Attachment 2
Geotechnical Engineering Report

HWA GeoSciences Inc.
Geotechnical & Pavement Engineering • Hydrogeology • Geoenvironmental • Inspection & Testing

December 21, 2022
HWA Project No. 2014-177-21

ESA
5309 Shilshole Avenue NW, Suite 200
Seattle, Washington 98107

Attention: Ms. Lisa Adolfson

Subject: **FINAL GEOTECHNICAL ENGINEERING REPORT**
Cheasty Greenspace Mountain Bike Trail
City of Seattle Parks and Recreation
Seattle, Washington

Dear Lisa,

In accordance with your request, HWA GeoSciences Inc. (HWA) has completed a geotechnical engineering investigation for the proposed Cheasty Greenspace Mountain Bike Trail in Seattle, Washington. The purpose of our investigation was to evaluate the general geologic conditions and provide geotechnical recommendations for design and construction of the proposed trail facilities. Our work included geologic field reconnaissance; review of available geologic literature and geotechnical reports, aerial photos, Lidar imagery, and topographic maps; completion of shallow subsurface explorations; geotechnical engineering analyses; and preparation of this letter report. Deep borings, wells, and inclinometers were not included in the scope of work, as the trails and the loads imposed by users are insignificant such that that level of investigation is not merited. Deep borings were not considered necessary to understand slope stratigraphy, as the available existing geotechnical information in the vicinity largely confirms the geologic conditions shown on the geologic map of the site. Revisions to the proposed trail alignments were made by ESA in response to recommendations of our draft report dated July 9, 2018. These revisions were incorporated in our July 25, 2018, draft report. The report was finalized on January 2nd, 2019. This report is a revision to the January 2nd, 2019, report, that accounts for the most recent trail alignment.

PROJECT UNDERSTANDING

The Seattle Department of Parks and Recreation is implementing a pilot program that will construct two soft surface mountain bike trails within the existing Cheasty Greenspace. The Cheasty Greenspace currently consists of 28.5 acres of wooded slopes and multiple wetlands on the east side of Beacon Hill (see Vicinity Map, Figure 1). The approximate alignments of the proposed trails are indicated on the Site and Exploration Plans, Figures 2A and 2B. We understand that the proposed trail alignments will consist primarily of two loops, with connector trails to streets and walkways. The proposed trail alignments avoid wetland

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areas as well as areas of known shallow slope instability north of the Parks maintenance yard. The alignments have been changed from those evaluated in our preliminary geotechnical report (HWA, 2015).

GENERAL GEOLOGIC CONDITIONS

The Geologic Map of Seattle indicates the Cheasty Greenspace is underlain by the typical glacial sequence of the Vashon Stade of the Fraser Glaciation (Troost et al, 2005). During the Vashon Stade, from approximately 20,000 to 13,000 years ago, the Puget lobe of the Cordilleran continental ice sheet advanced south from western British Columbia, filling the Puget Sound lowland. The maximum thickness of ice at the latitude of Seattle was approximately 3,000 feet. During advance of the ice, the sedimentary environment of lakes distant from the ice front transitioned from non-glacial to glacial. The local glaciolacustrine deposits are known as the Lawton clay. As the ice approached, glacial flour (silt and clay) was deposited in areas of slack water. Next, advance outwash consisting mostly of clean sand with pebbles was deposited in broad fans by meltwater emanating from the glacier. As the advancing glacier overrode the advance outwash, a layer of lodgment till was deposited at the base of the ice. The till consists of an unsorted, non-stratified mixture of clay, silt, sand, gravel, and cobbles/boulders. Due to the weight of the ice, the underlying deposits (lodgment till, advance outwash, Lawton clay, and older non-glacial terrestrial deposits) were over-consolidated to a very dense or hard condition. During retreat of the glacier, meltwater deposited sand and gravel in streams, or fine-grained soils in slackwater, depending the on the flow velocity. These recessional outwash and recessional lacustrine deposits were not run over by the glacier and are therefore normally consolidated.

Post-glacial geomorphic processes have included mass-wasting of steep slopes, alluvial reworking of sediments, and formation of wetlands in poorly drained areas.

The geologic map indicates the steep hillslopes of the site and vicinity have a core consisting of Lawton clay at the base (including approximately the lower half of the greenspace), with advance outwash above, and capped by till at the very top of the slope. Recessional outwash is mapped in the valley east of the greenspace, with New Rainier Vista largely built upon these deposits. Also, recessional lacustrine deposits are mapped below the north end of the greenspace. Mass wasting deposits were mapped across the entire slope from the southern end of the greenspace to the Parks maintenance yard, and landslide deposits were mapped from that area northward to beyond the north end of the greenspace, including the neighborhood between the Jackson Park golf course and Cheasty Blvd. These deposits consist of colluvium, landslide deposits, and alluvium from small hillside streams.

GEOLOGICALLY HAZARDOUS AREAS

The greenspace has numerous environmentally critical areas, as defined by Seattle Municipal Code 25.09.012. These are shown on the Site and Exploration Plans, Figures 2A and 2B. Potential landslide areas and steep slope areas have been mapped by the city, as documented on

the City Department of Construction and Inspections (DCI) GIS web site (Seattle DCI, 2018). Geologically hazardous areas on the site are described below. Wetlands are present in the large drainage swale dividing the site, and a smaller drainage that results from ground water seepage emanating from the slope (at handholes HH-5 and HH-6). Four smaller wetlands are present at scattered locations toward the toe of the overall slope, as shown on Figures 2A and 2B. Specifics associated with wetland critical areas are discussed in other reports.

Steep Slope Hazard Areas

As defined by Seattle DCI, "A 'steep slope' is a slope with an incline of 40 percent or more (10 feet of vertical rise over a horizontal distance of 25 feet or less) with a height of at least 10 feet." Slopes meeting these criteria were mapped by the City using topographic maps (prior to our 2015 study) and Lidar (Seattle 2016 version) along many portions of the site; see the yellow hatching based on the City's 2016 mapping on Figures 2A and 2B. Numerous additions were made to the steep slope hazard areas by the City relative to the prior mapping. The largest concentration of steep slopes is along the northern slope below the City's materials yard and above the mainstream. Steep slope areas also qualify as erosion hazard areas. Based on our geotechnical reconnaissance of the proposed trail alignments, only those additional areas which are at existing fill and cut slopes are of concern for trail construction, based on our slope reconnaissance in 2018. These existing fills and cut slopes are discussed in detail in following sections. We recommend that the trail be aligned and constructed to largely avoid steep slope areas, and existing fill and cut slopes as discussed later in this report. The trail alignments as shown in Figures 2A and 2B incorporates our recommendations.

Landslide Hazard Areas

A large portion of the northern half of the site is mapped as a potential slide area as indicated on Figures 2A and 2B, per the DCI critical areas GIS map (Seattle, 2018). The City delineation of the potential landslide area is per the recommendation of the Seattle Landslide Study, Figure D-2 (Shannon & Wilson, 2000 and 2003). Potential slide areas are defined as areas with documented historical landslides; "*areas that have shown significant movement during the last 10,000 years or are underlain by mass wastage debris deposited during this period"; areas described as potential landslide areas in the Seattle Landslide Study (Shannon & Wilson 2000 and 2003); steep slope areas as defined above; or physical or topographic indications of past sliding or "areas with geologic conditions that can promote earth movement."* The contact of granular advance outwash above Lawton clay is one such geologic condition in which ground water seepage at the contact contributes to the likelihood of landsliding. This contact runs through the site and has apparently contributed to slope instability since the last glaciation.

Documented landslides in the greenspace and vicinity are summarized below. Only the New Rainier Vista Slide, which occurred in 2003, is located in close proximity of the proposed trail alignment. The other observed slide areas are located a significant distance from the proposed

trail and will not affect the trail, nor will the trail affect the slope stability at those locations. Each of the documented landslides is discussed below.

New Rainer Vista Slide: A known slide area is mapped at the location of a soldier pile and lagging wall with tiebacks on the western edge of the New Rainier Vista housing development (see Figures 2A an 2B). Slide movement was observed starting in September 2003, as documented by Earth Consultants (2004a). A construction drawing for the slide repair (Earth Consultants, 2004b) indicated the presence of several low-relief slide scarps upslope from the proposed wall. The headscarp was mapped ranging from approximately one-third to one-half of the distance from Cheasty Boulevard toward the wall. Boreholes subsequently conducted for design of the wall (Earth Consultants, 2004c) typically encountered surficial loose silty sand over medium stiff to very stiff clays and silts to the full depths explored (up to 55 feet). Some borings encountered water-bearing silty sand layers within or below the clay or silt. Inclinometers were installed in four of the boreholes and monitored prior to wall construction. These instruments indicated slow lateral ground movement that was pronounced in the upper 10 feet at three of the inclinometers. Subtle movement starting above the bottom at 45 to 55 feet to about 10 feet (or the surface) was detected over time as well. The soldier pile and lagging wall was installed to stabilize this landslide. Our observations of this slide area are described in the Site Reconnaissance section. The slide appeared to be stable, as indicated by the degradation of scarps and lack of fresh soil exposures or wall deformation. We do not anticipate future movement of the slide mass due to the presence of the soldier pile and lagging wall. Per our recommendation, the section of proposed trail in this area has been constructed up slope such that the trail alignment stays out of the existing wall's zone of influence. The wall's zone of influence is defined as a 1H:1V line up from the toe of the wall intersects the ground surface. Additionally, we recommend that stormwater generated within the identified slide area be collected and tight lined to a suitable outlet. With the trail alignment out of the wall's zone of influence and assuming stormwater is collected properly through this area, no effect on slope stability is expected to be caused by the trail in this area.

1980s Cheasty Blvd Slide: A slide located near the north end of the greenspace has been documented and shown on the Seattle Department of Construction and Inspection (DCI) critical areas interactive map (City of Seattle, 2018; Shannon & Wilson, 2000 and 2003). This slide occurred in the 1980s, on the slope above Cheasty Blvd, below houses on 25th Ave S. This appears to have occurred in the road cut made for Cheasty Blvd. The slide was evidently a shallow slide rather than a deep-seated rotational slide. No evidence of recent sliding was observed in this area, nor any evidence of rotational failure anywhere along the Cheasty Blvd roadway. This slide area is located a significant distance from the proposed trail alignment and is not expected to be affected by the trail.

Andover Street Slide: A slide was noted as occurring in the 1940s, adjacent to Andover Street at the north end of the greenspace. Another slide occurred in 2014 apparently in this vicinity, as recorded by Stantec (2014). They noted in their Preliminary Geotechnical Evaluation for this project that a slide occurred on a property being redeveloped near S. Andover Street and

Martin Luther King Jr. Blvd. They observed that temporary excavations had been made in landslide debris and left open for a long time. After sliding, the slope was mitigated with a buttress of large quarry rock. Our review of dated aerial photos on Google Earth indicates that the subject redevelopment took place at S. Andover Street and 27th Ave S., and in 2014 the buttress ran south to north upslope of a completed townhouse building at the southwest corner of the lot. The 2015 aerial photo shows a soldier pile wall under construction extending northward from the rock buttress, and later aerial photos show two more townhouse buildings completed below the soldier pile wall. This slide area is located a significant distance from the proposed trail alignment and is not expected to be affected by the construction and operation of the trail.

Seismic Hazards

Seismic hazard areas are defined by the Seattle Municipal Code as lands subject to severe risk of earthquake damage as a result of seismically induced ground shaking, slope failures, settlement or soil liquefaction. The project site is within the Seattle Fault Zone. However, it is located outside of the area of presently known surface rupture which occurred approximately 1,100 years ago. Therefore, we expect the probability of surface rupture at the site to be low.

Liquefaction is a temporary loss of soil shear strength due to earthquake shaking. Loose, saturated cohesionless soils are highly susceptible to earthquake-induced liquefaction; however, recent experience and research has shown that certain silts and low-plasticity clays are also susceptible. Primary factors controlling the development of liquefaction include the intensity and duration of strong ground motions, the characteristics of subsurface soils, in-situ stress conditions and the depth to ground water. The uppermost soils typically consist of seasonally saturated sandy colluvial soils that have a moderate potential of liquefaction during the design earthquake, which could result in localized slope failures. The proposed trails will not affect the onset of liquefaction or the seismic response of the slopes.

EXISTING GEOTECHNICAL INFORMATION

We reviewed existing geotechnical information from the site vicinity, as found in City DCI records. Subsurface conditions as encountered in boreholes and test pits documented in geotechnical reports appeared to be in general agreement with the geologic map. Locations of the existing geotechnical subsurface explorations were determined from site plans included in the geotechnical reports, and are shown on the Site and Exploration Plans, Figures 2A and 2B.

Stantec Consulting Services, Inc. performed a limited preliminary geotechnical investigation of the greenspace (Stantec, 2014). Stantec's investigation was limited to an online and paper study of the geotechnical aspects of building a trail within the greenspace.

Geotechnical reports for projects in locations adjacent to or near the Cheasty Greenspace include several for projects in the valley at and beyond the toe of the overall slope. These reports include borings for Sound Transit's Link Light Rail along Martin Luther King Jr. Way S. (Golder, 2001).

Test pits and borings were conducted for the Rainier Vista Redevelopment, as well as for repair of the New Rainier Vista Slide (Earth Consultants, 2000, 2004c).
Other geotechnical investigations had been conducted west of the north end of the greenspace for residential projects, and included borings (Hart Crowser, 1986 and LSI ADAPT, 2001). Test pits were conducted for a residence farther north along 25th Ave S., beyond the area shown on Figures 2A and 2B (Hemphill, 2000).

At the top of the slope, borings were conducted for a Parks maintenance building at the site of the present maintenance yard, which was never built (Seattle Engineering Department, 1973).

Logs of all of the relevant geotechnical explorations associated with each of these reports are included in Appendix C of this report.

General Site Surface Conditions

Based on available topographic mapping with 5-foot contours (King County iMap) and confirmed with project site surveying, the slope below Cheasty Blvd, dropping down to the east, ranges from approximately 60 feet high at the north end, increasing to 100 feet in the southern portions. The terrain as observed on Lidar imagery shows drainage swales and ridges, and the ground surface is gently hummocky. This imagery reveals the entire slope to be a prehistoric landslide complex, based on the hummocky topography and an apparent compound headscarp forming the hillcrest above Cheasty Boulevard. Steep slope crests indicative of sidecast fill are obvious along Cheasty Blvd, the Parks maintenance yard, and the upper slope below Cheasty Blvd southwest of the yard. The fill character of these steep slopes was confirmed by site observations and handhole explorations. Aerial photos confirm the predominance of Bigleaf Maple trees as observed on site and their similar range of size, and therefore age, indicating forest disturbance of similar age (such as logging, forest fire, or landsliding). An aerial photo from 1936 (as seen on iMap) shows small deciduous trees and brush with some open areas in the greenspace property and adjacent undeveloped properties, indicating disturbance to the forest in the recent past, most likely from logging of the old growth forest.

Site Reconnaissance

An HWA engineering geologist and a geotechnical engineer evaluated site and surficial soil conditions on January 12, 2015, by performing a geologic reconnaissance of the site on foot along the general alignment of the previously proposed mountain bike trail. The site was traversed clockwise starting at the top of the slope just south of the existing Parks materials yard on Cheasty Blvd. An additional reconnaissance of the proposed trail system was conducted by HWA geologists on April 27, 2018. Trail staking established by the design team surveyors was followed throughout the site.

Slope geomorphology, vegetation patterns, tree growth, and surficial soils were observed during the traverses for signs of slope instability. At intervals the ground surface was probed with a ½-

inch diameter, 3-foot or 6-foot-long T-handled steel rod to observe density or cohesiveness of surficial soils. General observations and locations of note are discussed below.

The site is mostly wooded, with the vast majority of trees consisting of bigleaf maple from approximately 8 to 24 inches in diameter and 30 to 70 feet high. Cottonwood trees were observed in the southern end of the site on a gentle slope above Columbian Way. Alders, small cedars and Douglas firs were observed as lone trees in various places. Large portions of the wooded area consisted of all bigleaf maple with understory. Understory brush and ground vegetation mainly consisted of sword fern in most areas, with salal, Indian plum, and Oregon grape in various areas. Invasive English ivy was observed in portions of the site, with many areas cleared of ivy and native vegetation replanted. Invasive blackberry canes were observed, mainly along the lower slopes from the northern riparian zone, northward to the slide zone behind the soldier pile wall. Blackberries were observed in scattered places elsewhere, but not as brambles. Salmonberry was observed in the riparian zones and in other low places. The presence of salmonberry is indicative of high soil moisture content through the year.

The steepest observed slopes were inclined at approximately 1H:1V to 2½H:1V (Horizontal:Vertical) along heights of 15 to 25 feet, where fill was pushed out from the top of the slope at the City's materials yard and lawn areas to the south of the yard. The slopes mapped by the city as exceeding 40 percent (2½H:1V) included some of the fill slopes, as well as areas downslope to the north and east of the materials yard, a section along Cheasty Blvd, and isolated areas elsewhere. Otherwise, the slopes were variable in inclination over distances of tens of feet, generally between 3H:1V and 10H:1V.

Surficial soils as observed and probed predominantly consisted of loose grading to medium dense, brown, silty, gravelly sand. Silt and clay soils were observed in the lower slope, particularly north of the large ravine to the north end of the site, which includes the slide area retained by the soldier pile wall. A portion of the fill east of the maintenance yard consisted of clay as well. Rubble consisting of concrete, asphalt paving, and crushed rock were present on and within the granular fill slope to the southeast of the maintenance yard.

Probing depths ranged from 0.5 to 3 feet in the portion of the site south of the yard, 1 to 3.5 feet on slopes elsewhere, and 2 to 3 feet in wetland riparian areas. The soil at the surface in most slope areas (where not consisting of fill) was not a rich topsoil, nor was much duff accumulated. This lack of organic accumulation and topsoil formation is indicative of persistent erosion or slope instability, which may date to logging before the 1930s. The portion of critical (over 40%) slopes just north of the proposed southern loop had surficial soil consisting of gray, plastic silt or clay, as did the plateau at the toe of the fill slope. This material appears to be fill that was spread over the plateau and its edges, spilling downslope to the north and east. Fill slopes in this area were at approximately the angle of repose for granular soils (36 degrees) and higher for cohesive soils (averaging 40 degrees). The fill slopes below the maintenance yard are up to approximately

25 feet high. Signs of surficial creep and sloughing were observed in this area, where there was granular fill apparently sidecast over the slope; handhole HH-8 was advanced at this location.

Soils in the riparian zones consisted of soft or loose, dark brown, organic, silty sand that was saturated from ground water seepage and runoff.

