

**ENGINEERING DESIGN REPORT
FOR PHASE I REMEDIATION
Olympic Sculpture Park**

**Prepared for: Museum Development Authority and
Seattle Art Museum**

Project No. 020118-001-04 • April 14, 2004

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1.0 Introduction

This Engineering Design Report (EDR) presents the basis of design for the Phase I cleanup action at the former Unocal Marketing Terminal property (Site) in downtown Seattle. The Site is being redeveloped as a public park – the Olympic Sculpture Park (OSP) – with landscaped open space dedicated to exhibition of outdoor sculpture. The cleanup action will be conducted by the Museum Development Authority (MDA) pursuant to a Prospective Purchaser Consent Decree (No. 99-2-50226-4 SEA) between the MDA, the Seattle Art Museum (SAM), and the Washington State Department of Ecology (Ecology). This EDR has been prepared in accordance with the Consent Decree and WAC 173-340-400(4)(a).

1.1 Site Description

The Site is located near Pier 70, at the northern end of the waterfront business district in downtown Seattle, Washington (Figure 1). It is bounded to the east by Western Avenue, to the west by Elliott Bay, to the North by Bay Street, and to the South by Broad Street. From the early 1900s to 1975, Unocal used the Site for transfer and distribution of petroleum products. The former Unocal facility contained numerous above-grade product storage tanks, above- and below-grade product pipelines, loading racks, and a tanker loading dock (Pier 71). Products stored or used at the Site included gasoline, diesel fuel, lubricating and heating oils, and petroleum-based solvents. Since 1988, the tanker loading dock and all above-ground structures have been demolished. A pipeline tunnel beneath Elliott Avenue still remains, and abandoned underground fuel lines are still present beneath Alaskan Way and the Burlington Northern Railroad (BNRR) right-of-way. Figure 2 shows existing site features and topography.

1.2 Previous Cleanup Actions

In 1988, Unocal entered into an Order on Consent (Order) with Ecology to remediate petroleum-containing soils and groundwater at the Site. For the purposes of the Order, the Site was divided into the following four compliance areas (shown on Figure 2):

- Upper Yard;
- Elliott Avenue;
- Lower Yard; and
- Off-Site Area (including Alaskan Way and the BNRR right-of-way).

Unocal conducted extensive remedial actions at the Site pursuant to the Order. Approximately 65,000 tons of petroleum-contaminated soils were removed from the Upper Yard beginning in 1989. In general, total petroleum hydrocarbon (TPH) concentrations in soils remaining in the Upper Yard do not statistically exceed 200 mg/kg, the cleanup target for that compliance area. However, a relatively small volume

(estimated at 110 cubic yards) of impacted soils in the northwest corner of the Upper Yard could not be excavated because of its depth (approximately 16 to 26 feet below the adjacent street grade) and proximity to a shoring wall installed along Elliott Avenue. A detailed assessment of the areal and vertical extent of TPH impacted soils remaining in the Upper Yard was presented in the technical memorandum on Remedial Measures to Address Upper Yard Direct Contact and Leaching Concerns (Aspect 2003). Figures 6 and 7 in this EDR reproduce the summary of that analysis.

Amendment No. 4 of Unocal's Order on Consent established a remedial action level (RAL) of 7,500 mg/kg for TPH in Lower Yard soils (while maintaining the 200 mg/kg cleanup target). Between 1989 and 1997, Unocal excavated approximately 60,000 tons of Lower Yard soils exceeding this RAL. TPH concentrations exceeded 200 mg/kg in 31 percent of the confirmation soil samples, with an average concentration of about 900 mg/kg. The upper 95 percent confidence value of the data set was about 1,300 mg/kg, well below the RAL. Following confirmation sampling, Unocal backfilled the Lower Yard with soil materials from several sources. Imported rock was first placed in low-lying areas to an elevation of approximately 8 feet (based on SEANET vertical datum). Approximately 17,800 cubic yards (bulked volume) of stockpiled Lower and Upper Yard soils with an average TPH concentration of about 1,000 mg/kg were then backfilled. Finally, a minimum 2-foot-thick layer of imported "clean" soil (i.e., Class 1 soil per Ecology 1994) was placed over the entire Lower Yard to serve as an interim cap.

Petroleum contamination, including much more extensive LNAPL, has also been encountered in Off-Site Area soils and groundwater. A liquids extraction system installed by Unocal along the west side of the railroad tracks has operated almost continuously since December 1989, reducing the discharge of petroleum contamination to Elliott Bay. As of December 2003, approximately 23 million gallons of water have been extracted, treated, and discharged to the sewer, and approximately 4,800 gallons of LNAPL have been recovered.

1.3 Summary of Phase I Cleanup Action

The Olympic Sculpture Park cleanup action is currently planned to be completed in two phases. The first phase of remediation will address a portion of the cleanup action at the Upper and Lower Yards. The cleanup action is proposed to be completed in two phases to take advantage of the availability of clean fill soil from redevelopment of the former Arcade Plaza property located at 1321 Second Avenue in downtown Seattle. A Phase I Environmental Site Assessment (Hart Crowser 2002a) conducted for the Arcade Plaza and adjacent parking lot identified no previous site uses that would have impacted subsurface soils (Appendix A). In addition, the soil fines content was identified to be ideal for the OSP site soil capping requirements (Appendix B).

It is anticipated that roughly half of the total fill requirement for the Upper and Lower Yard cleanup action will occur during the first phase. Figures 3 and 4 show plan and section views of planned areas of soil placement and anticipated grades upon completion of Phase I construction.

In addition to soil importation and placement, Phase I remediation will include the following elements:

- Installation of erosion control measures to stabilize the Site during Phase I construction;
- Installation of a reduced permeability layer (RPC) within the clean fill layer in the northwest corner of the Upper Yard; and
- Installation of stormwater drain lines and erosion control measures to stabilize the Site during the interim period between Phase I construction and completion of the Upper and Lower Yard remediation planned for 2005.

1.4 EDR Organization

This EDR provides detailed analysis of remedial components discussed in the Cleanup Action Plan (CAP; Exhibit B to the Consent Decree) and identified in the technical remedial design memorandum (Aspect 2003a, 2003b, and 2003c) prepared for the Upper and Lower Yards. Only those remedial components pertinent to Phase I construction are addressed. For example, since no cleanup actions will take place in the Offsite Area during this initial phase, Offsite Area remedial activities are not addressed. A separate EDR will be prepared that addresses final (Phase II) design and construction of the OSP remediation.

This EDR consists of the following sections:

Section 1—Introduction

The introduction (this section) presents general background information, as well as the purpose and organization of the EDR.

Section 2—Cleanup Requirements

Section 2 presents the cleanup requirements pertinent to Phase I construction.

Section 3—Basis of Design

Section 3 presents the basis of design for remedial components that address the cleanup requirements discussed in Section 2, including engineering concepts and criteria.

Section 4—Compliance Monitoring Plan

The compliance monitoring plan (CMP) for Phase I construction is presented in Section 4. Compliance monitoring will be performed to confirm that the remedial components constructed in Phase I conform with the cleanup requirements and engineering criteria discussed in Sections 2 and 3, and that human health and the environment are protected during construction.

Section 5—Schedule

The schedule for the Phase I remedial action is presented in Section 5.

2.0 Cleanup Requirements

2.1 Upper Yard

The CAP identifies the following remedial action objectives (RAOs) for the Upper Yard:

- 1) Minimize potential for direct contact with residual petroleum-impacted soils in the vicinity of well MW-61A;
- 2) Minimize potential for leaching of hydrocarbons from residual petroleum-impacted soils in the vicinity of well MW-61A;
- 3) Prevent potential indoor air impacts; and
- 4) Verify that ambient air quality meets Washington State Model Toxics Control Act (MTCA) Method B cleanup levels or is within background conditions.

At the time the CAP was issued (October 1999), insufficient information was available to assess ambient air inhalation exposure potential. To provide data needed to address the ambient air RAO, monitoring was conducted in accordance with the Air Sampling/Monitoring and Contingency Plan (AS/M&CP), included in the Consent Decree as Exhibit F.

The results of the long-term ambient air monitoring conducted in accordance with Exhibit F were summarized in a Technical Memorandum regarding Remedial Measures to Address Inhalation Exposure Concerns (Aspect 2003c). Ambient air concentrations exceeding both the MTCA Method B cleanup levels proposed in the CAP and background levels were measured in the Upper Yard during the monitoring requiring remedial actions to address soil vapor emissions. Therefore, ambient and indoor air controls are required on the Upper Yard.

2.2 Lower Yard

The CAP identifies the following remedial action objectives for the Lower Yard:

- 1) Further minimize potential for direct contact with residual petroleum-impacted soils;
- 2) Further minimize potential for leaching of hydrocarbons from residual petroleum-impacted soils;
- 3) Prevent potential indoor air impacts; and
- 4) Verify that ambient air quality meets Method B cleanup levels or is within background conditions.

No RAO exceedences were measured in the Lower Yard during the four rounds of ambient air monitoring conducted in accordance with Exhibit F to the Consent Decree. Therefore, only RAOs 1) and 2) are addressed by this design.

3.0 Basis of Design

3.1 Well Decommissioning and Replacement

Unocal is conducting groundwater remediation monitoring as part of on-going remedial activities per an Order on Consent developed with Ecology in 1988. As a result of Unocal's groundwater activities, approximately 48 monitoring wells, 2 recovery wells, and 13 piezometers are currently located throughout the former marketing terminal property.

Figure 5 shows the locations of those monitoring and recovery wells in the immediate vicinity of the Upper and Lower Yards. Only the five highlighted wells (MW-30, MW-33, MW-59, MW-61A, and MW-66) are currently included in Unocal's groundwater monitoring program. Groundwater monitoring is no longer required in the remaining monitoring wells because contaminant concentrations have been either non-detect or below cleanup levels for at least 8 consecutive sampling events (spanning up to 6 years). In addition, five recovery wells (RW-16 and RW-21 through RW-24) have been demonstrated to be ineffective at LNAPL recovery and are no longer in use.

Among the five wells currently being monitored by Unocal, only well MW-61A is within the Phase I construction footprint. The MDA proposes to decommission this well at the start of Phase I construction and replace it at the completion of Phase I. Since additional construction will take place in Phase II at the current MW-61A location, the MDA proposes that the replacement well be installed in the Elliott Avenue sidewalk approximately 12 feet west of the current well location. The replacement well would be screened in the same elevation interval as well MW-61A.

The remaining four wells currently being monitored by Unocal (MW-30, MW-33, MW-59, and MW-66) shall be protected during construction. The MDA requests that Ecology confirm that Unocal may decommission other wells shown on Figure 5 since they are no longer in use.

3.2 Measures to Reduce Leaching Potential in the Upper Yard

The selected remedy described in the CAP includes installation of a reduced permeability layer in the northwest corner of the Upper Yard (i.e., in the vicinity of well MW-61A). Construction elements discussed in the CAP include the following:

- Grade the area to achieve a slope of 3 percent;
- Place a 1-foot-thick reduced permeability layer consisting of granular material with at least 10 percent fines, and having a vertical permeability of 1.2×10^{-4} to 1.0×10^{-6} cm/sec;

- Above the reduced permeability layer, install a 1-foot-thick gravel layer with perforated pipes to collect water and discharge it to sewer; and
- Overlay the gravel layer with filter fabric and a minimum of 3 feet of sandy loam suitable for landscaping.

The CAP envisioned that this would address the leaching RAO by reducing infiltration by about 50 percent.

During the initial phase of OSP design, cleanup measures to reduce leaching potential were further developed/modified, as documented in a technical memorandum to Ecology (Aspect Consulting 2003b). Based on the estimated areal and vertical extent of residual TPH-impacted vadose zone soils (see Figures 6 and 7), the following remedial measures were identified to reduce leaching potential in the vicinity of residual TPH-impacted soils in the Upper Yard:

- 1) Installation of a reduced permeability cap; and
- 2) Grading and drainage features to promote surface water runoff.

3.2.1 Reduced Permeability Cap

Figure 8 shows plan and section views of the reduced permeability cap (RPC), which will divert infiltrating water before it reaches residual TPH-impacted soils in the Upper Yard. As discussed below in Section 3.3, a large (approximately 24-feet thick) layer of clean imported fill will be placed in this area to address the ambient air RAO. The RPC will be installed within this clean fill layer, at the approximate grade of Elliott Avenue. It will consist of a minimum 12-inch-thickness of natural or amended earthen material having a vertical permeability of 1×10^{-5} cm/sec or less. Either the natural high silt-clay soils from the Arcade excavation or an amended earthen material such as controlled density fill are proposed to be used.

Boring logs and analysis of the physical properties of soil samples collected from explorations around the perimeter of the former Arcade Plaza property (Appendix A) indicate that the majority of the soil to be excavated is a sandy silt or silty sand with up to 80 percent fines content (see grain size curves in Appendix B). If construction timing is such that these soils are available from the excavation site when the RPC is planned for installation, it is proposed that these be used to construct the reduced permeability layer. Regardless of whether natural or amended earthen material is used, the minimum thickness and maximum vertical permeability criteria stated above will be achieved. Performance monitoring and testing of the RPC is discussed in Section 4.2.3.

The lateral dimensions of the reduced permeability layer will be approximately 57 feet by 190 feet as derived from a rectangle projected upward and outward at an angle of 2 horizontal:1 vertical (2H:1V) from the outermost edges of the underlying impacted soil layer. This is based on the very conservative assumption that water migrating through the unsaturated zone can move laterally at an angle of up to 2H:1V. Note that the rectangular projection intersects the existing ground surface along a portion of its northern edge. Soils will not be excavated to install the reduced permeability layer in this area. Instead, the layer will extend northward to abut the existing ground surface, as shown on Figure 8.

The reduced permeability layer will be sloped to drain at a 3 percent grade as shown on Figure 8. The layer's western edge will abut either the existing shoring wall along Elliott Avenue or another low permeability feature (e.g., bridge footing), thus providing a continuous barrier to infiltration. A perforated pipe oriented parallel to Elliott Avenue will be installed immediately above the layer to drain infiltrating water to sewer. The pipe will be surrounded by filter fabric and gravel, and will drain to the south at a 0.5 percent minimum grade. At the southern edge of the reduced permeability layer the pipe will transition from perforated to solid-wall and will discharge to the combined sewer beneath Elliott Avenue.

3.2.2 Surface Grading and Drainage Features

To reduce infiltration into the area above the reduced permeability layer, a graded slope with a well-drained pathway and vegetation is proposed at the finished park surface to promote surface water runoff. Design of the finished park surface will be addressed in the EDR for final (Phase II) OSP construction.

Surface grading will be performed and drainage features constructed in Phase I to prevent surface water runoff from the Upper Yard and control soil erosion during the interim period between Phase I and Phase II construction. As depicted on Figure 3, interim surface grading and drainage features will include the following:

- The relatively flat finished fill surface will be graded to promote surface water drainage away from the fill area perimeter to a central detention area, where a portion of the water will enter a perforated riser pipe;
- Fill placed along the east side of Elliott Avenue will be graded to promote surface water drainage to a collection point south of the reduced permeability layer, where the water will enter a second perforated riser pipe; and
- Fill soil will not be placed in the immediate area around the eastern end of the Unocal pipe tunnel. This is necessary to allow access for the pipe tunnel to be filled during final (Phase II) construction.

Water entering the perforated riser pipes will be routed to the combined sewer beneath Elliott Avenue. Thus, the majority of surface water that collects in the northwest corner of the Upper Yard under the current condition will be diverted away from that area. A portion of it will infiltrate in other areas of the Upper Yard, and a portion will be captured and routed to sewer. As a result, infiltration into the area above the reduced permeability layer will be substantially reduced upon completion of Phase I construction.

3.2.3 Amendment to Restrictive Covenant

The Restrictive Covenant for the Upper Yard (Exhibit D to the Consent Decree) contains an institutional control to protect the reduced permeability layer. Section 1 of the Restrictive Covenant prohibits any activity on the property that could potentially compromise the layer. It states:

Some examples of activities that are prohibited in the capped area include: drilling, digging, placement of any objects or use of any equipment which deforms or stresses the surface beyond its load-bearing capability, piercing the surface with a rod, spike, or similar item, bulldozing or earthwork.

Since the current design calls for covering the reduced permeability layer with over 20 feet of imported fill material, most of these examples of prohibited activities will no longer be of concern. Therefore, it is proposed that the Restrictive Covenant be amended to include a figure showing the areal extent and depth of the reduced permeability layer, and to prohibit any activity that may compromise this layer.

3.3 Measures to Reduce Soil Vapor Emissions in the Upper Yard

Ambient air monitoring indicated that remedial action addressing soil vapor emissions is required in the Upper Yard. The remedial action design basis was developed in a technical memorandum to Ecology (Aspect Consulting 2003c). Portions of that memorandum pertinent to Phase I construction are presented in this section.

The air quality exceedences measured in the Upper Yard likely resulted from soil vapor emissions emanating from localized zones of residual soil contamination. Based on information obtained during Unocal's 1997 remedial action (GeoEngineers 1997) and a 2002 investigation conducted in the vicinity of the proposed OSP Pavillion (Hart Crowser 2002b), the following two zones (shown on Figure 9) were identified as having the highest potential for significant soil vapor emissions to the Upper Yard:

- **Zone 1.** This zone, located in the Upper Yard's northwest corner, contains impacted soil that could not be excavated from the Upper Yard, impacted soil behind (i.e., west of) the existing shoring wall, and the eastern end of the Unocal pipe tunnel that runs beneath Elliott Avenue.
- **Zone 2.** This zone, located along the Yard's northern boundary, contains petroleum-impacted soil behind (i.e., immediately north of) the existing shoring wall.

As shown on Figure 9, three confirmation surface soil samples located within the Upper Yard but outside the above zones had TPH concentrations in excess of the 200 mg/kg cleanup target. However, the highest TPH detection among these was only 369 mg/kg and PID headspace measurements did not exceed 100 ppmv. Therefore, these three locations are judged to have a much lower potential for soil vapor emissions than the two zones described above. Similarly, perimeter soil in the vicinity of Boring B-101, which exhibited a maximum PID headspace measurement of 92 ppmv, is judged to have a low potential to impact Upper Yard ambient air.

3.3.1 Proposed Remedial Action and Required Emission Reductions

It is proposed that a layer of well-compacted clean fill be added to the Upper Yard to reduce soil vapor emissions and achieve the ambient air RAO. The fill layer will reduce the rate at which petroleum hydrocarbon vapors are emitted to ambient air from the potential source areas discussed above. The emission reductions that must be achieved by the fill layer to meet the MTCA Method B air cleanup levels are as follows:

<u>Analyte Group</u>	<u>Required Emission Reduction</u>
C ₈ -C ₁₀ Aliphatics	82%

C ₁₀ -C ₁₂ Aliphatics	35%
C ₈ -C ₁₀ Aromatics	20%

The magnitude of emission rate reduction achieved by placing a fill layer over a vapor source is dependent on both the fill layer thickness and its physical properties. To calculate emission reductions under various scenarios, we used Fick's Law of molecular diffusion in accordance with EPA guidance on soil vapor emissions from contaminated sites (EPA 2000). The analysis was conducted for the two localized areas having the highest potential for significant soil vapor emissions to the Upper Yard (Zone 1 and Zone 2). The detailed analysis can be found in the technical memorandum regarding remedial measures to address inhalation exposures (Aspect 2003c).

The evaluation process involved iteratively specifying fill soil properties to determine the minimum thicknesses of additional fill at Zones 1 and 2 to achieve the required emission reduction efficiencies. Since there is more than one independent variable in this evaluation, there is a range of potential solutions. For example, for a given fill layer thickness, tradeoffs can be made between the soil fines content and its compaction to achieve the same emission reduction efficiency. However, in order to avoid undue complexity in the requirements of the construction bid package, a single set of soil property limits were determined that meet the emission reduction criteria while providing the contractor flexibility in selecting among fill soils that may be available at the time of park construction.

3.3.2 Proposed Fill Soil Thicknesses and Limits

Based on the required emission reductions and analyses (Aspect 2003), the following fill soil thicknesses and limits are proposed:

- Minimum fill layer thicknesses of 29 feet at Zone 1 and 7 feet at Zone 2 (these thicknesses apply to the finished OSP grades relative to existing grades);
- Fill soil having a minimum fines content of 5 percent by weight and a water content (at the time of placement) of no less than 1 percent greater than the optimum water content for soil compaction (per ASTM D1557); and
- Soil compaction to at least 90 percent of the Modified Proctor Density (ASTM D1557).

The requirements for minimum fines content, water content, and compaction will be applied to all fill soils placed in the Upper Yard north of the east-west boundary line shown on Figure 9. This boundary line is conservatively located 100 feet south of the southernmost corner of Zone 1 to assure that potential emissions from both Zones 1 and 2 are adequately addressed. The proposed minimum fill thickness requirements (29 feet at Zone 1 and 7 feet at Zone 2) are not applicable to Phase I construction but will be achieved by the finished OSP construction.

Based on boring logs and analysis of the physical properties of soil samples collected from explorations around the perimeter of the former Arcade Plaza property (Appendix B), the majority of soils excavated from that property are expected to meet the proposed minimum fines and water content criteria. Fill soils entering the Site will be field-screened for fines content. Soils with low fines content will be placed in the southern

portion of the Upper Yard and/or in the Lower Yard. If necessary, water will be added to soils at the time of placement in the northern portion of the Upper Yard to achieve the water content criterion. Performance monitoring, including periodic laboratory testing, will be conducted prior to import, and during placement and compaction of fill soils in the northern portion of the Upper Yard, as discussed (see Section 4.2.3)

3.4 Measures to Reduce Direct Contact Potential in the Upper Yard

As discussed above, a large (approximately 29-foot-thick) layer of clean imported fill is proposed in the vicinity of well MW-61A to address the ambient air RAO. In addition, a reduced permeability layer will be installed within this clean fill layer, and a restrictive covenant will prohibit any activity that may compromise the reduced permeability layer. These features will provide more than adequate protection against direct contact exposure to residual impacted soil in this portion of the Upper Yard.

3.5 Measures to Reduce Direct Contact and Leaching Potential in the Lower Yard

The design basis for reducing direct contact and leaching potential in the Lower Yard was developed in a technical memorandum to Ecology regarding remedial measures to address Lower Yard direct contact and leaching concerns (Aspect Consulting 2003a). Portions of that memorandum pertinent to Phase I construction are presented in this section.

3.5.1 Measures to Reduce Direct Contact Potential

To reduce direct contact potential, it is proposed to place additional clean fill over the entire Lower Yard area. A minimum 1-foot thickness of additional clean fill is proposed which, along with the clean fill layer already in place, will bring the total cover soil thickness to a minimum of 3 feet.

3.5.2 Measures to Reduce Leaching Potential

To reduce the potential for residual contaminants in soil to leach into groundwater, it is proposed that the park design include surface grading and drainage features that promote runoff of surface water from the Lower Yard area, thereby reducing infiltration. Design of the finished park surface will be addressed in the EDR for final (Phase II) OSP construction.

Similar to the Upper Yard (discussed in Section 3.2.2), Phase I surface grading will be performed and drainage features constructed in the Lower Yard to prevent surface water runoff and control soil erosion during the interim period between Phase I and Phase II construction. As depicted on Figure 3, interim surface grading and drainage features will include the following:

- The relatively flat finished fill surface will be graded to promote surface water drainage away from the fill area perimeter to a central detention area, where a portion of the water will enter a perforated riser pipe;

- Fill placed along the east and west sides of the Lower Yard will be graded to promote surface water drainage to central collection points, where the water will enter perforated riser pipes; and
- Fill soil will not be placed in the immediate area around the western end of the Unocal pipe tunnel. This is necessary to allow access for the pipe tunnel to be filled during final (Phase II) construction.

Water entering the perforated riser pipes will be routed to the combined sewer beneath Elliott Avenue. Thus, a significant portion of surface water that collects in the Lower Yard under the current condition will be captured and routed to sewer. As a result, leaching potential will be significantly reduced upon completion of Phase I construction.

3.5.3 Amendment to Restrictive Covenant

Section 1 of the Restrictive Covenant for the Lower Yard (Exhibit D to the Consent Decree) prohibits any activity on the property that may result in the release or exposure to the environment of residual TPH-contaminated soil. It states:

Some examples of activities that are prohibited in the capped area include: drilling, digging, placement of any objects or use of any equipment which deforms or stresses the surface beyond its load-bearing capability, piercing the surface with a rod, spike, or similar item, bulldozing or earthwork.

It is proposed that the Restrictive Covenant be amended to include a figure showing clean fill thicknesses placed in the Lower Yard. Activities that may result in exposure to underlying TPH-contaminated soil would be prohibited as described above. The revised institutional controls would allow activities, such as installing sculpture foundations and plantings, in areas where fill is much thicker than 3 feet, and would identify the actions, prohibitions, and agency notifications that must occur if the property owner will alter the 3 foot cap.

4.0 Compliance Monitoring Plan

This section presents a summary of the compliance monitoring to be performed during Phase I construction. Compliance monitoring can be broken down as follows:

- **Protection Monitoring** to confirm that human health and the environment are protected during cleanup construction;
- **Performance Monitoring** to confirm that cleanup construction has attained the cleanup requirements prescribed in the CAP; and
- **Confirmation Monitoring** to confirm the long-term effectiveness of the cleanup action.

Only protection and performance monitoring are associated with Phase I construction of the OSP. Confirmation monitoring will be addressed in the EDR for final (Phase II) design and construction.

4.1 Planned Protection Monitoring Activities

Protection monitoring for human health will be implemented by ensuring that site workers are trained in health and safety and follow a site-specific health and safety plan. Access to the site will be controlled by security fencing.

Impacted media identified at the Site include soil, groundwater, and ambient air. The only Phase I cleanup activity in which potential exposure to groundwater containing LNAPL could occur is in the replacement of monitoring well MW-61a. In addition to these liquids, installing the replacement well will likely generate a relatively small quantity of impacted soil cuttings. Generated media (soil cuttings and liquids) will be drummed, characterized, and appropriately disposed of off-site.

Apart from monitoring well replacement, the only invasive work planned in Phase I is that associated with installation of the storm drain pipes. Installation of pipes within the Upper and Lower Yards is not a concern since they will be placed either on the existing ground surface or on fill soils (i.e., no excavation of existing soils). Pipes installed in the Upper Yard will be routed to the combined sewer beneath Elliott Avenue via an existing side-sewer connection, so only very minor excavation of existing soils will be required. Some excavation beneath Elliott Avenue will be necessary to install a storm drain pipe from the Lower Yard to the existing combined sewer (see Figure 3). This is the only construction segment where significant soil excavation is anticipated. The sewer connection will be made between the soil borings HC-SB12 and HC-SB13 depicted on Figure 6. As shown on that figure, contamination was not encountered in soil samples collected from these two borings. Therefore, while the potential exists, available data suggest that it is unlikely that impacted soil will be encountered during excavation for this sewer connection.

It is also possible, although unlikely, that one or more truckloads of imported fill soils may be found to be contaminated (Section 4.2.1).

Potentially-contaminated soils, if encountered during excavation or fill importation, will be temporarily stored in a designated stockpiling area that has appropriate contact and runoff controls. In addition, soil stockpiles will be managed in a manner to ensure protection of human health and the environment (e.g., minimize dust generation).

As discussed in Section 3.3.1, Method B ambient air cleanup levels developed for three petroleum hydrocarbon fractions (C₈-C₁₀ aliphatics, C₁₀-C₁₂ aliphatics, and C₈-C₁₀ aromatics) were exceeded in the Upper Yard during ambient air monitoring. The largest measured exceedence, for C₈-C₁₀ aliphatics, was 740 µg/m³, or about 5.4 times the corresponding cleanup level. The cleanup levels address risks associated with unrestricted (e.g., residential) use of the Site, and were developed assuming lifetime exposure to the contaminants. Contaminant concentrations measured at the Site during ambient air monitoring do not exceed any worker exposure limits, and do not represent a short-term exposure concern. Therefore, it is proposed that routine ambient air monitoring (photo-ionization detector (PID) field screening) be conducted only during certain construction activities, including replacement well installation, soil excavation (e.g., for the Lower Yard storm sewer connection beneath Elliott Avenue), and handling of potentially-contaminated soils (if encountered).

4.2 Planned Performance Monitoring Activities

Performance monitoring will be conducted in the following areas:

- Field-Screening of Imported Fill Soils;
- Field-Screening of Excavated Soils;
- Installation of Reduced Permeability Layer in Upper Yard;
- Soil Placement and Compaction in Northern Portion of Upper Yard; and
- Contingency Plan for Potentially-Contaminated Soils.

4.2.1 Field Screening of Imported Fill Soils

Only clean soils, free of debris, will be specified as fill import to the Site. To ensure the imported soil is clean, field screening for evidence of soil contamination will be conducted both at the former Arcade Plaza property (as soil is being excavated and loaded into trucks) and at the Site (as the loaded trucks arrive). Soils will be inspected for debris, petroleum sheens, staining, and odor. In addition, the headspace of jar samples collected from any suspect soils will be monitored for organic vapors using a PID. We understand that soils excavated at the former Arcade Plaza property will be field screened also (contractor and geotechnical engineer are the same for both projects); and that any soils containing debris or any evidence of potential contamination will not be sent to the OSP Site. However, in the event that such soils are identified in a loaded truck arriving at the Site, they will be managed in accordance with the procedures discussed in Section 4.2.5.

Each truckload of fill arriving at the Site will also be field-screened for fines content to determine whether it is suitable for placement in the northern portion of the Upper Yard. Fill placed in this area of the Site must have a minimum fines content of 5 percent by weight to address soil vapor emissions concerns. Boring logs and physical analysis of soil samples collected from explorations around the perimeter of the former Arcade Plaza property (see Appendix B) indicate that a large portion of the soils to be excavated will likely meet this criterion.

In addition to field screening, fill materials placed in the northern portion of the Upper Yard will be periodically sampled and submitted for laboratory analysis of fines content. This is discussed in Section 4.2.4.

4.2.2 Field Screening of Excavated Soils

Although unanticipated, contamination and/or debris may be encountered during excavation of Site soils, including excavation from beneath Elliott Avenue to connect the Lower Yard storm drain to the combined sewer. Field screening for evidence of contamination will be conducted during all Site excavation activities. Soils will be inspected for debris, petroleum sheens, staining, and odor, and soil headspace in jar samples will be monitored using a PID. If suspect soils are encountered, they will be stockpiled separately and managed in accordance with the procedures discussed in Section 4.2.5. Contaminant control measures will be implemented as needed during excavation of potentially contaminated soils. These may include modification of the excavation method, dust and vapor emission suppression, runoff controls, and other measures.

4.2.3 Installation of Reduced Permeability Layer in Upper Yard

As discussed in Section 3.2.1, the reduced permeability layer in the northwest corner of the Upper Yard will consist of a minimum 12-inch thickness of natural or amended earthen material having a vertical permeability of 1×10^{-5} cm/sec or less. The following performance monitoring activities will be conducted to verify that these criteria are met:

- **Vertical Permeability of Amended Earthen Material.** In the event that an amended earthen material such as controlled density fill (CDF) is used, a guarantee will be obtained from the material supplier that the mix design will meet the permeability criterion. The material will be mixed and the reduced permeability layer constructed in accordance with the supplier's recommendations.
- **Vertical Permeability of Natural Earthen Material.** The use of unamended high-clay-content soils excavated from the former Arcade Plaza property to construct the reduced permeability layer would require laboratory and field testing to confirm that the vertical permeability criterion is achieved. In the event that the construction contractor elects to pursue this option, high-clay-content soils in sufficient quantity to construct the layer (400 to 500 cubic yards) will be collected and tested prior to their transport to the site. Three representative soil samples will be collected from the Arcade site during installation of the soldier pile walls used for the excavation shoring. These soils will be submitted for determination of Modified Proctor Density (ASTM D1557), Atterberg Limits, and hydraulic conductivity testing. The material submitted for the hydraulic conductivity testing will be compacted at 85 to 90 percent

of the Proctor density. The results will be used to identify the compaction and Atterburg limits required to achieve the vertical permeability criterion for those soils suitable for construction of the RPC. Following placement of the RPC, a nuclear densometer will be used to confirm that the required compaction has been achieved. The minimum frequency of field compaction testing will be one test per lift per 1,000 square feet.

