE)

On this 5 day of OCTOBER, 2006, personally appeared before me WILLIAM A. LOONEY to me known to be the PRESIDENT of the corporation that executed the within and foregoing instrument, and acknowledged said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that (he/she/was) ~~they were~~ authorized to execute said instrument for said corporation and that the seal affixed is the corporate seal of the said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year first above written.

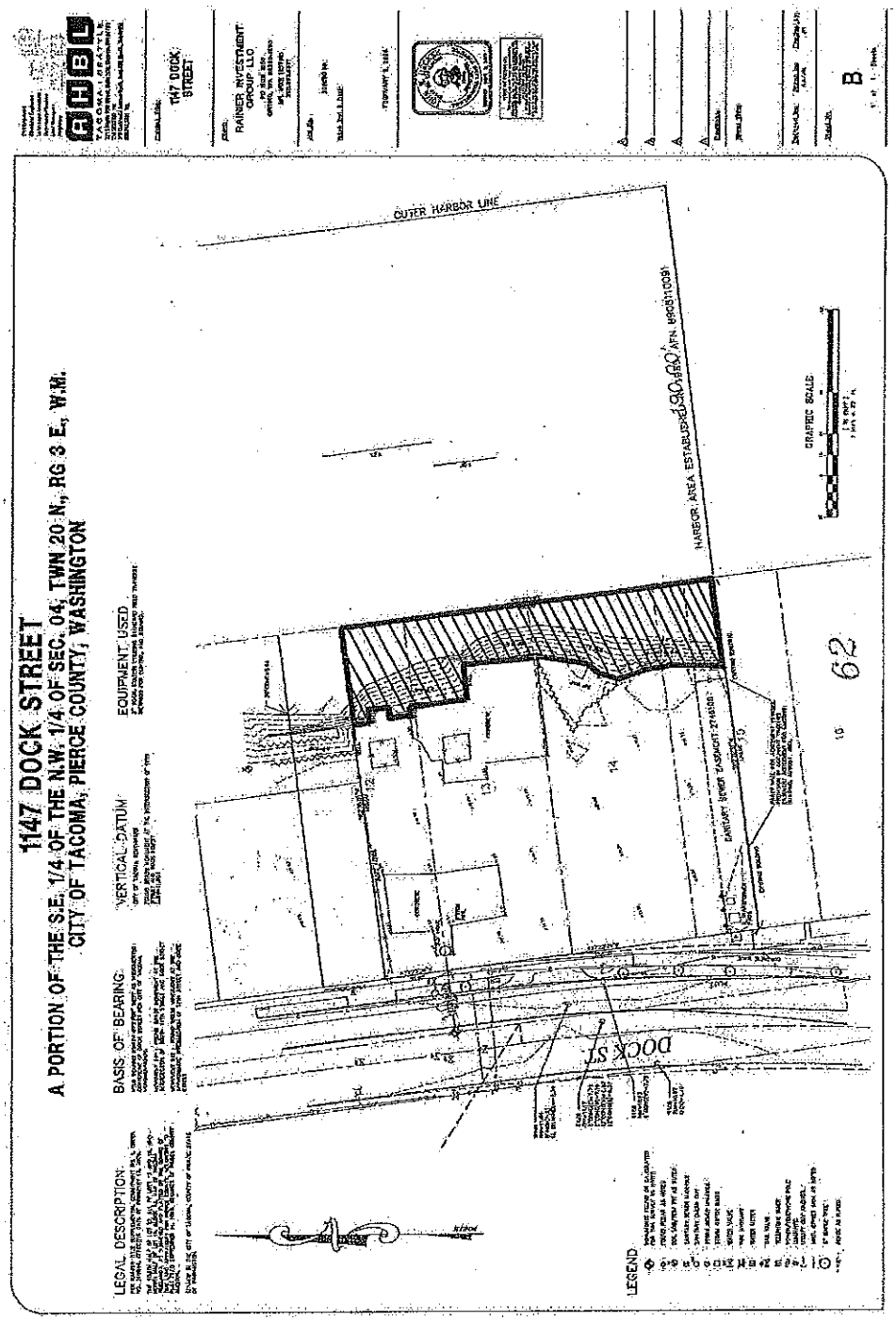
Notary Public in and for the State of

Washington, residing at University Place
My appointment expires 12/9/2007



Foss Institutional Controls/RC – No. 8950001971.doc

ATTACHMENT 2: Restrictive Covenant, Federal Asset Recovery, Inc., Parcel Number 8950001971, Pierce County, Washington.