Three areas of recent slope instability were observed during the reconnaissance:

1) **Along the fill slope around the Parks materials yard:** The fill historically spread over the crest of the slope showed signs of sloughing or surficial sliding during the winter of 2014-2015 near the easternmost point. Fresh soil exposures near the top and deposits of sloughed and eroded granular soils down the 15- to 25-foot-high slope were evident during our 2015 reconnaissance. In 2018 handhole HH-8 was advanced through this surficial granular fill into underlying clay fill. It is likely that surface runoff and perched seasonal ground water contribute to periodic sloughing in wetter than normal conditions. As the granular fill is at the angle of repose (as noted above), the soil readily sloughs underfoot and has only scattered vegetation. We anticipate that future sloughing will occur within the fill soils, particularly those that are granular. We do not anticipate deep-seated sliding to occur. Per our recommendation the proposed trail has been routed away from these steep slopes.
2) **Above the existing soldier pile wall just west of Dakota St and 24th Ave S. (New Rainier Vista Slide Area):** This curving wall retains the toe of the forested slope within Rainier Vista common space, above a playground and the P-patch. The wall ranges from approximately 6 to 10 feet high and is approximately 300 feet long, with tiebacks along the eastern portion, as well as multiple clean outs in front of the wall, for drainage piping that extends behind the northern portion of the wall to the greenspace property line as shown on construction plans (ECI, 2004b). Two irregular slide scarps were observed in 2015 at approximately 100- and 150-feet upslope from the wall. The scarps were on the order of 1 to 2 feet high and did not appear recent, being sloughed and moss-covered. Horizontal separation appeared to be less than 1½ feet at each scarp. The age of the scarps, based on weathering and vegetation, appeared to fit within the timeline of 2003 sliding, prior to construction of the soldier pile wall (ECI, 2004b). There were fewer and smaller trees in this area, likely due to past instability. However, the trees were not tipped upslope as would occur from deep, rotational sliding, such that in our opinion the most recent slide activity, before the wall was constructed, was relatively shallow and translational. These scarps were not apparent during our 2018 reconnaissance of the currently proposed trail. We do not anticipate future translational sliding in this area due to retention by the soldier pile wall. Recommendations for trail and stormwater modifications in this area are provided below.
3) **The head end of the western riparian area, below hand hole HH-5:** Ground water seepage was observed emanating in a bowl-shaped headwater area extending

approximately 40 to 50 feet across. The bowl was gently sloping at the top, and increasing in slope as it transitions to a stream valley. Along the upper edge of the bowl, the slope was over-steepened to approximately 1H:1V to 1½H:1V over a height of 3 to 6 feet, with shallower slopes above. The localized over-steepening of this slope is due to sloughing induced by ground water seepage. The slope incrementally retreats headward over time. This slope was vegetated and in 2015 did not show recent signs of sloughing. Probing in the bowl extended only up to 3 feet, in soft, dark brown, organic sandy silt that was saturated. The probe terminated abruptly in dense gravelly sand. Future episodic headward retreat is expected. The currently proposed trails avoid this area. Soil creep appears to be the most prevalent means of current downslope soil movement across this area of the site. Based on the mostly upright nature of the trees on site, slope creep appears to have affected trees primarily early in life, after the site was exposed to runoff and erosion associated with historic logging, burning, and/or landsliding. We expect continued soil creep at this location. As the proposed trail alignment has been shifted away from this area, construction and operation of the trail will not affect future anticipated soil creep.

SUBSURFACE EXPLORATIONS

Manual equipment was used to advance subsurface explorations in two phases – first in 2015 along the previously proposed general trail alignment, and in 2018 along the presently proposed trail system. The 2015 handholes were advanced at areas of proposed wetland crossings and steep slope traverses. Due to the potential critical area impacts, it was decided by Parks to eliminate these areas from the current trail proposal. On January 15, 2015, HWA representatives visited the site and performed a subsurface investigation consisting of six hand borings, designated handholes HH-1 through HH-6. The hand borings were advanced to depths ranging from 2 to 5.75 feet below ground surface (bgs) with a post-hole digger and bucket auger. Dynamic Cone Penetration (DCP) tests were completed at four hand boring locations, to explore the relative density of near-surface soils.

The second phase of explorations was conducted on May 16 and 17, 2018. These handholes, designated HH-7 through HH-13, were advanced until met with gravel refusal at depths ranging from 3.8 to 9.5 feet. DCP tests were completed at each of these handholes except HH-8, in which coarse gravel and rubble precluded its advancement in the upper few feet.

Each handhole and DCP test was advanced and logged by an HWA geologist or geotechnical engineer. Representative soil samples were obtained at selected intervals, and transported to HWA's Bothell laboratory for further examination and testing.

The DCP test equipment consists of a steel extension shaft assembly, with a 60 degree hardened steel cone tip attached to one end, which is driven into the subsoil by means of a sliding drop hammer. The base diameter of the cone is 20 mm (0.79 inches). The diameter of the shaft is 8 mm (0.315 inches) less than the cone, to reduce rod friction at shallow penetration depths. The

DCP is driven by repeatedly dropping an 8-kg (17.6-pound) sliding hammer from a fixed height of 575 mm (22.6 inches). The depth of cone penetration is measured after each hammer drop or given number of drops (depending on soil resistance) and the in-situ shear strength of the soil is reported in terms of the DCP Index (DCI). The DCI is based on the average penetration depth resulting from 1 blow of the hammer and is reported as millimeters per blow (mm/blow). The data obtained from the DCP tests was then correlated to Standard Penetration Test (SPT) values, in order to evaluate the strength of the subgrade soils for use in evaluating the allowable bearing capacity of the site soils. The DCP data, converted to SPT, is plotted on the handhole logs in Appendix A.

The approximate locations of the handholes are indicated on the Site and Exploration Plan, Figures 2A and 2B. Exploration logs of the handholes and DCP tests are presented in Appendix A, Figures A-2 through A-14. A legend of the terms and symbols used on the exploration logs is included on Figure A-1.

SUBSURFACE SOIL CONDITIONS

Soil units encountered in our subsurface explorations and in previous geotechnical investigations in the vicinity are described below. Our preliminary subsurface explorations in 2015 were focused on three proposed structures, namely a set of steps and two boardwalks. Such structures are not part of the current proposed trail system due to changes in trail alignments. In 2018 four handholes were advanced on steep existing fill slopes in the southern portion of the site; another was advanced on a steep existing cut slope by Columbian Way; and two were advanced in the northern portion of the site to assess typical soil conditions for the upper and lower slopes of that area. Soils encountered in our explorations and in existing geotechnical explorations are described below.

Fill: Fill soils consisting of very loose to loose, brown, gravelly, silty, sand with woody debris and organics were encountered in handhole HH-1. This fill material appeared to have been placed during grading of the area for the materials yard just to the north. Soil consisting of very loose to loose, brown, gravelly, silty sand with scattered concrete rubble was present on the slope at handhole HH-8. Medium stiff to stiff clay and silt was present on the slope surface in the vicinity of handholes HH-7 and HH-9. The clay was encountered in HH-8 below the granular fill from 4 to 8.5 feet, from the surface to 6.5 feet in HH-7, and to a depth of 1.5 feet in HH-9. Both types of fill appeared to have been graded over the edge of the upper "plateau" upon which is the Parks maintenance yard, within which clay fill was encountered over glacial till in previous borings (Seattle Engineering Department, 1973).

Buried Topsoil: Buried Topsoil consisting of very loose to loose, brown, silty, sand with woody debris and organics. It is differentiated from the fill by odor and presence of abundant organic matter, and by absence of jumbled appearance. This unit was encountered in handhole HH-1 below the fill. Handhole HH-1 was terminated in this unit upon refusal on gravel. It appears that when fill was placed it was simply pushed over the top of a cleared area vegetated with

blackberry brambles.

Topsoil: Topsoil very similar in consistency to the buried topsoil in HH-1 was encountered at the surface in HH-2. Handhole HH-2 was dug at the toe of a relatively steep change in grade (due to fill placement). The topsoil was thin – only about six inches thick and supported the growth of blackberry brambles and weeds. This unit is also a fill as indicated by the woven geosynthetic fabric separating it from the unit below. Topsoil was more weakly developed elsewhere on slopes throughout the site, and often there was none with colluvium at the ground surface beneath minor duff.

Organic Silt: Organic silt stream and wetland deposits consisting of very soft sandy silt with abundant organics were encountered at the ground surface in handholes HH-3 and HH-4. The organic silt was so soft that the DCP sank under the weight of the hammer. These organic silt soils were encountered in both wetland areas near the formerly proposed boardwalk locations. This soil unit is very thin – approximately 0.25 feet thick. It is highly compressible, and will undergo consolidation settlement under the application of load. These soils will also undergo biodegradation settlement over time as the organic material within the soil biodegrades. Organic silt deposits are expected to be present anywhere within mapped wetlands.

Coarse-Grained Alluvium: Coarse-grained alluvial deposits were encountered below a depth of 0.25 feet in hand borings HH-3 and HH-4. These soils consisted of very loose grading to dense, gray, silty, fine to coarse sand and gravel. Alluvial soils should be anticipated anywhere along the riparian corridor mapped as a wetland along the large ravine north of the maintenance yard.

Colluvium: Loose to medium soils formed by weathering and downslope movement by physical and biological means were encountered in handholes HH-5 and HH-6, and HH-10 through HH-13. Colluvium was observed at the surface throughout the majority of the greenspace. These soils typically consisted of gravelly, silty sand to sandy silt and was most likely derived from glacial till, advance outwash, and Lawton clay soils. Colluvium was differentiated from topsoil by observing reduced organic content. The upper 4 to 10 feet of the borings within the 2003 slide area consisted of loose, brown silty sand or sandy silt, which we interpret to be colluvium (ECI, 2004c).

Weathered Till: Soils beneath colluvium below a depth of 0.25 feet in hand borings HH-5 and HH-6 appeared to be weathered till, partly based on its presence immediately above glacial till encountered in handhole HH-5. These soils consisted of very loose grading to dense, silty, fine to coarse sand and gravel.

Weathered Advance Outwash: Loose grading to dense, silty sand was encountered in HH-2 under geosynthetic fabric. Color, presence of rust mottling, and density indicate a high degree of weathering near the ground surface with the degree of weathering lessening with depth. Handhole HH-2 was terminated in this unit.

Recessional Lacustrine Deposits: Very soft to soft, laminated to massively bedded silt and clay

deposits were encountered in a previous boring east of the greenspace for Sound Transit's Link Light Rail along Martin Luther King Jr. Blvd (Golder, 2001) at a depth of 12 to 30 feet (the full depth explored). This was interpreted in their report as Vashon recessional lacustrine deposits. Based on our interpretation of borehole logs by others, these deposits were also apparently encountered in test pits and borings for New Rainier Vista (ECI, 2000) and in borings for repair of the 2003 slide (ECI, 2004c).

Recessional Outwash: Medium dense, silty sand was encountered in previous borings within the greenspace for repair of the 2003 slide (ECI, 2004c). Layers up to several feet thick of loose to medium dense or medium stiff, brown silty sand, silt, and clay were encountered to depths of up to 30 to 40 feet.

Glacial Till: Dense, silty sand with gravel that was evidently till-like was documented in borings at the top of the hill in the existing Parks maintenance yard (Seattle Engineering Department, 1973). Very dense, olive gray, silty gravelly sand was encountered in hand hole HH-5 below weathered till. Based on the high density as shown by DCP testing and observations of the soil texture, this was interpreted as glacial till. The transition between weathered and unweathered till is gradual and is interpreted from increase in density and color change with the absence of rust mottling. The location of this apparent glacial till is lower down the hill than would be expected from the geologic map. However, glacial till typically drapes the landscape when deposited, and so till deposits can be present beneath colluvium which was undetected by the geologic mapping published at 1:24,000 scale. Alternatively, the apparent till could be a block within mass wasting deposits on the slope. Glacial till was encountered northeast of the site along 25th Ave S (Hemphill, 2000). The location is beyond the area shown on Figures 2A and 2B, but the logs are included in Appendix C.

Advance Outwash: Very dense, clean sand with scattered gravel was encountered beneath the fill in handholes HH-7, HH-8, and HH-9.

Lawton Clay: Very stiff to hard, gray or bluish gray, clay or silt was encountered at depths below approximately 35 to 40 feet, in some of the boreholes drilled within the greenspace for design of the 2003 slide repair to the full depths of explored of (ECI, 2004c). Other reports indicate the presence of "blue" clay on the slope north of the greenspace (Hart Crowser, 1986), and clayey silt beneath granular fill on a residential lot on 25th Ave S above Cheasty Blvd (LSI ADAPT, 2001). This was also encountered in some of the boreholes downslope of the greenspace, below depths of approximately 10 to 16 feet (ECI, 2000).

GROUND WATER CONDITIONS

Ground water seepage was observed at several locations, most of which were closer to the bottom of the overall slope than the top. The approximate locations in which ground water seepage was observed during our site visits are indicated in Figures 2A and 2B. The exception was ground water seepage below Cheasty Blvd at the head of the large stream valley. These seepages formed the head ends of surface drainages. Based on the geologic mapping and our site

soil observations, it is likely that most of the seepage emanates from granular soils just above their contact over hard silts and clays. The presence, specific locations, and flow quantity of ground water seepage should be expected to vary seasonally.

Ground water was observed in three of our subsurface explorations. Handholes HH-3 and HH-4 were dug in a wetland. Water levels observed in each hand hole were at ground surface, and 1 foot below ground surface respectively. Seepage was observed from saturated soils below a depth of 3 feet in HH-6. Ground water monitoring wells were not installed in the 2018 handholes, as seasonal, transient perched ground water is assumed to occur at shallow depths on the slopes.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

Construction of the mountain bike trails within the Cheasty greenspace is feasible from a geotechnical standpoint. If properly designed, in our opinion construction of the proposed trails will not result in increased deep-seated instability of the overall slope, and with proper construction and maintenance of slope retention and drainage facilities, the trails will not result in increased shallow slope instability. It should be noted that future localized areas of shallow slope instability, which could occur virtually anywhere on the site, may affect the trails. We do not anticipate this to be a significant safety issue. Where the trail is affected by future slope instability, sloughed or slid soils would need to be removed from the trail or the trail rerouted around the slide area and drainage re-established where affected. Trail setbacks from certain existing fill and cut slopes as noted below are recommended as buffers to avoid causing or being affected by slope instability. Otherwise, the trails can traverse the potential slide area without the need for buffers.

Specific attention will need to be paid to the trail alignment, grades, drainage and surfacing to limit the amount of maintenance required to maintain a functional and environmentally friendly trail system. We recommend additional drainage measures where the trail crosses the 2003 slide area. Modifications have been made to the trail alignments per our recommendations in order to avoid steep fill and cut slopes. Recommendations to address particular issues are discussed in the following sections. As we understand trails will be field-fitted during construction around trees and other features as needed, HWA should be engaged to provide geotechnical monitoring during construction.

SEISMIC DESIGN PARAMETERS

Earthquake loading for the slopes along the trail alignment was developed in accordance with Section 3.4 of the *AASHTO Guide Specifications for LRFD Seismic Bridge Design*, 2nd Edition, 2011. For seismic analysis, the Site Class is required to be established and is determined based on the average soil properties in the upper 100 feet below the ground surface. Based on our

explorations and understanding of site geology, it is our opinion that the slopes within the proposed trail alignments consist of soils consistent with Site Class D. Therefore, Site Class D should be used with AASHTO seismic evaluations for slope stability of this project. Table 1 presents recommended seismic coefficients for use with the General Procedure described in AASHTO (2011), which is based upon a design event with a 7 percent probability of exceedance in 75 years (equal to a return period of 1,033 years). These seismic parameters were used to evaluate slope stability for the proposed trail alignment and will be used for structural design of structures identified during final design.

The spectral acceleration coefficient at 1-second period (S_{D1}) is greater than 0.5; therefore, the Seismic Design Category D, as given by AASHTO Table 3.5-1 (AASHTO, 2011), should be used.

Table 1.
Seismic Coefficients for Evaluation Using
AASHTO Guide Specifications calculated by USGS 2014 Seismic Hazard Map

Site Class	Peak Ground Acceleration PGA (g)	Spectral Acceleration at 0.2 sec S_S (g)	Spectral Acceleration at 1.0 sec S_1 (g)	Site Coefficients			Acceleration Coefficient A_S (g)
				F_{pga}	F_a	F_v	
D	0.461	1.021	0.342	1.039	1.091	1.716	0.479

Based on the above parameters, the design Acceleration Coefficient (A_S) for Site Class D at the project site is 0.479g. Slope stability was analyzed using a horizontal seismic acceleration coefficient k_h of one-half the peak ground acceleration or 0.24g and a vertical seismic acceleration coefficient k_v of 0.0g. These seismic parameters should also be utilized for design of any structures that may be added to the project.

SLOPE STABILITY

The Cheasty greenspace has and will continue to be an active slope environment. Therefore, future episodes of slope instability may be expected within the greenspace. Based on our experience with similar slope topography and geology, we do not expect that large scale deep-seated slope instability is likely across the greenspace. However, continued shallow slope movements are expected to occur across portions of the greenspace over time.

As the loads associated with the proposed trails are not anticipated to change the stability of the existing slopes from their current condition, slope evaluations have been focused on identifying areas of potential slope instability under current conditions. HWA has evaluated the greenspace to identify areas of potential shallow slope instability through visual assessment of slope

characteristics including geomorphology, surficial soils, and vegetation patterns; and review of geologic mapping and existing geotechnical information in the immediate vicinity. Where potential for slope instability was visually evident, the trail alignment has been routed by the design team to avoid these areas. Where previously proposed trail alignments traversed along or at the base of slopes, not showing visual evidence of potential instability, preliminary limit-equilibrium slope stability analysis has been completed. These analyses indicate that most subject locations possess adequate factors of safety under static and pseudo-static loading conditions. However, areas of steep fill south of the Parks maintenance yard and the cut slope adjacent to Columbia Way proved to be areas of potential slope instability. Modifications to the proposed trail alignments are reflected in the alignments shown in Figures 2A and 2B.

TRAIL ALIGNMENT

In addition to trail user criteria, the trail alignment shown in Figures 2A and 2B was chosen by the design team based in part on the following guidelines:

- Avoiding wetlands and their buffers,
- Routing the trail outside of the identified areas of instability,
- Avoiding steep slopes (greater than 40 percent, or 2.5H:1V) where possible,
- Avoiding ground water seepage zones where possible,
- Minimizing cut heights where the trails must traverse steel slopes,
- Minimizing steepness of trail grades, and
- Installing and maintaining suitable drainage features.

In general, the proposed mountain bike trail alignments, shown in Figures 2A and 2B appear to be suitable for the site conditions. Per our recommendation the following revisions were made to the preliminary trail alignments in order to avoid additional areas of potential slope instability.