If the required soil compaction and/or vertical permeability is judged not to be achievable (prior to layer construction), or if verification testing indicates that it cannot be achieved, an amended earthen material such as CDF will be used to construct the reduced permeability layer, as described above.

4.2.4 Soil Placement and Compaction in Northern Portion of Upper Yard

As discussed in Section 3.3.2, fill placed in the northern portion of the Upper Yard will have a minimum fines content of 5 percent by weight, and a water content (at the time of placement) of no less than 1 percent greater than the optimum water content for soil compaction (per ASTM D1557). In addition, compaction to at least 90 percent of the Modified Proctor Density (ASTM D1557) will be achieved. The following performance monitoring activities will be conducted to verify that these criteria are met:

- **Laboratory Testing Prior to Soil Excavation.** During installation of perimeter soldier piles for excavation shoring at the former Arcade Plaza property, selected soil samples will be submitted for determination of Modified Proctor Density (ASTM D1557). Before bringing fill soil to the OSP Site, the contractor will submit the modified Proctor Density test data for the soils intended as fill cover for emissions control to ensure that the fill material meets the soil fill capping criteria.
- **Field Screening of Fines Content.** As discussed in Section 4.2.1, each truckload of fill arriving at the Site will be field-screened for fines content. Trucks containing fill that is conservatively judged to have less than 5 percent fines by weight will be directed to another area of the Site.
- **Laboratory Verification of Fines Content.** Representative grab samples of soil placed in the northern portion of the Upper Yard will be submitted for laboratory determination of fines content to verify that the 5 percent minimum criterion is being achieved. The minimum frequency of fines content testing will be one test per 1,000 cubic yards of fill placed. Roughly 15,000 to 20,000 cy of fill are expected to be placed within the emissions reduction area.
- **Field Verification of Soil Compaction and Water Content.** Fill will be placed in 8- to 16-inch lifts and compacted. (If necessary, water will be added prior to compaction.) Following lift compaction, a nuclear densometer will be used to confirm that the compaction and water content criteria have been achieved. The minimum frequency of nuclear densometer testing will be one test per 10,000 square feet of each lift of fill compacted.

4.2.5 Contingency Plan for Potentially Contaminated Soils

This section addresses procedures that will be followed in the event that potentially contaminated soils are encountered during construction. Generation of potentially contaminated soils is not anticipated except for a small quantity of drill cuttings associated with the replacement of monitoring well MW-61A. However, possible sources of contaminated soils include fill imported to the Site, surface soils impacted by fuel spills during construction, and soils excavated from beneath Elliott Avenue to connect the Lower Yard storm drain to the combined sewer.

A specific area of the Site will be identified for temporary stockpiling of any soils identified as suspect based on visual and olfactory screening. Stockpiles shall be constructed to isolate stored soils from the environment including:

- A chemically resistant bottom geomembrane liner. Non-reinforced geomembrane liners shall have a minimum thickness of 20 mil. Scrim reinforced geomembrane liners shall have a minimum weight of 40 pounds per 1,000 square feet. The ground surface on which the geomembrane is placed shall be free of rocks greater than 0.5 inch in diameter and any other object that could damage the membrane.
- Geomembrane cover to prevent precipitation from entering the stockpile. Non-reinforced geomembrane liners shall have a minimum thickness of 10 mil. Scrim reinforced geomembrane liners shall have a minimum weight of 26 pounds per 1,000 square feet. The cover material shall be anchored to prevent it from being removed by wind.
- Impermeable berms a minimum of 12 inches in height constructed around stockpiles to contain any liquid which might drain from the soils. Berms shall also be constructed to prevent stormwater from entering soil stockpiles.
- Liquid that collects within the bermed stockpile area shall be removed, temporarily stored, tested and disposed of, as appropriate, based on testing results.

Because limited suspect soil is expected to be encountered, sampling will be conducted on a representative grab sample of any soil material suspected to be contaminated. One sample for every 10 cy of suspect soil will be obtained. The soil will be stockpiled pending results of the sample analysis.

Chemical analyses will be selected based on field observations and PID screening as follows:

- If petroleum contamination is suspected, the soil samples will be analyzed for BTEX by EPA Method 8021 or 8260, for TPH in the gasoline range by Method NWTPH-G, and by TPH in the diesel and heavy oil ranges by Method NWTPH-Dx. Concentrations will be compared with the Lower Yard soil cleanup levels provided in Consent Decree CAP as summarized in Table 1.
- If soil containing debris is observed (other than the soldier piles and concrete debris generated from the OSP site), a representative sample of the debris-containing soil will be collected and analyzed for diesel and heavy oil range petroleum using Method NWTPH-Dx, poly-aromatic hydrocarbons (PAHs) using EPA Method 8270, and

selected metals (Pb, As, Cd, Cr, and Hg) using EPA Method 6020. Concentrations will be compared to MTCA Method A levels.

Stockpiles exceeding these cleanup levels will be disposed of at a suitable permitted landfill or soil recycling facility. If these cleanup levels are not exceeded in any soil sample, the stockpile will be used as fill on the Lower Yard.

5.0 Schedule

As discussed above, OSP construction will be completed in two phases. Anticipated dates for project milestones are as follows:

- Finalize EDR for Phase I Construction April 2004
- Conduct 30-Day Public Comment Period May 2004
- Conduct Phase I Construction mid-June to October 2004
- Finalize Design Documents for Phase II Construction November 2004
- Conduct 30-Day Public Comment Period December 2004
- Conduct Phase II Construction February to June 2005

6.0 Limitations

Work for this project was performed and this report prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of Seattle Art Museum and the Museum Development Authority for specific application to the referenced property. This report does not represent a legal opinion. No other warranty, expressed or implied, is made.

7.0 References

Aspect Consulting 2003a. Memorandum Re: Remedial Measures to Address Lower Yard Direct Contact and Leaching Concerns, Former Unocal Seattle Marketing Terminal Property. February 21, 2003.

Aspect Consulting 2003b. Memorandum Re: Remedial Measures to Address Upper Yard Direct Contact and Leaching Concerns, Former Unocal Seattle Marketing Terminal Property. April 7, 2003.

Aspect Consulting 2003c. Memorandum Re: Remedial Measures to Address Inhalation Exposure Concerns, Former Unocal Seattle Marketing Terminal Property. June 10, 2003.

Ecology 2004. Letter from B. Sato to D. Carlisle (GeoEngineers) regarding Proposed Ground Water Monitoring Schedule 2004, Unocal Former Seattle Marketing Terminal, Seattle, Washington. February 25, 2004.

GeoEngineers 2004. Progress Report No. 84, Former Unocal Seattle Marketing Terminal 0724, 3001 Elliott Avenue, Seattle, Washington. January 30, 2004.

Hart Crowser 2002a. Memorandum Re: Preliminary Environmental Assessment (Phase I), Arcade Plaza Building and Parking Lot, 1321 Second Avenue, Seattle, Washington. April 19, 2002.

Hart Crowser 2002b. Memorandum Re: Subsurface Conditions, Settlement Estimates for Bridges and Elliott Tunnel Infilling, Olympic Sculpture Park. September 27, 2002.

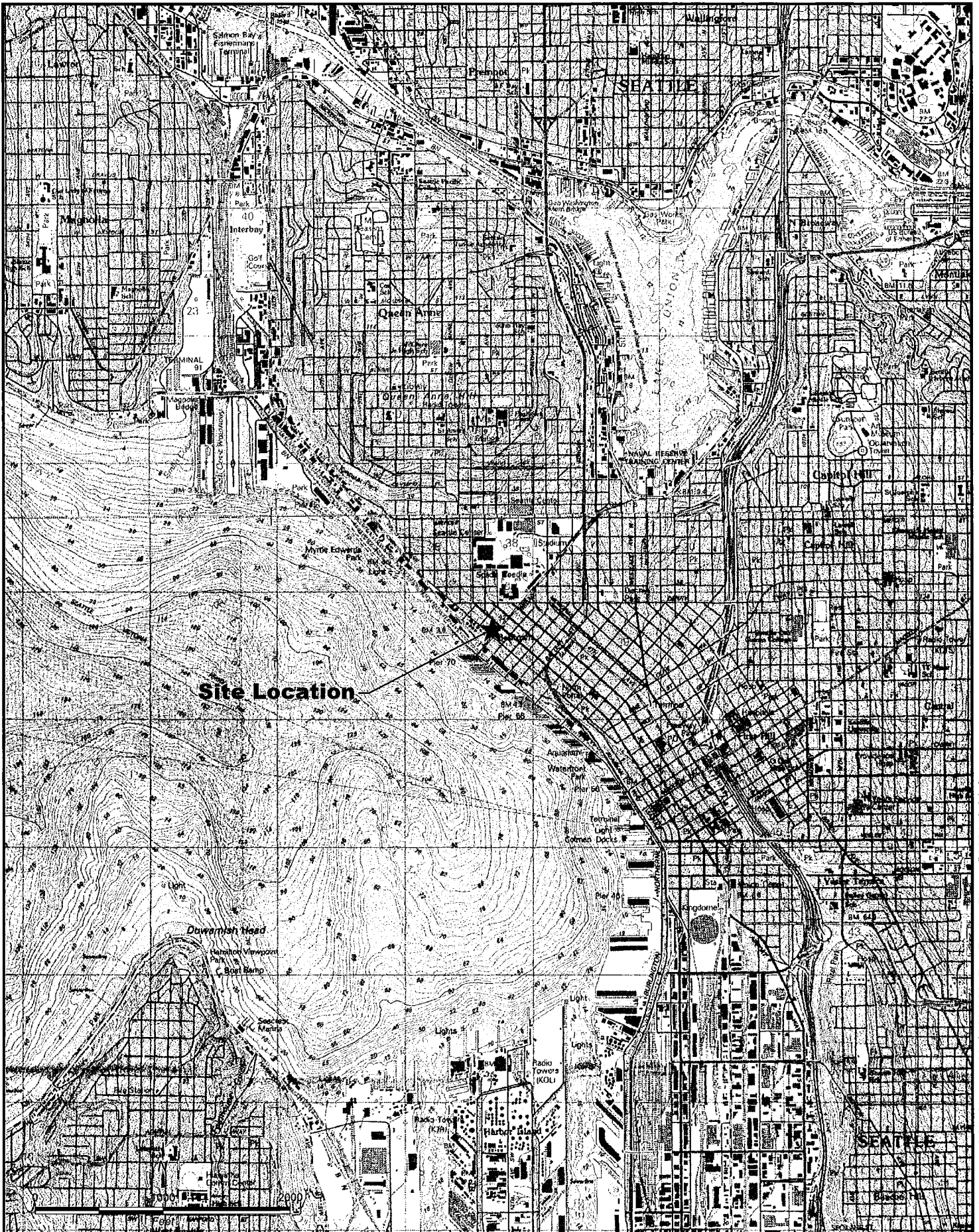
Hart Crowser 2003b. Geotechnical Engineering Report, Washington Mutual Office Building, Seattle, Washington. August 13, 2003.

Table 1—Lower Yard Soil Cleanup Levels

Constituent	Soil Cleanup Level in mg/kg
Benzene	0.5
Toluene	40
Ethylbenzene	20
Xylenes	20
TPH	3,200

Notes:

- 1) These soil cleanup levels were proposed in the Cleanup Action Plan (Exhibit A to the Prospective Purchaser Consent Decree).



Site Location

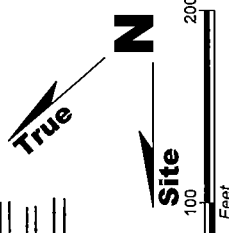
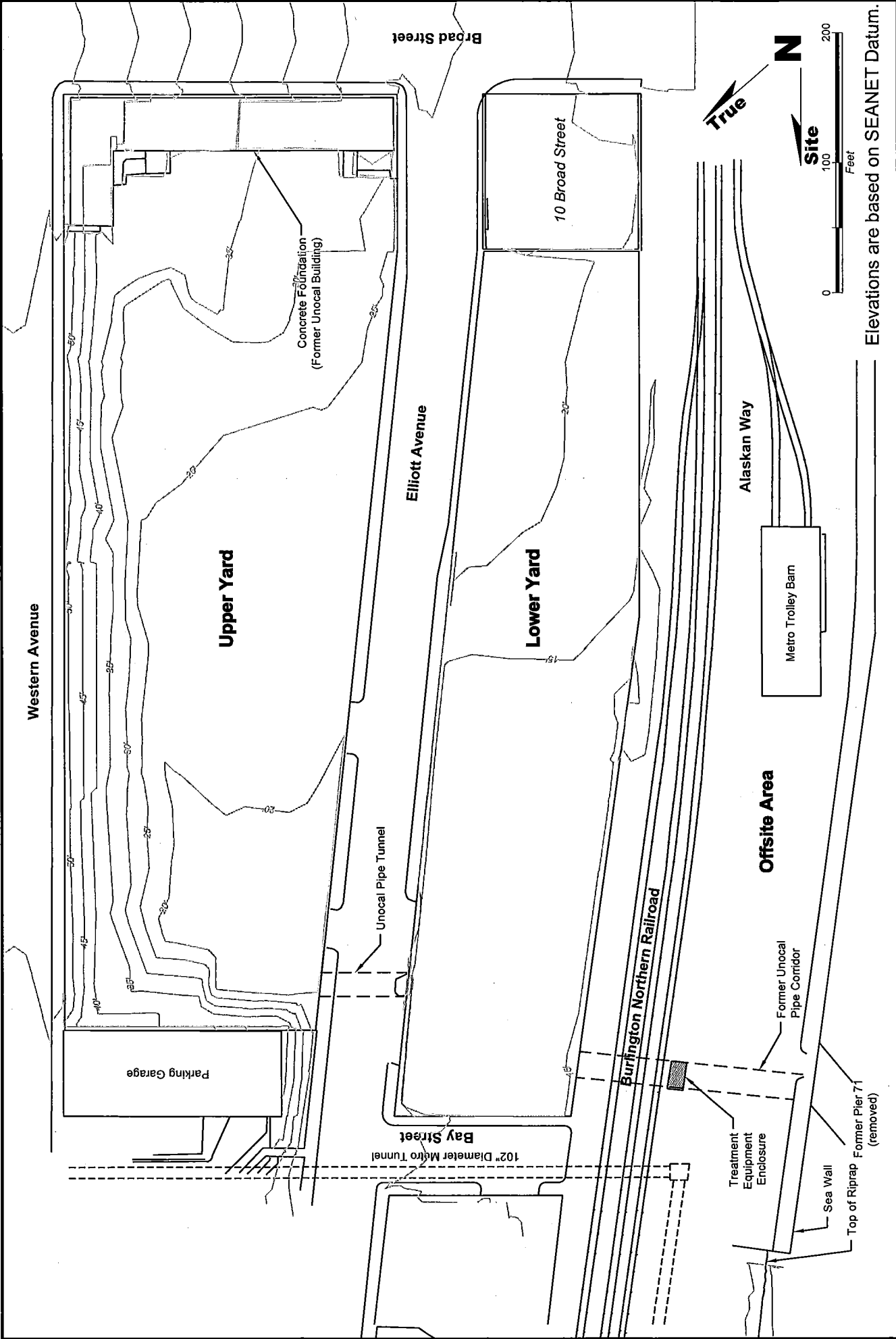


170 Madrone Lane North Tel: (206) 780-9370
 Bainbridge Island, WA 98110 Fax: (206) 780-9438

Site Vicinity Map

Olympic Sculpture Park
 Seattle, Washington

DATE: March 2004	PROJECT NO. 020118
DESIGNED BY: DAH	FIGURE NO. 1
DRAWN BY: SDM	
REVISED BY: JRS	



Elevations are based on SEANET Datum.

DATE	March 2004	PROJECT NO.	020118
DESIGNED BY	DAH	DRAWN BY	SDM
REVIEWED BY	JRS	FIGURE NO.	2

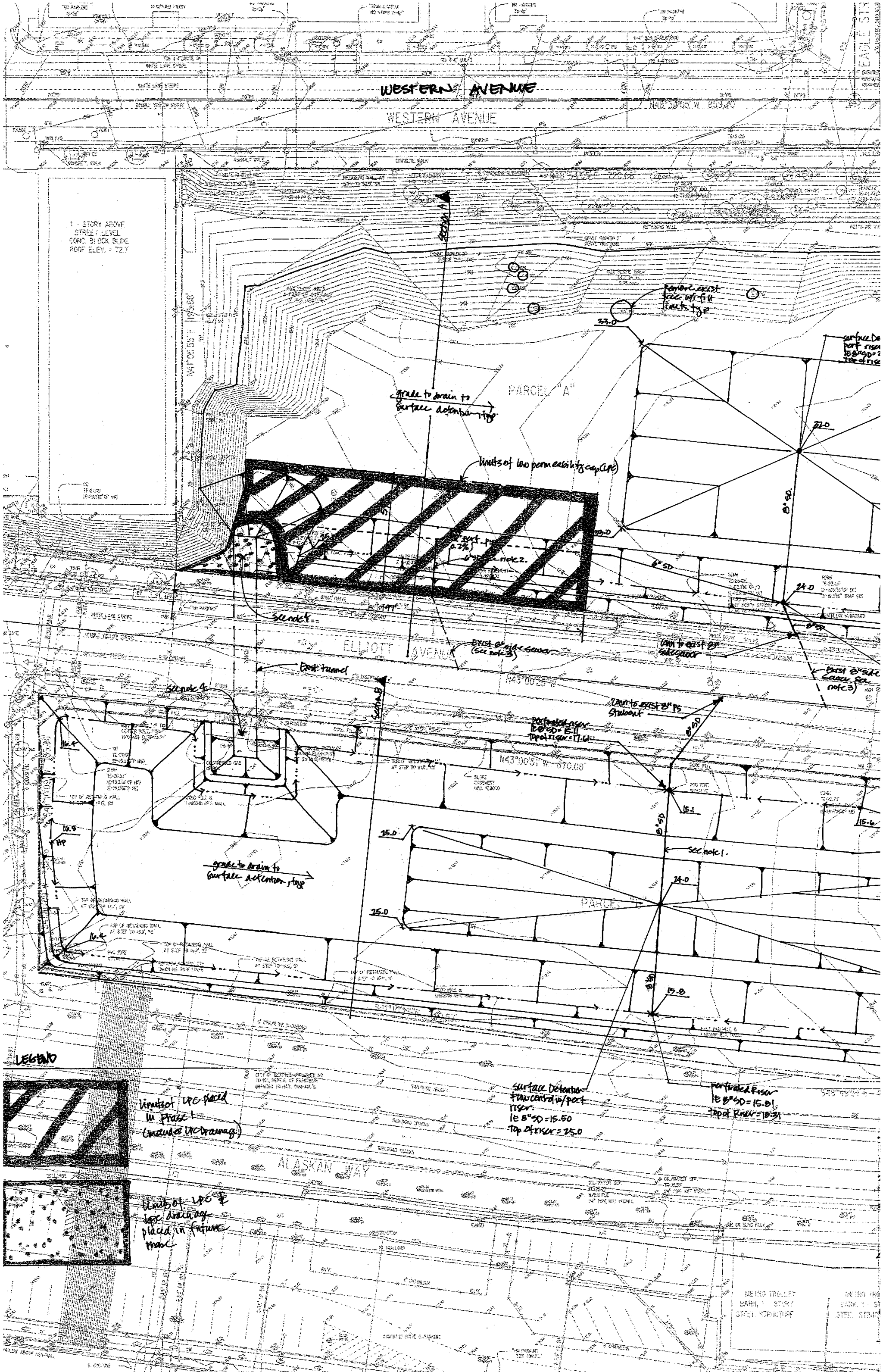
Site Compliance Areas and Existing Topography

Olympic Sculpture Park
Seattle, Washington

Aspect consulting
IN-DEPTH PERSPECTIVE

176 Madrone Lane North
Bainbridge Island, WA 98110
Tel: (206) 760-6370
Fax: (206) 760-6498

Note: The locations of all features shown are approximate.
Reference: Unocal/Seattle Marketing Terminal undated.



1 - STORY ABOVE
STREET LEVEL
COND. BLOCK BLDG
ROOF ELEV. = 72.7

WESTERN AVENUE

WESTERN AVENUE

ELLIOTT AVENUE

ALASKAN WAY

grade to drain to
surface detention riser

limits of low permeability cap (LPC)

Remove exist
cell, fit
duct type

surface do
not rise
15.50' to
top of rise

Section 2

East tunnel

Section 4

grade to drain to
surface detention riser

EXIST 8" side sewer
(see note 3)

PLAN TO EXIST BY
SUBSTATION

EXIST 8" SIDE
SEWER SEE
NOTE 3

PLAN TO EXIST BY
SUBSTATION

perforated riser
18" Ø SD = 15.11
top of riser = 17.61

N43°00'51" W 870.08'

15.1

15.6

15.0

15.0

15.0

15.0

15.0

15.0

15.0

15.0

15.0

15.0

15.0

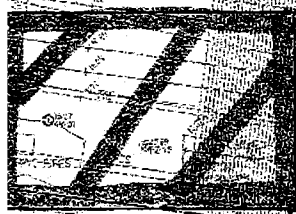
15.0

15.0

15.0

15.0

LEGEND



limits of LPC placed
in Phase 1
(includes drainage)



limits of LPC
placed in future
phases

Surface Detention
Riser
18" Ø SD = 15.50
Top of riser = 25.0

perforated riser
18" Ø SD = 15.01
Top of riser = 18.31

METRO TROLLEY
BARR. 1 - STORY
STEEL STRUCTURE

METRO AND
PARK 1 - STORY
STEEL STRUCTURE

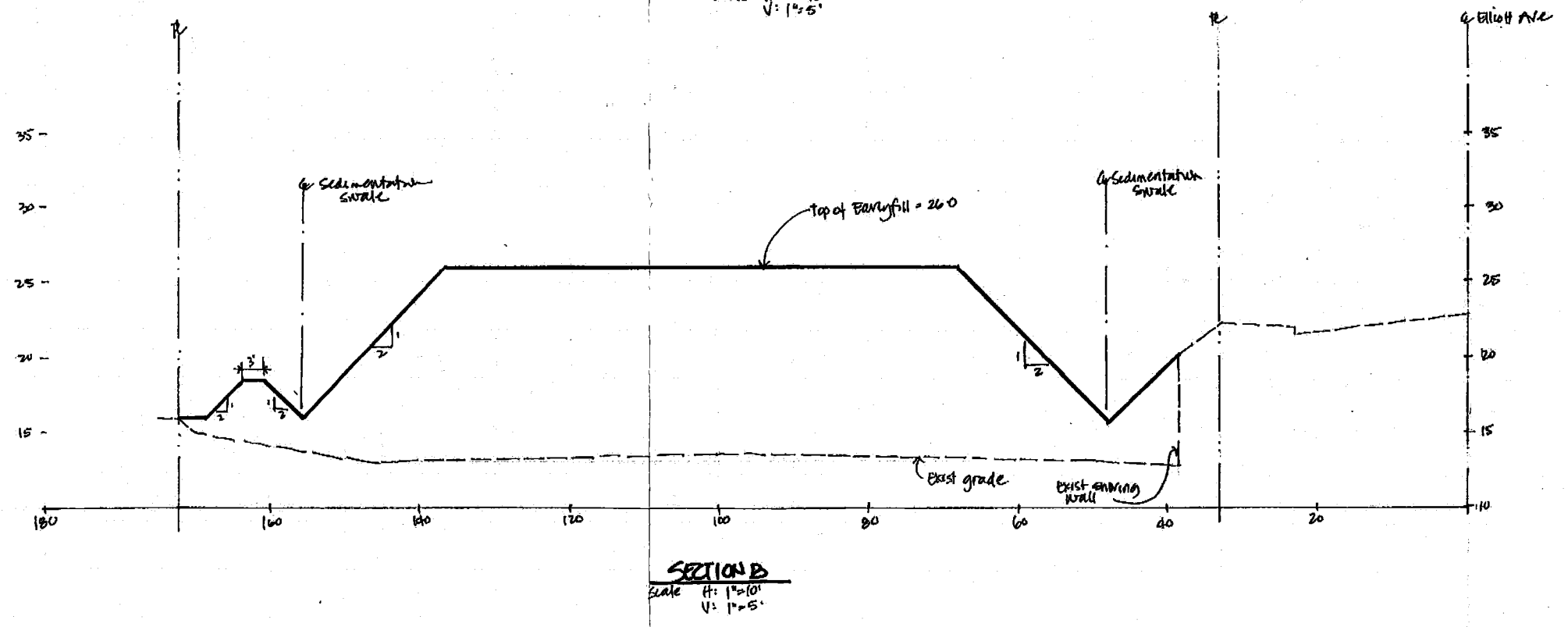
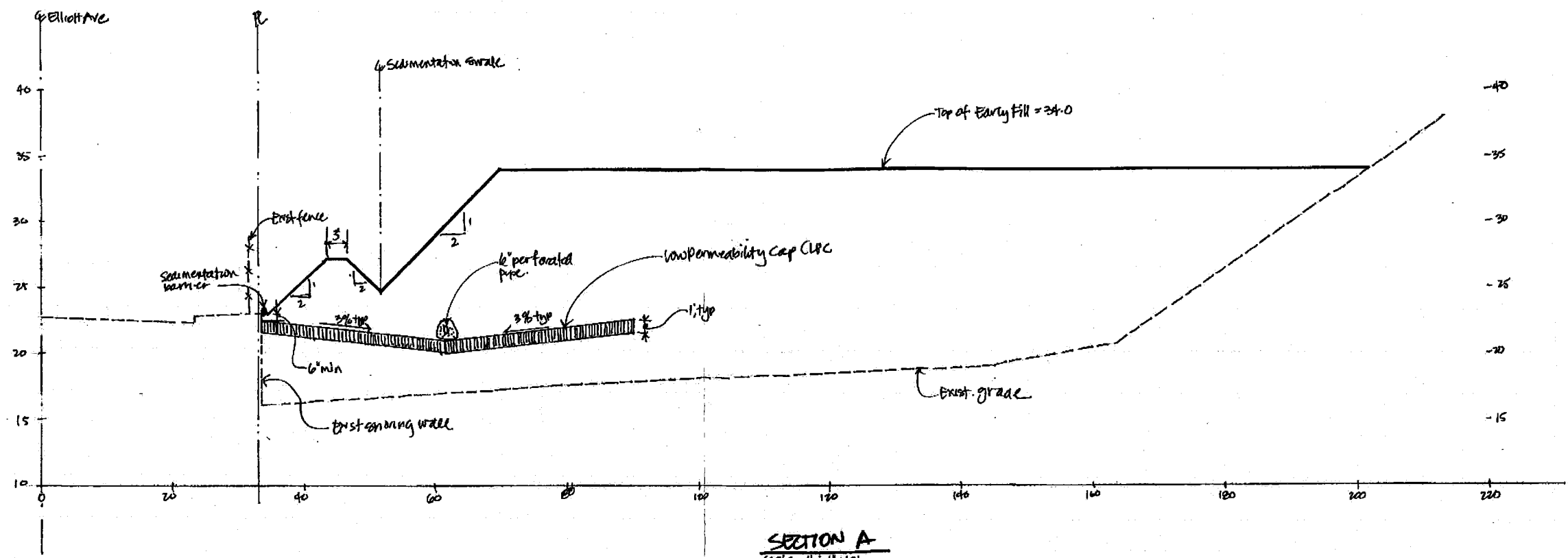


Figure 4

Western Avenue

Upper Yard

Proposed Location for MW-61A Replacement Well

Elliott Avenue

Lower Yard

10 Broad Street

Offsite Area

Bay Street

Broad Street

Legend

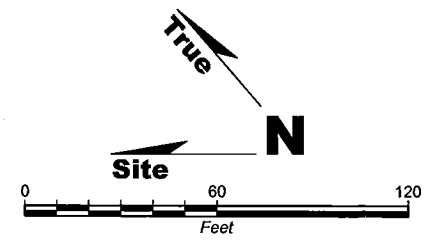
- Monitoring Well
- Recovery Well



Well Included in Unocal Monitoring Program (as of March 2004)

Note

Groundwater is monitored for petroleum constituents (gasoline-, diesel-, and heavy oil-range TPH and BTEX) and sheen.