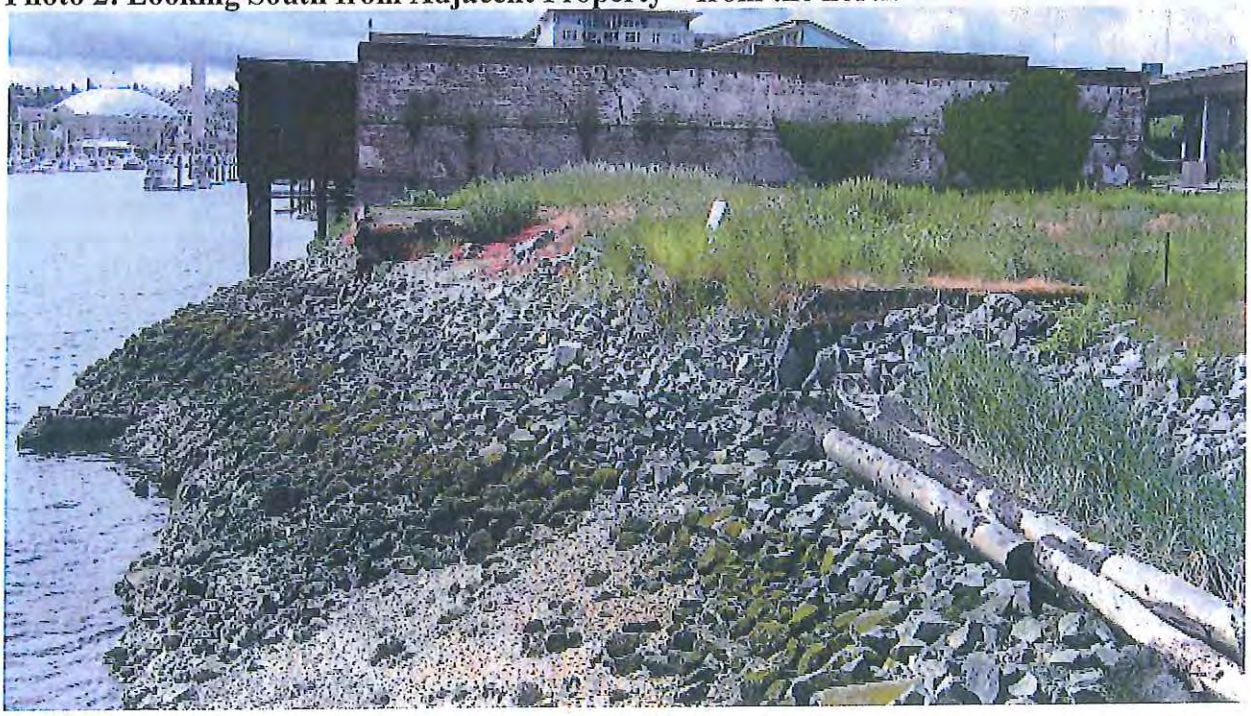


Site 4B-B

6.6 Photo log

Photo 1: Looking South from Concrete Slab on Waterfront – from the north

Photo 2: Looking South from Adjacent Property – from the north



Site 4B-B

Photo 3: Site – from the southwest corner

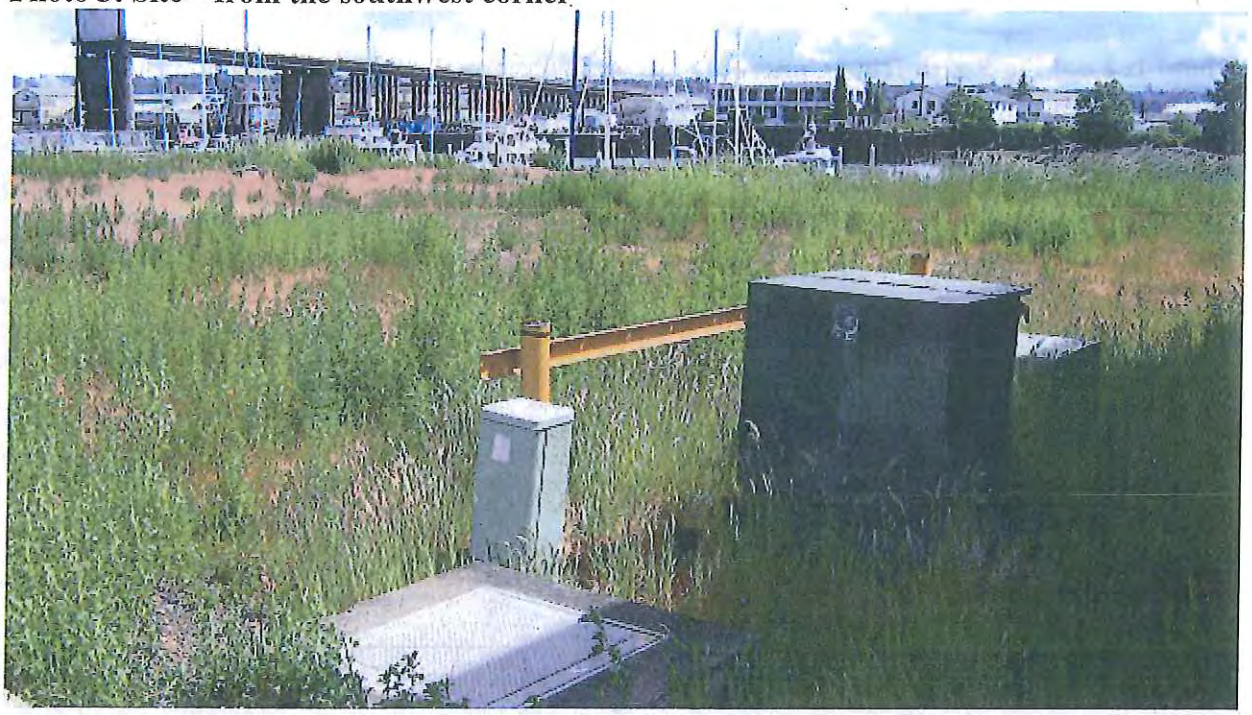


Photo 4: Site and Dock Street – from the south

APPENDIX B
Report Limitations and Guidelines for Use

APPENDIX B
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

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

Report Use and Reliance

The data report has been prepared for the City of Tacoma for the Jefferson Avenue and Hood Street Stormwater Upgrade Project and may be distributed by the City to entities engaged in the progressive design build process for this project. The report is not intended for use by others, and the information contained herein is not applicable to other projects or properties. The purpose of this limitation is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions.

This report is intended to be used only for the specific purpose or project originally contemplated for our services, and use of this report is not recommended for any other purpose or project. The data and information were developed and compiled for this project only, and no representation or warranty is made, either express or implied.

GeoEngineers shall not be responsible for any alterations, modifications or additions to the data herein or the consequences of any interpretations of the data. As such, any reliance by the City of Tacoma on this data report shall be at the risk of the City of Tacoma and without liability to GeoEngineers.

If changes are made to the project or property after the date of the report, we recommend that GeoEngineers be given the opportunity to review the data, and then we can provide written modifications or confirmation, as appropriate.

Information Provided by Others

GeoEngineers makes no warranties or guarantees regarding the accuracy or completeness of data or information provided or compiled by others and shall not be responsible for user's interpretation of such data or information.

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