Parks Maintenance Yard Area: The fill slope below the maintenance yard (southern to eastern slope) shows evidence of sloughing. Site observations and stability analysis suggest that the fill slope is currently standing near the angle of repose of the soil. We recommended the trail alignment be rerouted to avoid the steep fill slope below the maintenance yard. Additionally, to reduce the potential for future instability within this fill, we recommend collecting and dispersing the drainage from the park's maintenance yard to an area below the proposed trails.

Columbia Way Area: We recommended placing the trail outside of the existing road cut which is a mapped steep slope area. Due to the presence of wetlands above, the trail was routed even farther from the roadcut to avoid the wetlands and their buffers.

Top of 2003 Slide Area: At the top of the 2003 slide area, retained by the soldier pile wall, we recommended the upslope portion of trail be rerouted outside of the slide area (closer to Cheasty Blvd).

Bottom of 2003 Slide Area: The trail near the top of the existing soldier pile and lagging wall will be routed at least a minimum distance behind the wall where a 1H:1V line up from the toe of the wall intersects the ground surface. This alignment is shown on Figures 2A and 2B.

All proposed trails should be completed in accordance with the recommendations provided by the International Mountain Bike Association (IMBA). IMBA recommends limiting trail grades to a maximum of 15% with an average grade not to exceed 10% to limit the potential for surface erosion. We recommend that IMBA's recommendations for grade be followed for the design of the Cheasty Mountain bike trails. The IMBA also recommends that trails be designed to follow slope contours to avoid concentrated surface water flows along the trail.

DRAINAGE RECOMMENDATIONS

Soils that become exposed on slopes are prone to erosion from rainfall and runoff. Trail surfaces that are steep with a high proportion of fine-grained soils as found throughout the site at the surface will be especially prone to erosion from bike traffic during both dry and wet conditions. Trail sections should be sloped no more than 15% to minimize the potential of erosion. Per current trail design standards, we recommend against the use of water bars for diversion of runoff from the trail. Water bars typically become plugged with sediment such that runoff is not diverted off the trail, but continues to run down the trail resulting in greater erosion during storm events, and concentrated runoff and erosion where the water ends up diverting from the trail. Concentrated runoff is undesirable in steep slope and potential landslide areas. We recommend the current standard of regularly spaced gentle dips in the trail to break up long sloping runs. Runoff on the trail will naturally divert from the trail at these dips, which are not prone to plugging and thus failure as are water bars, such that regularly spaced runoff diversions will persist and thus prevent concentration of flow such as would result from failure of a number of water bar diversions.

Where the trail will cross the lower portion of the 2003 slide, we recommend that surface runoff be collected from the trail and tightlined to the storm system in front of (downslope from) the wall. The purpose of this is to prevent inadvertently concentrating runoff into slide scarps or other ground cracks, which could result in increased pore pressures in the slide plane and thus increased pressure on the soldier pile wall.

Permanent erosion control measures for any side cuts and fills made for the trails will need to be undertaken, and would likely consist of mulching or matting, with native perennial plantings. Ground water seepage zones and resulting surface runoff as observed in 2015 are avoided by the presently proposed trail alignments. Other areas of seepage could become apparent during and

after trail construction. The trail should not be constructed with wet crossings of seepage or runoff, as bicycle and foot traffic will cause disturbance of wet soils that will result in rutting and erosion of the trail (requiring higher maintenance) and silty runoff (impacting wetlands and streams down gradient).
At locations where crossing seepage or runoff cannot be avoided, measures to prevent wet crossings include boardwalks, culverts, or rock drainage blankets should be used. Perched ground water seepage may be intercepted by trail cuts where seepage may not have been apparent at the ground surface. Shallow ditching or perforated pipes along the cut side of the trail with tight-lined culverts or other diversions to the opposite side would serve to collect this seepage. Trail surface runoff should be diverted by typical methods for trails in wet, steep forested areas such as inclining the trail outward where possible and, in areas of high runoff, inclining the trail to the upslope side to a ditch and tight-lining runoff beneath the trail.

EARTHWORK

We recommend the trail width be kept to the minimum necessary for a single-track trail, in order to reduce the need for and magnitude of cuts and fills where the trails cross steep slopes. Avoiding the existing fill and cut slopes as noted previously will also reduce this need.

Necessary fills should be benched into the slope, and not placed as a wedge over the slope surface. Organic soils should be stripped where fills will occur, and any loose underlying soils compacted to a firm and unyielding condition. Fill should consist of sand with up to 15% by weight of non-plastic fines. The fill should be placed in horizontal lifts and compacted with hand-operated equipment to a dense condition (at least 90 percent of modified Proctor dry density per ASTM D:1557).

Shallow cuts should be sloped no greater than 2.5H:1V. On slopes greater than 5H:1V, cuts greater than 2 feet high will need to be retained. We recommend the use of treated timber walls laterally supported by driven pin piles. Recommendations for walls are included in the Structures section.

TRAIL SURFACING

The near surface soils along the proposed maintain bike trail alignments are highly variable but generally consist of very loose and highly moisture sensitive soils. The appropriate mountain bike trail surfacing will likely vary along the alignment and will be dependent on the subsurface soils, slope conditions, seepage conditions, trail grade and the anticipated trail usage. IMBA outlines multiple levels of trail surfacing options (in increasing order) to maintain trail functionality through varying conditions. It is likely that some if not all of these options will need to be implemented into the trail design.

- **Microtopography Modification:** Compacted native soil comprises the trail surfacing. This approach uses onsite materials to create raised trail surface, causeways, basins, and mounds with the goal of maximizing drainage. Flatter areas are most suitable for this

approach.

- **Foundation Modification:** The trail bed is excavated to place a layer of drain rock that is then overlain by native soil that is placed to form the trail surfacing. If the fines content is high in the native soils, migration of fines into the drainage layer could result in loss of drainage functionality of the rock over time. Wrapping the drainrock in a non-woven geotextile separator fabric adds expense but would add longevity without significantly increasing effort.

- **Surface Modification:** Place imported material for the trail surfacing. Our experience indicates that a well-graded crushed surfacing top course from a ledge rock source with a non-plastic fines content of around 10% works well for supporting wheeled trail uses (e.g. bicycles) without scattering. Gravel deposit sources of Crushed Surfacing Top Course (CSTC) provide the correct gradation but the rounded faces don't provide the interlock between particles necessary to minimize scattering. Proprietary products are available that improve the compatibility and or cohesion of native soils.

- **Extreme Measures:** These include methods familiar to road construction such as ditches and culverts, collection and tight-line, and re-grading. IMBA puts the aforementioned geotextile in this category as well. As noted in the Drainage section we recommend collection and tightlining of runoff from the trail where it crosses the 2003 slide area.

BOARDWALK FOUNDATIONS

It is our understanding that the proposed trail alignment will cross an existing watercourse just to the east of the intersection of Cheasty Boulevard South and 25th Avenue South. We understand that a short boardwalk structure will be constructed at this location. HWA did not drill a geotechnical exploration at the proposed crossing. However, hand boring HH-11 was drilled just to the south of the proposed crossing. This exploration suggests that the soils in the vicinity of the crossing consist of 1-2 feet of topsoil and colluvium over native fine grained transitional bed soils. The transitional bed soils will provide adequate support for the proposed boardwalk structure. We recommend that the boardwalk structure be supported on shallow foundations bearing on hard transitional bed soils.

Construction of the boardwalk foundations should start by excavation of the near surface colluvium and topsoil to expose the underlying hard transitional bed bearing soils. Once the transitional bed soils are exposed, the excavation should be advanced an additional 1-foot into the hard fine-grained bearing soils. The base of the excavation should be cleared of all loose and deleterious material and inspected by the geotechnical engineer. Once the subgrade conditions are approved, a 6-inch-thick leveling pad, consisting of crushed rock, should be placed across the base of the excavation and compacted to a dense and unyielding condition. The boardwalk foundations should be placed directly on the crushed rock leveling pad.

It should be noted that the transitional bed bearing soils, at the boardwalk location, are expected to be fine grained and moisture sensitive. We recommend that all boardwalk foundation excavations be completed during the dry summer months to avoid degradation of the bearing soils.

TRAIL MAINTENANCE

Continued maintenance of the mountain bike trail will be necessary to maintain the functionality of the trail system, protect nearby surface waters from increased sedimentation due to erosion, and to reduce impacts to slope stability. The need for maintenance of the trail surface can be minimized by good alignment selection; suitable trail inclination, earthwork and drainage measures; and regular maintenance of drainage measures. The type and frequency of the required maintenance will depend on several factors including trail use, final trail alignment, and inclinations of the trail sections. Steeper trail sections generally require more frequent maintenance than flatter trail alignments.

LIMITATIONS

We have prepared this report for ESA and the City of Seattle Parks Department and their agents for use in design of a portion of this project. It should be noted that this report is based on site reconnaissance and limited subsurface explorations. The conclusions and interpretations presented in this report should not be construed as a warranty of the subsurface conditions. Experience has shown that soil and ground water conditions can vary significantly over small distances. Inconsistent conditions can occur between explorations and may not be detected by a geotechnical study. We expect that additional geotechnical evaluations will be required as the proposed trail system is taken from preliminary design to final design. If, during future site operations, subsurface conditions are encountered which vary appreciably from those described herein, HWA should be notified for review of the recommendations of this report, and revision of such if necessary.

Within the limitations of scope, schedule and budget, HWA attempted to execute these services in accordance with generally accepted professional principles and practices in the fields of geotechnical engineering and engineering geology in the area at the time the report was prepared. No warranty, express or implied, is made. The scope of our work did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous substances in the soil, surface water, or ground water at this site.

This firm does not practice or consult in the field of safety engineering. We do not direct the contractor's operations, and cannot be responsible for the safety of personnel other than our own on the site. As such, the safety of others is the responsibility of the contractor. The contractor should notify the owner if he considers any of the recommended actions presented herein unsafe.

We appreciate this opportunity to be of service.

Sincerely,

HWA GEOSCIENCES INC.

12/21/2022

Donald J. Huling, P.E.
Geotechnical Engineer, Principal

LIST OF FIGURES (FOLLOWING TEXT)

LIST OF APPENDICES

References:

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0 250 500 750 1000

BASE MAP PROVIDED BY: Google Maps

HWA GEOSCIENCES INC.

Cheasty Greenspace
Mountain Bike Trail
Seattle, Washington

VICINITY MAP

DRAWN BY BFM	FIGURE # 1
CHECK BY BT	PROJECT # 2014-177-21
DATE: 06.21.2018	

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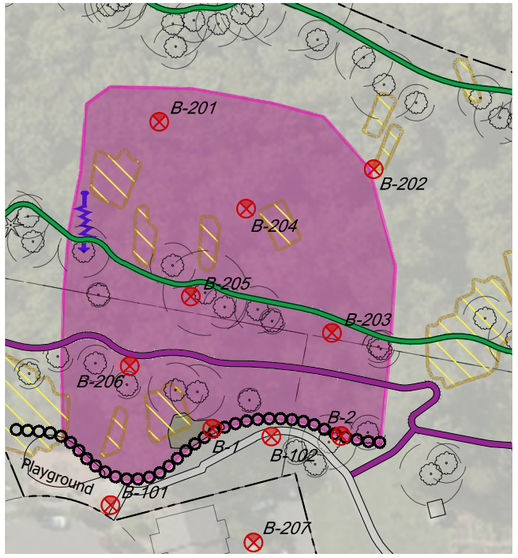

ENLARGED PLAN

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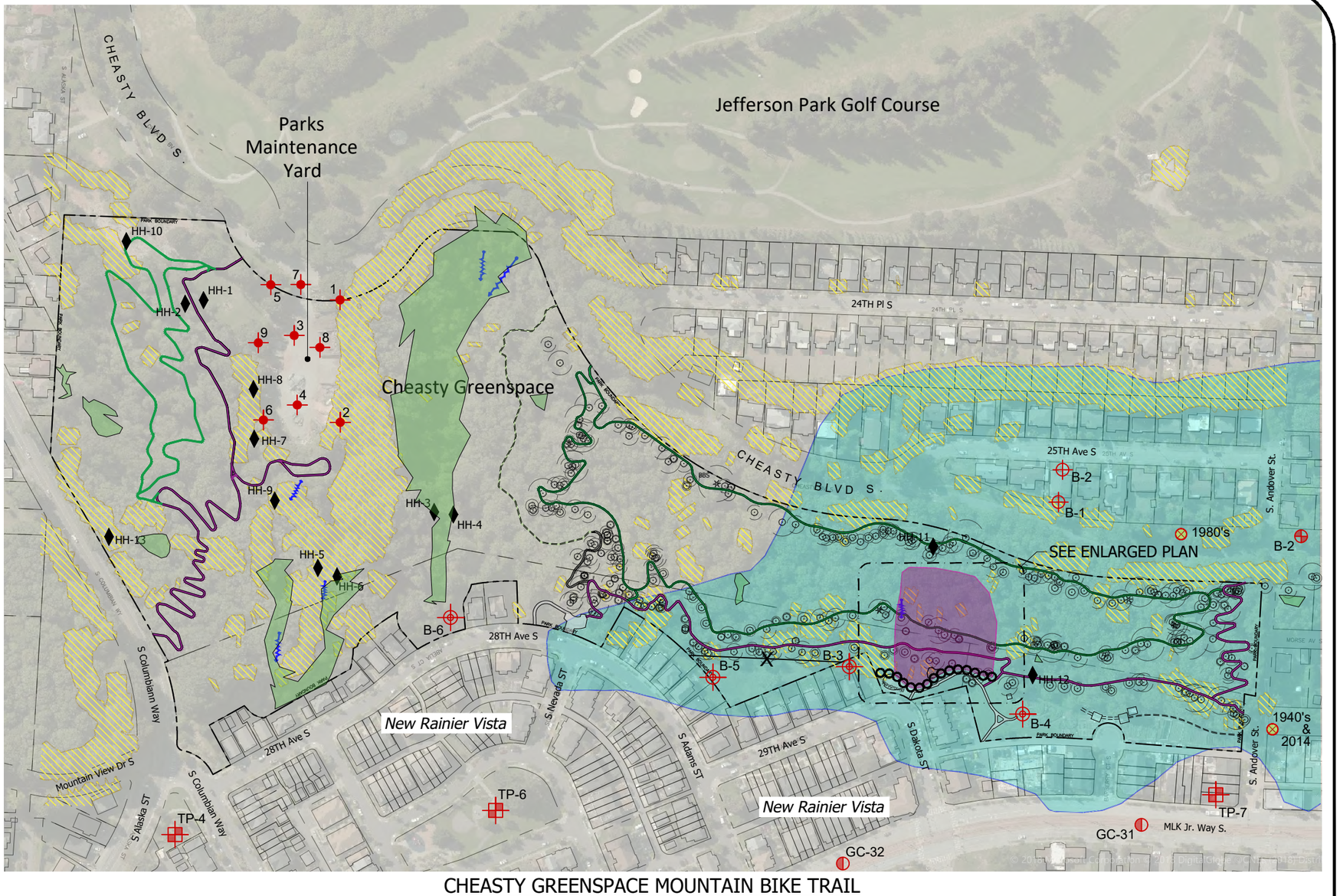
LEGEND

- GROUND WATER SEEPAGE AND RUNOFF (HWA, 2015)
- MAPPED STEEP SLOPE AREA (SEATTLE GIS; 2016 UPDATE)
- MAPPED POTENTIAL SLIDE AREA (SEATTLE GIS; SHANNON & WILSON, 2000)
- MAPPED WETLAND AREA (ESA, PRESENT STUDY)
- APPROXIMATE AREA OF 2003 LANDSLIDE (ECI, 2004)
- APPROXIMATE LOCATION OF DOCUMENTED LANDSLIDES AND ERA (SHANNON & WILSON, 2000)
- SOLDIER PILE WALL
- MOUNTAIN BIKE TRAIL
- MULTI-USE TRAIL
- PARK BOUNDARY

EXPLORATION LEGEND

- HH-13 — HANDHOLE DESIGNATION AND APPROXIMATE LOCATION (HWA 2015, 2018)
- *B-207* — BOREHOLE DESIGNATION AND APPROXIMATE LOCATION (ECI, 2003-2004)
- B-2 — BOREHOLE DESIGNATION AND APPROXIMATE LOCATION (LSI ADAPT, 2001)
- GC-32 — BOREHOLE DESIGNATION AND APPROXIMATE LOCATION (GOLDER, 2001)
- B-6 — BOREHOLE DESIGNATION AND APPROXIMATE LOCATION (ECI, 2000)
- TP-7 — TEST PITS DESIGNATION AND APPROXIMATE LOCATION (ECI, 2000)
- B-2 — BOREHOLE DESIGNATION AND APPROXIMATE LOCATION (HARTCROWSER, 1986)
- 9 — BOREHOLE DESIGNATION AND APPROXIMATE LOCATION (SEATTLE ENG. DEPT., 1973)

BASE MAP PROVIDED BY: Google Maps & ESA 12.20.2022



CHEASTY GREENSPACE MOUNTAIN BIKE TRAIL

Scale: 1" = 250'-0"

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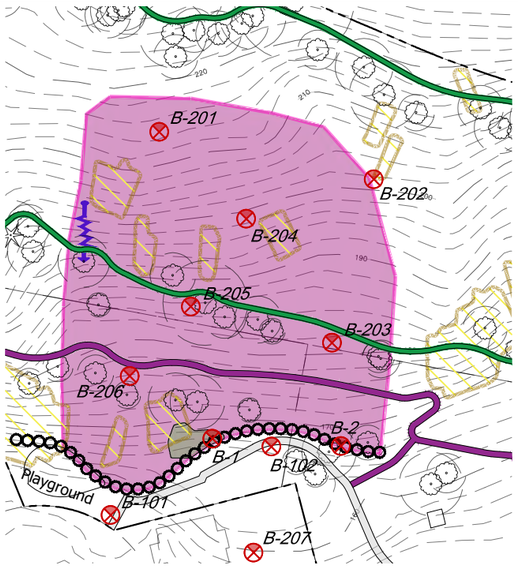
HWA GEOSCIENCES INC.