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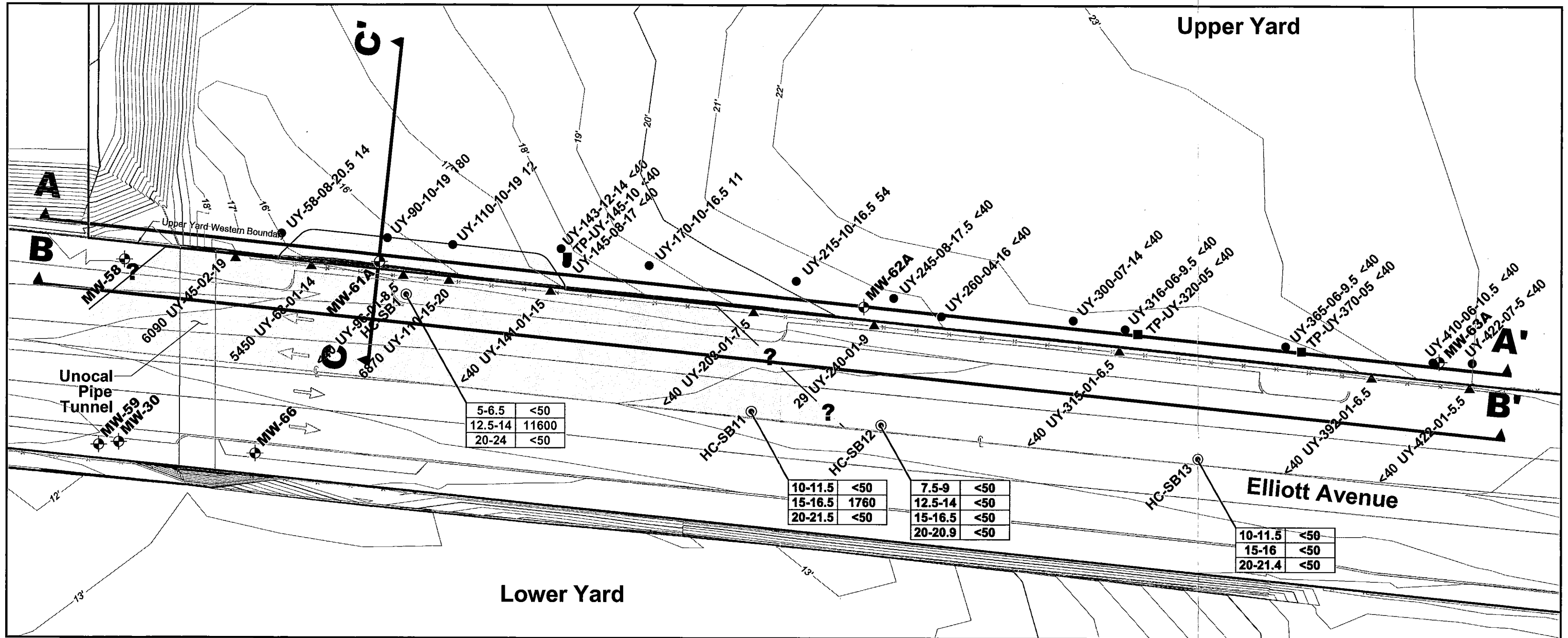
179 Madrone Lane North
Bainbridge Island, WA 98110
(206) 780-9370

811 First Avenue #460
Seattle, WA 98104
(206)-328-7443

Well Location Map

Olympic Sculpture Park
Seattle, Washington

DATE March 2004	PROJECT NO. 020118
DESIGNED BY: LJH	FIGURE NO. 5
DRAWN BY: SDM	
REVISED BY: JRS	

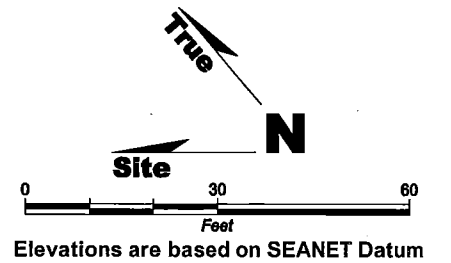


Legend

- MW-X Monitoring Well
- HC-SBX Boring
- TP-UY-X-X Test Pit
- UY-X-X-X Post-Excavation Surface Soil Sample
- UY-X-X-X Property Line Soil Sample
(collected from behind shoring wall)
- <40 Total Petroleum Hydrocarbons (TPH) in mg/kg
- | | |
|-------|-----|
| 5-6.5 | <50 |
|-------|-----|

 TPH (Total) in mg/kg
- Soil Sample Depth Interval (in Feet)
- Existing Elevation Contour (in Feet)

Estimated Areal Extent of Residual TPH-Impacted Soil in Northwest Corner of Upper Yard and Adjacent Elliott Avenue



Aspect consulting
IN-DEPTH PERSPECTIVE

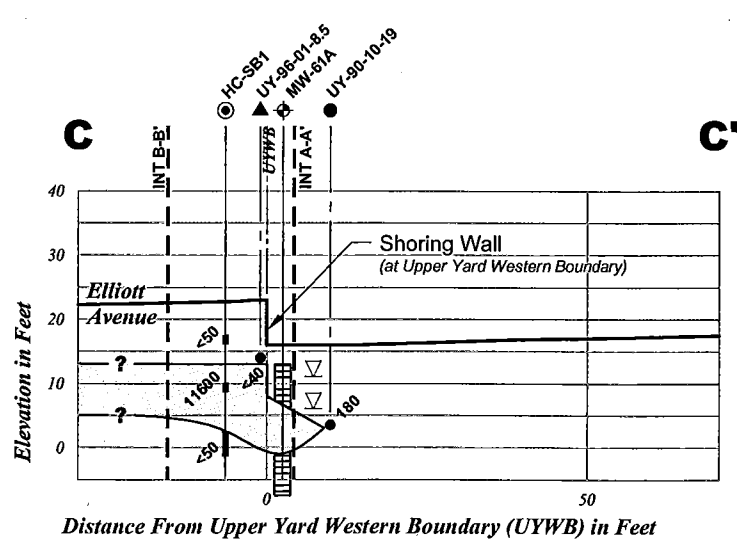
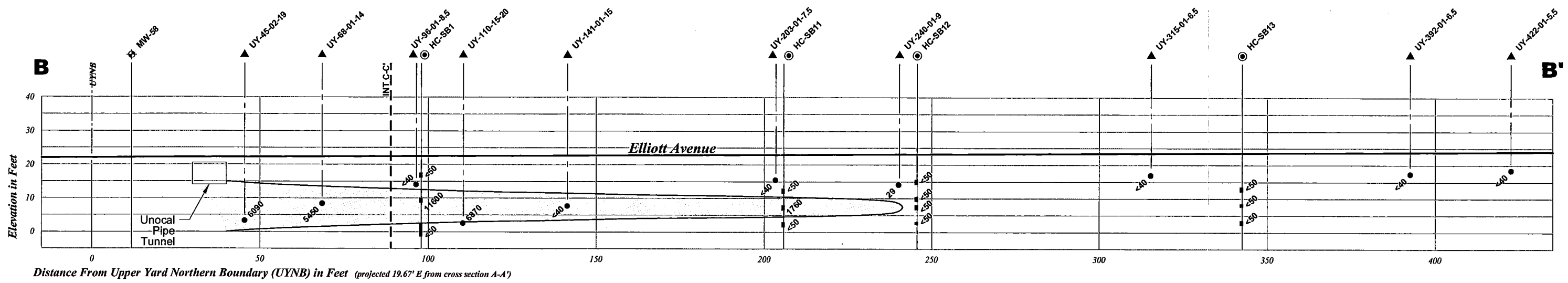
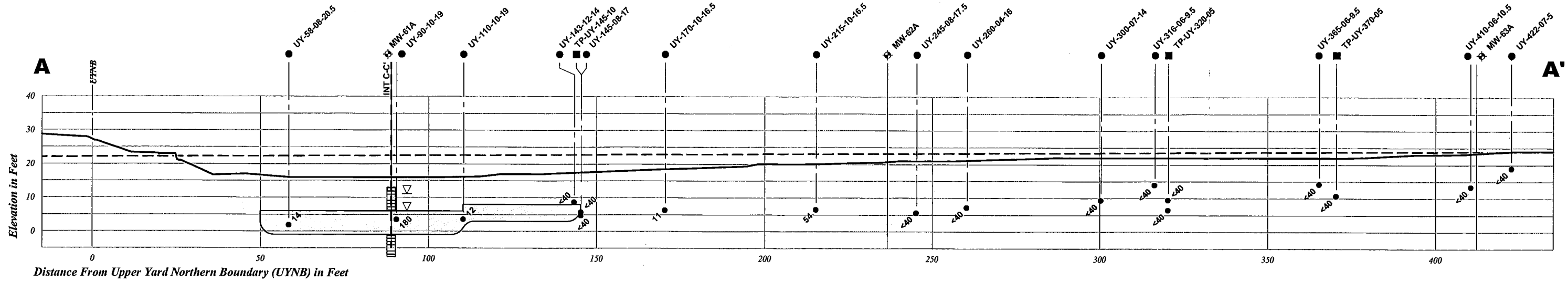
179 Madrone Lane North
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(206) 760-6370

811 First Avenue #480
Seattle, WA 98104
(206) 328-7443

**Estimated Areal Extent of Residual
TPH-Impacted Soil - Upper Yard**

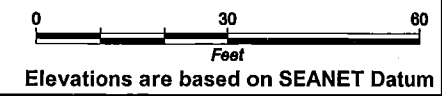
Olympic Sculpture Park
Seattle, Washington

DATE: March 2004	PROJECT NO. 020118
DESIGNED BY: DAH	FIGURE NO. 6
DRAWN BY: SDM	
REVISED BY: JRS	



Legend

- Generalized Elevation of Elliott Avenue
- Generalized Elevation of Elliott Avenue
- Total Petroleum Hydrocarbons (TPH) in mg/kg
- Estimated Extent of Soil with TPH Concentrations greater than 200 mg/kg
- Well
- Groundwater Level
- Screen



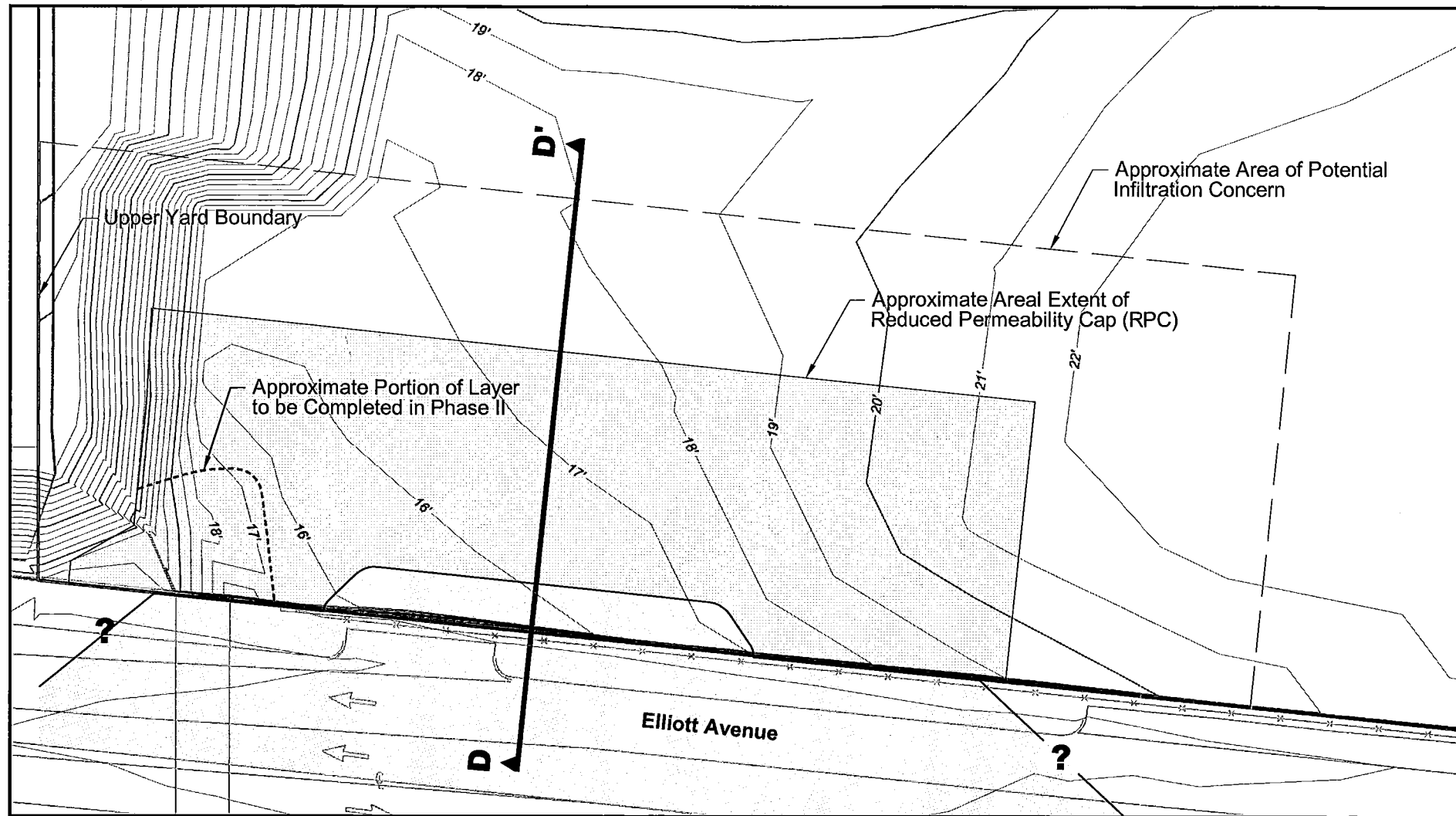
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IN-DEPTH PERSPECTIVE

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(206) 760-9370

811 First Avenue #480
Seattle, WA 98104
(206) 328-7443

Cross Sections A - A', B - B' and C - C'
Upper Yard
Olympic Sculpture Park
Seattle, Washington

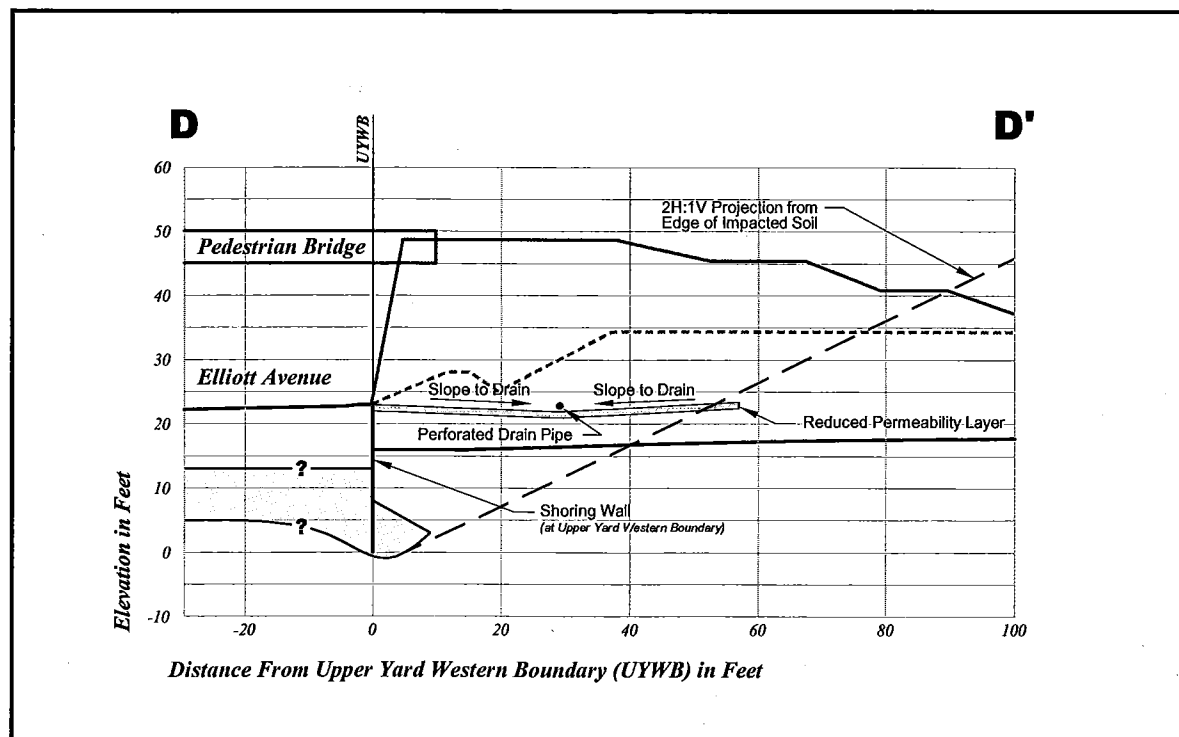
DATE: March 2004	PROJECT NO. 020118
DESIGNED BY: DAH	FIGURE NO. 7
DRAWN BY: SDM	
REVISED BY: JRS	



Plan View

Legend

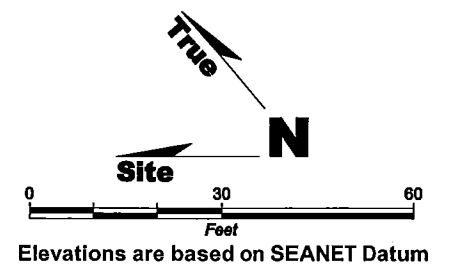
- Cross Section Location and Designation
- Existing Elevation Contour (in Feet)
- Estimated Extent of Soil with TPH Concentrations greater than 200 mg/kg

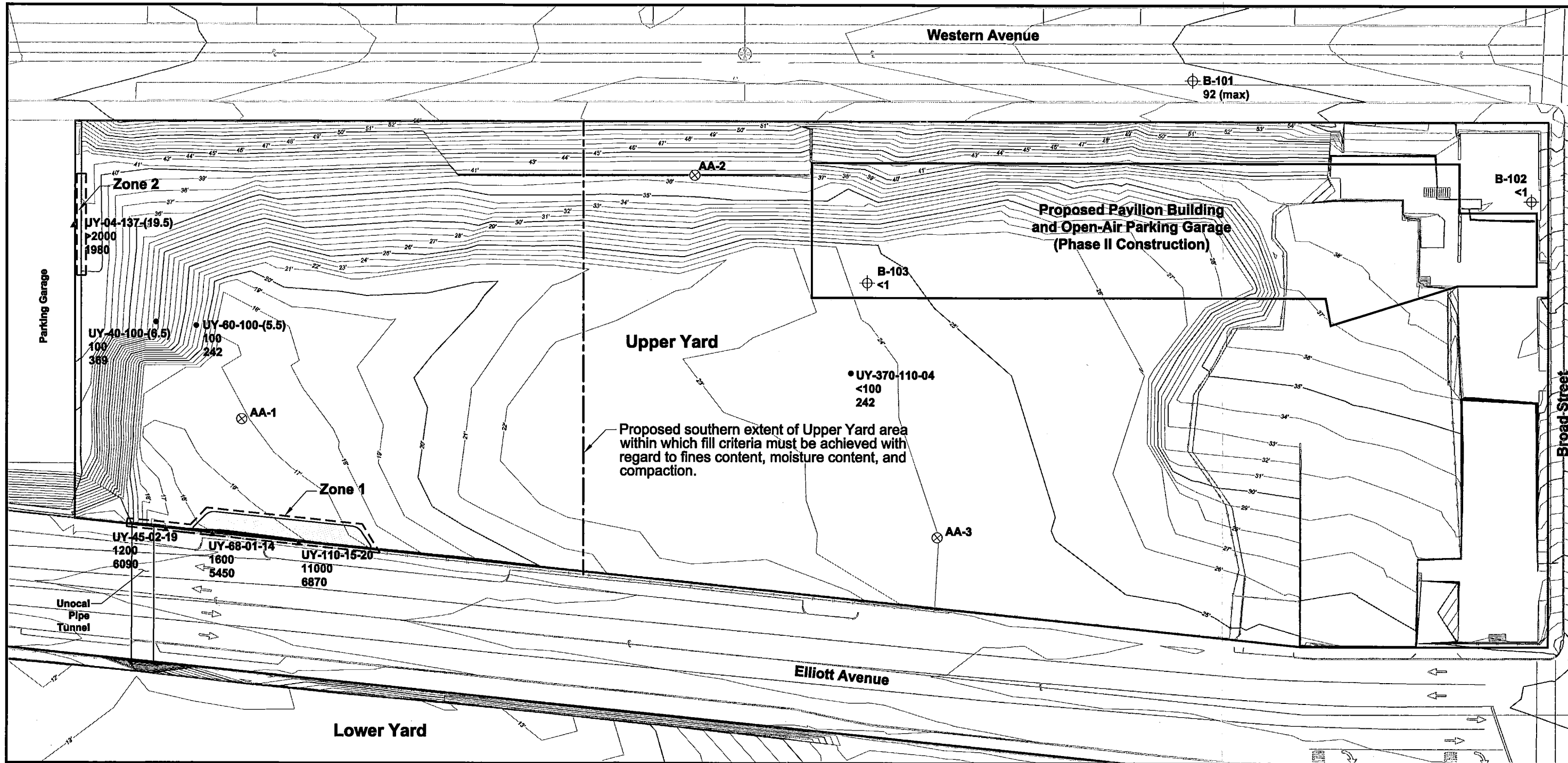


Section








Legend

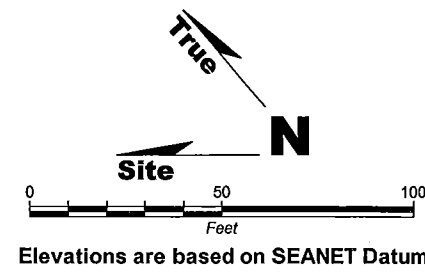
- Existing Ground Surface
- Approximate Ground Surface at End of Phase I Construction
- Ground Surface - Finished Construction
- Estimated Extent of Soil with TPH Concentrations greater than 200 mg/kg





Legend

-  Existing Elevation Contour (in Feet)
 -  Estimated Extent of Soils Remaining in NW corner of Upper Yard with TPH Concentrations > 200 mg/kg
 -  Zone of Potentially Significant Soil Vapor Emissions
 -  Post-Excavation Surface Soil Sample
 -  Property Line Soil Sample (collected from behind shoring wall)
 -  Geotechnical Boring, August 2002
 -  Ambient Air Monitoring Station
- UY-45-02-19 Soil Sample ID, 1997 Remedial Action - last number is approximate depth in feet below Elliot Avenue grade.
 1200 Soil Vapor Concentration by PID Headspace Screening (in ppmv)
 6090 Total TPH in Soil (in mg/kg)



Aspect consulting
 IN-DEPTH PERSPECTIVE
 170 Madrone Lane North, Bainbridge Island, WA 98110 (206) 760-9370
 811 First Avenue #480, Seattle, WA 98104 (206) 328-7443

Extent of Soil Cap to Meet Air Emission Controls - Upper Yard
 Olympic Sculpture Park
 Seattle, Washington

DATE: March 2004	PROJECT NO.: 020118
DESIGNED BY: DAH	FIGURE NO.: 9
DRAWN BY: SDM	
REVIEWED BY: JRS	

APPENDIX A

Phase I Environmental Site Assessment (Excerpts from Hart Crowser 2002a)



HARTCROWSER

Delivering smarter solutions

April 19, 2002

Anchorage

Mr. John Battle
Pine Street Group, L.L.C.
1500 4th Avenue, Suite 600
Seattle, Washington 98101

Boston

**Re: Preliminary Environmental Assessment (Phase I)
Arcade Plaza Building and Parking Lot
1321 Second Avenue
Seattle, Washington
7731**

Denver

Dear Mr. Battle:

Edmonds

This letter report presents the results of our preliminary environmental assessment at the subject property referenced above. The project work scope was completed in accordance with our proposal 02-51-1123, dated March 15, 2002. The property contains an eight-story office building constructed in 1927. We understand that you are working for Washington Mutual, who is in the process of purchasing the property for redevelopment. Our preliminary environmental assessment provides information on the current conditions and the past practices at the property to evaluate whether it is likely that potentially adverse environmental conditions may be present.

Eureka

Jersey City

We understand that a Hazardous Materials Survey is currently being conducted by Prezant Associates. Therefore, our work does not include an assessment of asbestos-containing materials, lead-based paint, PCBs, and other hazardous building materials.

Juneau

Our report begins with a Summary of Findings which is followed by our:

Long Beach

- Scope of Work;
- Subject Property Description;
- Site Geology/Hydrogeology Summary;
- Historical Characterization;
- Regulatory Agency Database List and File Review;
- Site Reconnaissance;
- Potential for Contamination; and
- Limitations.

Portland

Seattle



Figure 1 is a Vicinity Map showing the location of the subject property. Figure 2 is a Plan Map showing the general vicinity of the subject property and the location of the photographs taken during the site reconnaissance. Photographs are presented in Appendix A. Copies of historical documents are presented in Appendix B. Appendix C presents the EDR Inc. (EDR) site assessment report.

Anchorage

Boston

SUMMARY OF FINDINGS

Based on the information gathered during our historical and agency database list review, personal interviews, and site reconnaissance, the potential for subsurface contamination is low for the subject property. The property was occupied by a residence in the late 1800s, and by retail stores and offices since the early 1900s. No areas of potential environmental concerns were identified adjacent to the subject property.

Denver

Edmonds

SCOPE OF WORK

Our preliminary environmental assessment included:

Fairbanks

- Conducting a historical review of the subject property and surrounding area;
- Reviewing regulatory agency database lists for the subject property and adjacent sites;
- Conducting a site reconnaissance to observe the subject property and surrounding properties; and
- Preparing this letter report presenting the findings of our work.

Jersey City

Juneau

SUBJECT PROPERTY DESCRIPTION

Long Beach

The subject property is located at 1321 Second Avenue in downtown Seattle, Washington (Figures 1 and 2). The property is a 43,000-square-foot lot containing an eight-story plus basement office building known as the Arcade Plaza (also known as the Museum Plaza). The property also includes a 14,000-square-foot commercial parking lot operated by Ampco. The upper floors of the building are currently vacant. Retail tenants are present on the Second Avenue and First Avenue levels. The property is owned by the Seattle Art Museum.

Portland

Seattle



SITE GEOLOGY/HYDROGEOLOGY SUMMARY

Based on soil borings conducted by Hart Crowser on the subject property block in 1981, the predominant soil type on the east end of the property near Second Avenue is dense to very dense, silty Sand. The soil type at the west end of the property near First Avenue is stiff to hard, clayey Silt and sandy Silt. Both units extend to a depth of about 70 to 80 feet below the existing ground surface.

Groundwater was encountered in the Hart Crowser borings at approximately 20 to 30 feet below grade. The topography of the property slopes downhill to the southwest with elevations ranging from 94 feet at the intersection of Second and Union to 70 feet on First Avenue at the Ampco parking lot. Based on surrounding area topography, the inferred groundwater flow direction is to the southwest toward Elliot Bay. However, local flow directions in this area may be complex and influenced by utility trenches, foundation backfill, or other subsurface structure which act as preferential pathway for near-surface groundwater flow.

HISTORICAL CHARACTERIZATION

We researched the history of land use activities on the subject property and adjacent sites to identify potential sources of contamination or activities that could impact the subject property.

Historical characterization of the subject property and the adjacent sites was developed from the following sources:

- Aerial photographs (Pacific Aerial Survey 1953; Puget Sound Regional Transportation Study 1961 and 1965; Washington Department of Natural Resources 1970, 1985, and 1995);
- Topographic maps (U.S. Coast and Geodetic Survey 1899, and USGS South Seattle 7.5' Quadrangle, 1983);
- Fire Insurance Maps (Sanborn 1884, 1888, 1893, 1905, 1950, and 1969);
- Real Estate Maps (Baist 1905 and 1912; and Kroll 1920, 1930, and 1939);
- King County Tax Assessor records (Puget Sound Regional Archives);



- Seattle Now & Then Volume 3, by Paul Dorpat;
- Seattle Department of Construction and Land Use (DCLU) permits and plans;
- Seattle Street Directories (Polk 1938, 1940, 1951, 1959, 1969, 1969, 1979, 1989-1990, and 1996); and
- Interview with Martin Smith building manager Chuck Taug.

A Chain of Title was not available for review. Dates in the text refer to historical records and provide an approximate indication of the period of operation for each business or activity identified, except where explicitly stated. Copies of Sanborn and Baist maps, and tax records are presented in Appendix B.

Subject Property

A large residence was constructed on the west half of the subject property in 1865 and occupied by Seattle founder Arthur Denny. Sanborn maps indicate that the residence (1328 First Avenue) and outlying sheds were also present in the 1880s and 1890s. The residence also contained a doctor's office in 1893. Arthur Denny died in 1899, and the pasture behind the home on Second Avenue was developed as the Arcade Building in 1901. As indicated in the 1905 Sanborn, the Arcade Building contained offices and shops fronting Second Avenue and extended a full block south to University Street. The Denny house stood until 1907 when it was razed for development of the Arcade Annex Building. The Arcade Annex fronted First Avenue and also extended a full block from Union to University Streets. The two Arcade buildings were separated by an alleyway "known as Arcade Way" extending the full block.

The northern 180 feet of the Arcade Annex and Arcade Building were demolished to make way for the existing Arcade Plaza building in 1927. The building was occupied by the Rhodes Department Store from 1927 until the mid-1960s. A building department plan indicates that a paint booth was present in the penthouse in the 1950s. Otherwise, the entire building was used for retail and office purposes. The building was occupied by a variety of federal offices (including the Departments of Housing and Urban Development, Health, and Social Security) in the 1960s and 1970s. The National Bank of Commerce in was also present on the fifth and sixth floors in 1969. The building was listed as vacant in 1989. According to the current building manager, Nordstrom offices occupied floors three through eight for at least twelve years until 2001. Nordstrom Credit Union was listed as the



tenant in the 1996 directory. Ken's Camera and Kinko's Inc. copy center have been present in the Second Avenue lobby area since the mid-1980s.

The Ampco parking lot was occupied by two Arcade buildings from the early 1900s until at least 1964 on the Second Avenue side, and 1990 on the First Avenue side. A workshop and a photo store are shown as ground floor spaces in the 1950 Sanborn. The workshop is identified as a restaurant in the 1969 Sanborn. A two-story parking garage (Arcade Plaza Parking) was constructed in 1964. The Arcade Annex building and parking garage were demolished in 1990 to make way for the Seattle Art Museum and the Ampco parking lot.

Surrounding Properties

The surrounding area was residential in the 1870s and 1880s and transitioned to a commercial district dominated by hotels in the 1890s and 1900s. The Harold Poll Building located across Union Street to the north, was constructed in 1910. The Harbor Cleaning center (dry cleaners) was located in the Poll Building at 108 Union Street in 1989-90. Sound Printing was also located in the Poll Building at 106 Union Street from the 1930s until the 1980s.

The Seattle Daily Times and A.W. Denny Building located kitty-corner to the northeast across Second and Union were constructed by 1905. The City Dye Works was listed in the Daily Times building at 202 Union Street in 1938 and 1940. The dye works was listed as a branch, though it was not determined whether it was an office, a drop-off site, or a dyeing facility. An eight-story parking garage (The Parkade) was constructed on the Denny Building and Daily Times site in 1969.

Upgradient properties across Second Avenue in the early 1900s included the Hotel Curtis, and the Esterbrook and Walker Buildings. The buildings contained offices, lodgings, restaurants, and shops until demolition occurred in the early-1990s to make way for the Benaroya Concert Hall completed in 1998.

The existing parking garage located to the west across First Avenue was constructed in 1928. Street level retail shops have been present since the 1930s. In-house Hart Crowser documents and historical maps indicate that a Burlington Northern rail tunnel is located beneath the Benaroya site and the intersection of Second Avenue and Union Street.

As discussed in the subject property review, the adjacent property to the south contained the Arcade and Arcade Annex buildings, and the parking garage until construction of the art museum occurred in the early 1990s.



Aside from the brief appearances of the City Dye Works and Harbor Cleaning Center in the 1930s and 1980s, respectively, our review of historical records for the surrounding properties did not identify other any past activities of environmental concern such as gasoline retailing, other dry cleaning, or industrial manufacturing on the surrounding properties.

REGULATORY AGENCY DATABASE LIST AND FILE REVIEW

This section describes the regulatory agency database lists reviewed for sites of concern by Environmental Data Resources, Inc. (EDR) and the results of our regulatory agency file review. EDR is a firm that acquires data from government agencies on various media such as magnetic tape, disk, and hard copy. The purpose of the regulatory agency database list review was to screen for potential sources of contamination or activities of environmental concern for the subject property and adjacent properties. The agency-published databases were screened for sites of potential concern in general accordance with current American Society for Testing and Materials (ASTM) standards. Because our regulatory agency database search was based on current agency records, our results are only as accurate as the records provided.