Cheasty Greenspace Mountain Bike Trail Seattle, Washington	SITE AND EXPLORATION PLAN	DRAWN BY: BFM	FIGURE #: 2A
		CHECK BY: BT	PROJECT #: 2014-177-21
		DATE: 12.27.2022	

C:\USERS\CFRY\DESKTOP\2014-177-21 CHEASTY GREENSPACE MOUNTAIN BIKE TRAIL\2014-177-21 CHEASTY GREENSPACE MOUNTAIN BIKE TRAIL.DWG <Fig 2a> Plotted: 12/27/2022 4:02 PM



ENLARGED PLAN

Scale: 1" = 100'-0"

LEGEND

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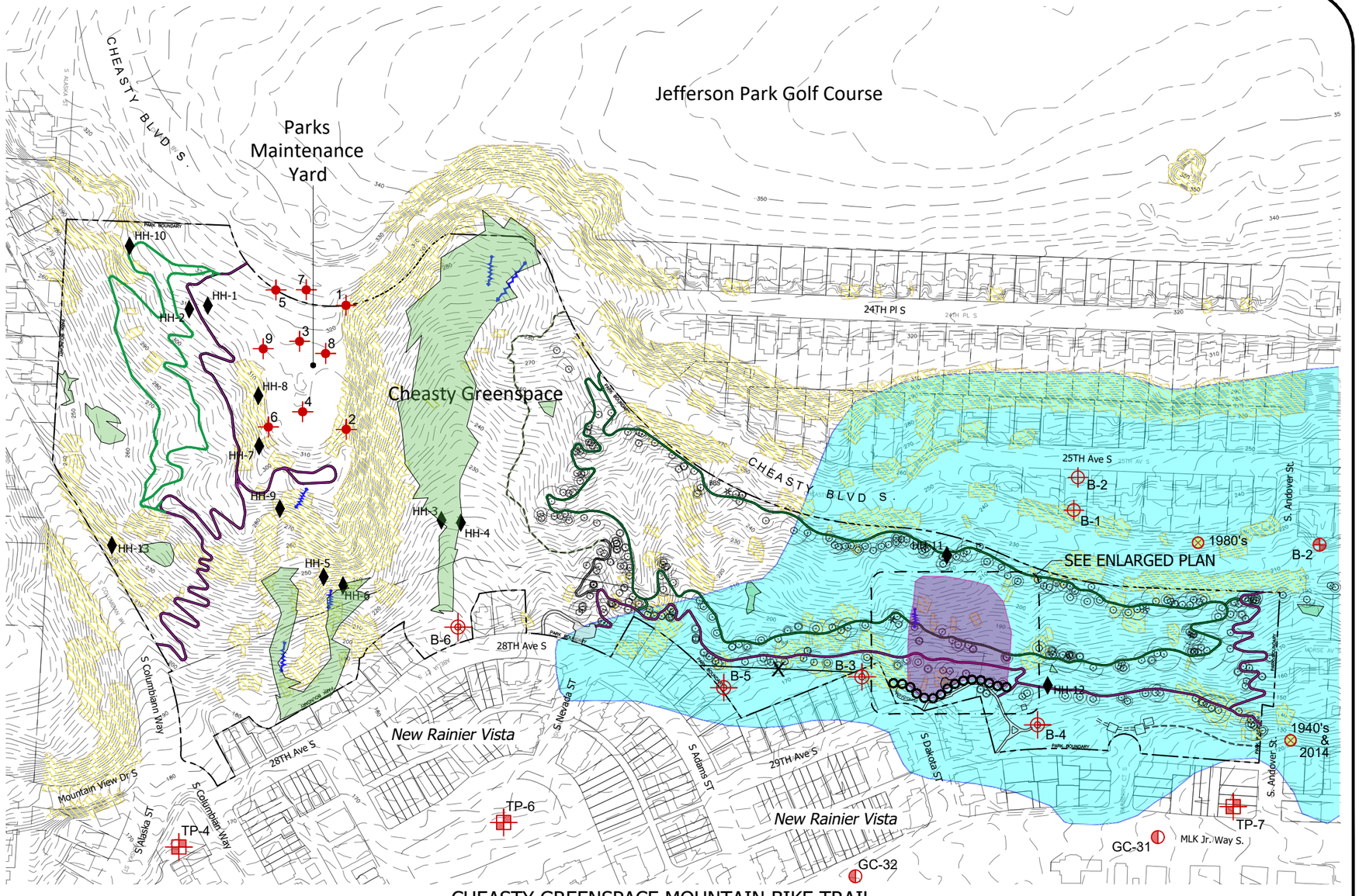

CHEASTY GREENSPACE MOUNTAIN BIKE TRAIL

Scale: 1" = 250'-0"

0 125 250 375 500

HWA GeoSciences Inc.

Cheasty Greenspace Mountain Bike Trail Seattle, Washington

SITE AND EXPLORATION PLAN

DRAWN BY	BFM
CHECK BY	BT
DATE:	12.27.2022
FIGURE #	2B
PROJECT #	2014-177-21

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APPENDIX A
FIELD EXPLORATIONS

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALUE

COHESIONLESS SOILS			COHESIVE SOILS		
Density	N (blows/ft)	Approximate Relative Density(%)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	0 - 15	Very Soft	0 to 2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	35 - 65	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	over 30	>4000

USCS SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP DESCRIPTIONS	
Coarse Grained Soils	Gravel and Gravelly Soils	Clean Gravel (little or no fines)	GW	Well-graded GRAVEL
			GP	Poorly-graded GRAVEL
	More than 50% of Coarse Fraction Retained on No. 4 Sieve	Gravel with Fines (appreciable amount of fines)	GM	Silty GRAVEL
			GC	Clayey GRAVEL
More than 50% Retained on No. 200 Sieve Size	Sand and Sandy Soils	Clean Sand (little or no fines)	SW	Well-graded SAND
			SP	Poorly-graded SAND
	50% or More of Coarse Fraction Passing No. 4 Sieve	Sand with Fines (appreciable amount of fines)	SM	Silty SAND
			SC	Clayey SAND
Fine Grained Soils	Silt and Clay	Liquid Limit Less than 50%	ML	SILT
			CL	Lean CLAY
			OL	Organic SILT/Organic CLAY
50% or More Passing No. 200 Sieve Size	Silt and Clay	Liquid Limit 50% or More	MH	Elastic SILT
			CH	Fat CLAY
			OH	Organic SILT/Organic CLAY
Highly Organic Soils			PT	PEAT

TEST SYMBOLS

%F	Percent Fines
AL	Atterberg Limits: PL = Plastic Limit, LL = Liquid Limit
CBR	California Bearing Ratio
CN	Consolidation
DD	Dry Density (pcf)
DS	Direct Shear
GS	Grain Size Distribution
K	Permeability
MD	Moisture/Density Relationship (Proctor)
MR	Resilient Modulus
PID	Photoionization Device Reading
PP	Pocket Penetrometer Approx. Compressive Strength (tsf)
SG	Specific Gravity
TC	Triaxial Compression
TV	Torvane Approx. Shear Strength (tsf)
UC	Unconfined Compression

SAMPLE TYPE SYMBOLS

- 2.0" OD Split Spoon (SPT) (140 lb. hammer with 30 in. drop)
- Shelby Tube
- 3-1/4" OD Split Spoon with Brass Rings
- Small Bag Sample
- Large Bag (Bulk) Sample
- Core Run
- Non-standard Penetration Test (3.0" OD split spoon)

GROUNDWATER SYMBOLS

- Groundwater Level (measured at time of drilling)
- Groundwater Level (measured in well or open hole after water level stabilized)

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5 mm) to No. 200 (0.074 mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074mm)

COMPONENT PROPORTIONS

PROPORTION RANGE	DESCRIPTIVE TERMS
< 5%	Clean
5 - 12%	Slightly (Clayey, Silty, Sandy)
12 - 30%	Clayey, Silty, Sandy, Gravelly
30 - 50%	Very (Clayey, Silty, Sandy, Gravelly)
Components are arranged in order of increasing quantities.	

NOTES: Soil classifications presented on exploration logs are based on visual and laboratory observation.
Soil descriptions are presented in the following general order:

Density/consistency, color, modifier (if any) GROUP NAME, additions to group name (if any), moisture content. Proportion, gradation, and angularity of constituents, additional comments. (GEOLOGIC INTERPRETATION)

Please refer to the discussion in the report text as well as the exploration logs for a more complete description of subsurface conditions.

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
MOIST	Damp but no visible water.
WET	Visible free water, usually soil is below water table.

HWA GEOSCIENCES INC.

Cheasty Greenspace Mountain Bike Trail
Seattle, Washington

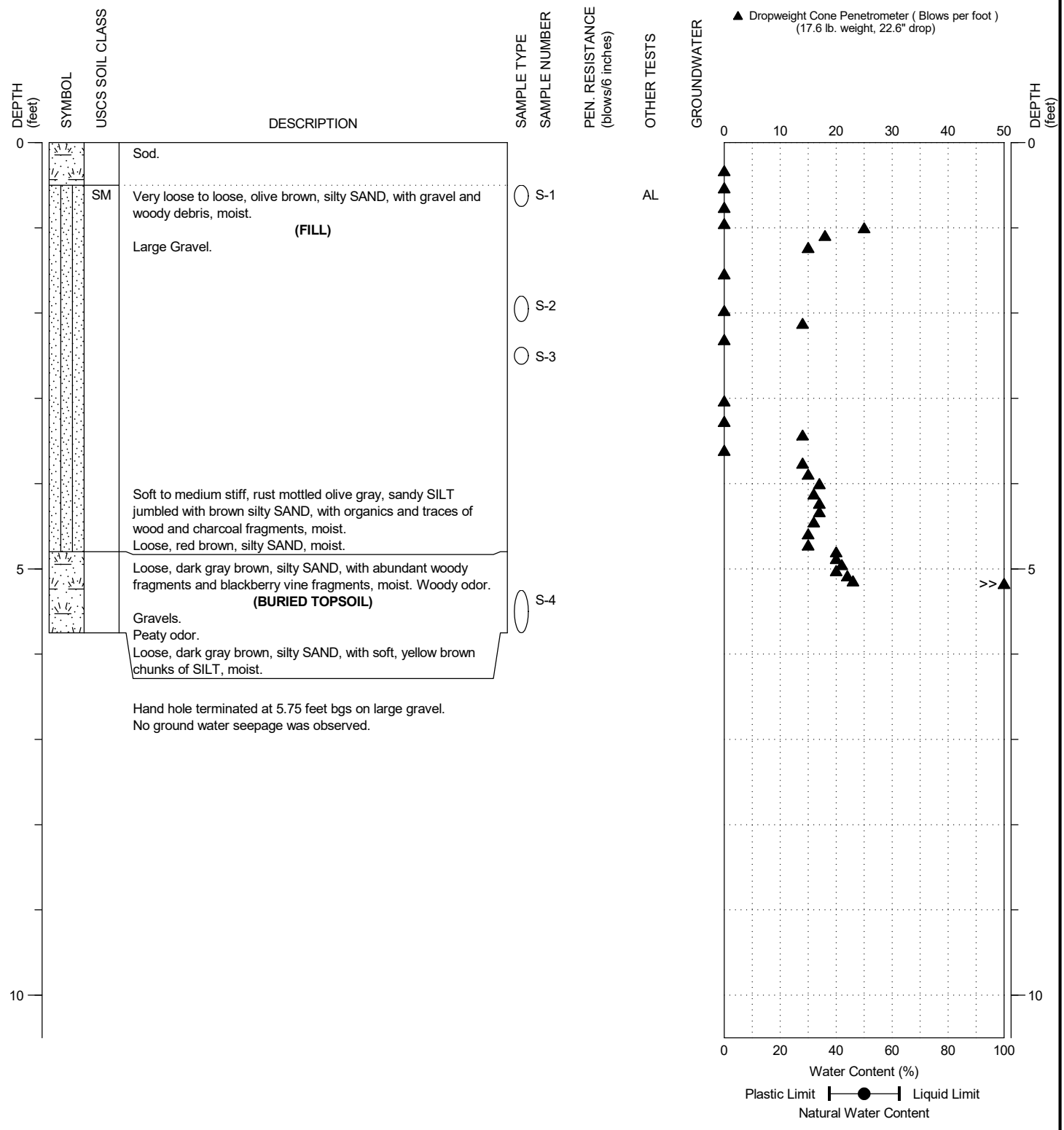
LEGEND OF TERMS AND SYMBOLS USED ON EXPLORATION LOGS

PROJECT NO.: 2014-177-21 FIGURE: A-1

DRILLING COMPANY: HWA GeoSciences Inc.
DRILLING METHOD: Hand Auger
SAMPLING METHOD: Grab
LOCATION: See Figure 2

SURFACE ELEVATION: 315.00 ± feet
CASING ELEVATION ± feet

DATE STARTED: 1/15/2015
DATE COMPLETED: 1/15/2015
LOGGED BY: T. Hesedahl



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

Cheasty Greenspace Mountain Bike Trail
Seattle, Washington

HAND HOLE:
HH- 1

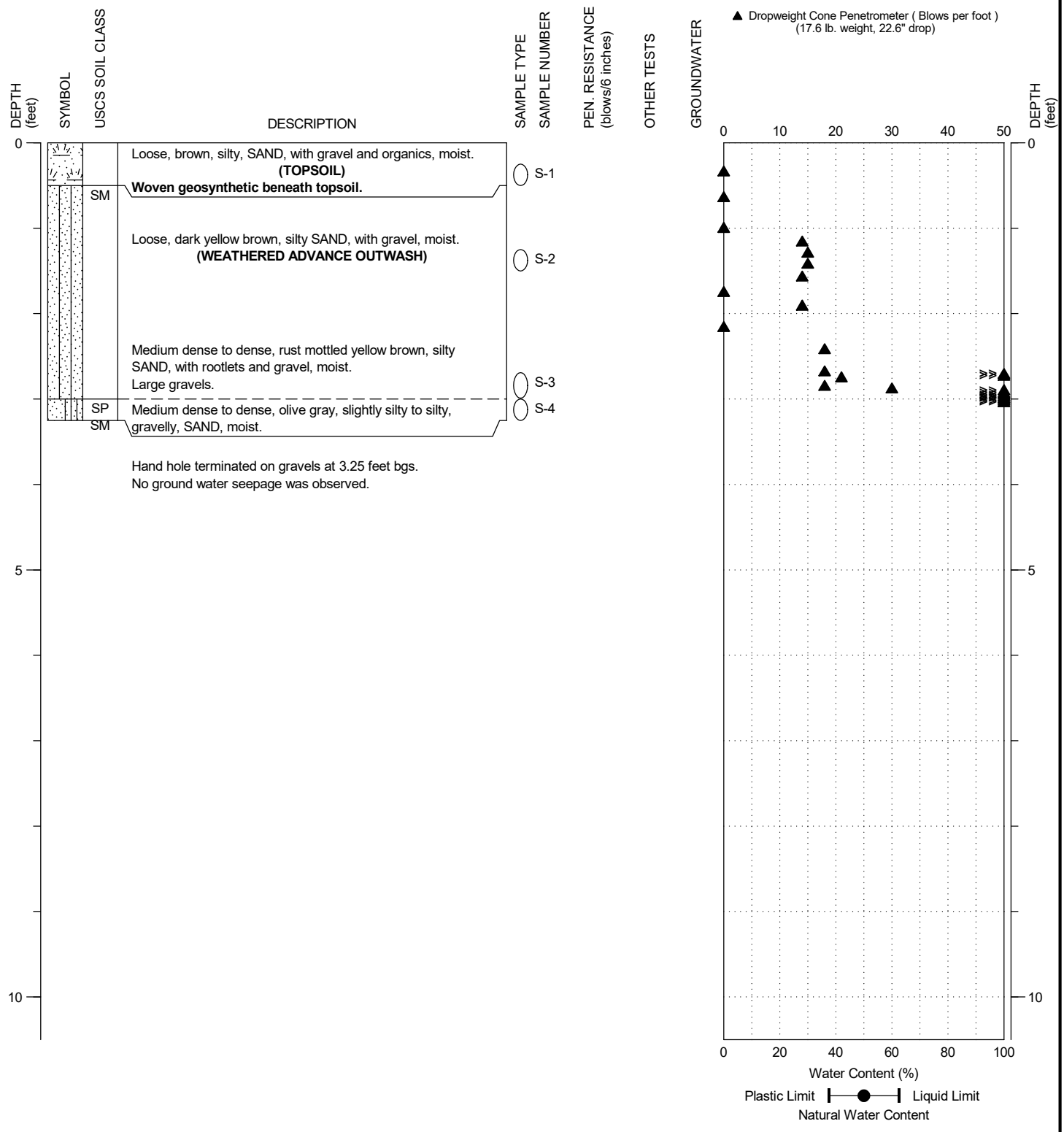
PAGE: 1 of 1

PROJECT NO.: 2014-177-21 FIGURE: A-2

DRILLING COMPANY: HWA GeoSciences Inc.
DRILLING METHOD: Hand Auger
SAMPLING METHOD: Grab
LOCATION: See Figure 2

SURFACE ELEVATION: 310.00 ± feet
CASING ELEVATION ± feet

DATE STARTED: 1/15/2015
DATE COMPLETED: 1/15/2015
LOGGED BY: T. Hesedahl



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

Cheasty Greenspace Mountain Bike Trail
Seattle, Washington

HAND HOLE:
HH- 2

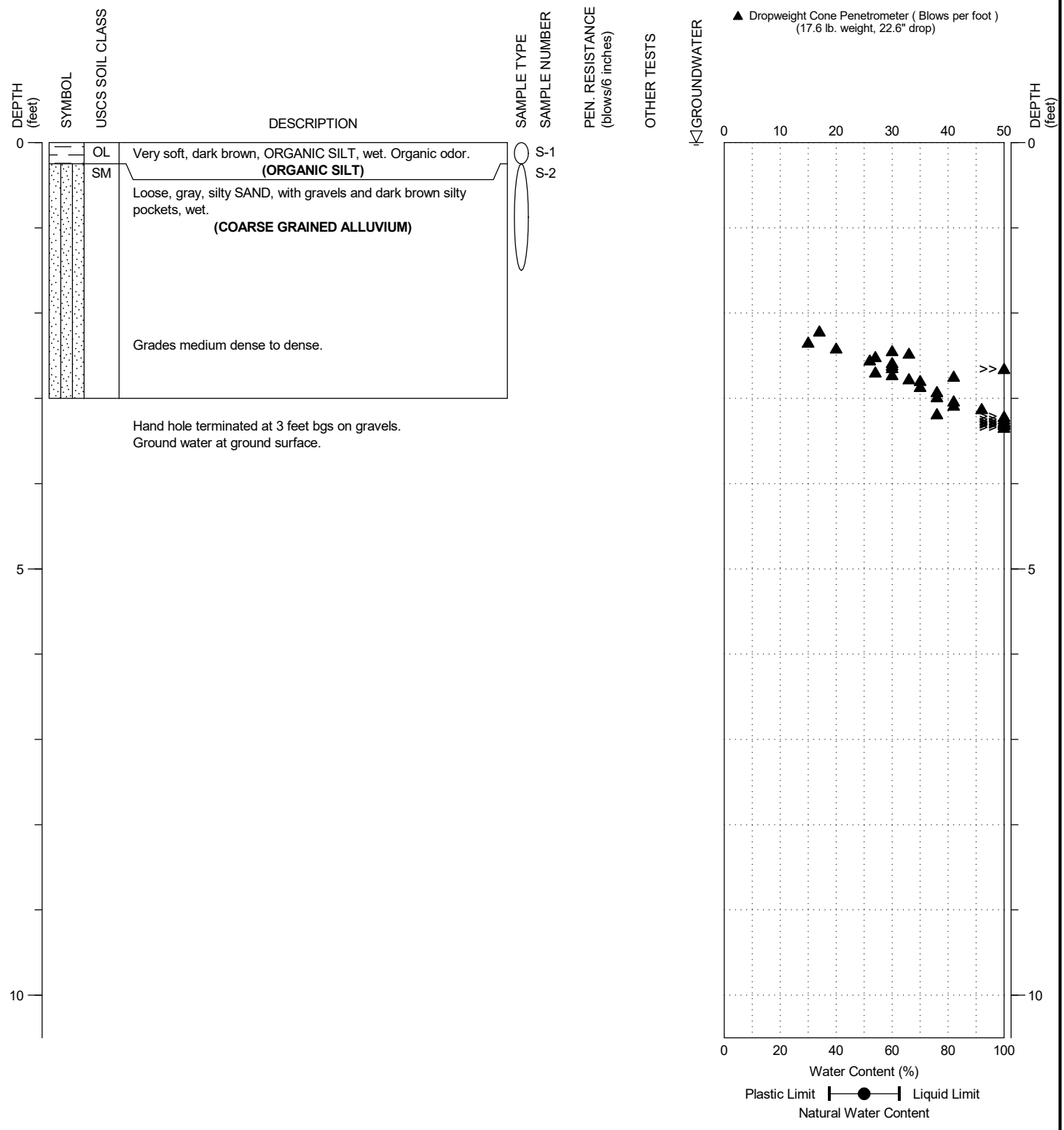
PAGE: 1 of 1

PROJECT NO.: 2014-177-21 FIGURE: A-3

DRILLING COMPANY: HWA GeoSciences Inc.
DRILLING METHOD: Hand Auger
SAMPLING METHOD: Grab
LOCATION: See Figure 2

SURFACE ELEVATION: 220.00 ± feet
CASING ELEVATION ± feet

DATE STARTED: 1/15/2015
DATE COMPLETED: 1/15/2015
LOGGED BY: T. Hesedahl



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

Cheasty Greenspace Mountain Bike Trail
Seattle, Washington

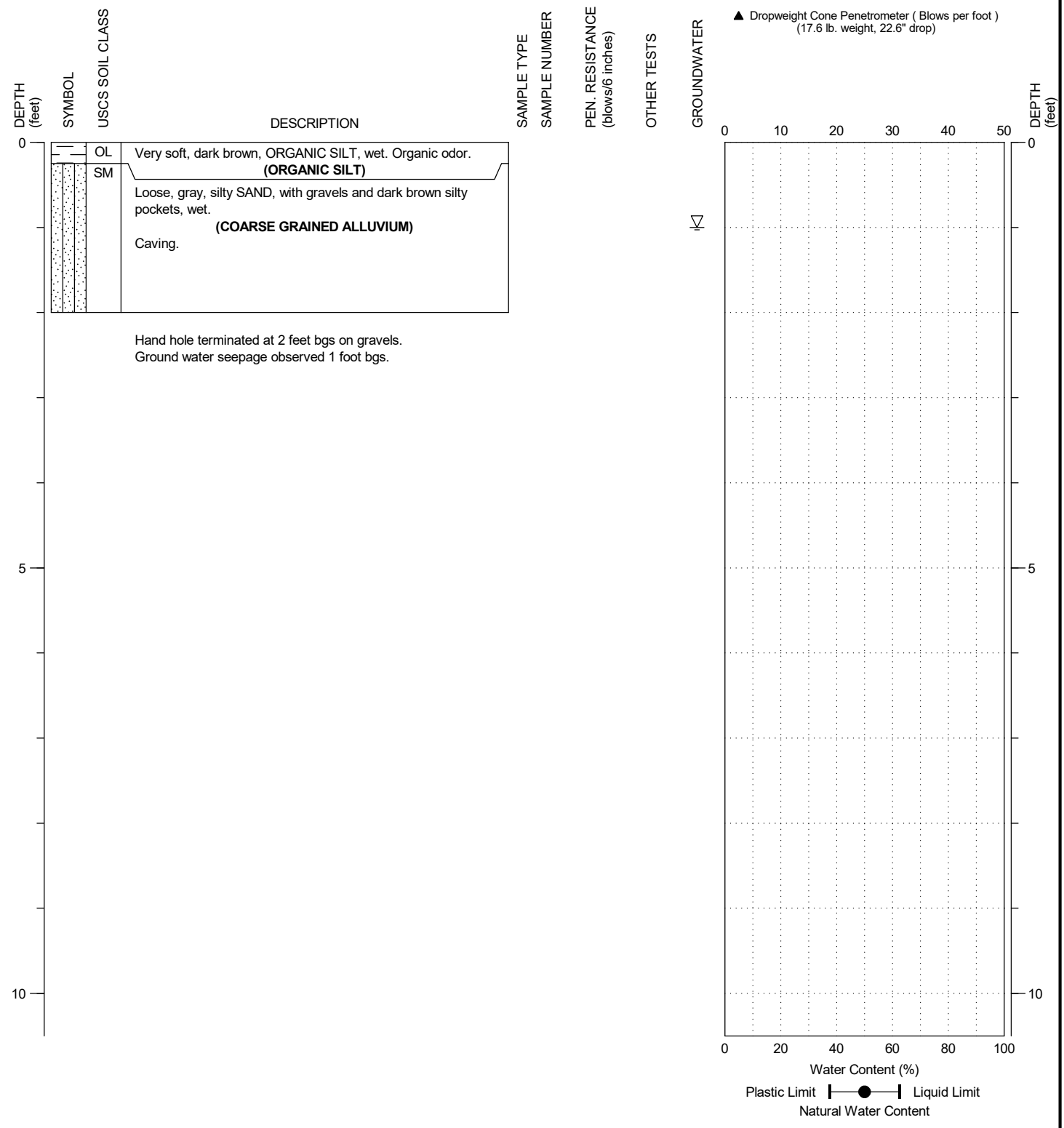
HAND HOLE:
HH- 3

PROJECT NO.: 2014-177-21 FIGURE: A-4

DRILLING COMPANY: HWA GeoSciences Inc.
DRILLING METHOD: Hand Auger
SAMPLING METHOD: Grab
LOCATION: See Figure 2

SURFACE ELEVATION: 220.00 ± feet
CASING ELEVATION ± feet

DATE STARTED: 1/15/2015
DATE COMPLETED: 1/15/2015
LOGGED BY: T. Hesedahl



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

Cheasty Greenspace Mountain Bike Trail
Seattle, Washington

HAND HOLE:
HH- 4

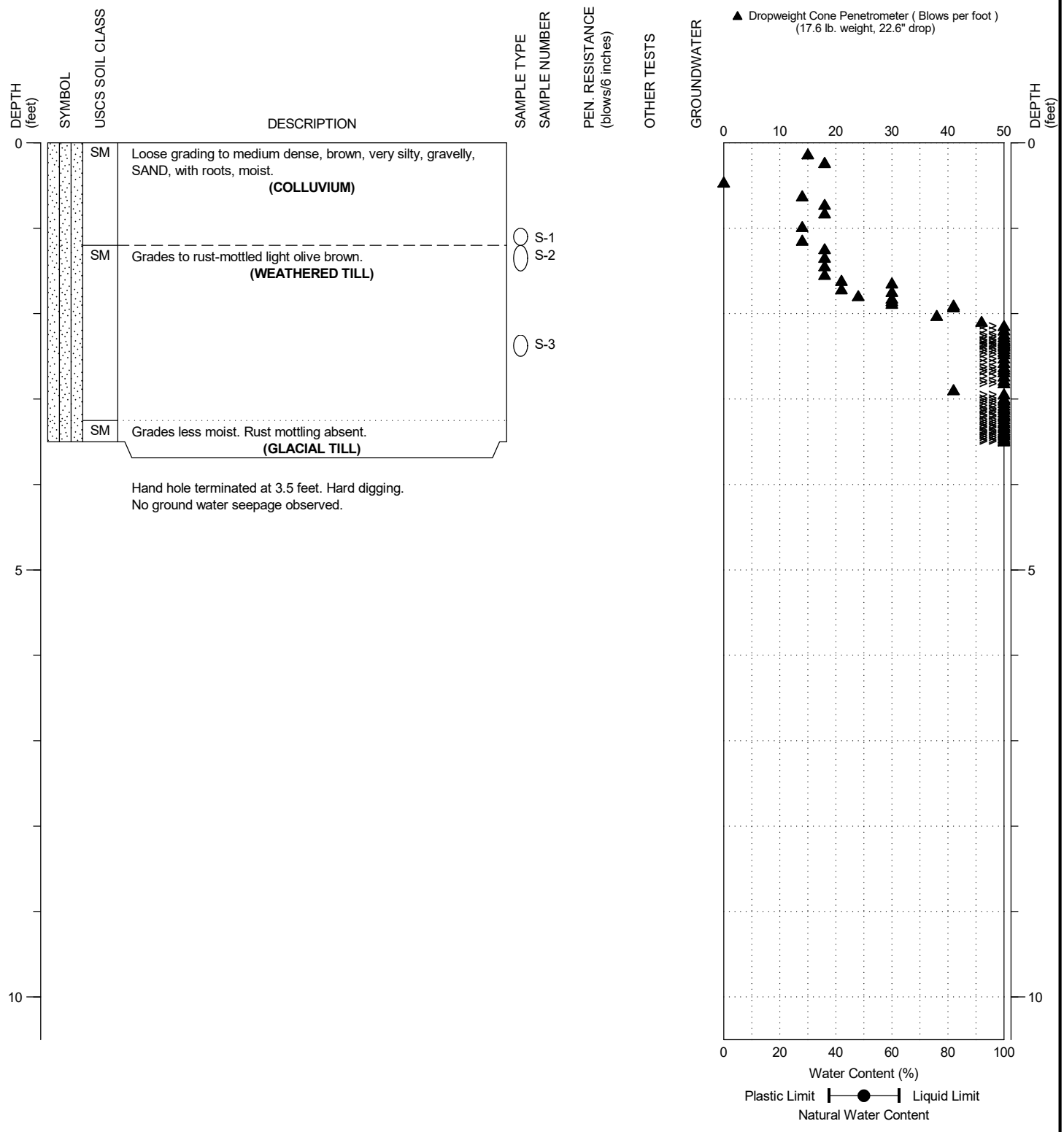
PAGE: 1 of 1

PROJECT NO.: 2014-177-21 FIGURE: A-5

DRILLING COMPANY: HWA GeoSciences Inc.
DRILLING METHOD: Hand Auger
SAMPLING METHOD: Grab
LOCATION: See Figure 2

SURFACE ELEVATION: 260.00 ± feet
CASING ELEVATION ± feet

DATE STARTED: 1/15/2015
DATE COMPLETED: 1/15/2015
LOGGED BY: T. Hesedahl



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

Cheasty Greenspace Mountain Bike Trail
Seattle, Washington

HAND HOLE:
HH- 5

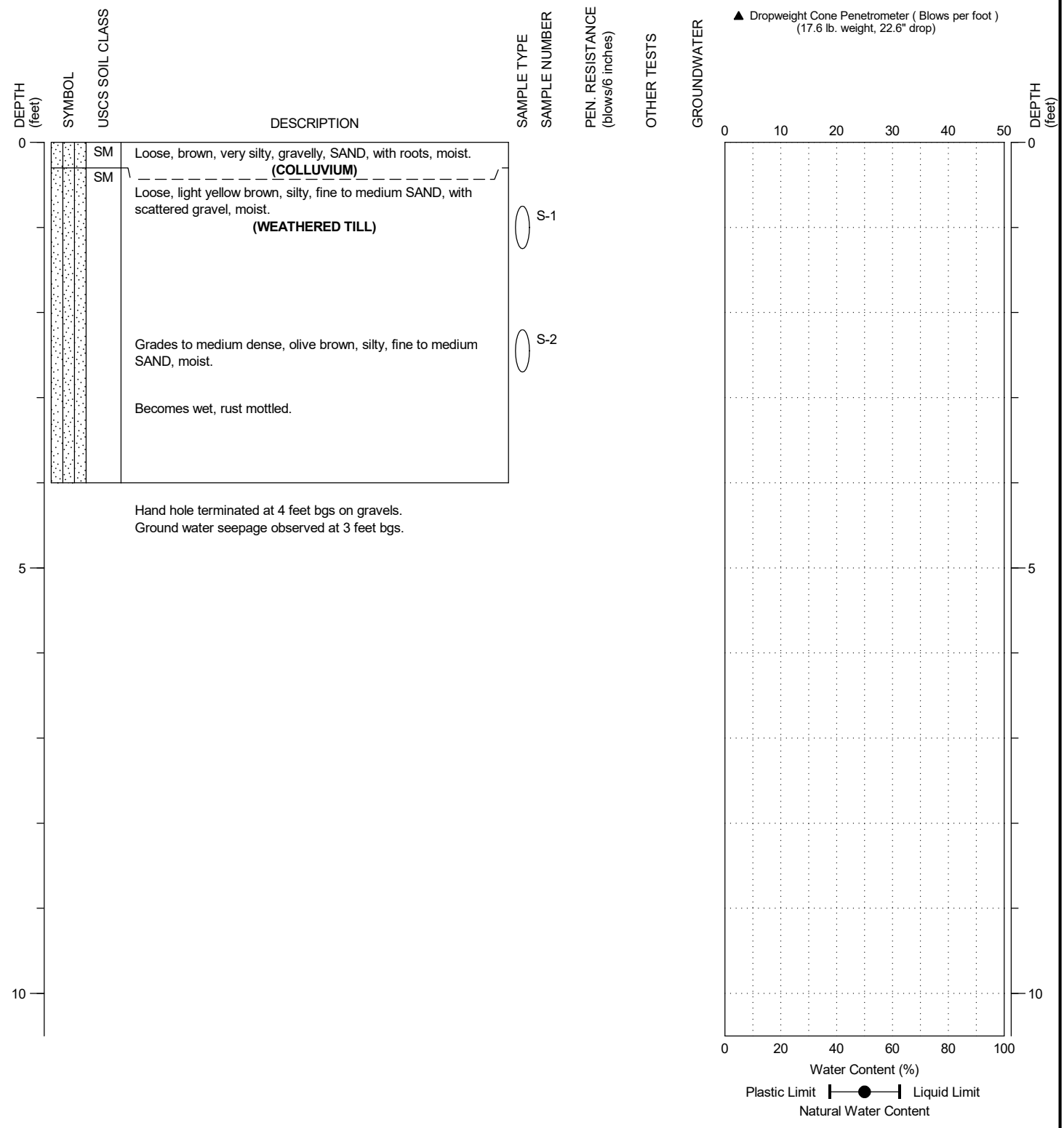
PAGE: 1 of 1

PROJECT NO.: 2014-177-21 FIGURE: A-6

DRILLING COMPANY: HWA GeoSciences Inc.
DRILLING METHOD: Hand Auger
SAMPLING METHOD: Grab
LOCATION: See Figure 2

SURFACE ELEVATION: 230.00 ± feet
CASING ELEVATION ± feet

DATE STARTED: 1/15/2015
DATE COMPLETED: 1/15/2015
LOGGED BY: T. Hesedahl



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

Cheasty Greenspace Mountain Bike Trail
Seattle, Washington

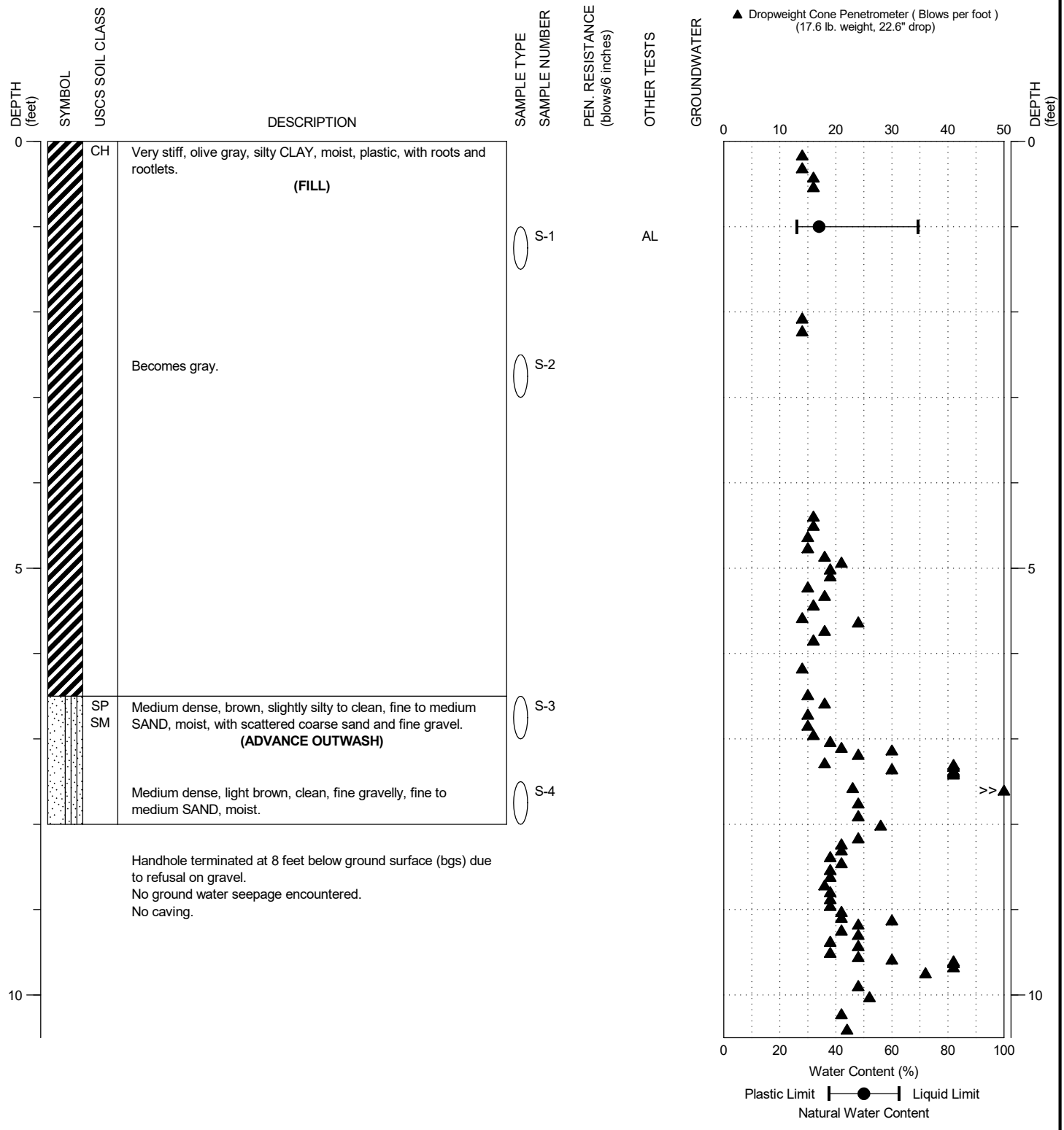
HAND HOLE:
HH- 6

PROJECT NO.: 2014-177-21 FIGURE: A-7

DRILLING COMPANY: HWA GeoSciences Inc.
DRILLING METHOD: Hand Auger
SAMPLING METHOD: Grab
LOCATION: See Figure 2

SURFACE ELEVATION: ± feet
CASING ELEVATION ± feet

DATE STARTED: 5/16/2018
DATE COMPLETED: 5/16/2018
LOGGED BY: A. York



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HWA GEOSCIENCES INC.