Regulatory agency database lists reviewed and approximate search distances from the subject property are detailed below:

- Environmental Protection Agency (EPA) National Priorities List (NPL) (January 2002) - List of "Superfund" sites; search radius of 1 mile;
- EPA Region 10 Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) List (November 2001) - List of sites which are either proposed to or are on the NPL and sites currently being reviewed for possible inclusion on the NPL; search radius of 1/2 mile;
- EPA Emergency Response Notification System (ERNS) List (June 2000) - List of reported CERCLA oil or hazardous substance releases or spills; search for subject property;
- EPA Region 10 Resource Conservation and Recovery Information System (RCRIS) List (December 2001)
 - Treatment/Storage/Disposal (TSD) - List of generators and transporters of hazardous waste, and TSD facilities; search radius of 1 mile;



- Large Quantity Generator (LQG), Small Quantity Generator (SQG) - List of facilities that qualify as large or small quantity generators of hazardous wastes under RCRA; search radius of 1/4 mile;
- EPA Region 10 RCRA Corrective Action Sites (CORRACTS) List (November 2001) - List of RCRA facilities which are undergoing corrective action; search radius of 1 mile;
- EPA Region 10 Superfund (CERCLA) Consent Decrees (CONSENT) List (Variable) - List of major legal settlements establishing responsibility and standards for cleanup at NPL sites; search radius of 1 mile;
- EPA Region 10 Facility Index System (FINDS) List (October 2001) - Lists both facility information and "pointers" to other sources that contain more detail; search for subject property;
- EPA Federal Superfund Liens (NPL Liens) List (October 1991) - List of filed Superfund liens; search for subject property;
- EPA PCB Activity Database System (PADS) List (December 2001) - Lists generators, transporters, commercial storers, and/or brokers and disposers of PCBs who are required to notify the EPA of such activities; search for subject property;
- EPA Region 10 RCRA Administrative Action Tracking System (RAATS) List (April 1995) - List of sites under RCRA pertaining to major violators undergoing enforcement actions, search for subject property;
- EPA Region 10 Toxic Release Inventory System (TRIS) List (December 1999) - Inventory of toxic chemicals emissions from certain facilities; search for subject property;
- EPA Toxic Substances Control Act (TSCA) List (December 1998) - Identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list; search for subject property;
- EPA Delisted NPL Sites (Delisted NPL) (January 2002) - Sites identified for deletion from the NPL where no further response is appropriate; search for subject property;
- EPA No Further Remedial Action Planned (NFRAP) List (November 2001) - Identifies sites that have been removed from CERCLIS; search for subject property;



- Federal Records of Decision (ROD) List (October 2001) - List of Superfund Sites where ROD property has been developed; search radius of 1 mile;
- US Department of Transportation (HMIRS) List (September 2001) - List of hazardous material spill incidents reported to DOT; search for subject property;
- Nuclear Regulatory Commission (MLTS) List (February 2002) - List of sites which possess or use radioactive materials and are subject to NRC licensing requirements; search for subject property;
- Washington Confirmed and Suspected Contaminated Sites List (CSCSL) (November 2001) - List of sites currently being investigated by the Washington State Department of Ecology (Ecology) under the Model Toxics Control Act (MTCA); search radius of 1 mile;
- Ecology Hazardous Sites List (HSL) (February 2002) - List of sites assessed and ranked using the Washington Ranking Method (WARM); search radius of 1 mile;
- Ecology Leaking Underground Storage Tank (LUST) Site List (March 2002) - List of registered leaking USTs in Washington; search radius of 1/2 mile;
- Ecology Underground Storage Tank (UST) Registration List (March 2002) - List of registered USTs in Washington; search radius of 1/4 mile;
- Ecology Solid Waste Facilities/Landfill Sites (SWF/LF) (December 2001) - List of permitted solid waste landfills operating in Washington; search radius of 1/2 mile; and
- Ecology Independent Cleanup Reports (ICR) (October 2001) - List of sites undergoing cleanup for which reports have been received by Ecology from either the owner or operator; search radius of 1/2 mile.

EDR conducted a review of the regulatory agency database lists indicated above. The report of the database search provided by EDR includes a list of databases searched, a statistical profile indicating the number of properties within 1 mile of the subject property, selected detailed information from federal and state lists, and an overview map illustrating the identifiable and mappable sites within 1 mile of the subject property. The EDR report is presented in Appendix C of this report. Refer to the EDR report for more detailed information and additional local database lists reviewed.



The purpose of a file review is to acquire regulatory agency file information for the subject property and adjacent sites of potential concern based on their database-type listing and to identify potential sources of contamination or activities of environmental concern. The review is limited to current files and does not include a review of archived information.

On April 15, 2002, we made Freedom of Information Act (FOIA) requests to Ecology and EPA to inquire about the availability of regulatory file information for the subject property. Based on information provided in the EDR report, we did not require additional information for nearby properties regarding potential sources of contamination or activities of environmental concern to the subject property. The following summarizes the results of the database search and review of available file information.

Subject Property

The Arcade Plaza c/o Martin Smith, was identified on the RCRIS Small Quantity Generator list. No files were available at Ecology's Northwest Regional Office in Bellevue, Washington. Chuck Taug did not know the reason for the listing. The Martin Smith building engineer, Richard O'Neil, did not respond to our phone messages. Our request to EPA is pending and any pertinent information will be furnished as an addendum to this report.

Nearby Site Information

Several surrounding area properties were listed on the Ecology's LUST or ICR lists. These include the following:

- J.C. Penney at Second and Union (LUST list);
- Parkade at 1400 Second Avenue (ICR and LUST lists);
- Jones Building Ampco Garage at 1331 Third Avenue (ICR and LUST lists); and
- US WEST, a.k.a. 1200 Third Avenue (LUST list).

Other than US West, none of the above sites were listed as having groundwater contamination. The Parkade and J.C. Penney sites were reported to Ecology as "cleaned up" in 1994 and 1995, respectively. The Jones building was reported as "cleaned up" in 1996. The US West site is located two blocks to the southeast, and is in the inferred cross-gradient groundwater flow direction to the subject property.



Seattle Steam, identified on the CSCSL list, is located two blocks to the west, downgradient from the subject property.

The EDR report also identified several area properties as UST and RCRA Small Quantity Generator sites. Appearance of sites on the RCRA and UST lists indicates hazardous waste generation and registration of underground storage tanks, respectively, and does not necessarily indicate releases to soils and/or groundwater.

In summary, none of the neighboring properties identified in the EDR report appear to have a likely potential for adversely impacting the subject property. The sites listed in the area with leaking USTs reported are either located in a cross-gradient or downgradient groundwater flow direction, have been reported as cleaned up, or are positioned at such a distance from the subject property to unlikely have adversely affected it.

SITE RECONNAISSANCE

On April 5, 2002, Rob Roberts of Hart Crowser conducted a site reconnaissance to observe the subject property and current business/land use in a 1-block radius. Mr. Roberts was accompanied by Chuck Taug, the building manager for Martin Smith. Photographs taken during the visit are presented in Appendix A. The following observations were recorded.

Subject Property

The subject property contains the eight-story Arcade Plaza building and an Ampco surface parking lot (Photos 1 and 2, respectively). The building is heated by central steam service, and served by Metro sewer. Floors three through eight were recently occupied by Nordstrom offices and were vacant at the time of our visit. The first floor was occupied by Bella Vita Salon, Books for Kids, and Seattle Art Museum offices. The second floor contained the main lobby and entrance from Second Avenue. Businesses present on the second floor were Seattle's Best Coffee offices, Ken's Camera, and Kinko's Inc. copy center. Small-scale processing of color film is conducted at Ken's Camera. Kinko's conducts photocopying only. No blue printing or printing involving chemicals is performed at Kinko's.

The building contains a full basement and a partial sub-basement. The basement contains storage areas and a chiller room (Photo 3). Several drums of water purification chemicals were present in the chiller room. A flammables cabinet present in the chiller room contained a partially filled 2-gallon gasoline can, and a half-gallon container of paint thinner.



Seattle Steam service reportedly enters the building on the First Avenue-side of the basement, however, the steam lines were not accessible for viewing during our visit.

The sub-basement is located beneath the western 1/4 of the building, and extends partially below the First Avenue sidewalk. The sub-basement contains a loading dock and is accessed through a tunnel located on Post Avenue (Figure 2). The sub-basement also contains a parking garage, a trash compactor, and a storage room. Several empty water purification drums were present in the storage room. A floor drain was present in the parking garage (Photo 4). The building manager stated that the floor drain was connected to the sewer system.

A penthouse located on the roof contains elevator equipment, HVAC equipment, and a propane-fueled emergency generator.

Electric passenger and freight elevators, garbage chutes, and janitor sinks are located on the southwest corner of each floor.

The Ampco lot is asphalt-paved and contains approximately 50 parking spaces. No petroleum products or hazardous materials were observed in the lot.

Underground Storage Tanks (USTs). No underground storage tanks are known to exist. We did not observe vent pipes or fill ports indicative of potential USTs.

Chemicals. Chemicals observed in the building include water treatment materials for the chiller system, janitorial supplies, and photo-processing chemicals at Ken's Camera. Small containers of gasoline and paint thinner were observed in the flammables cabinet in the chiller room.

Petroleum Products and Fuels. A propane tank is present in the penthouse generator room. No other petroleum products or fuels were present.

Hazardous Waste. According to Mr. Taug, no hazardous waste is produced or stored at the property. At Ken's Camera, silver-containing chemicals (bleach fixer and stabilizer) are passed through a silver recovery unit. According to Ken's manager Bob Perin, the silver is picked up for recycling by Hallmark Refining. Mr. Perin stated that Ken's uses C-41 developer, which is diluted during the processing and acceptable for disposal into the sewer system.

Solid Waste. Waste is primarily office trash and is collected by Emerald Services.



Site Vicinity

Surrounding area properties included Office buildings to the north across Union Street, the Parkade garage kitty-corner to the northeast, the Benaroya Concert Hall to the east across Second Avenue, the Seattle Art Museum adjacent to the south, and a three-story parking garage with street-level shops to the west across First Avenue. We did not observe any indications of hazardous material storage or use, or surface indications of USTs including vent pipes or fill ports on the surrounding properties. None of the surrounding property uses appear to present a concern for the subject property subsurface conditions.

POTENTIAL FOR CONTAMINATION

Subject Property

The potential for contaminated soil and groundwater resulting from past activities on the subject property appears low. Historical use of the property has been for residential, retail, and office use since the late 1800s. Building plans indicated that Rhodes department store conducted some spray-painting in the 1950s. Since the building is served by sanitary sewers, past use of paints, and possibly solvents, present a minor concern.

A potential exists for demolition debris to exist beneath the Ampco lot. The original Arcade building was demolished on the east side of the lot in the 1960s. Demolition material was often dumped into the basement of the building. Debris can contain elevated concentrations of lead from paint.

The appearance of the subject property on the RCRIS Small Quantity Generator list presents a low potential for contamination. The listing is likely the result of a one-time disposal of a small quantity of wastes, possibly from the photo developer, or maintenance materials including paints and solvents.

Surrounding Properties

The potential for surrounding properties to have adversely affected the subject property is generally low. The surrounding land use since the early 1900s has been primarily offices and retail developments. The Sound Printing and Harbor Cleaners located across Union Street on First Avenue were cross-gradient and would not likely impact the property. The dye works present to the northeast in the 1930s presents some limited concern. However,



this location appears to have been a branch office, and dyeing may not have taken place at that location. The site was redeveloped as a parking garage in the 1960s.

There are no agency-listed sites with reported groundwater contamination on the neighboring upgradient properties to the north and east. The upgradient LUST sites at J.C. Penney, Parkade, and the Jones Building were not reported as having groundwater contamination. If groundwater contamination had occurred and was not detected, it is possible that the subject property could be impacted. However, based on distance, the impacts would likely be minimal, and would not likely significantly impact construction on the subject property. In summary, we did not identify any major sources of migrating contaminants and past or present use of USTs or hazardous materials on the immediately adjacent properties.

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 Pine Street Group LLC, for specific application to the subject property. This report is not meant to represent a legal opinion. No other warranty, express or implied, is made.

It should be noted that Hart Crowser relied on information provided by the individuals indicated above. Hart Crowser can only relay this information and cannot be responsible for its accuracy or completeness.

Our work did not include sampling or testing of drinking water for lead content, sampling for indoor air quality, assessment of sewer systems, sampling for radon vapor, a "good-faith" survey of asbestos and lead, and other items not the standard of practice for our time, unless otherwise noted herein.



Pine Street Group, L.L.C.
April 19, 2002

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Page 14

Any questions regarding our work and this letter report, the presentation of the information and the interpretation of the data are welcome and should be referred the undersigned.

We trust that this report meets your needs.

Sincerely,

HART CROWSER, INC.

ROB ROBERTS
Project Environmental Specialist
cer@hartcrowser.com

ROBERT WEAVER
Principal
rmw@hartcrowser.com

Attachments:

Figure 1 - Vicinity Map

Figure 2 - Site Plan

Appendix A - Site Reconnaissance Photographs

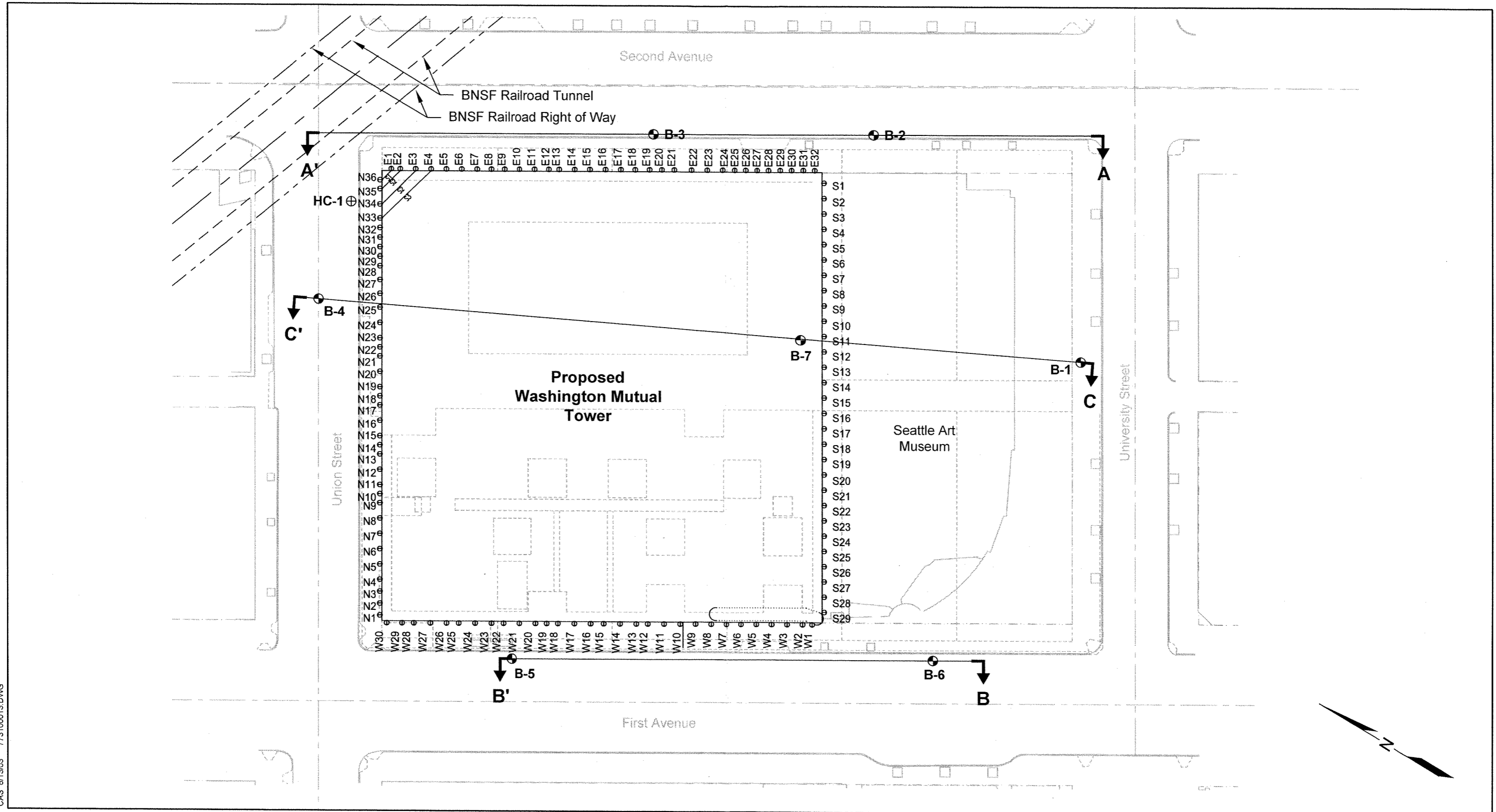
Appendix B - Historical Documents

Appendix C - Site Assessment Report

EDR, Inc.

APPENDIX B

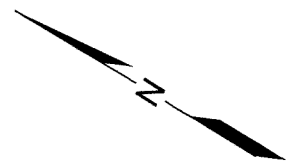
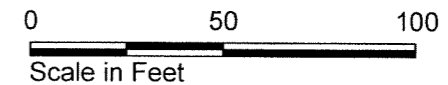
**Boring Logs and Results of
Physical Testing of Soil Samples,
Former Arcade Plaza (Excerpts
from Hart Crowser 2003b)**



CAS 8/13/03 773100013.DWG

Source: Base map prepared from NBBJ drawing titled "Shoring Plan", Sheet No. SH2.01, dated 7/18/03.

Boring Location and Number		Generalized Subsurface Profile Location and Designation	
HC-1 ⊕	2003	A	↑
B-1 ⊙	1980 and 1981	A'	
		⊙ S1	Proposed Soldier Pile Location and Number



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

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

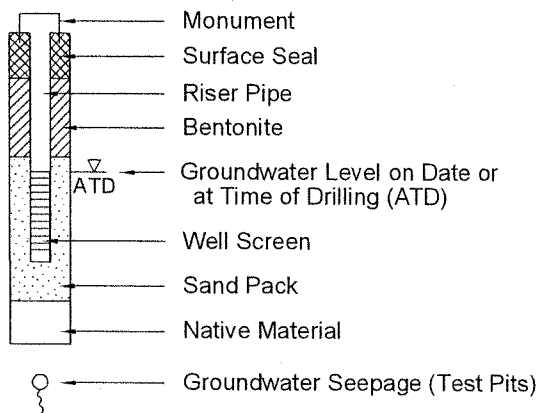
Test Pit Samples

	Grab (Jar)
	Bag
	Shelby Tube

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
	Water Content in Percent
	Liquid Limit
	Natural
	Plastic Limit
PID	Photoionization Detector Reading
CA	Chemical Analysis
DT	<i>In Situ</i> Density Test

Groundwater Observation Wells



HC Standards Standard Report Figures A-1 s/a-1 Standard



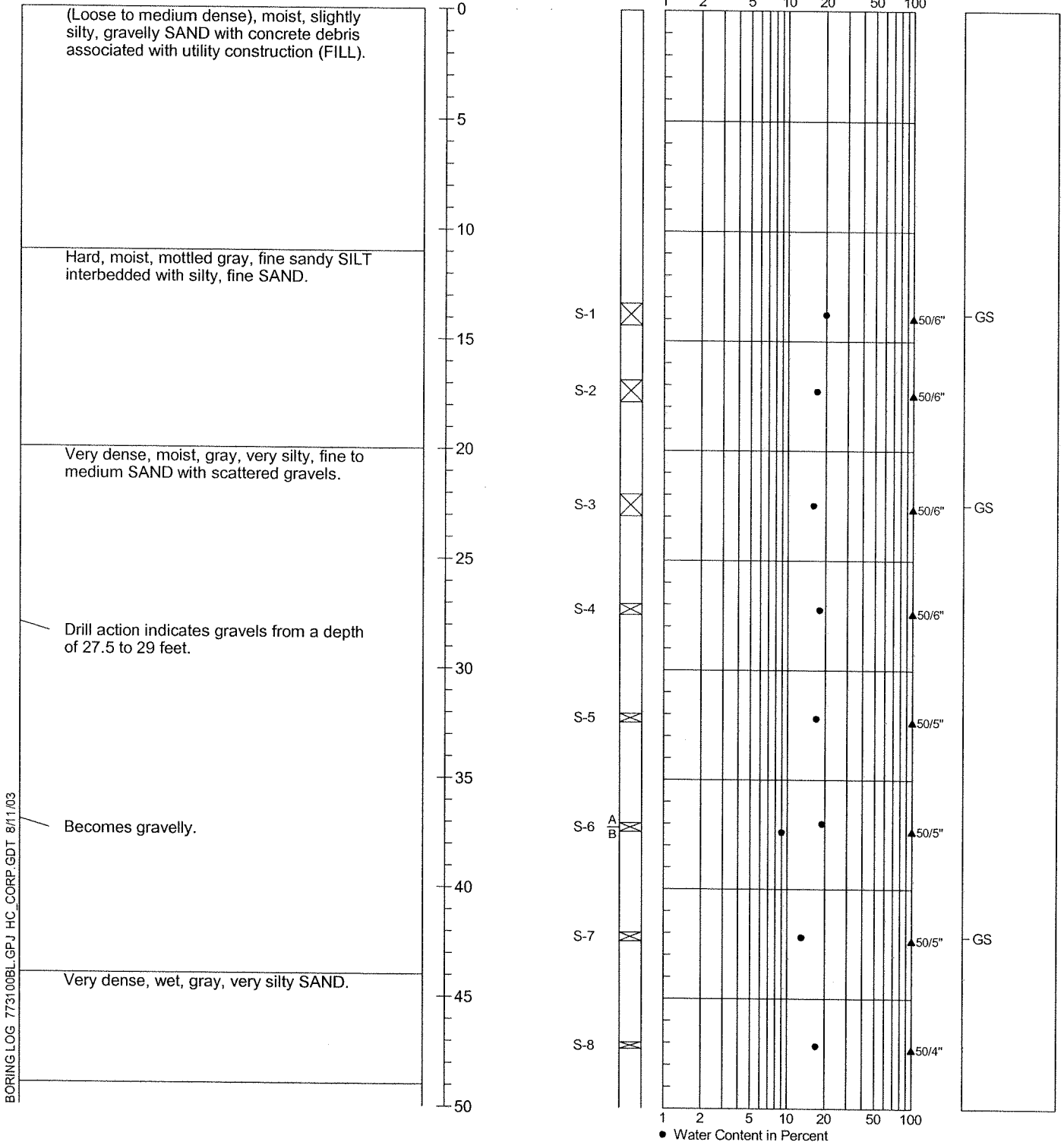
Boring Log HC-1

Soil Descriptions
 Approximate Ground Surface Elevation in Feet: 103 (NAVD 88)

Depth
 in Feet

STANDARD PENETRATION
 RESISTANCE

LAB
 TESTS



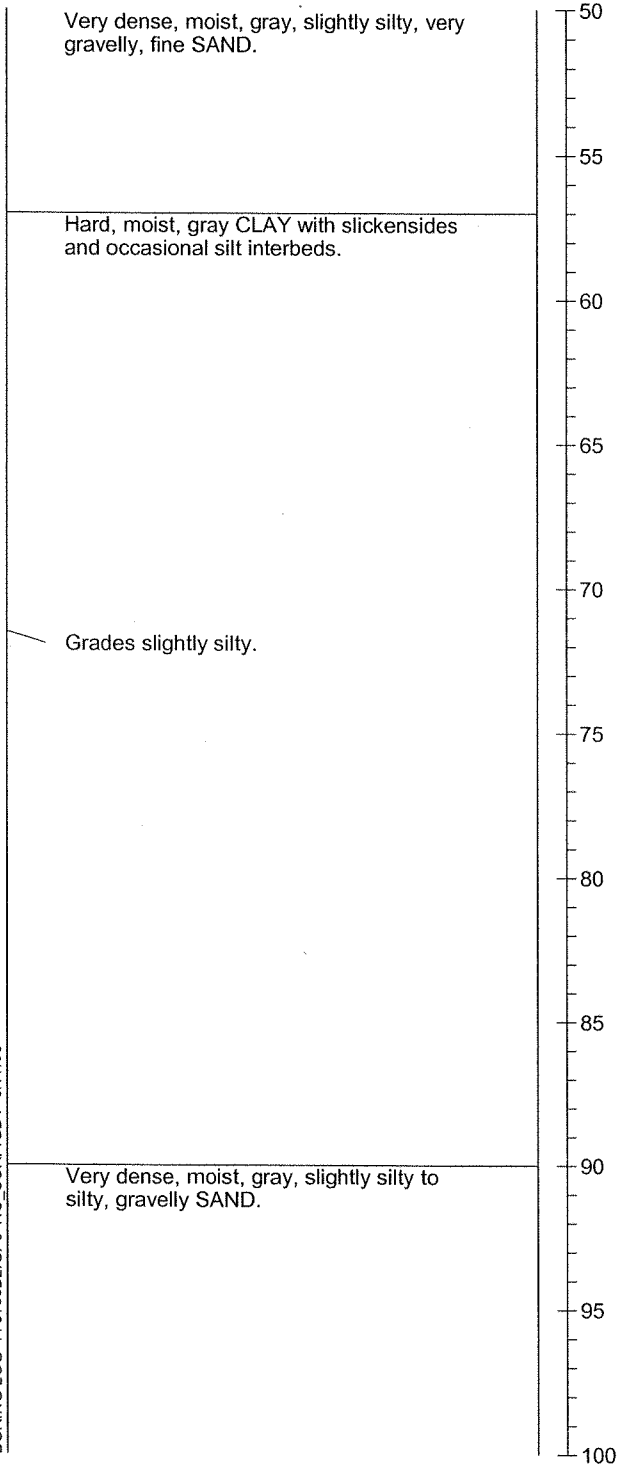
BORING LOG 773100BL.GPJ HC_CORP.GDT 8/11/03



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.

Boring Log HC-1

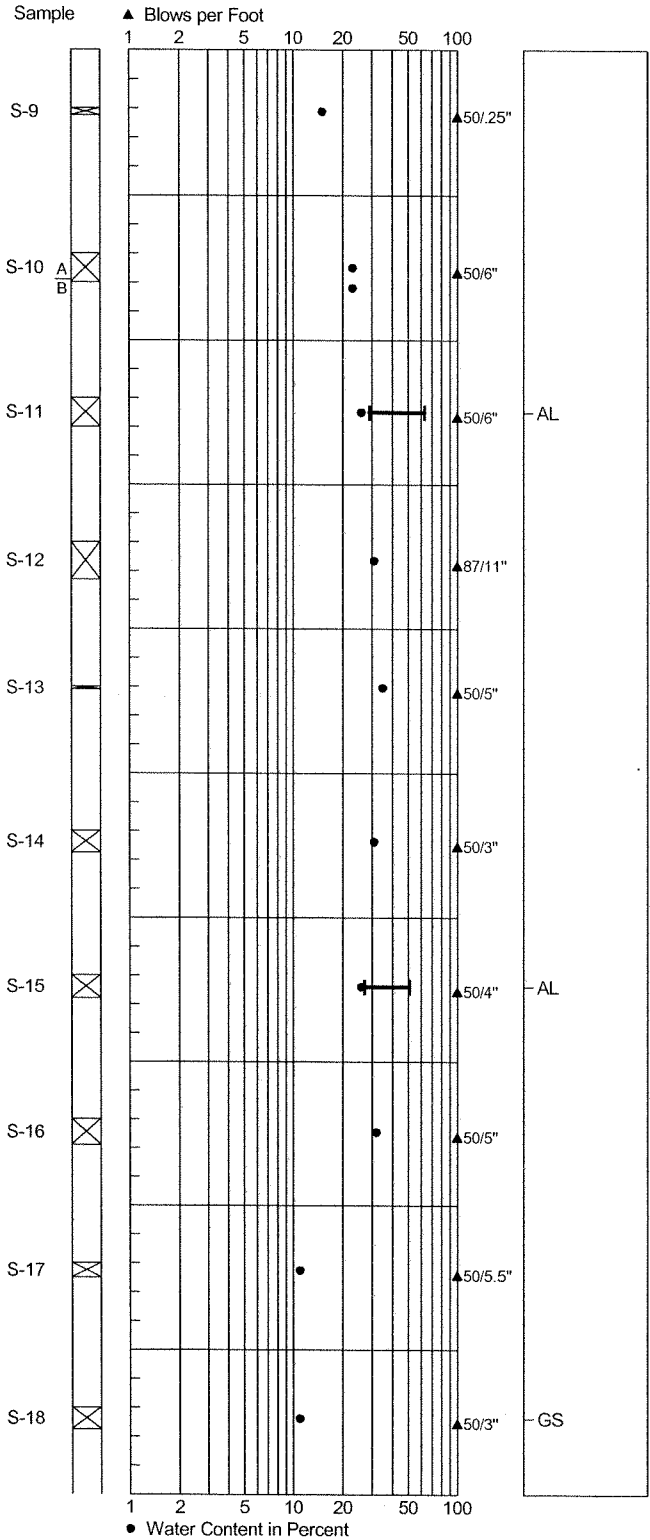
Soil Descriptions
 Approximate Ground Surface Elevation in Feet: 103 (NAVD 88)



BORING LOG 773100BL.GPJ HC_CORP.GDT 8/11/03

STANDARD PENETRATION RESISTANCE

LAB TESTS



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.



7731

5/03

Figure A-2

2/3

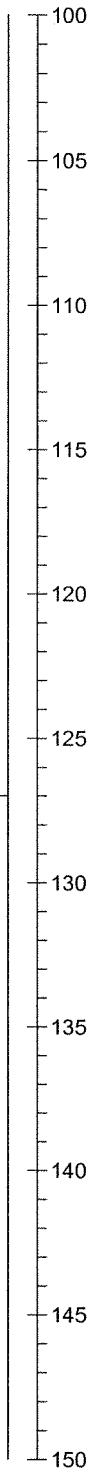
Boring Log HC-1

Soil Descriptions

Approximate Ground Surface Elevation in Feet: 103 (NAVD 88)

Very dense, moist, gray, slightly silty to silty, gravelly SAND.

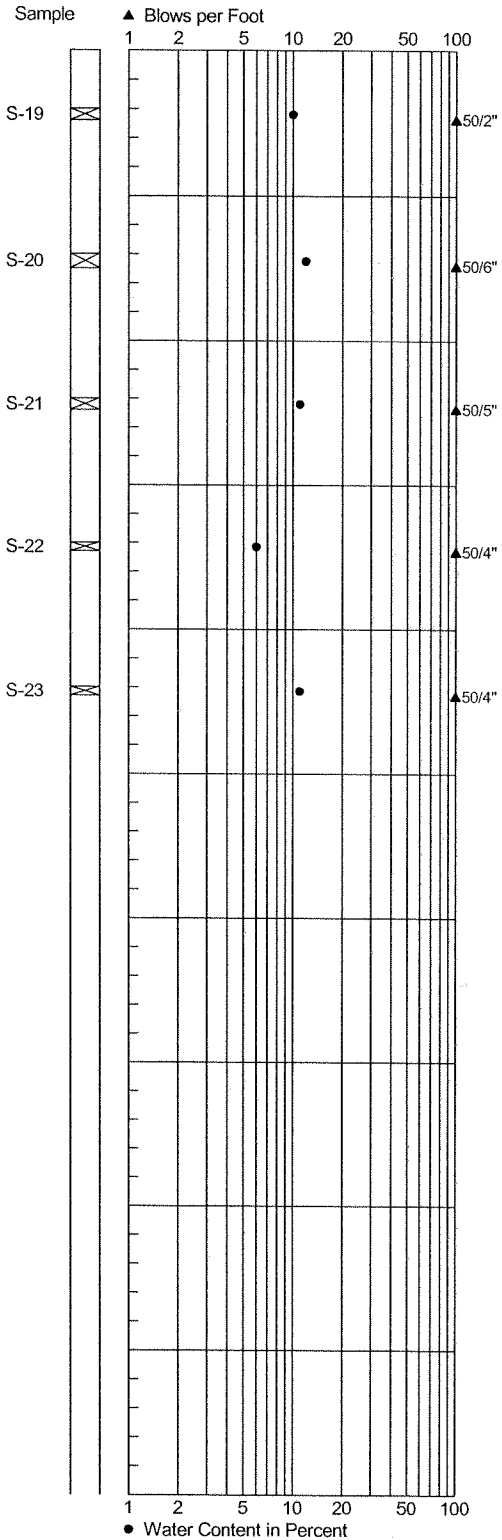
Depth
in Feet



Bottom of Boring at 127.0 Feet.
Completed 05/12/03.