Cheasty Greenspace Mountain Bike Trail
Seattle, Washington

HAND HOLE:
HH- 7

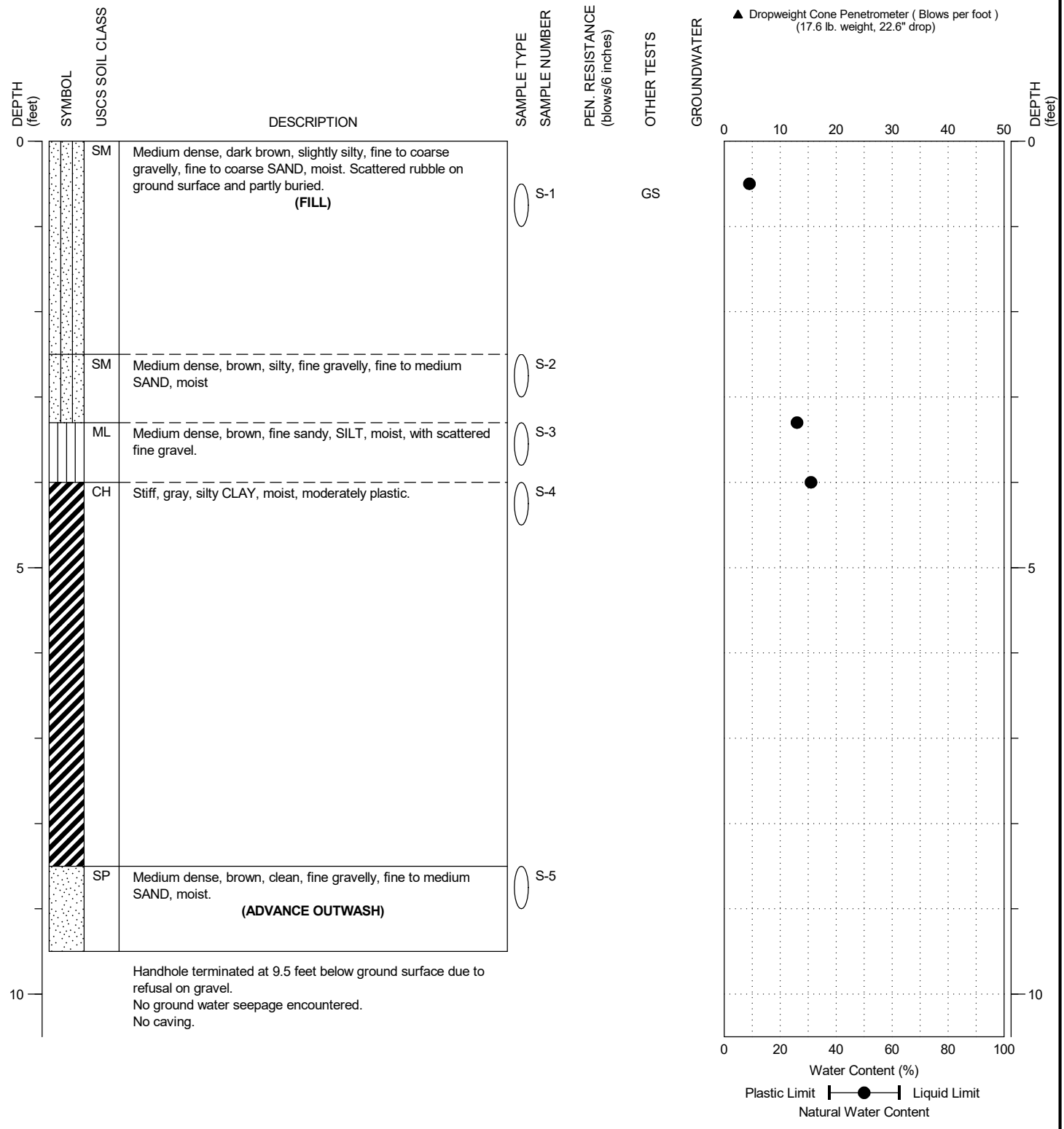
PAGE: 1 of 1

PROJECT NO.: 2014-177-21 FIGURE: A-8

DRILLING COMPANY: HWA GeoSciences Inc.
DRILLING METHOD: Hand Auger
SAMPLING METHOD: Grab
LOCATION: See Figure 2

SURFACE ELEVATION: ± feet
CASING ELEVATION ± feet

DATE STARTED: 5/16/2018
DATE COMPLETED: 5/16/2018
LOGGED BY: A. York



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

Cheasty Greenspace Mountain Bike Trail
Seattle, Washington

HAND HOLE:
HH- 8

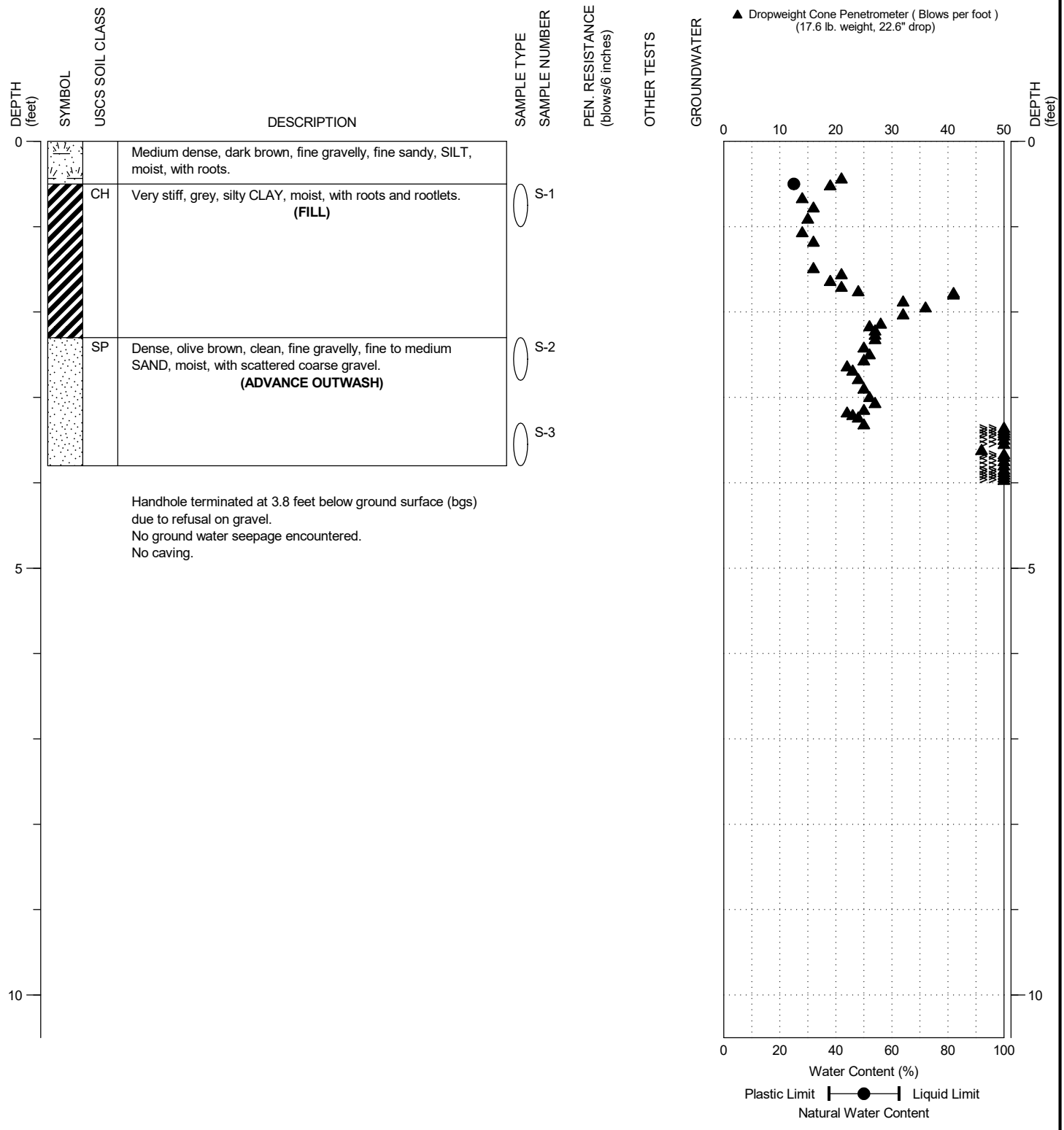
PAGE: 1 of 1

PROJECT NO.: 2014-177-21 FIGURE: A-9

DRILLING COMPANY: HWA GeoSciences Inc.
DRILLING METHOD: Hand Auger
SAMPLING METHOD: Grab
LOCATION: See Figure 2

SURFACE ELEVATION: ± feet
CASING ELEVATION ± feet

DATE STARTED: 5/16/2018
DATE COMPLETED: 5/16/2018
LOGGED BY: A. York



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

Cheasty Greenspace Mountain Bike Trail
Seattle, Washington

HAND HOLE:
HH- 9

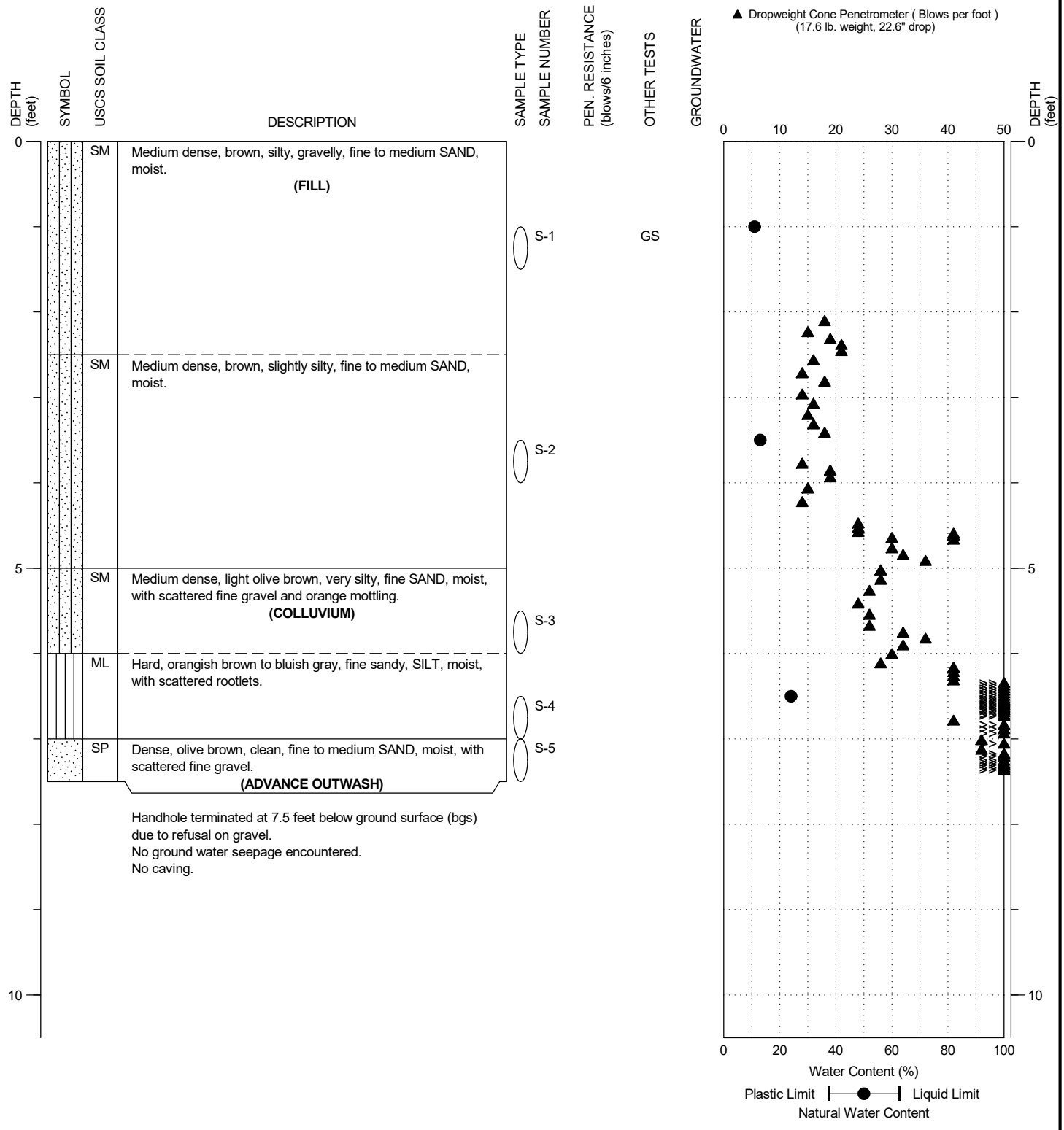
PAGE: 1 of 1

PROJECT NO.: 2014-177-21 FIGURE: A-10

DRILLING COMPANY: HWA GeoSciences Inc.
DRILLING METHOD: Hand Auger
SAMPLING METHOD: Grab
LOCATION: See Figure 2

SURFACE ELEVATION: ± feet
CASING ELEVATION ± feet

DATE STARTED: 5/17/2018
DATE COMPLETED: 5/17/2018
LOGGED BY: A. York



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

Cheasty Greenspace Mountain Bike Trail
Seattle, Washington

HAND HOLE:
HH-10

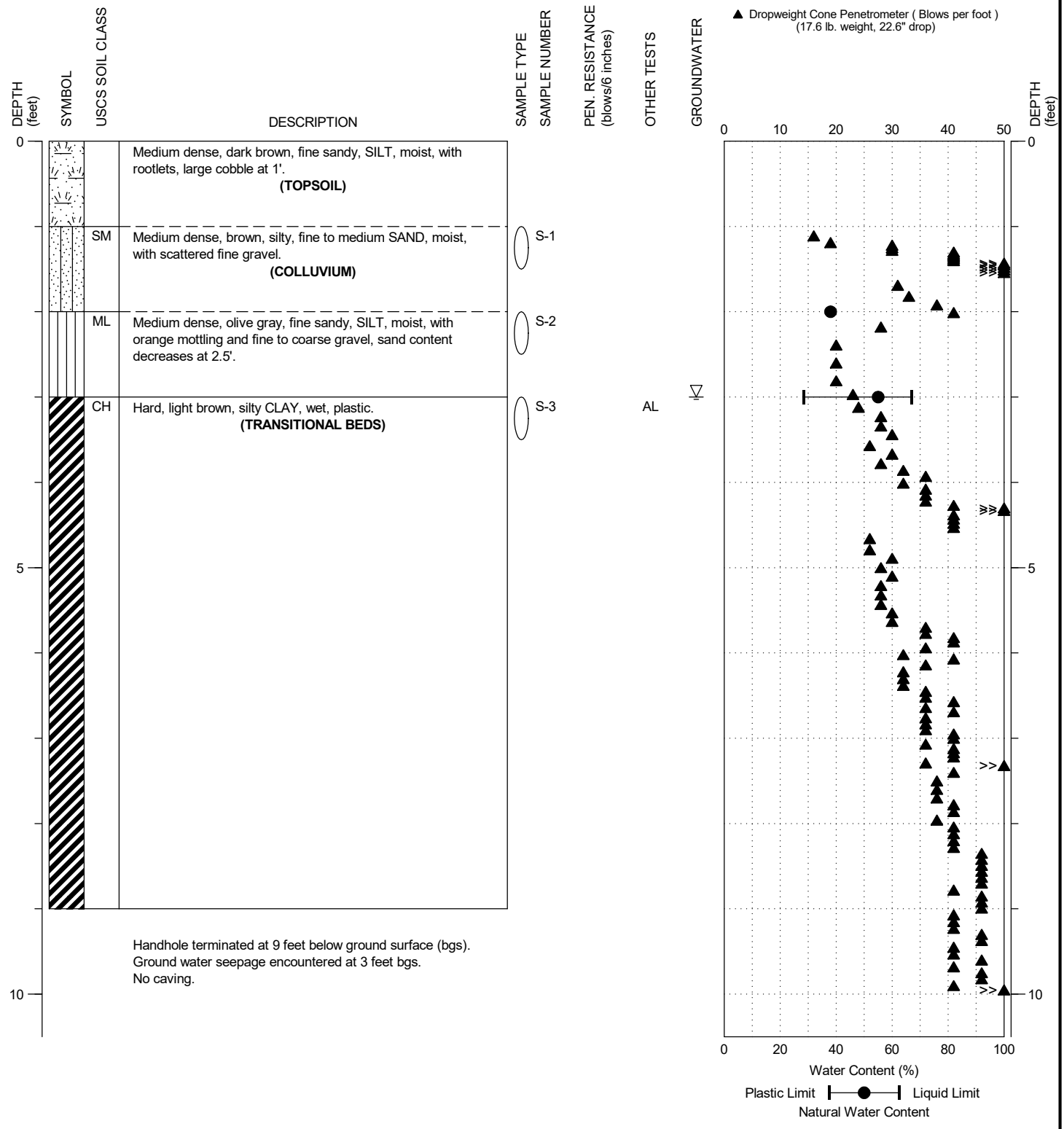
PAGE: 1 of 1

PROJECT NO.: 2014-177-21 FIGURE: A-11

DRILLING COMPANY: HWA GeoSciences Inc.
DRILLING METHOD: Hand Auger
SAMPLING METHOD: Grab
LOCATION: See Figure 2