STANDARD PENETRATION RESISTANCE

LAB TESTS



BORING LOG 773100BL.GPJ HC_CORP.GDT 8/11/03



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5/03

Figure A-2

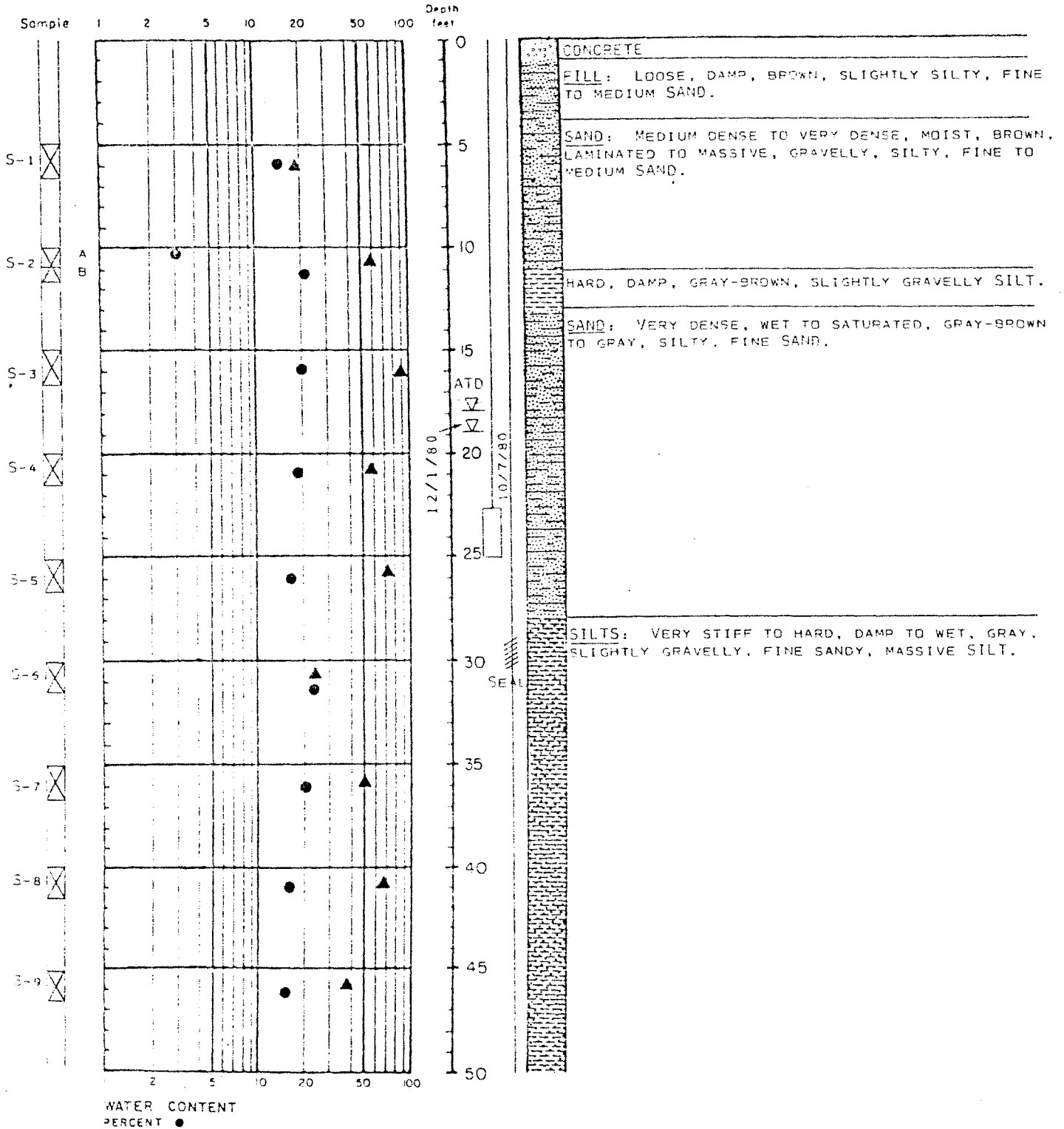
3/3

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. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

Boring Log B-1

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)
BLOWS PER FOOT ▲

SOIL INTERPRETATION



LEGEND

- 2" O.D. Split Spoon Sample
- 3" O.D. Shelby Sample
- No Sample Recovery
- ATD At Time of Drilling
- Water Level
- Observation Well
- Liquid Limit
- Plastic Limit
- PP Pocket Penetrometer (1sf)
- tv Torvane (1sf)

NOTE: Soil descriptions are interpretive and actual changes may be gradual.



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Figure A-3

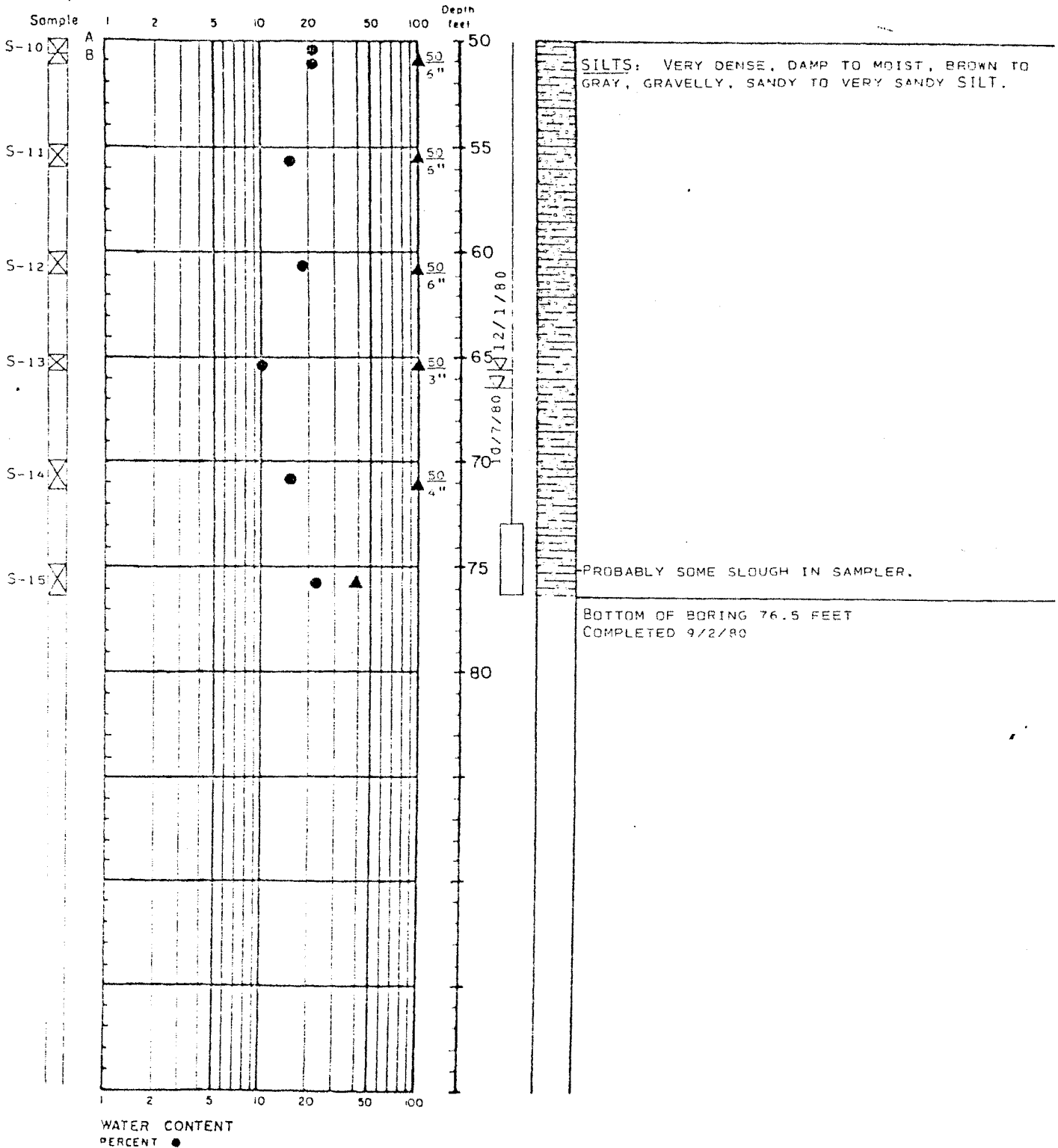
8/03

1/2

HEL 8/6/03 773100005

Boring Log B-1

SOIL INTERPRETATION



LEGEND

- ⊗ 2" O.D. Split Spoon Sample
- ⊠ 3" O.D. Shelby Sample
- * No Sample Recovery
- ATD At Time of Drilling
- ▽ Water Level
- Observation Well
- Liquid Limit
- Plastic Limit
- PP Pocket Penetrometer (1sf)
- tv Torvane (1sf)

NOTE: Soil descriptions are interpretive and actual changes may be gradual.



HARTCROWSER

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8/03

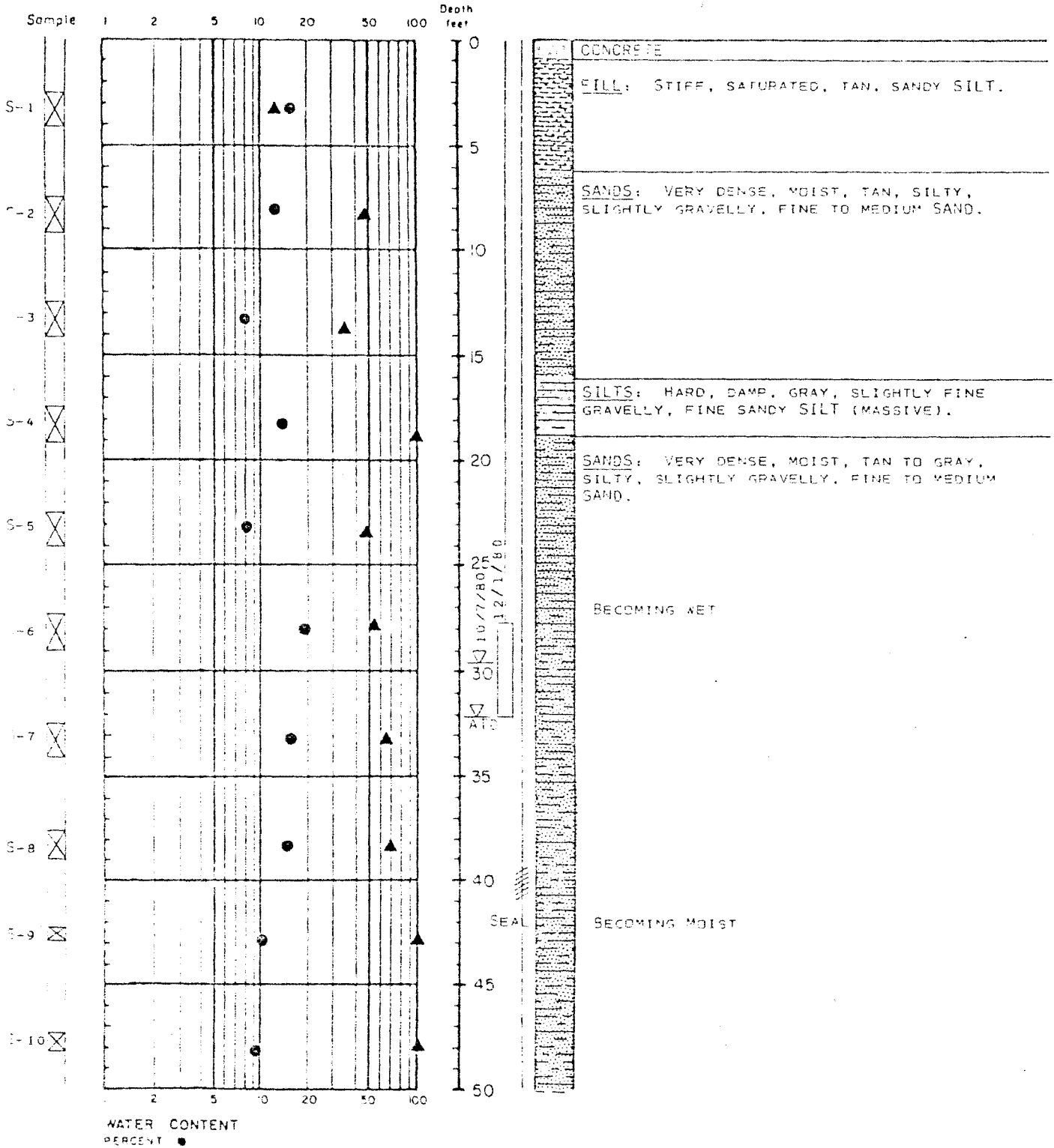
Figure A-3

2/2

Boring Log B-2

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)
BLOWS PER FOOT ▲

SOIL INTERPRETATION



LEGEND

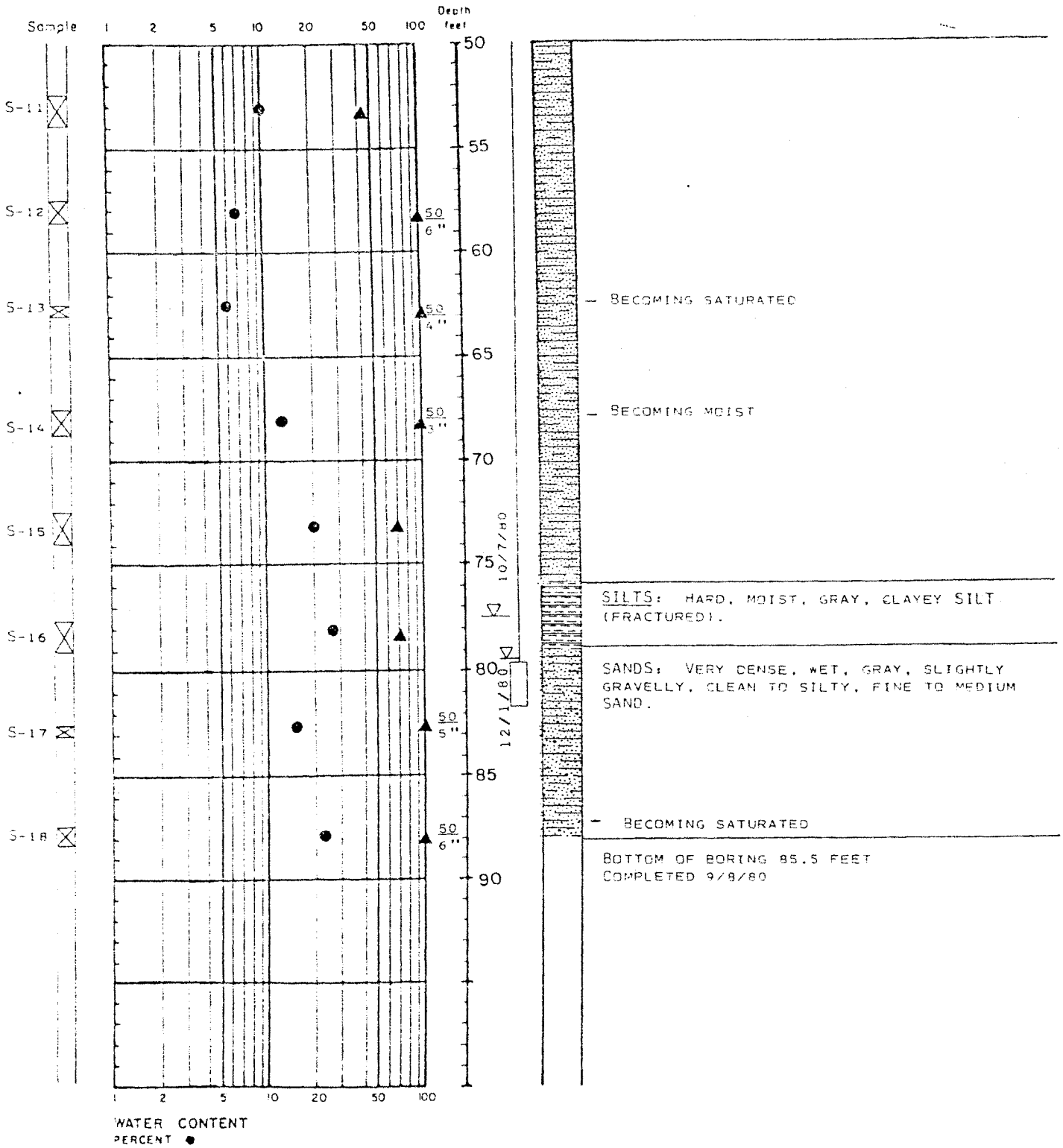
- 2' O.D. Spill Spoon Sample
- 3" O.D. Shelby Sample
- No Sample Recovery
- ATD At Time of Drilling
- Water Level
- Observation Well
- Liquid Limit
- Plastic Limit
- PP Pocket Penetrometer (tsf)
- tv Torvane (tsf)

NOTE: Soil descriptions are interpretive and actual changes may be gradual.

HEL 8/6/03 773100006

Boring Log B-2

SOIL INTERPRETATION



LEGEND

- ⊗ 2" O.D. Spill Spoon Sample
- ⊗ 3" O.D. Shelby Sample
- No Sample Recovery
- ATD At Time of Drilling
- ▽ Water Level
- Observation Well
- Liquid Limit
- Plastic Limit
- PP Packet Penetrometer (lbf)
- lv Torvane (lbf)

NOTE: Soil descriptions are interpretive and actual changes may be gradual.



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Figure A-4

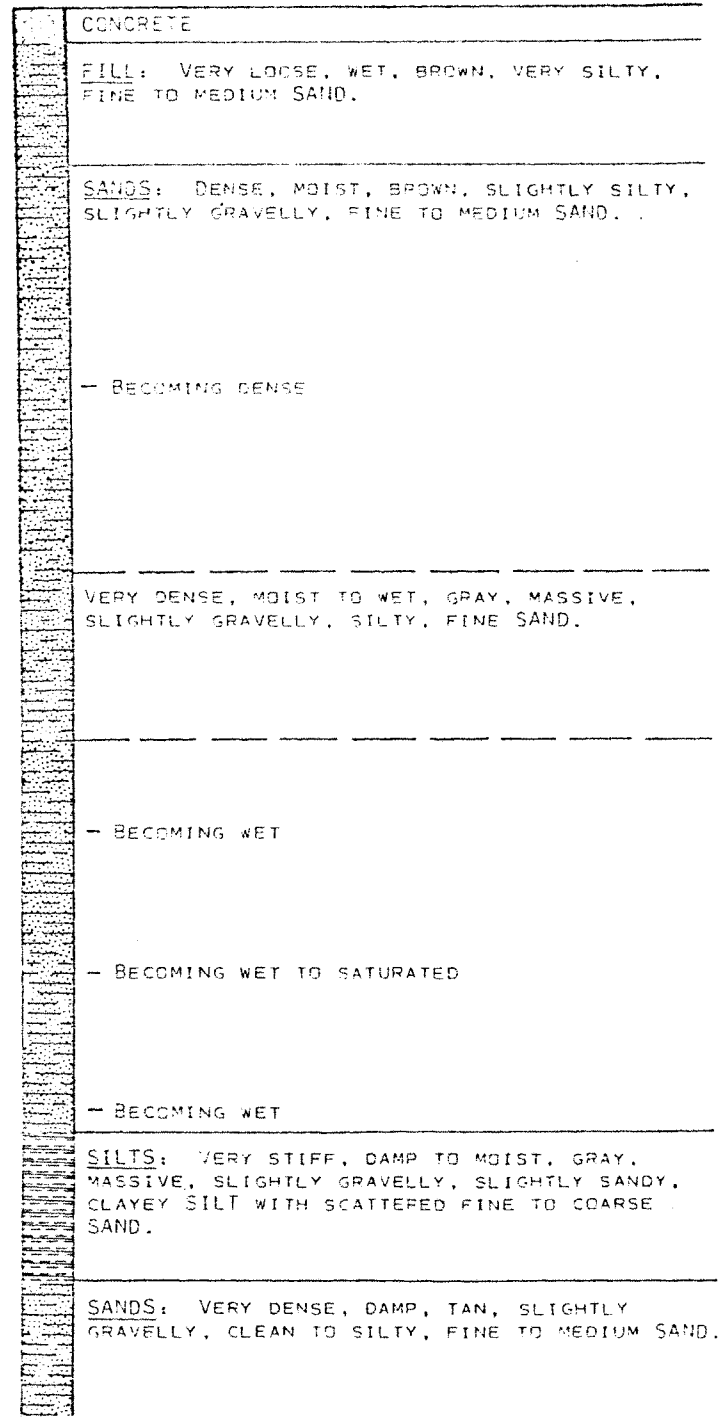
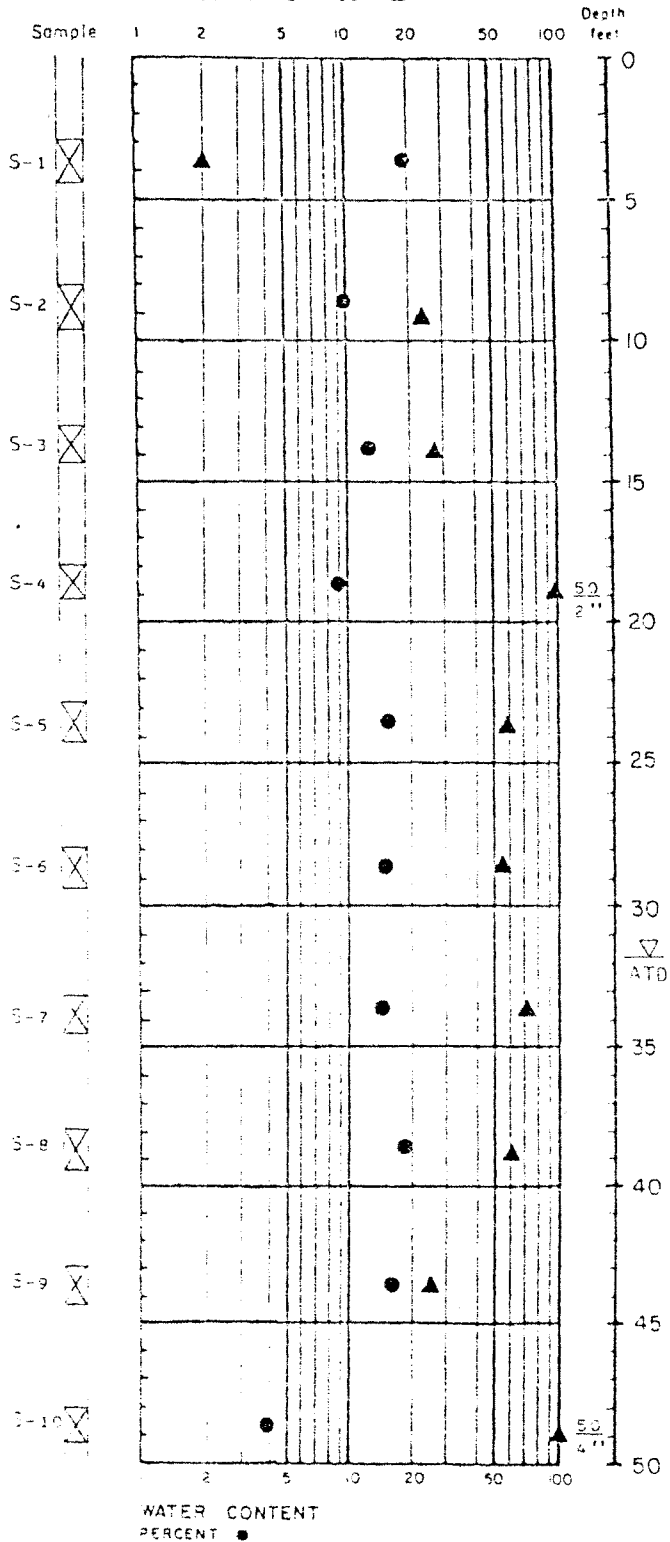
8/03

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Boring Log B-3

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)
BLOWS PER FOOT ▲

SOIL INTERPRETATION



HEL 8/6/03 773100007

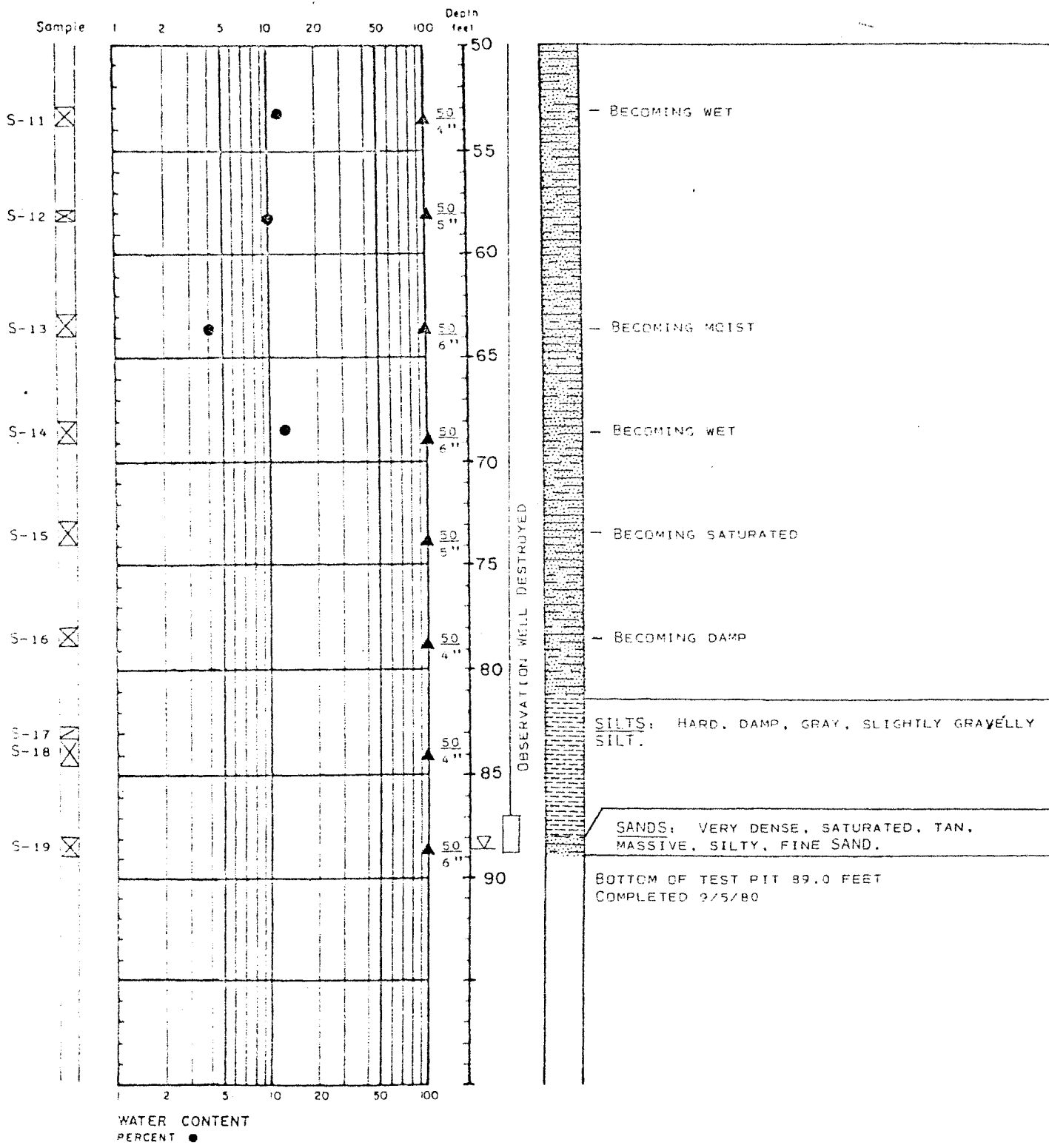
LEGEND

- ☒ 2" O.D. Split Spoon Sample
- ☒ 3" O.D. Shelby Sample
- No Sample Recovery
- ATD At Time of Drilling
- ▽ Water Level
- Observation Well
- Liquid Limit
- Plastic Limit
- PP Pocket Penetrometer (1sf)
- TV Torvane (1sf)

NOTE: Soil descriptions are interpretive and actual changes may be gradual.

Boring Log B-3

SOIL INTERPRETATION



HEL 8/6/03 773100007

LEGEND

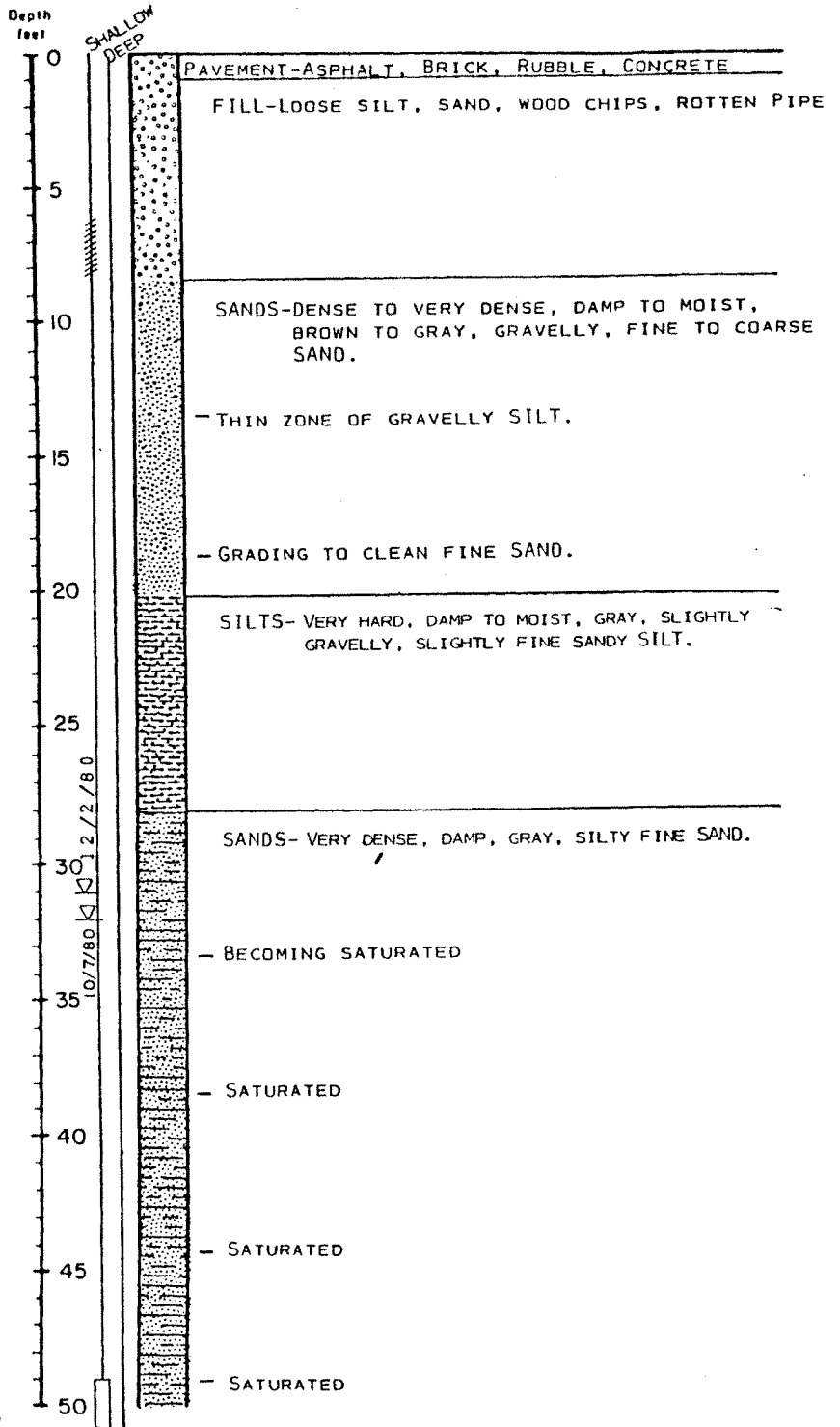
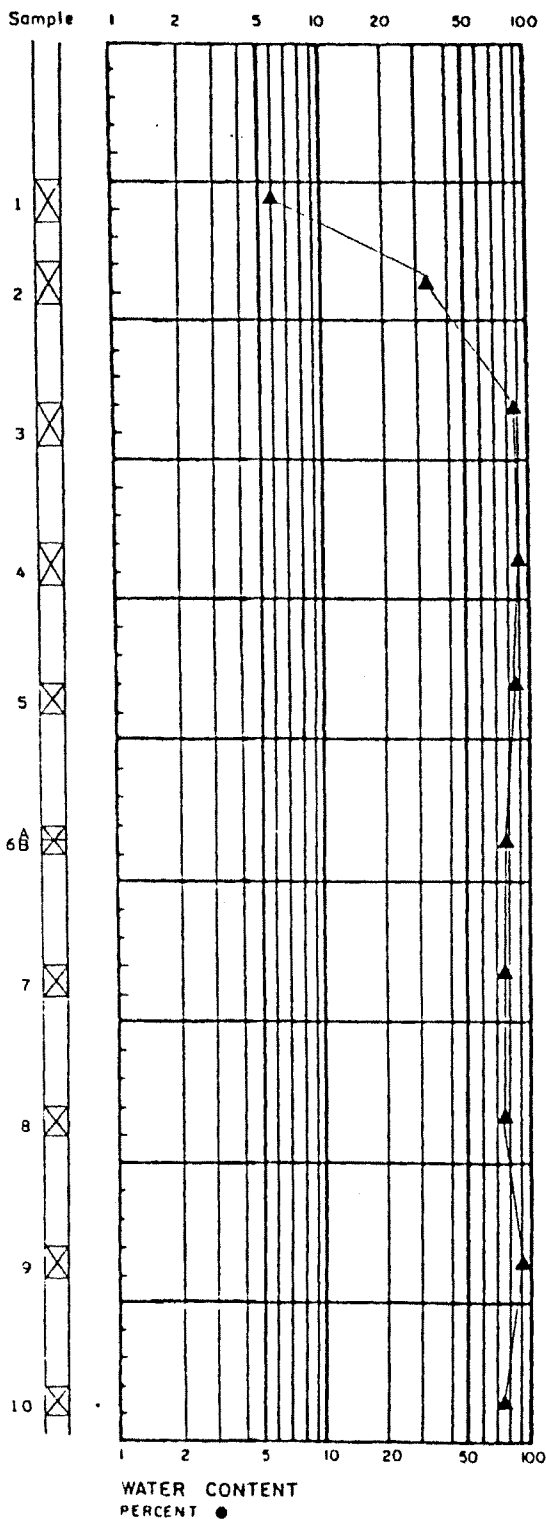
- ⊗ 2" O.D. Split Spoon Sample
- ⊠ 3" O.D. Shelby Sample
- No Sample Recovery
- ATD At Time of Drilling
- ▽ Water Level
- Observation Well
- Liquid Limit
- Plastic Limit
- PP Pocket Penetrometer (1sf)
- tv Torvane (1sf)

NOTE: Soil descriptions are interpretive and actual changes may be gradual.