SURFACE ELEVATION: ± feet
CASING ELEVATION ± feet

DATE STARTED: 5/17/2018
DATE COMPLETED: 5/17/2018
LOGGED BY: A. York



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

Cheasty Greenspace Mountain Bike Trail
Seattle, Washington

HAND HOLE:
HH-11

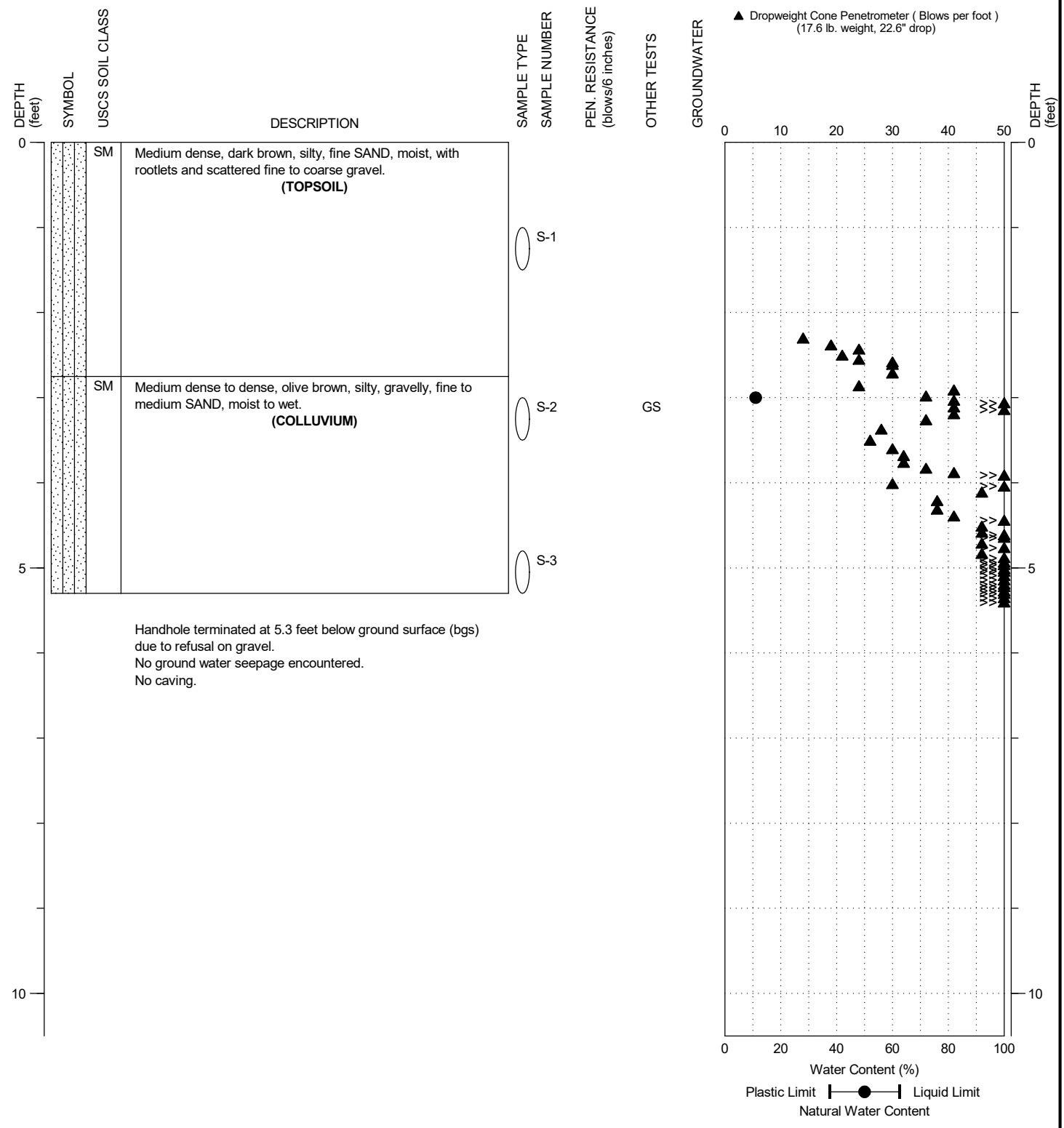
PAGE: 1 of 1

PROJECT NO.: 2014-177-21 FIGURE: A-12

DRILLING COMPANY: HWA GeoSciences Inc.
DRILLING METHOD: Hand Auger
SAMPLING METHOD: Grab
LOCATION: See Figure 2

SURFACE ELEVATION: ± feet
CASING ELEVATION ± feet

DATE STARTED: 5/17/2018
DATE COMPLETED: 5/17/2018
LOGGED BY: A. York



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

Cheasty Greenspace Mountain Bike Trail
Seattle, Washington

HAND HOLE:
HH-12

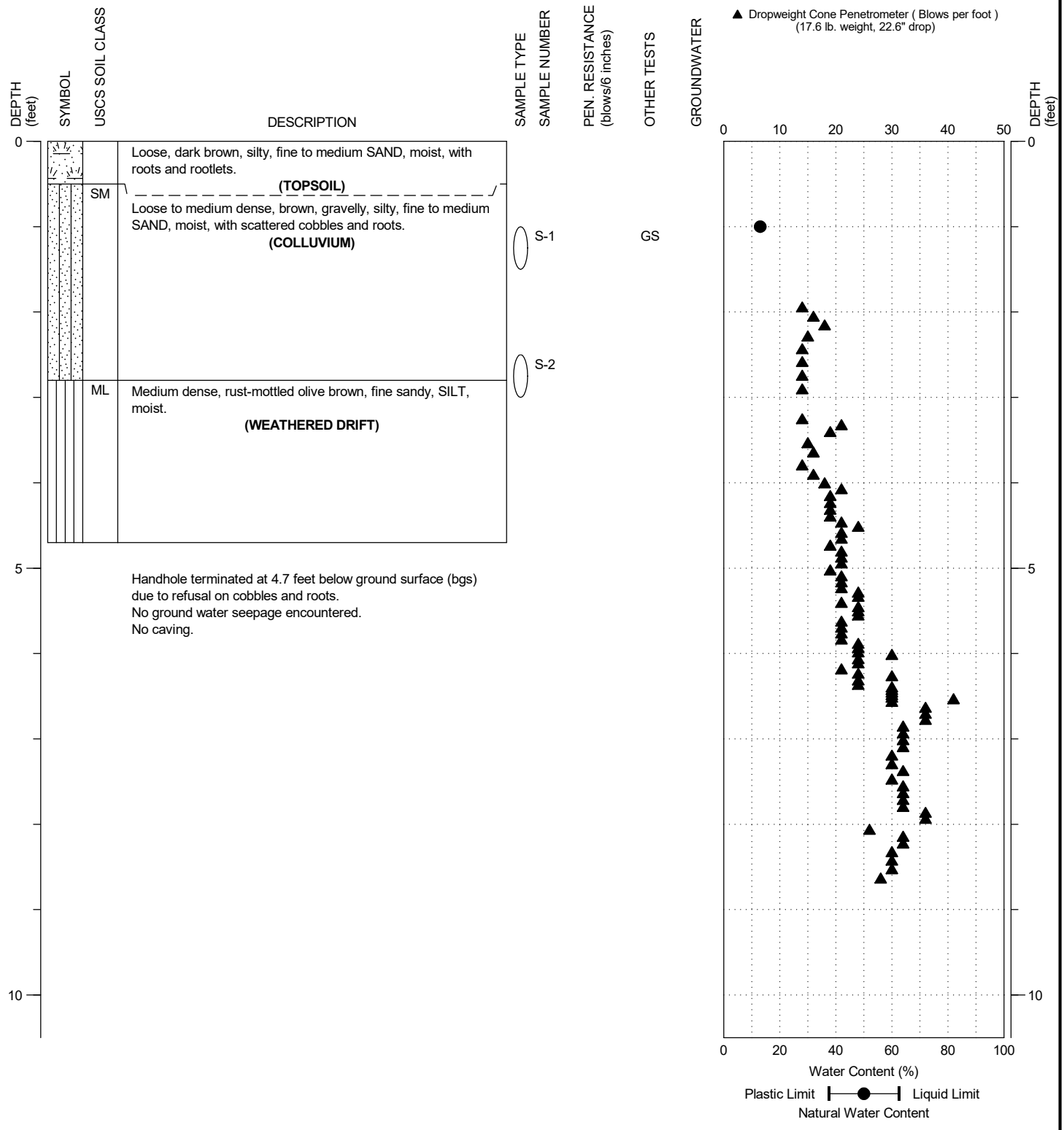
PAGE: 1 of 1

PROJECT NO.: 2014-177-21 FIGURE: A-13

DRILLING COMPANY: HWA GeoSciences Inc.
DRILLING METHOD: Hand Auger
SAMPLING METHOD: Grab
LOCATION: See Figure 2

SURFACE ELEVATION: ± feet
CASING ELEVATION ± feet

DATE STARTED: 5/17/2018
DATE COMPLETED: 5/17/2018
LOGGED BY: A. York



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

Cheasty Greenspace Mountain Bike Trail
Seattle, Washington

HAND HOLE:
HH-13

PAGE: 1 of 1

PROJECT NO.: 2014-177-21 FIGURE: A-14

APPENDIX B
LABORATORY DATA

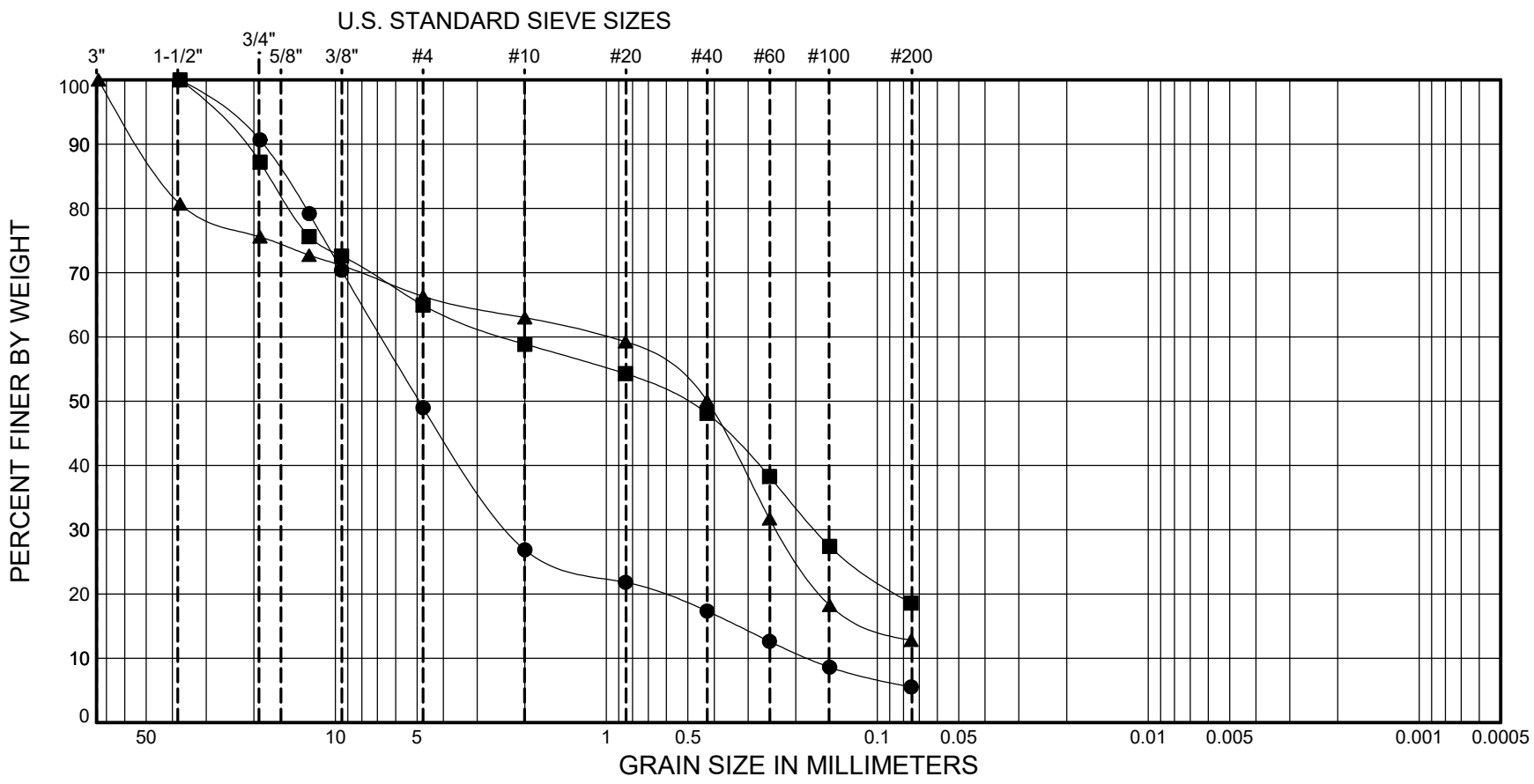
EXPLORATION DESIGNATION	TOP DEPTH (feet)	BOTTOM DEPTH (feet)	MOISTURE CONTENT (%)	ORGANIC CONTENT (%)	SPECIFIC GRAVITY	ATTERBERG LIMITS (%)			% GRAVEL	% SAND	% FINES	ASTM SOIL CLASSIFICATION	SAMPLE DESCRIPTION
						LL	PL	PI					
HH- 7,S-1	1.0	1.5	34.1			69	26	43				CH	Gray, fat CLAY
HH- 8,S-1	0.5	1.0	9.4						51.0	43.5	5.5	GP-GM	Very dark brown, poorly graded GRAVEL with silt and sand
HH- 8,S-3	3.3	3.8	26.2									ML	Olive-brown, SILT with sand
HH- 8,S-4	4.0	4.5	30.8									CL	Grayish-brown, lean CLAY
HH- 9,S-1	0.5	1.0	25.5									CL	Grayish-brown, lean CLAY
HH-10,S-1	1.0	1.5	10.8						35.1	46.3	18.6	SM	Yellowish-brown, silty SAND with gravel
HH-10,S-2	3.5	4.0	12.7									SM	Dark yellowish-brown, silty SAND with gravel
HH-10,S-4	6.5	7.0	23.9									ML	Yellowish-brown, sandy SILT
HH-11,S-2	2.0	2.5	37.7									ML	Olive-brown, SILT
HH-11,S-3	3.0	3.5	55.1			67	28	39				CH	Yellowish-brown, fat CLAY with sand
HH-12,S-2	3.0	3.5	11.5						33.7	53.5	12.8	SM	Olive-brown, silty SAND with gravel
HH-13,S-1	1.0	1.5	13.4						13.4	57.1	29.5	SM	Dark yellowish-brown, silty SAND

Notes: 1. This table summarizes information presented elsewhere in the report and should be used in conjunction with the report test, other graphs and tables, and the exploration logs.
2. The soil classifications in this table are based on ASTM D2487 and D2488 as applicable.

HWA GEOSCIENCES INC.

Cheasty Greenspace Mountain Bike Trail
Seattle, Washington

SUMMARY OF MATERIAL PROPERTIES



SYMBOL	SAMPLE		DEPTH (ft.)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	HH- 8	S-1	0.5 - 1.0	(GP-GM) Very dark brown, poorly graded GRAVEL with silt and sand	9				51.0	43.5	5.5
■	HH-10	S-1	1.0 - 1.5	(SM) Yellowish-brown, silty SAND with gravel	11				35.1	46.3	18.6
▲	HH-12	S-2	3.0 - 3.5	(SM) Olive-brown, silty SAND with gravel	11				33.7	53.5	12.8

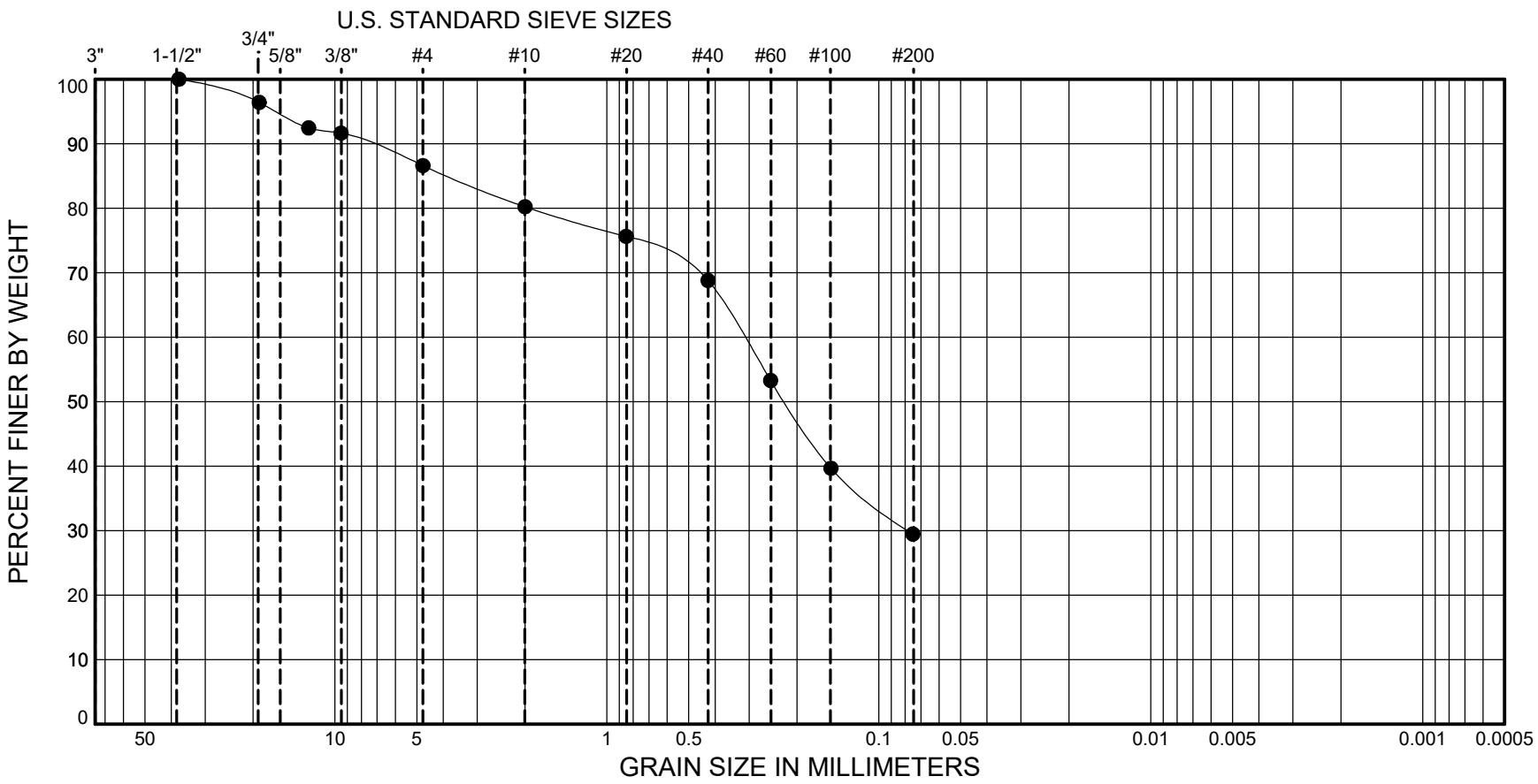
HWA GEOSCIENCES INC.