Boring Log B-4

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)
BLOWS PER FOOT ▲

SOIL INTERPRETATION



HEL 8/6/03 773100008

LEGEND

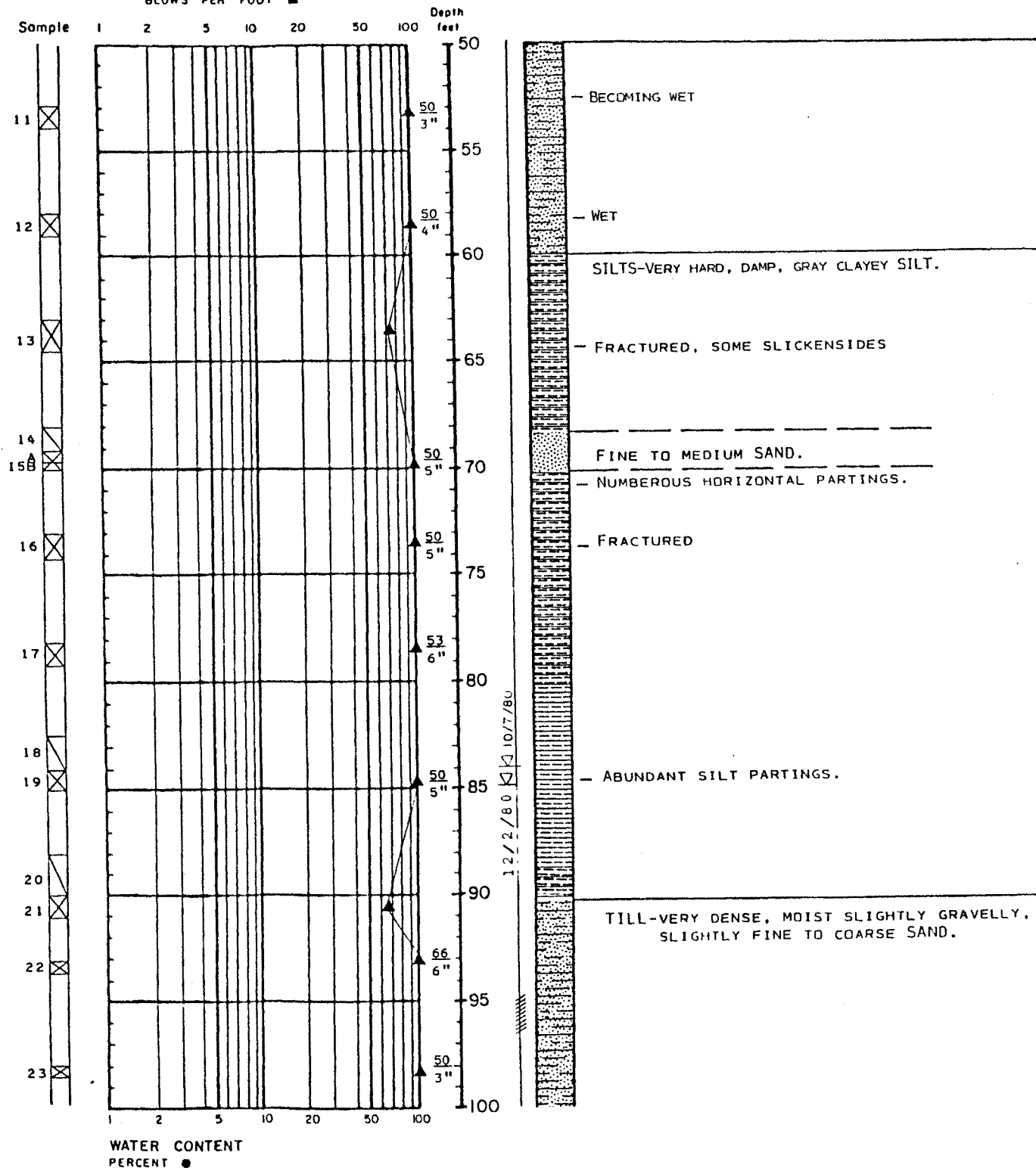
- ☒ 2" O.D. Split Spoon Sample
- ☒ 3" O.D. Shelby Sample
- No Sample Recovery
- ATD At Time of Drilling
- ▽ Water Level
- Observation Well
- Liquid Limit
- Plastic Limit
- PP Pocket Penetrometer (1sf)
- tv Torvane (1sf)

NOTE: Soil descriptions are interpretive and actual changes may be gradual.

Boring Log B-4

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)
BLOWS PER FOOT ▲

SOIL INTERPRETATION



HEL 8/6/03 773100008

LEGEND

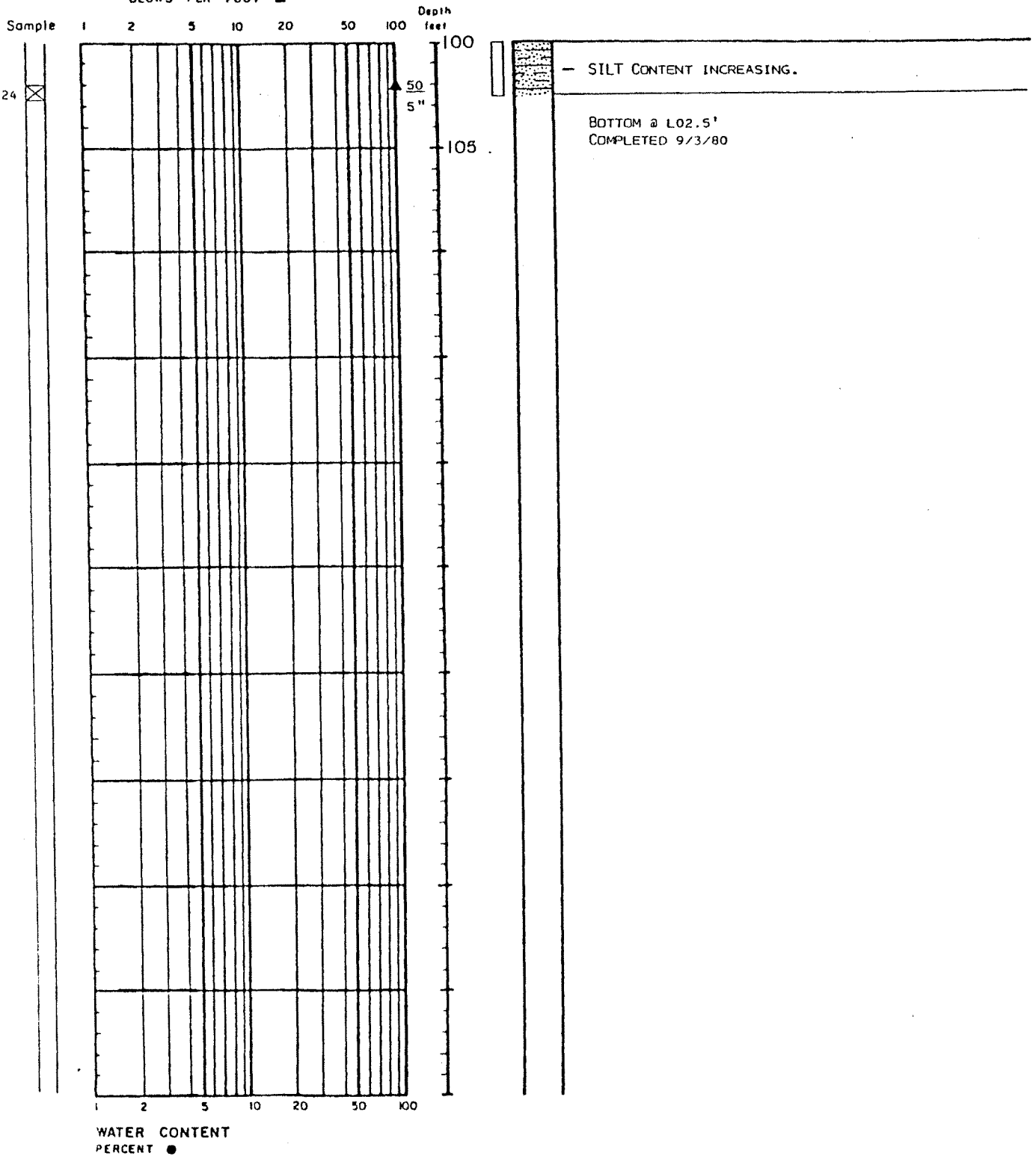
- ⊗ 2" O.D. Split Spoon Sample
- ⊠ 3" O.D. Shelby Sample
- No Sample Recovery
- ATD At Time of Drilling
- ▽ Water Level
- Observation Well
- Liquid Limit
- Plastic Limit
- PP Pocket Penetrometer (1sf)
- tv Torvane (1sf)

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Figure A-6 2/3

Boring Log B-4

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)
BLOWS PER FOOT ▲

SOIL INTERPRETATION



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LEGEND

- ⊗ 2" O.D. Split Spoon Sample
- ⊠ 3" O.D. Shelby Sample
- * No Sample Recovery

- ATD At Time of Drilling
- ▽ Water Level
- Observation Well

- Liquid Limit
- Plastic Limit
- PP Pocket Penetrometer (tsf)
- tv Torvane (tsf)

NOTE: Soil descriptions are interpretive and actual changes may be gradual.



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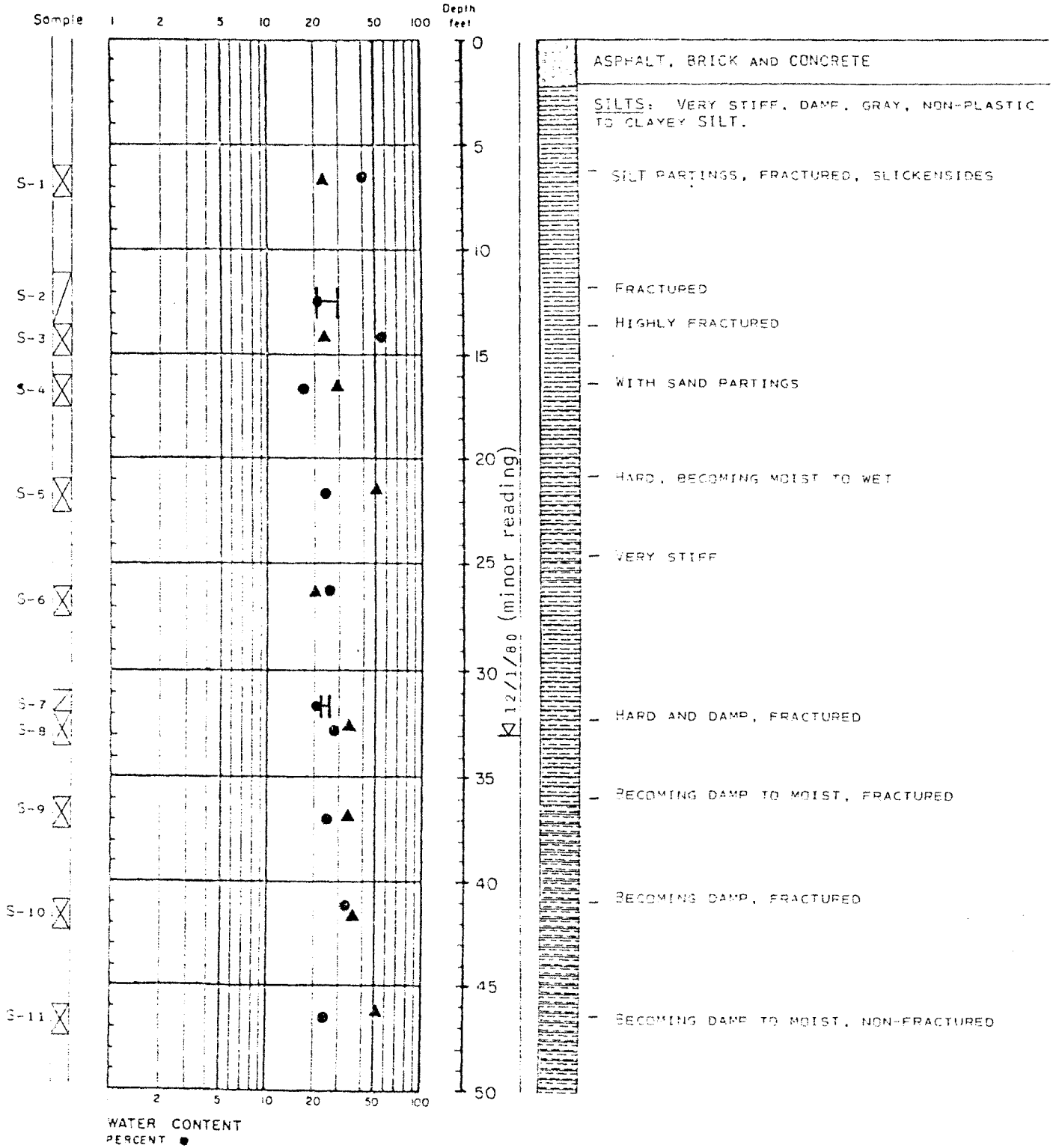
Figure A-6

3/3

Boring Log B-5

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)
BLOWS PER FOOT ▲

SOIL INTERPRETATION



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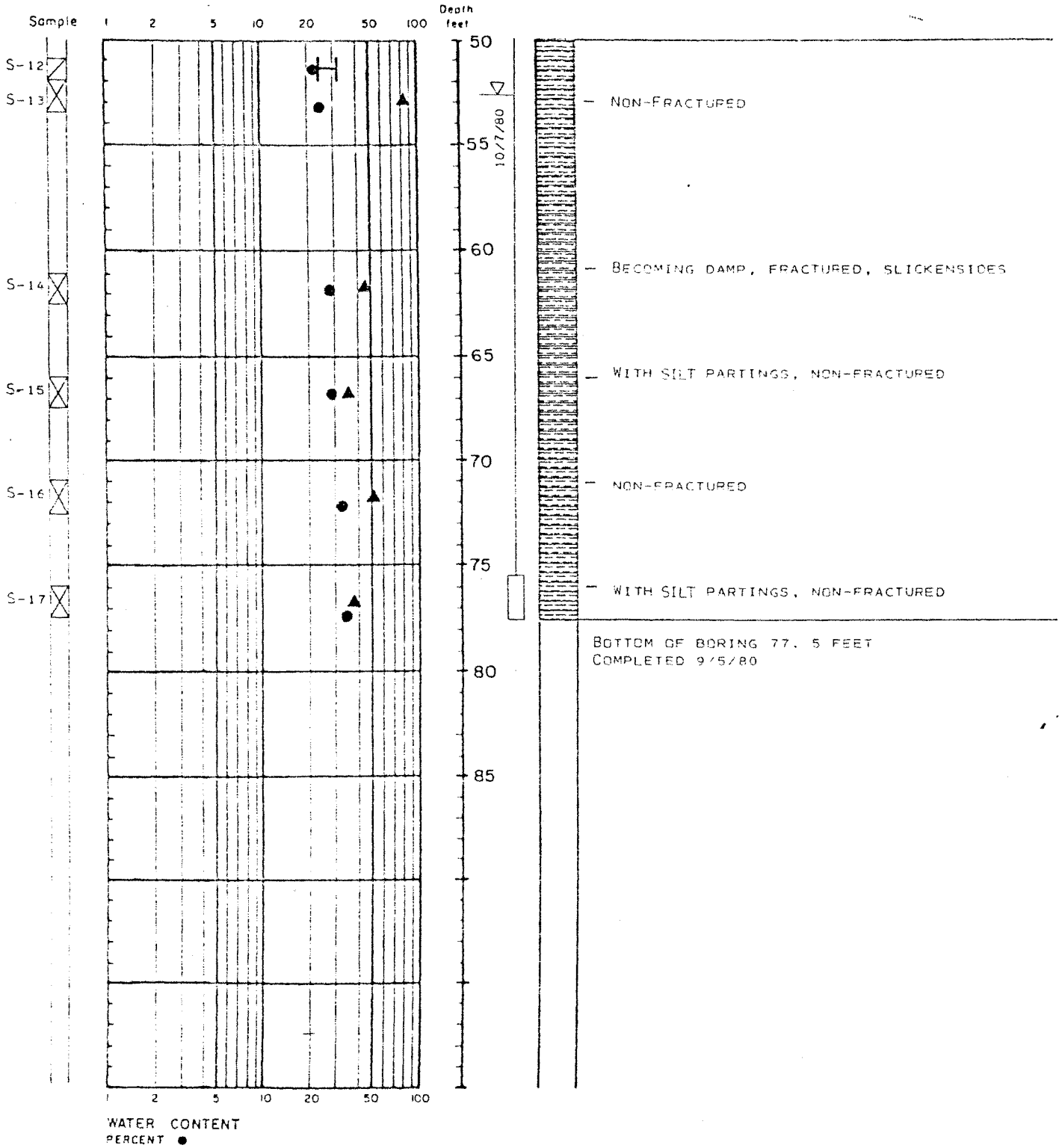
LEGEND

- 2" O.D. Split Spoon Sample
- 3" O.D. Shelby Sample
- No Sample Recovery
- ATD At Time of Drilling
- Water Level
- Observation Well
- Liquid Limit
- Plastic Limit
- PP Pocket Penetrometer (1sf)
- Tv Torvane (1sf)

NOTE: Soil descriptions are interpretive and actual changes may be gradual.

Boring Log B-5

SOIL INTERPRETATION



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LEGEND

- ⊗ 2" O.D. Split Spoon Sample
- ⊠ 3" O.D. Shelby Sample
- No Sample Recovery
- ATD At Time of Drilling
- ▽ Water Level
- Observation Well
- Liquid Limit
- Plastic Limit
- pp Pocket Penetrometer (tsf)
- tv Torvane (tsf)

NOTE: Soil descriptions are interpretive and actual changes may be gradual.



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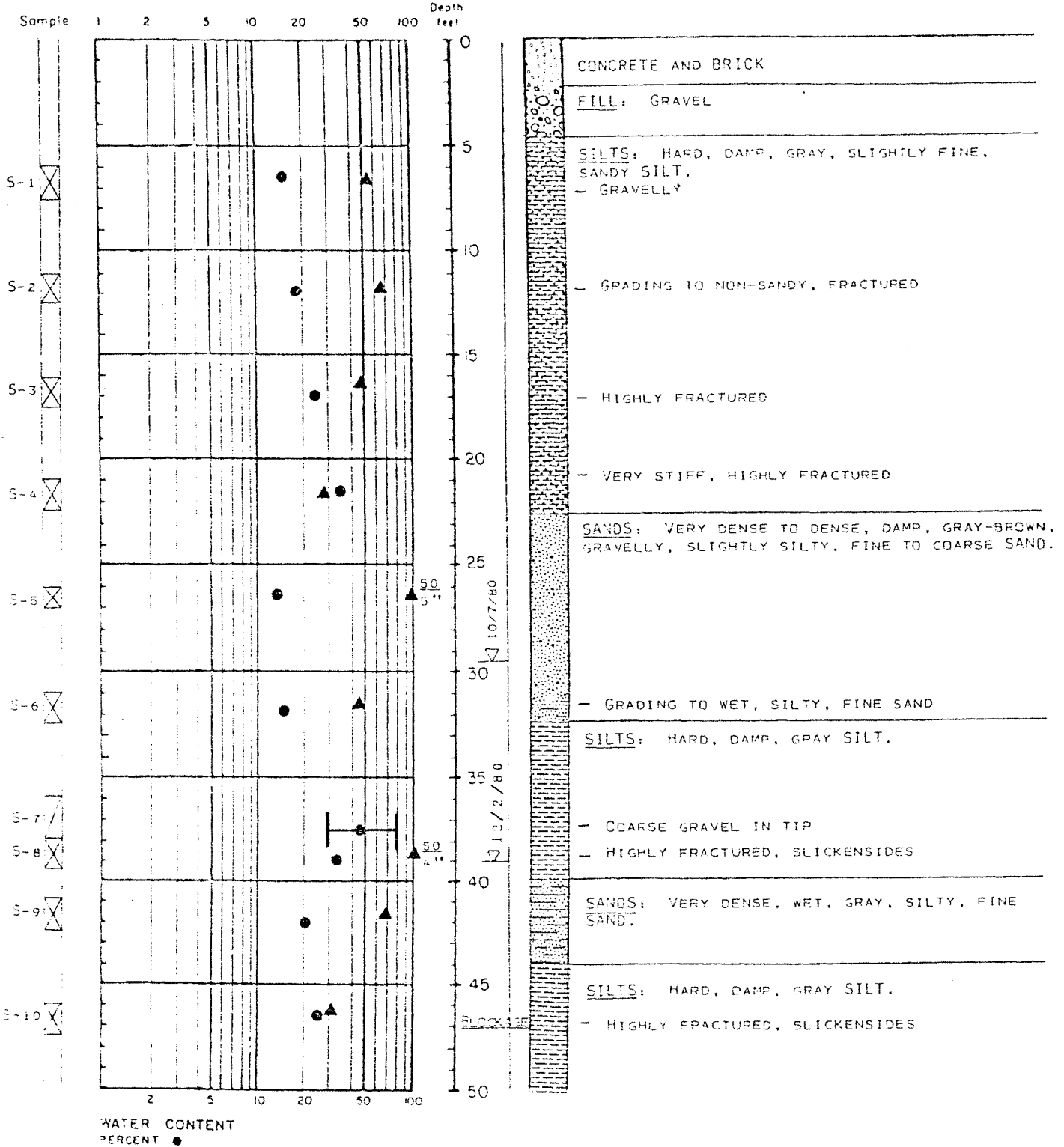
Figure A-7

2/2

Boring Log B-6

STANDARD PENETRATION RESISTANCE
 (140 pound weight, 30 inch drop)
 BLOWS PER FOOT ▲

SOIL INTERPRETATION



HEL 8/6/03 773100010

LEGEND

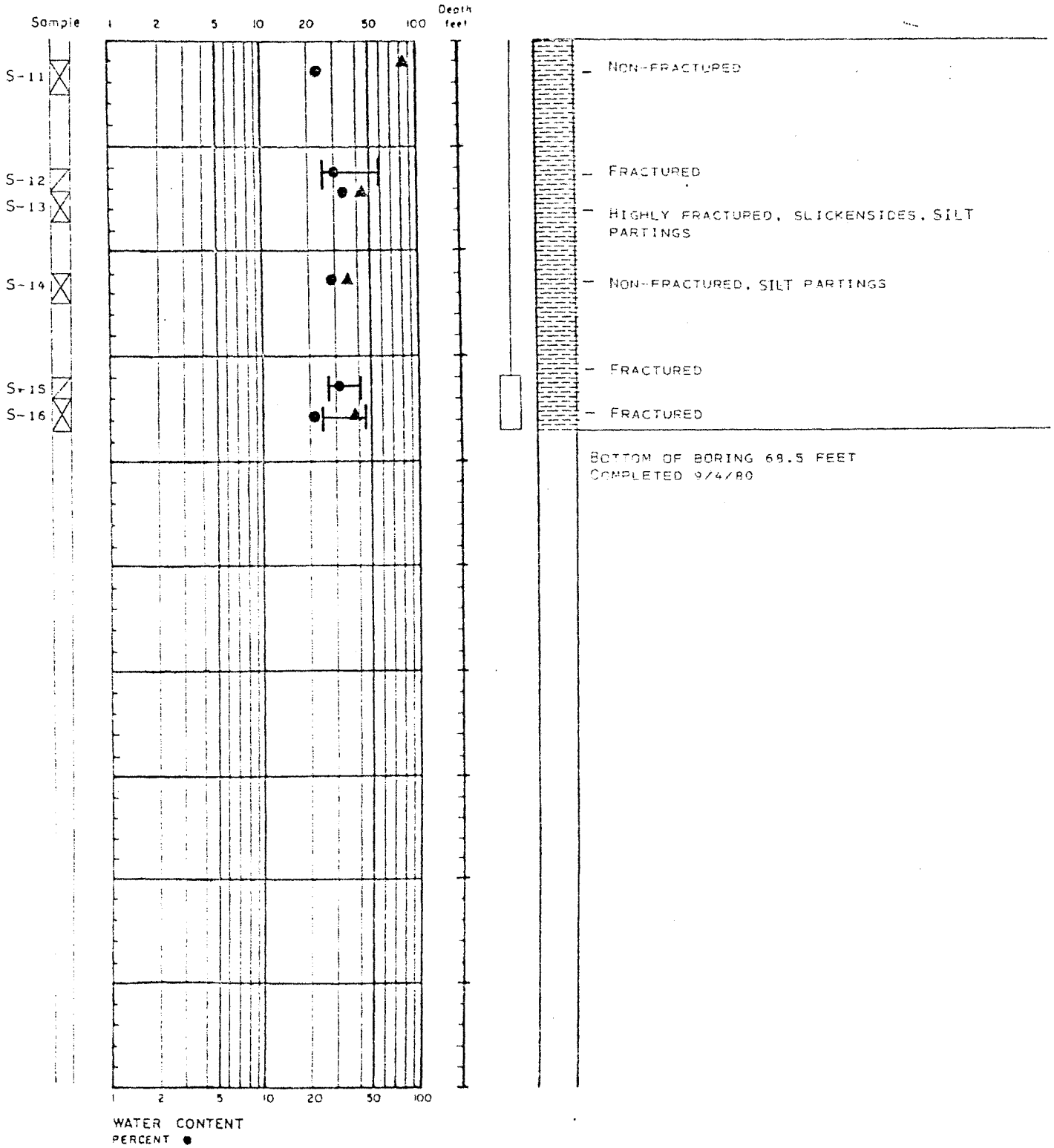
- ☒ 2" O.D. Split Spoon Sample
- ☒ 3" O.D. Shelby Sample
- No Sample Recovery
- ATD At Time of Drilling
- ▽ Water Level
- Observation Well
- Liquid Limit
- Plastic Limit
- PP Pocket Penetrometer (tsf)
- tv Torvane (tsf)

NOTE: Soil descriptions are interpretative and actual changes may be gradual.



Boring Log B-6

SOIL INTERPRETATION



HEL 8/6/03 773100010



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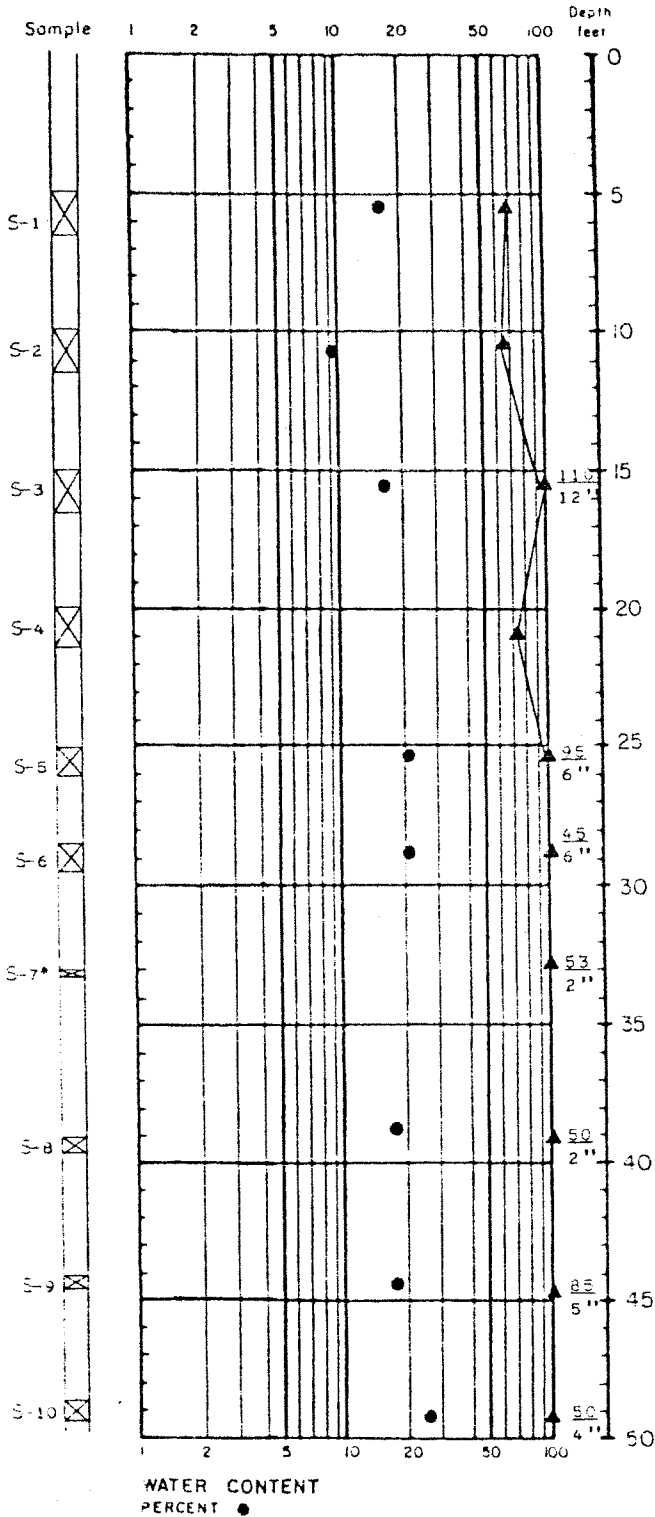
Figure A-8

2/2

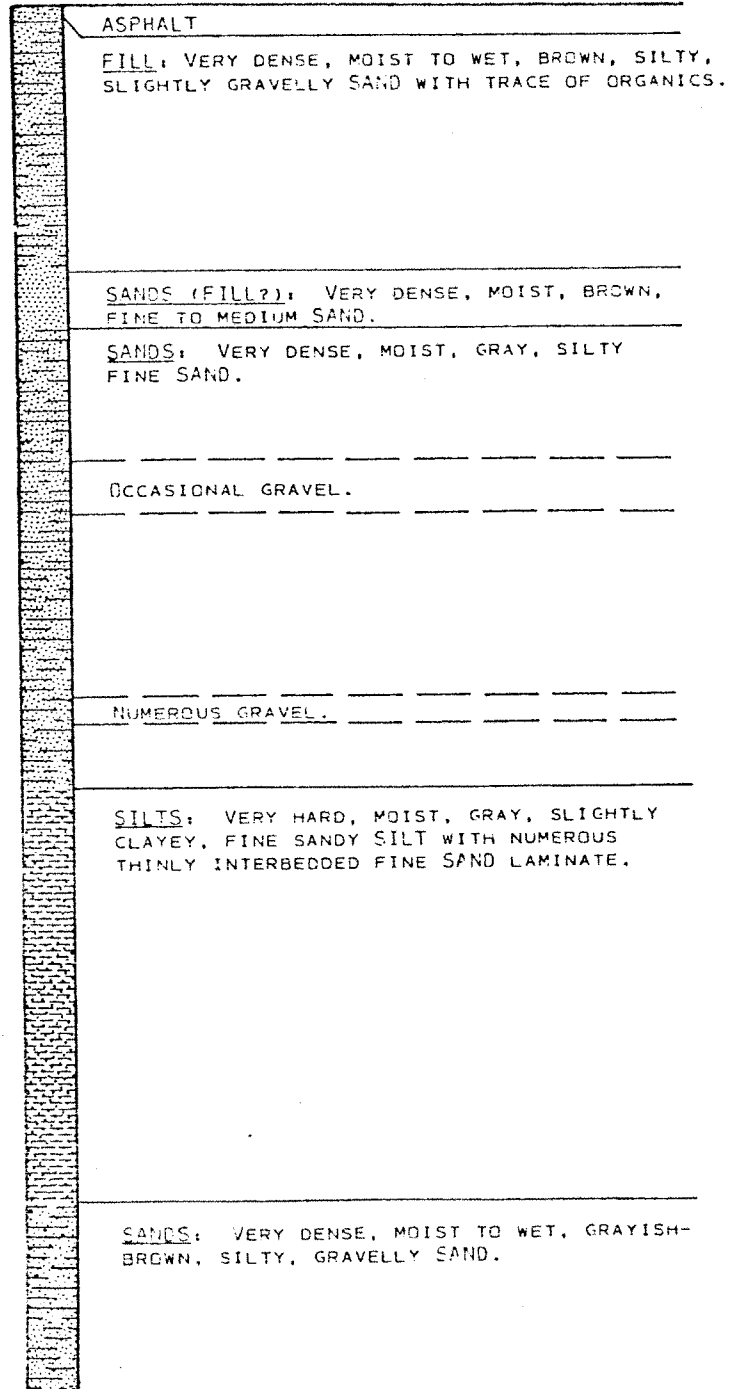
Boring Log B-7

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)
BLOWS PER FOOT ▲

SOIL INTERPRETATION



GROUND SURFACE ELEVATION APPROXIMATELY 73 FEET.



HEL 8/6/03 773100011

LEGEND

- ☒ 2" O.D. Split Spoon Sample
- ☒ 3" O.D. Shelby Sample
- No Sample Recovery
- ATD At Time of Drilling
- ▽ Water Level
- Observation Well
- Liquid Limit
- Plastic Limit
- pp Pocket Penetrometer (tsf)
- tv Torvane (tsf)

NOTE: Soil descriptions are interpretive and actual changes may be gradual.



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Figure A-9

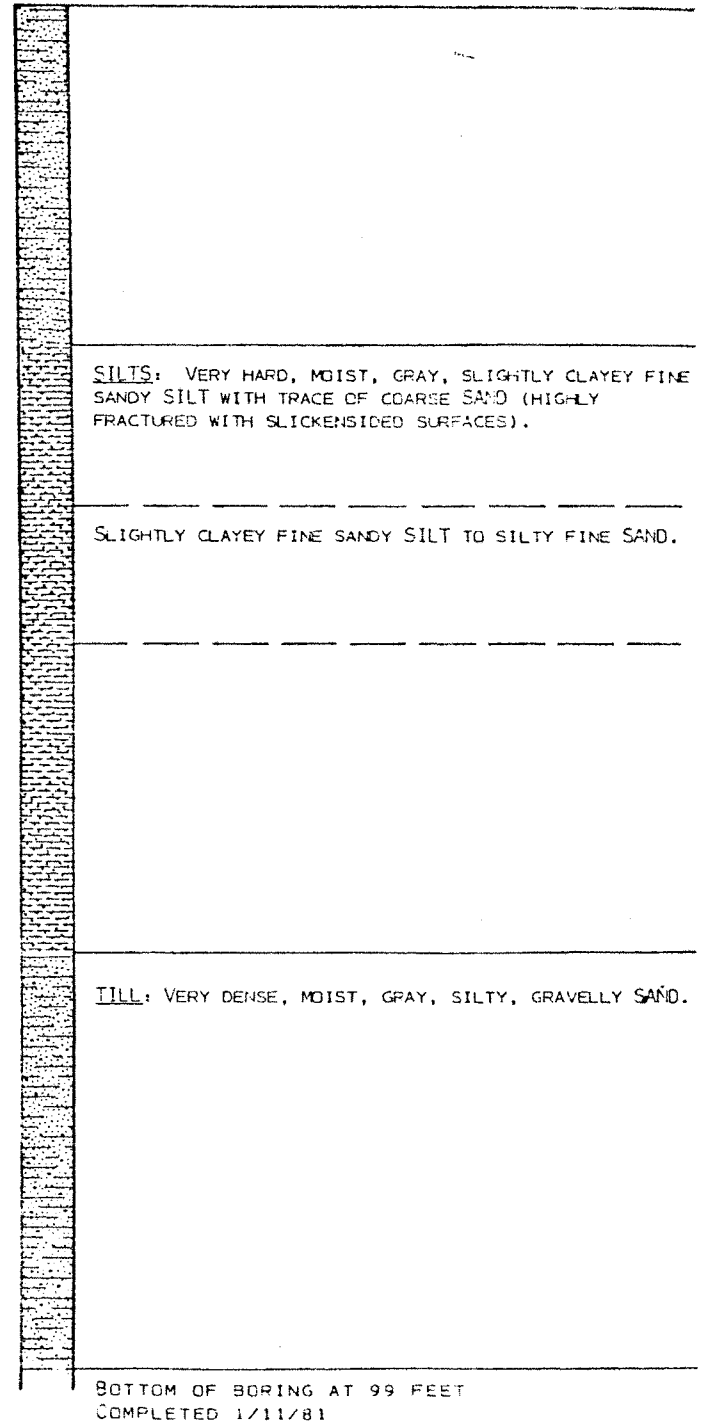
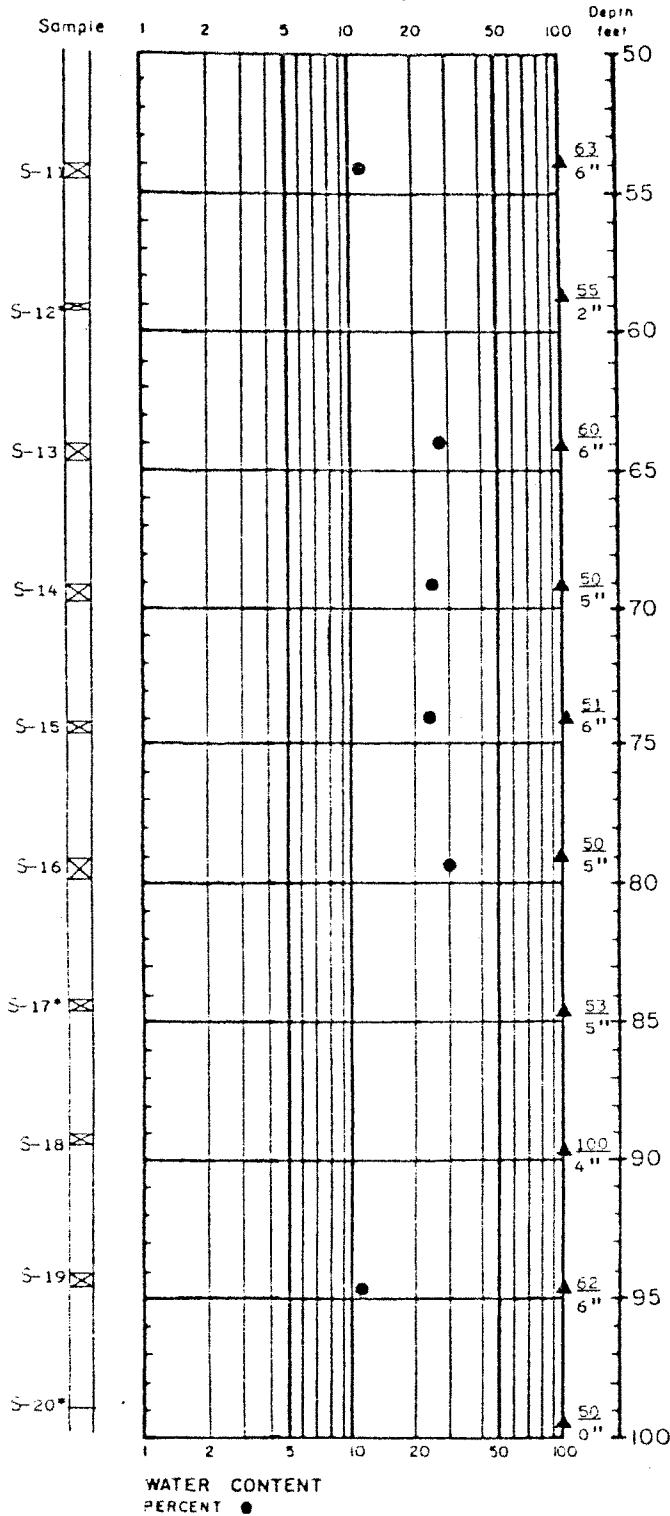
8/03

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Boring Log B-7

STANDARD PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)
BLOWS PER FOOT ▲

SOIL INTERPRETATION



HEL 8/6/03 773100011

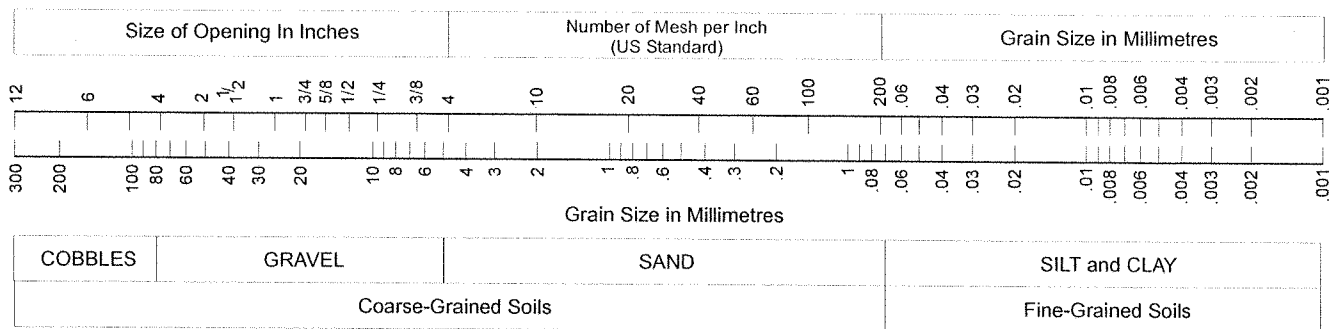
LEGEND

- ☒ 2" O.D. Split Spoon Sample
- ☐ 3" O.D. Shelby Sample
- * No Sample Recovery
- ATD At Time of Drilling
- ▽ Water Level
- Observation Well
- Liquid Limit
- Plastic Limit
- PP Pocket Penetrometer (1sf)
- tv Torvane (1sf)

NOTE: Soil descriptions are interpretive and actual changes may be gradual.

Unified Soil Classification (USC) System

Soil Grain Size



Coarse-Grained Soils

G W	G P	G M	G C	S W	S P	S M	S C
Clean GRAVEL <5% fines		GRAVEL with >12% fines		Clean SAND <5% fines		SAND with >12% fines	
GRAVEL >50% coarse fraction larger than No. 4				SAND >50% coarse fraction smaller than No. 4			
Coarse-Grained Soils >50% larger than No. 200 sieve							

$$G W \text{ and } S W \left(\frac{D_{60}}{D_{10}} \right) > 4 \text{ for } G W \quad \& \quad 1 \leq \left(\frac{D_{30}}{D_{10} \times D_{60}} \right)^2 \leq 3$$

G P and S P Clean GRAVEL or SAND not meeting requirements for G W and S W

G M and S M Atterberg limits below A line with PI < 4

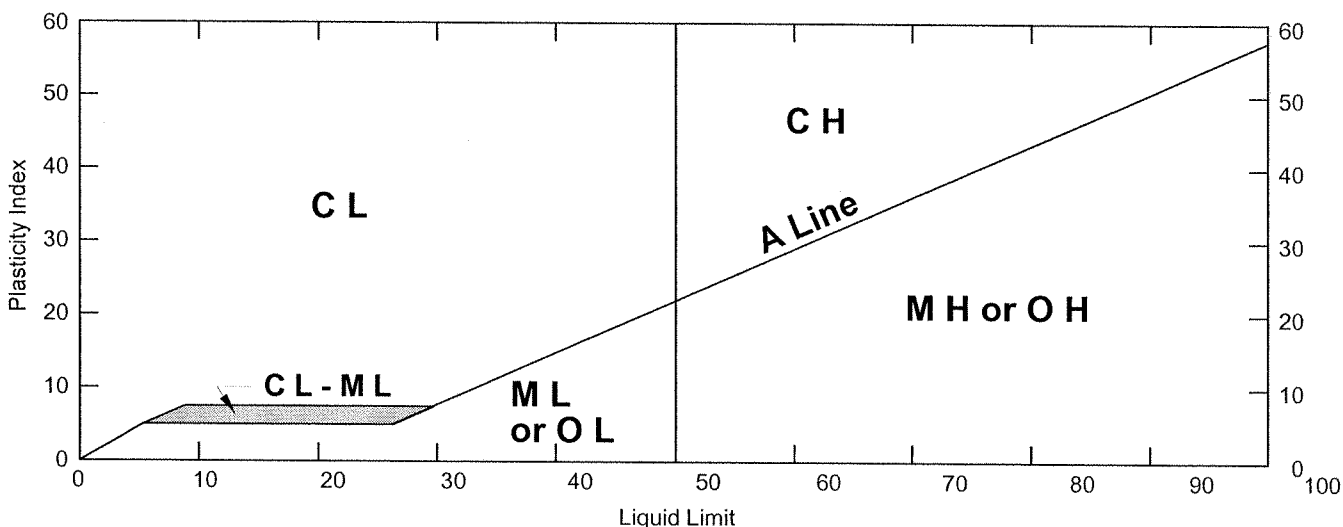
G C and S C Atterberg limits above A Line with PI > 7

* Coarse-grained soils with percentage of fines between 5 and 12 are considered borderline cases requiring use of dual symbols.

D₁₀, D₃₀, and D₆₀ are the particles diameter of which 10, 30, and 60 percent, respectively, of the soil weight are finer.

Fine-Grained Soils

ML	CL	OL	MH	CH	OH	Pt
SILT		CLAY		Organic		Highly Organic Soils
Soils with Liquid Limit <50%			Soils with Liquid Limit >50%			
Fine-Grained Soils >50% smaller than No. 200 sieve						



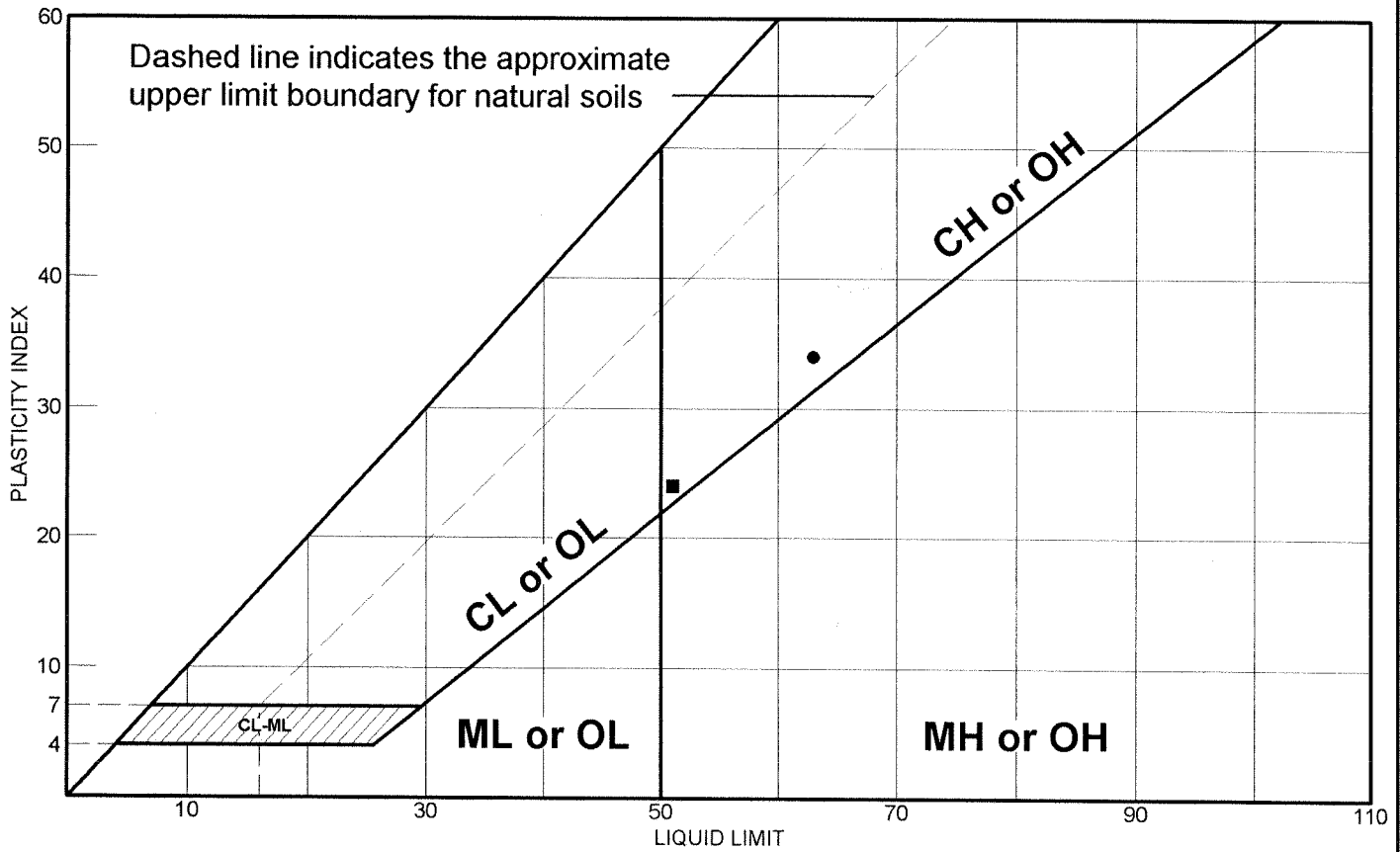
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Figure B-1

LIQUID AND PLASTIC LIMITS TEST REPORT



Location + Description		LL	PL	PI	-200	USCS
● Source: HC-1	Sample No.: S-11					
Fat CLAY		63	29	34		CH
■ Source: HC-1	Sample No.: S-15					
Fat CLAY		51	27	24		CH

Remarks:

●

■

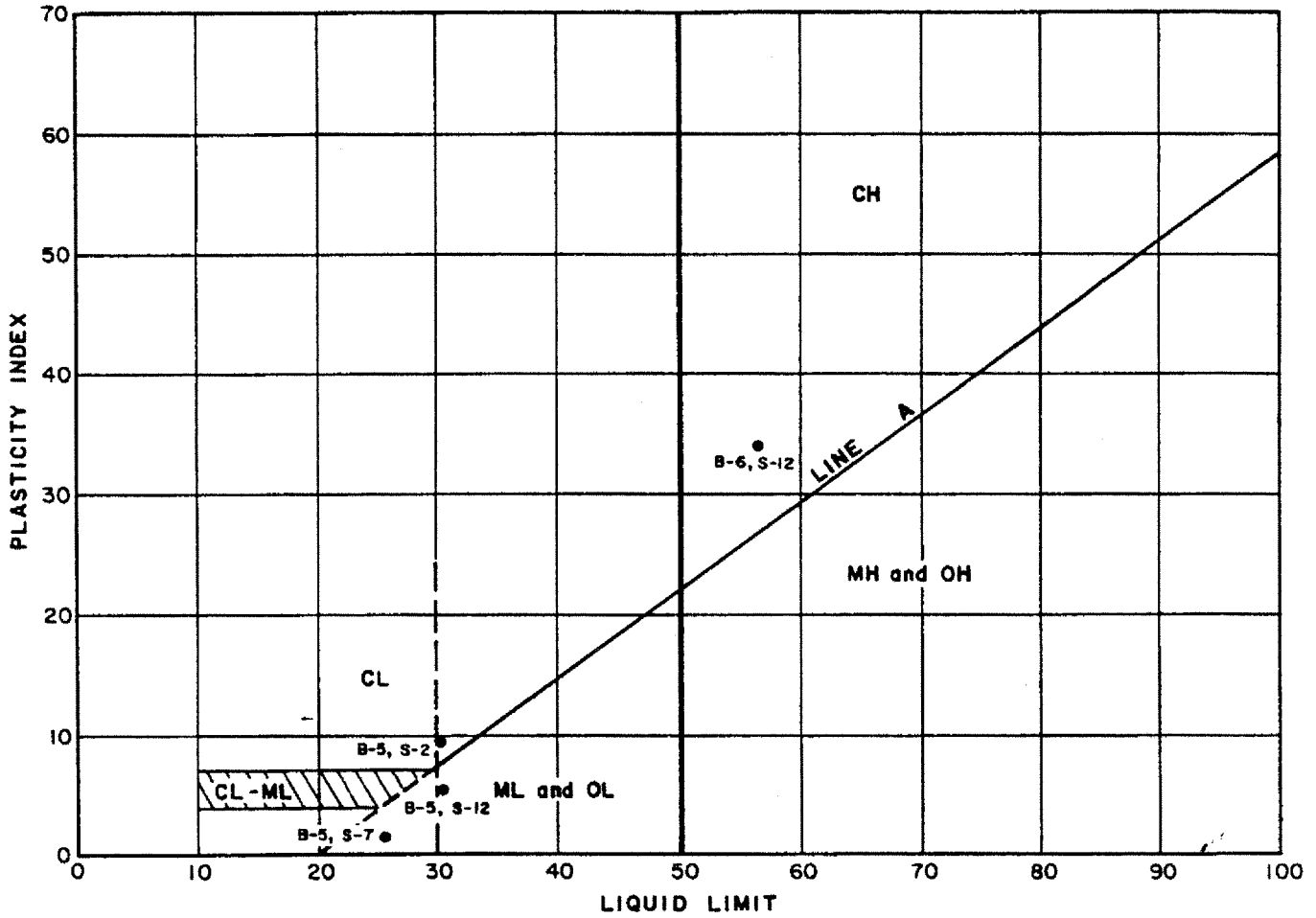
Project: Washington Mutual Office Building Development - Tasks 1 & 2

Client: Pine Street Group LLC

Location: Seattle, WA



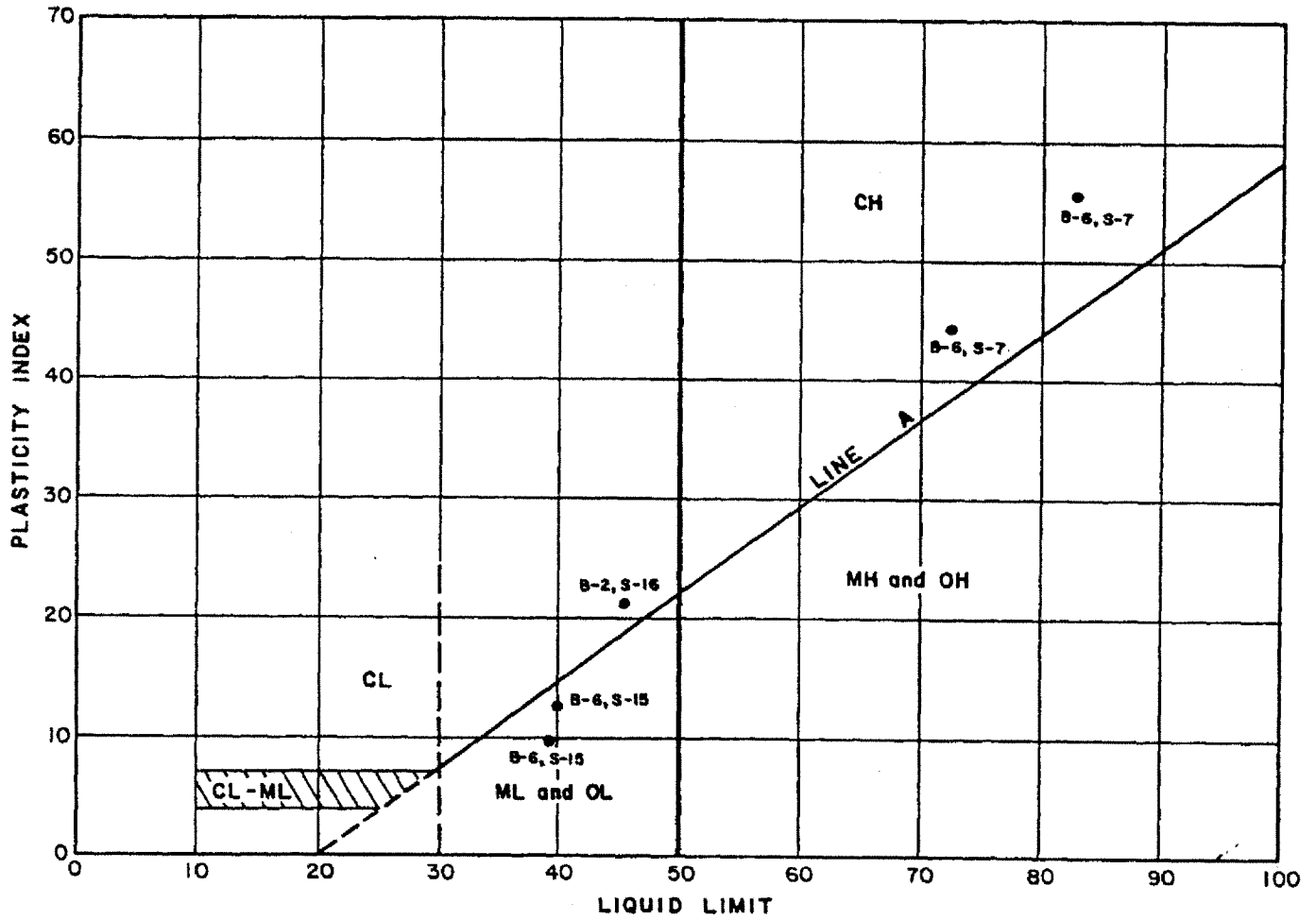
Plasticity Chart



Boring	Sample	Depth	W.C.	L.L.	PL.	PI.	Classification	U.S.C.
B-5	S-2	12.0		30	21	9	SILTY CLAY.	CL
B-5	S-7	31.4- 31.7	23	26	24	2	SILT.	ML
B-5	S-12	51.1- 51.4	26	31	25	5	CLAYEY SILT.	ML
B-6	S-12	56.6- 56.8	34	57	24	33	SILTY CLAY.	CH



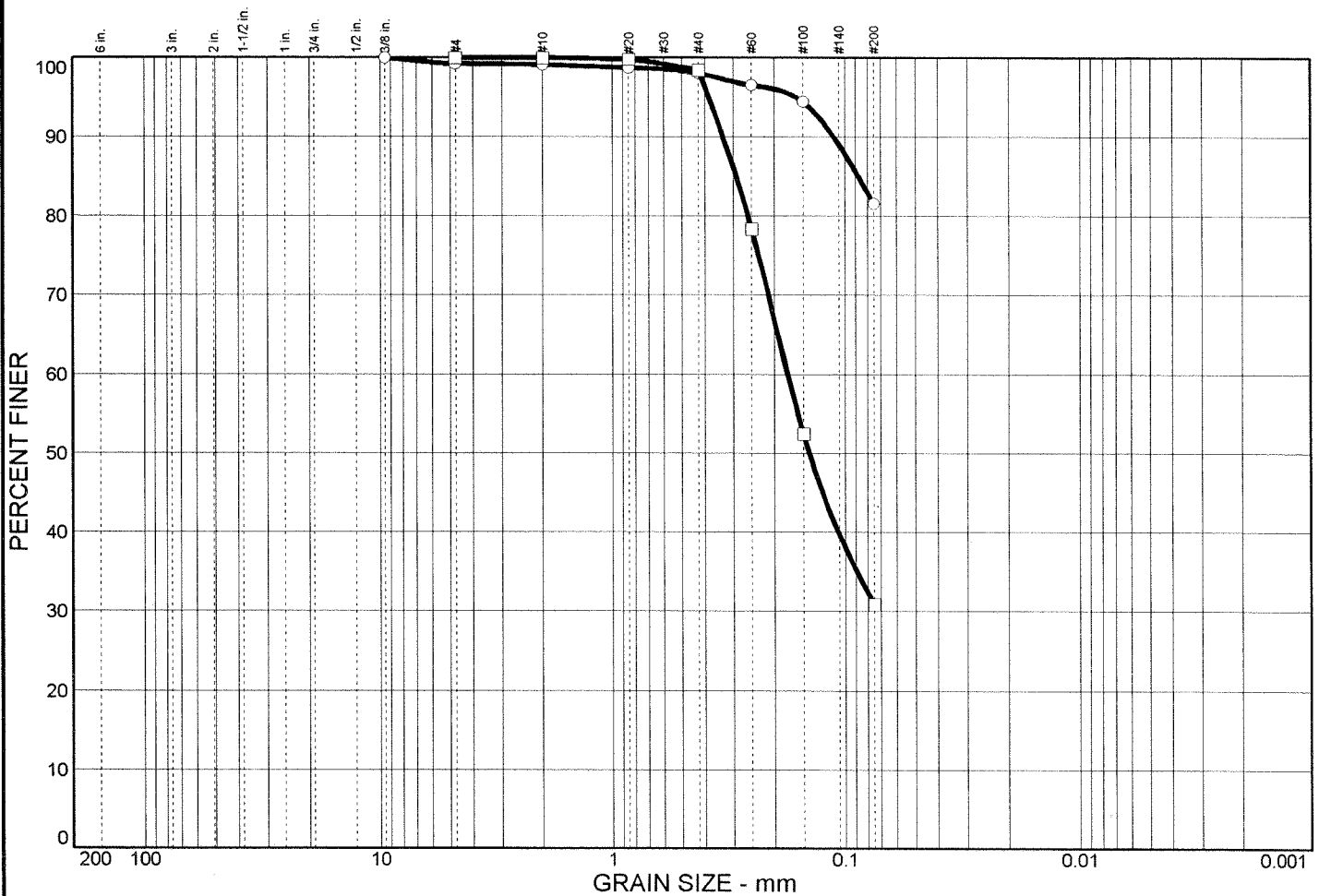
Plasticity Chart



Boring	Sample	Depth	W.C.	L.L.	PL.	PI.	Classification	U.S.C.
B-6	S-15	66.0- 66.7	31	40	27	13	CLAYEY SILT.	ML
B-6	S-7	37.0- 38.0	34	83	28	55	CLAY.	CH
B-6	S-15	66.0- 67.0	31	39	29	10	SILT.	ML
B-6	S-16	77.5- 78.0		46	25	21	VERY SILTY CLAY	CL



Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	0.8	0.1	1.1	16.5	81.5	
□	0.0	0.0	0.0	1.6	67.6	30.8	

LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
○		0.0875							
□		0.292	0.175	0.142					

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Sandy SILT	ML	20%
□ Very silty, fine SAND	SM	16%

Remarks:

○

□

Project: Washington Mutual Office Building Development - Tasks 1 & 2

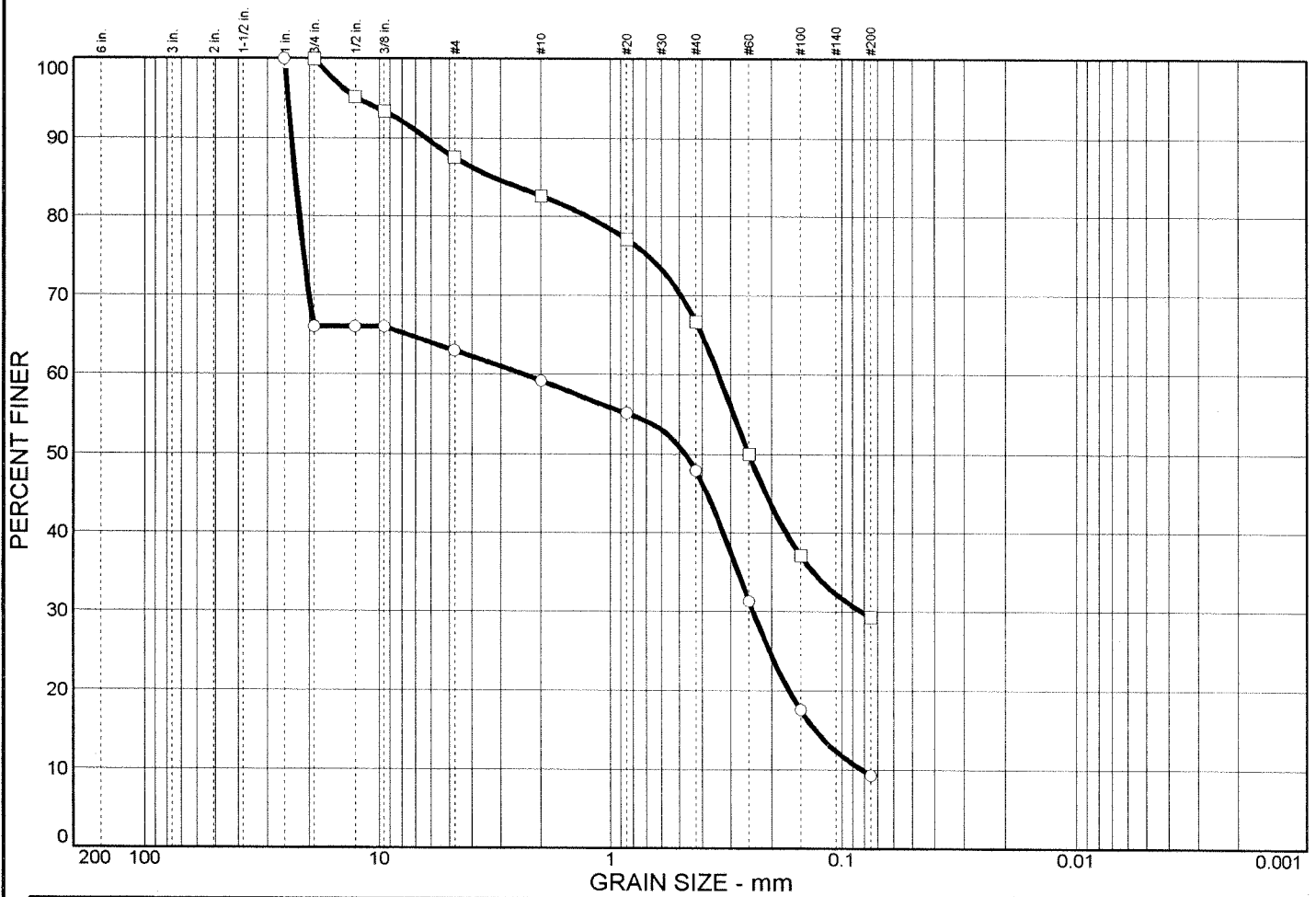
Client: Pine Street Group LLC

○ **Source:** HC-1 **Sample No.:** S-1

□ **Source:** HC-1 **Sample No.:** S-3



Particle Size Distribution Report



% COBBLES	% GRAVEL		% SAND			% FINES	
	CRS.	FINE	CRS.	MEDIUM	FINE	SILT	CLAY
○	0.0	34.0	3.8	11.3	38.6	9.3	
□	0.0	0.0	4.9	15.9	37.4	29.3	

LL	PI	D85	D60	D50	D30	D15	D10	C _c	C _u
○		22.8	2.38	0.471	0.240	0.130	0.0819	0.30	29.04
□		3.25	0.339	0.250	0.0820				

MATERIAL DESCRIPTION	USCS	NAT. MOIST.
○ Slightly silty, very gravelly, medium to fine SAND	SP-SM	13%
□ Gravelly, silty, medium to fine SAND	SM	11%

Remarks:

- Small sample size
-

Project: Washington Mutual Office Building Development - Tasks 1 & 2

Client: Pine Street Group LLC

○ **Source:** HC-1

Sample No.: S-7

□ **Source:** HC-1

Sample No.: S-18



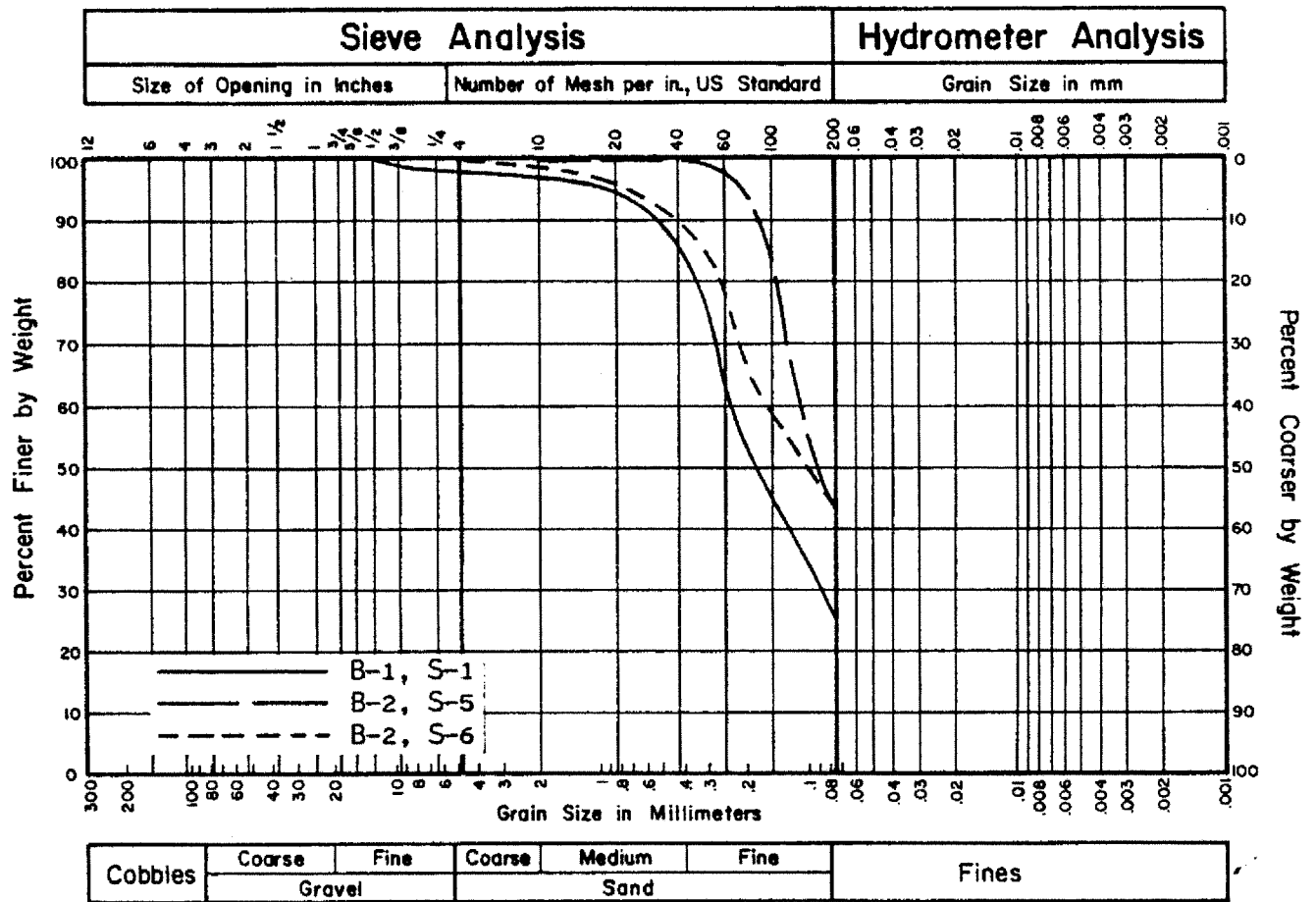
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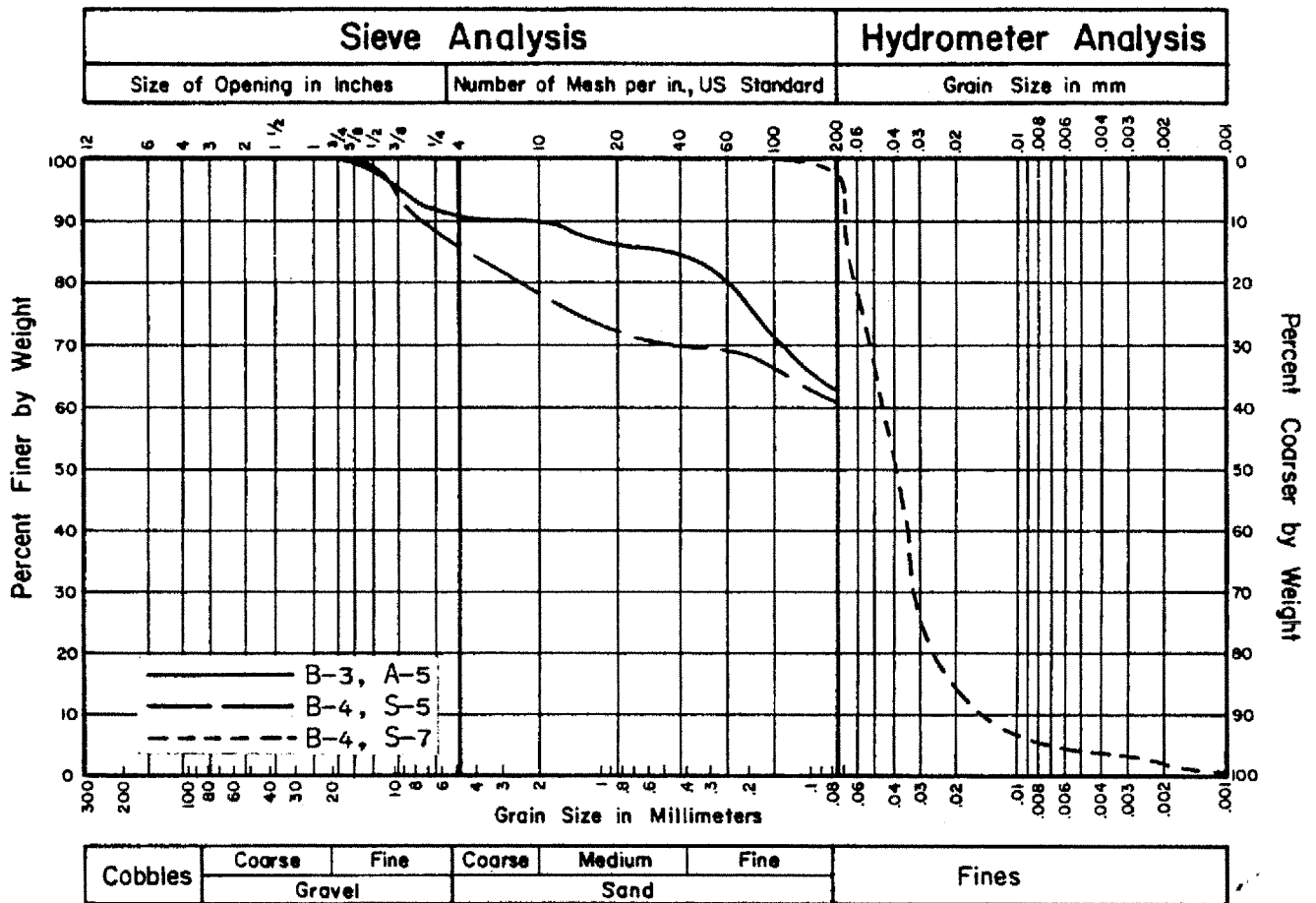
Figure No. B-6

Grain Size Classification



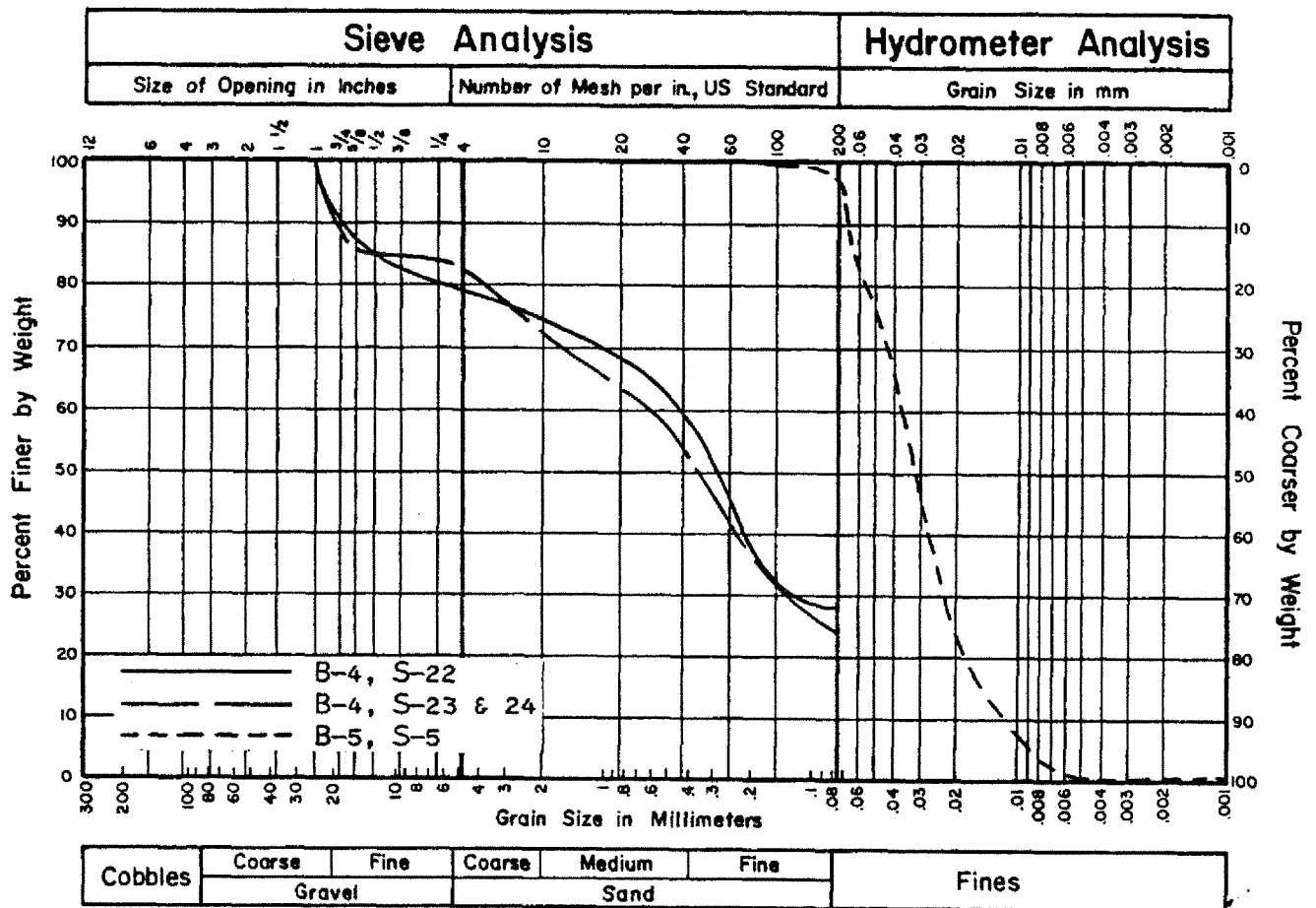
Sample	Depth-ft	U.S.C.	Classification	Nat. W.C. %	Atterberg Limits		
					LL	PL	PI
B-1 S-1	5.0- 5.6	SM	VERY SILTY FINE SAND.	14.6			
B-2 S-5	22.5- 24.0	SM	VERY SILTY FINE SAND.	8.4			
B-2 S-6	27.5- 28.0	SM	VERY SILTY FINE SAND.	18.4			

Grain Size Classification



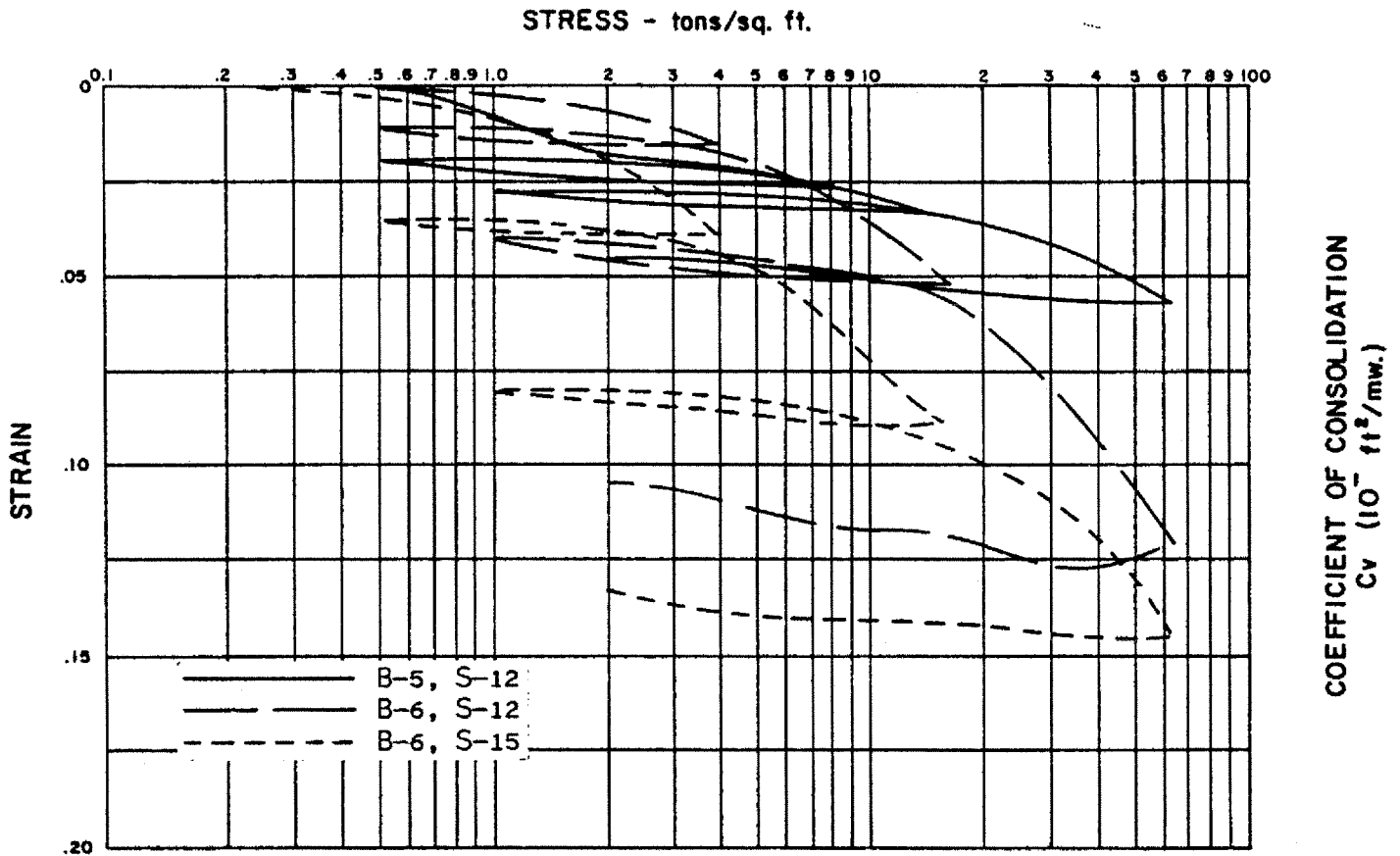
Sample	Depth-ft	U.S.C.	Classification	Nat. W.C. %	Atterberg Limits		
					LL	PL	PI
B-3	22.0-	ML	SLIGHTLY GRAVELLY, FINE, VERY SANDY SILT.	14.0			
S-5	24.5						
B-4	22.5-	ML	GRAVELLY, VERY SANDY SILT.	14.1			
S-5	23.5						
B-4	33.0-	ML	SILT.	25.6			
S-7	34.0						

Grain Size Classification



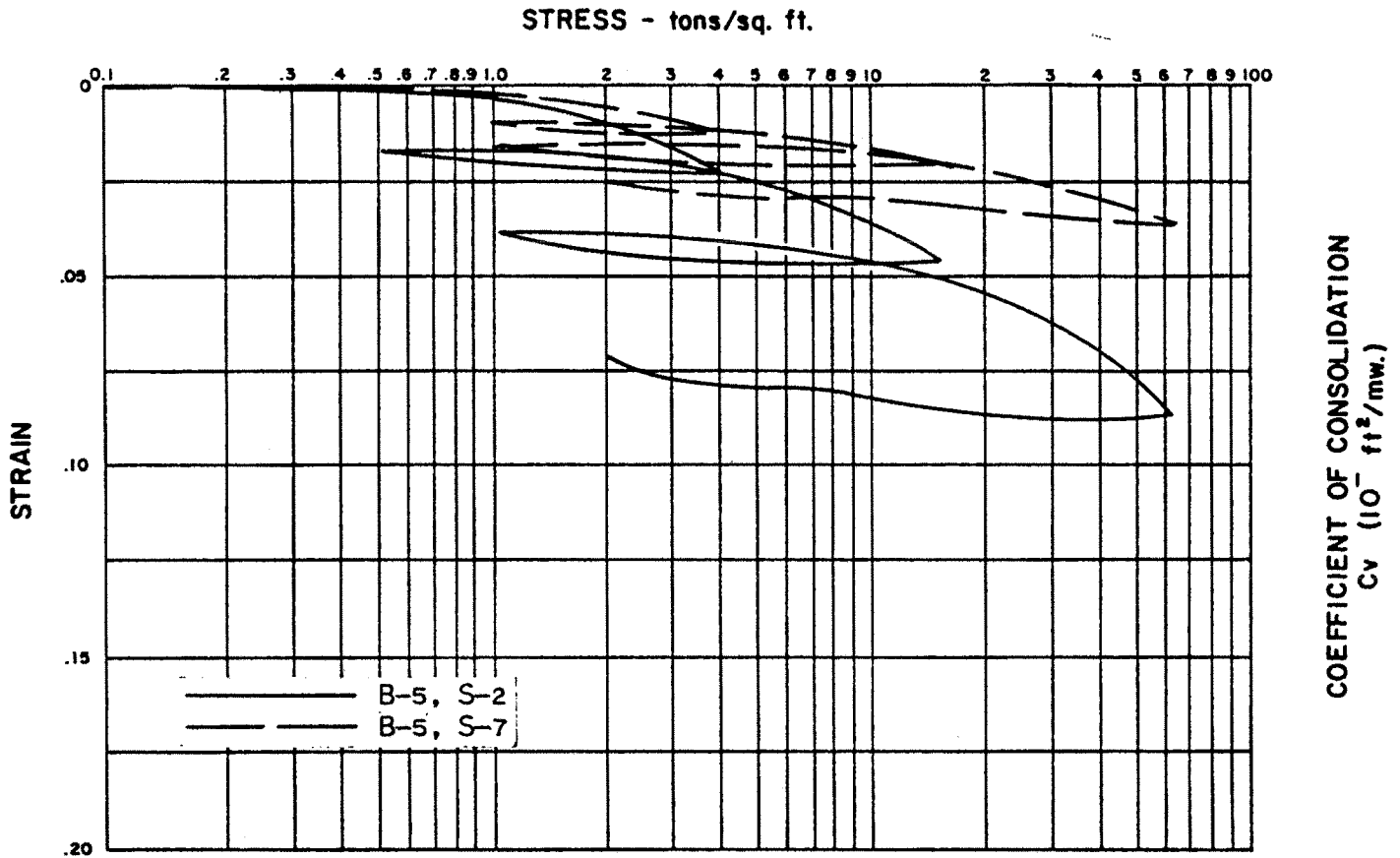
Sample	Depth-ft	U.S.C.	Classification	Nat. W.C. %	Atterberg Limits		
					LL	PL	PI
B-4 S-22	93.0- 93.5	SM	GRAVELLY, VERY SILTY, MEDIUM TO FINE SAND.	9.1			
B-4 S-23 & 24 (COMBINED)	98.0- 98.3	SM	GRAVELLY, VERY SILTY, MEDIUM TO FINE SAND.	12.3			
B-5 S-5	21.0- 22.5	ML	SILT.	22.4			

Consolidation Test Results



SAMPLE	DEPTH feet	% WATER CONTENT		ATTERBERG LIMITS			CLASSIFICATION	WET UNIT WEIGHT
		Before	After	LL	PL	PI		
B-5 S-12	51.0- 52.0	26	26	31	25	6	CLAYEY SILT.	
B-6 S-12	56.6- 56.8	34	34	57	24	33	SILTY CLAY.	114 PCF
B-6 S-15	66.0- 67.0	31		39	29	10	SILT.	

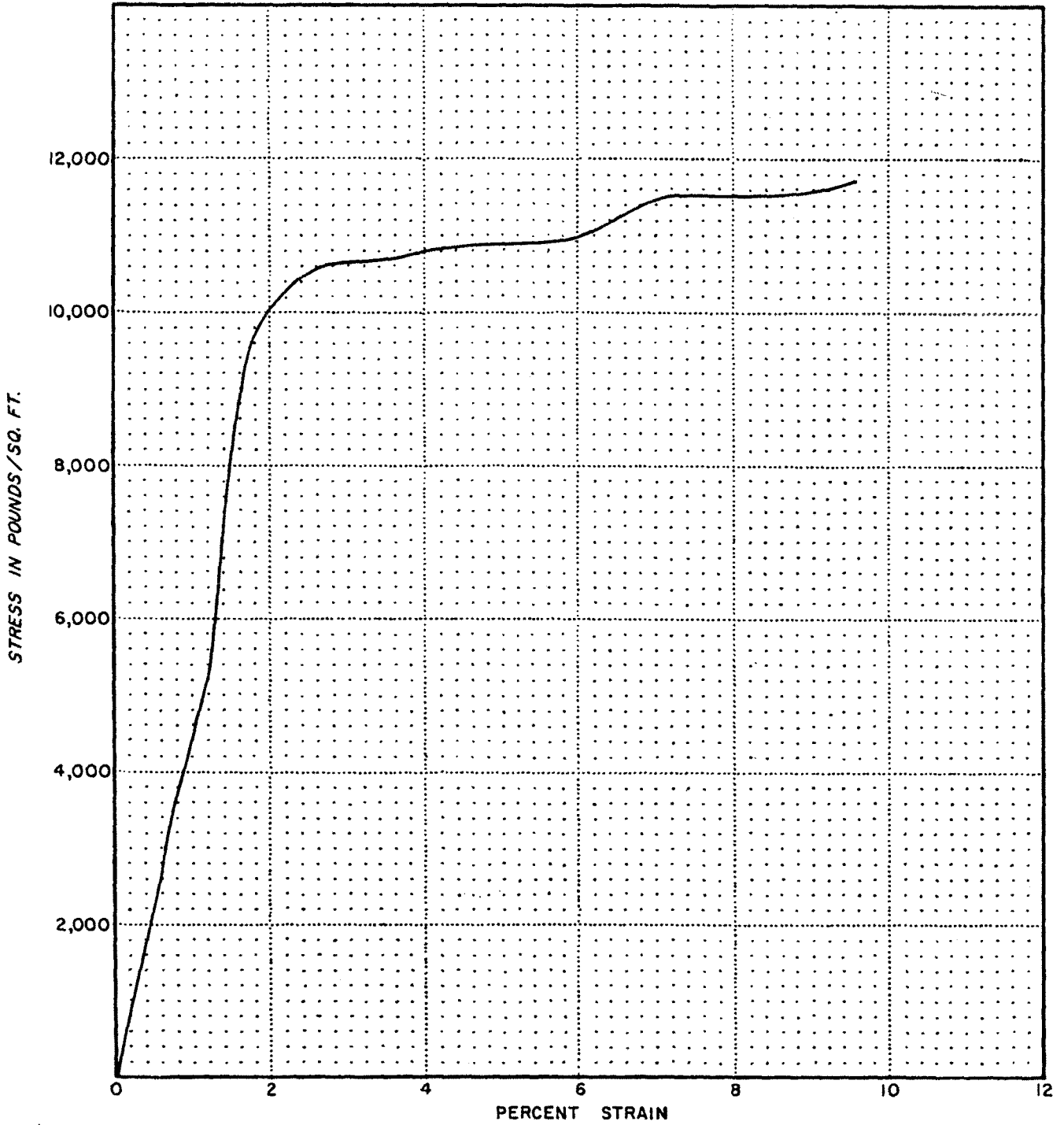
Consolidation Test Results



SAMPLE	DEPTH feet	% WATER CONTENT		ATTERBERG LIMITS			CLASSIFICATION	WET UNIT WEIGHT
		Before	After	LL	PL	PI		
B-5 S-2	12.2- 12.5	25.3	25.6	30	21	9	SILTY CLAY.	121.3
B-5 S-7	31.0- 32.0	23.2	23.1	26	24	1		

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Unconsolidated Undrained Test



SAMPLE CLASSIFICATION

TEST NO.	2
BORING NO.	B-6
SAMPLE NO.	S-12
DEPTH.	56.0-57.0
HEIGHT, INCHES	5.433
DIAMETER, INCHES	2.863
WET WEIGHT	1146.2
WET UNIT WEIGHT, PCF.	85.5
W.C. %, BEFORE TEST	32.5

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