Cheasty Greenspace Mountain Bike Trail
Seattle, Washington

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D6913

PROJECT NO.: 2014-177-21 FIGURE: B-2

GRAVEL		SAND			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		



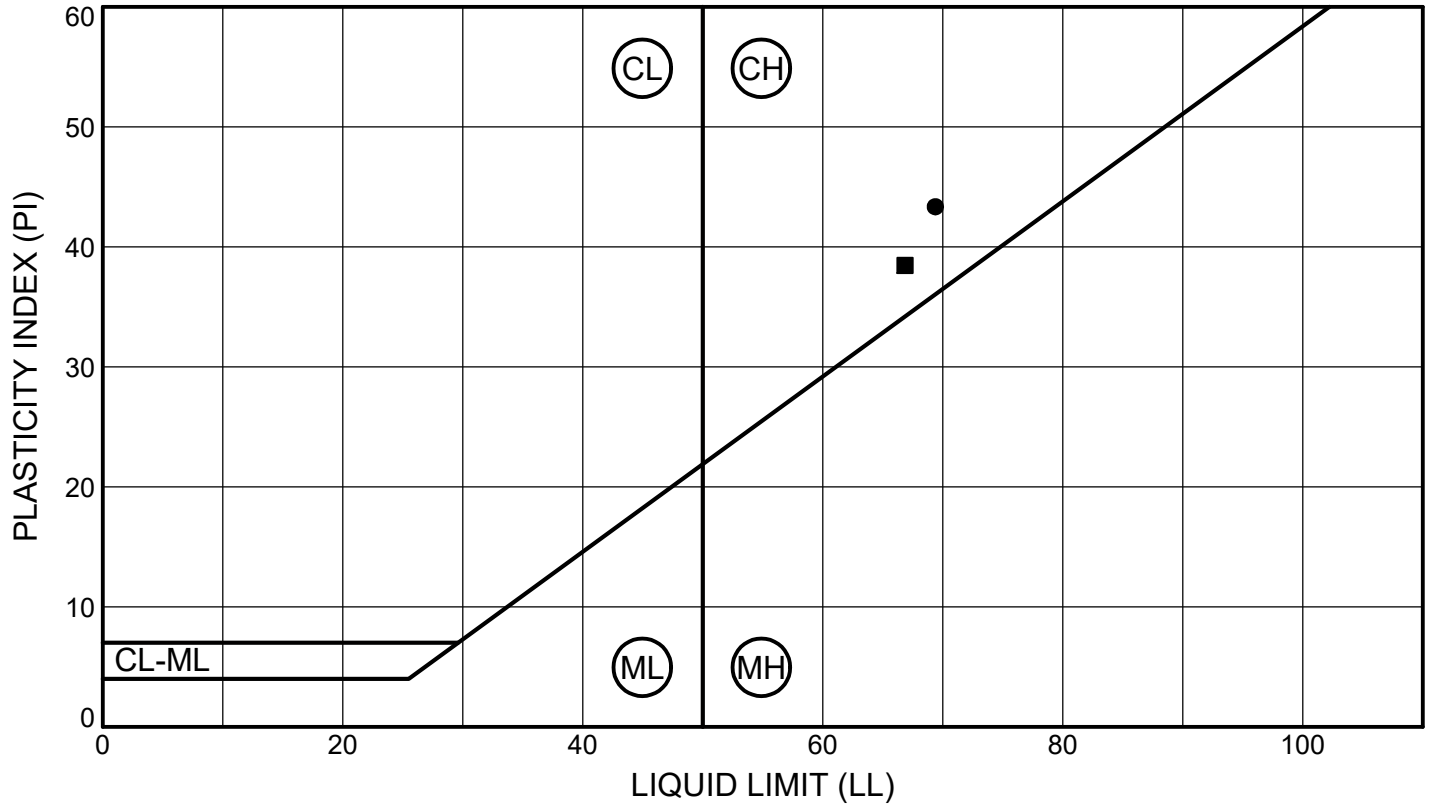
SYMBOL	SAMPLE		DEPTH (ft.)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	HH-13	S-1	1.0 - 1.5	(SM) Dark yellowish-brown, silty SAND	13				13.4	57.1	29.5

HWA GeoSciences Inc.

Cheasty Greenspace Mountain Bike Trail
Seattle, Washington

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D6913

PROJECT NO.: 2014-177-21 FIGURE: B-3



SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION	% MC	LL	PL	PI	% Fines
●	HH- 7	S-1	1.0 - 1.5	(CH) Gray, fat CLAY	34	69	26	43	
■	HH-11	S-3	3.0 - 3.5	(CH) Yellowish-brown, fat CLAY with sand	55	67	28	39	

HWA GEOSCIENCES INC.

Cheasty Greenspace Mountain Bike Trail
Seattle, Washington

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS
METHOD ASTM D4318

PROJECT NO.: 2014-177-21 FIGURE: B-4

APPENDIX C
EXISTING GEOTECHNICAL INFORMATION

1973 SEATTLE ENGINEERING DEPARTMENT 006221

8348

SECTION

CHEASTY BLVD.

DELIVERY

DELIVERY

SHOPS & WAREHOUSES

DISTRICT WAREHOUSE BELOW

PARKING

TRUCKS & VANS

300

275

250

225

SEATTLE ENGINEERING DEPARTMENT

MATERIALS LABORATORY

8393

CS 7.241

LOG OF TEST BORING

DATE 3-23-73

HOLE NO.

PROJECT Park Dept Cheasty Blvd

GRD. ELEV. 302.2

LOCATION North Grid Line 4° N of & Sta 3+08

STRATA	DEPTH	SAMPLE NO.	BLOW COUNT			STD. PEN.	DESCRIPTION OF MATERIAL				WATER LEVEL
							COMPOSITION	CONSISTENCY	MOISTURE	COLOR	
Top Soil							1° GRAY CLAY				
							BRN SILTY SAND w/ GRAVEL & ORGANIC				
Compact silty SAND w/gravel	5	A	2	25	25	50	SILTY FINE SAND w/ GRAVEL	COMP	MOIST	BRN	
					6"						
	10	B	15	40	50	90	SILTY SAND w/GRAVEL	V. COMP	MOIST	BRN	BOTTOM
	15	C	16	32	35	67	SILTY SAND w/GRAVEL	V. COMP	MOIST	BRN	
Bottom											
	20	D									
	25	E									

1 WATER 3-26-73 3-30-73

INSPECTOR

SEATTLE ENGINEERING DEPARTMENT
MATERIALS LABORATORY

8394

CS 7.241

LOG OF TEST BORING

DATE 3-22-73 HOLE NO. 2

PROJECT PARK DEPT GRD. ELEV. 290.9

LOCATION NORTH GRID LINE STA 5+50

STRATA	DEPTH	SAMPLE NO.	BLOW COUNT	STD. PEN.	DESCRIPTION OF MATERIAL: COMPOSITION	CONSISTENCY	MOISTURE	COLOR	WATER LEVEL
FILL soft clayey					1° BRN SILTY SAND BL GRAY				
	5	A	0 / 1	2	CLAY-SILT (DISTURBED) FILL	V. SOFT	MOIST	GRAY	
Loose silty SAND	10	B	1 3	6	SILT FINE SAND W/ GRAVEL & ORGANIC	LOOSE	MOIST	BRN	
					GRAVELLY DRILLING				
Firm to compact silty SAND with gravel	15	C	7 12	25	SILTY SAND W/ GRAVEL & SANDY LAYERS	FIRM	MOIST	BRN	
	20	D	10 20	43	FINE SAND W/ SILT & SILTY LAYERS & TRACE GRAVEL	COMP	MOIST	BRN	
					12" FINE SAND W/		MOIST	BRN	
	25	E	2 16	36	COARSE SAND LAYER	COMP			
					6" SILTY SAND W/ GRAVEL			BRN	
Bottom	30	F	16 36	66	SILTY FINE SAND W/ GRAVEL	V. COMP	MOIST	BRN	

REMOVED BY OTHERS 3-26-73

INSPECTOR H. W. KOKITA

SEATTLE ENGINEERING DEPARTMENT

MATERIALS LABORATORY

8394

CS 7.241

LOG OF TEST BORING

DATE 3-23-73 HOLE NO B

PROJECT Park Dept. GRD. ELEV. 303.6

LOCATION Kaio. Grid Line Sta 3+95

STRATA	DEPTH	SAMPLE NO.	BLOW COUNT	STD. PEN.	DESCRIPTION OF MATERIAL: COMPOSITION	CONSISTENCY	MOISTURE	COLOR	WATER LEVEL
Very soft to medium soft clayey FILL					GRAT CLAT				
	5	A	1 1 2	3	CLAT-SILT (DISTURBED) FILL	SOFT	MOIST	GRAY	
	10	B	1 2 3	5	CLAT-SILT (DISTURBED) FILL	SOFT	MOIST	GRAY	
	15	C	1 4 4	8	CLAT-SILT (DISTURBED) FILL	MED	MOIST	GRAY	
					HARDER DRILLING				
Very compact silty fine SAND	20	D	12 50/6" X	100+	SILTY FINE SAND w/ GRAVEL	V. COMP	MOIST	BRN	
	25	E	50/6" X X	100+	SILTY FINE SAND w/ GRAVEL	V. COMP	MOIST	BRN	
	30	F	50/2" X X	100+	SILTY FINE SAND w/ GRAVEL	V. COMP	MOIST	BRN	
Bottom									

Remarks by others 3-30-73 No water noted 3-26-73

INSPECTOR Ken Kokta

SEATTLE ENGINEERING DEPARTMENT
MATERIALS LABORATORY

CS 7.241

8395

1 of 2

LOG OF TEST BORING

DATE 3-22-73 HOLE NO. 4

PROJECT Park Dept GRD. ELEV. 301.7

LOCATION Middle Grid Line 8° South Sta 5+10

STRATA	DEPTH	SAMPLE NO.	BLOW COUNT	STD. PEN.	DESCRIPTION OF MATERIAL: COMPOSITION	CONSISTENCY	MOISTURE	COLOR	WATER LEVEL
					CLAY-SILT			GRAY	3-30-73 NO WATER 3-26-73 3-23-73
		A							
	5		1 1 2	3	CLAY-SILT (DISTORTED) w/ WOOD FILL	SOFT	MOIST	GRAY	
			2 3" shelby		Unconf. Comp. strength = 1.1 Tsf; Torvane shear strength = 0.5 Tsf; Density 115 pcf, wet 84 pcf dry				
		B	1 2 3	5	CLAY-SILT (DISTORTED)	SOFT	MOIST	GRAY	
	10				FILL				
		C	1 2 3	5	CLAY-SILT (DISTORTED)	SOFT	MOIST	GRAY	
	15				BRN. SAND & GRAVEL FILL				
					HARDER DRILLING				
		D	2 3 5	8	SILTY SAND w/ GRAVEL	LOOSE	MOIST TO WET	BRN	
Loose silty SAND	20								
Compact silty SAND		E	5 15 23	38	SILTY SAND w/ GRAVEL & FINE SAND LAYERS ON ROCK	COMP	MOIST WET	BRN	
	25								
		F	15 25 29	54	SILTY FINE SAND w/ GRAVEL & SAND STRIPS	V. COMP	MOIST MOIST	BRN BRN	
	30								

Soft to very soft clayey FILL

γ_D = 84 pcf q_u = 1.1 Tsf c = 0.5 Tsf

Station

INSPECTOR H. W. Cocke

8395

2 of 2

SEATTLE ENGINEERING DEPARTMENT

MATERIALS LABORATORY

CS 7.241

LOG OF TEST BORING

DATE 3-22-73

HOLE NO. 4

PROJECT Park Dept.

GRD. ELEV.

LOCATION

STRATA	DEPTH	SAMPLE NO.	BLOW COUNT			STD. PEN.	DESCRIPTION OF MATERIAL				WATER LEVEL
							COMPOSITION	CONSISTENCY	MOISTURE	COLOR	
Compact silty SAND							HARDER DRILLING				
			3"								
	35	G	50	X	X	100+	SANDY SILT w/GRAVEL	V. COMP	MOIST	BRN	
					4½"						
		H	20	30	50	80+	SANDY SILT w/GRAVEL & FINE SAND LAYERS	V. COMP	MOIST WET	BRN	
Bottom	40										

INSPECTOR Hugo Kokita

SEATTLE ENGINEERING DEPARTMENT
MATERIALS LABORATORY

8396

CS 7.241

LOG OF TEST BORING

DATE 3-23-73 HOLE NO. S

PROJECT PARK DEPT. GRD. ELEV. 303.7

LOCATION SOUTH GRID LINE 10' N. & STA 3+00

STRATA	DEPTH	SAMPLE NO.	BLOW COUNT	STD. PEN.	DESCRIPTION OF MATERIAL: COMPOSITION	CONSISTENCY	MOISTURE	COLOR	WATER LEVEL
Soft to very soft clayey FILL					GRAY CLAY				
	5	A	1 1 1	2	CLAY-SILT (DISTURBED) w/ ORGANIC FILL	V. SOFT	MOIST	GRAY	3-30-73 3-26-73
					ROCK				
	10	B	2 4 3	7	3" CLAY-SILT		MOIST	GRAY	
					2" ROOT & ORGANIC SILT			BRN	
very compact silty SAND	15	C	13 28 44	72	SILTY FINE SAND w/ GRAVEL & SANDY LAYERS	V. COMP	MOIST	BRN	
					10" SILTY FINE SAND				
	20	D	3 25 39	64	w/ GRAVEL	V. COMP	WET	BRN	
					8" SILT		MOIST	BRN	
	25	E	3 24 31	55	FINE SAND w/	V. COMP	WET	BRN	
Bottom					THIN SILT LAYERS			BRN	

INSPECTOR HW KOKITA

SEATTLE ENGINEERING DEPARTMENT
MATERIALS LABORATORY

8396

CS 7.241

LOG OF TEST BORING

DATE 3-22-73 HOLE NO 6

PROJECT PARK DEPT GRD. ELEV. 289.8

LOCATION SOUTH GRID LINE STAT 5+40

STRATA	DEPTH	SAMPLE NO.	BLOW COUNT	STD. PEN.	DESCRIPTION OF MATERIAL: COMPOSITION	CONSISTENCY	MOISTURE	COLOR	WATER LEVEL
Soft clayey FILL					CLAY - SILT			GRAY	
	5	A	1 2 2	4	CLAY - SILT (DISTURBED) FILL	SOFT	MOIST	GRAY	
					← HARBOR DRILL - GRAVELLY TRACE ORGANIC AT TOP				
	10	B	4 10 10	20	SILTY FINE SAND W/ GRAVEL	FIRM	MOIST	BRN	
	15	C	5 10 19	29	SILTY SAND W/ GRAVEL & SANDY LAYERS	FIRM	MOIST WET	BRN BRN	
	20	D	7 15 12	27	SILTY SAND W/ GRAVEL & SANDY LAYER & SILT LAYER	FIRM	MOIST WET	BRN BRN	
Firm to very compact silty SAND with gravel	25	E	6 16 19	35	SILTY SAND W/ GRAVEL	COMP	MOIST TO WET	BRN	3-30-73 3-26-73
	30	F	5 25 32	57	SILTY SAND W/ GRAVEL	V. COMP	MOIST	BRN	
Bottom									

INSTALLED PIEZOMETER

INSPECTOR HW KOLTZA

8397

CS 7.241

SEATTLE ENGINEERING DEPARTMENT

MATERIALS LABORATORY

LOG OF TEST BORING

DATE 3-23-73

HOLE NO. 7

PROJECT Park Dept

GRD. ELEV. 305.9

LOCATION Mid. Grid Line Sta. 2+95

STRATA	DEPTH	SAMPLE NO.	BLOW COUNT			STD. PEN.	COMPOSITION	CONSISTENCY	MOISTURE	COLOR	WATER LEVEL
Very soft clayey FILL							Gray Clay				
	5	A	1	1	2	3	Clay-silt (distorted)	Soft	Moist	Gray	
							w/sand pockets			Brn	
							& organic				
Compact silty SAND w/gravel							← Harder Drilling				
	10	B	10	25	18	43	Silty fine sand	Comp	Moist	Brn	3-26-73 3-30-73
							w/gravel				
							& fine sand seams			Brn	
	15	C	4	16	14	30	Silt sand w/gravel	Firm	Moist	Brn	
							& sand seams		Wet	Brn	Bottom 4-3-73
			5"								
	20	D	50	x	x	100+	Silty sand w/gravel	V.comp	Moist	Brn	
Bottom											
	25	E									

INSPECTOR Hw Kocita

SEATTLE ENGINEERING DEPARTMENT

MATERIALS LABORATORY

8397

CS 7.241

LOG OF TEST BORING

DATE 7-18-73

HOLE NO. 8

PROJECT CHEASTY BLVD — PARK DEPT.

GRD. ELEV.

LOCATION PER PLAN.

STRATA	DEPTH	SAMPLE NO.	BLOW COUNT	STD. PEN.	DESCRIPTION OF MATERIAL				WATER LEVEL
					COMPOSITION	CONSISTENCY	MOISTURE	COLOR	
					SILT-CLAY TRACE GRAVEL		MOIST	GRAY	
Very soft clayey FILL	5	A	2 2 3	5	SILTY CLAY CLAY LUMPS	MED.	MOIST	GRAY	
	10	B	1 2 2	4	SILTY CLAY CLAY LUMPS JUMBLED	SOFT	MOIST	GRAY	
	15	C	2 3 5	8	4" SILTY CLAY 10" SANDY SILT W/ORGANIC CHARCOL TRACE GRAVEL.	MED.	MOIST	GRAY BRN	
		C1			4" SILT W/TRACE V. FINE SAND.			BRN.	NO H2O 7-24-73 7-27-73
					HARDER DRILLING				
Compact silty SAND w/ gravel	20	D	16 20 27	47	TRACE ORGANIC FRACTURED ROCK SILTY SAND W/ GRAVEL	COMP.	MOIST	BRN	
					FINE SAND W/ GRAVEL		MOIST	BRN.	
	25	E	22 44 49	93	SILTY SAND W/ GRAVEL	V. COMP.	MOIST	BRN.	PIEZO INSTALLED 7-18-73 SAND IN TIP
BOTTOM 7-18-73									
	30	F							

INSPECTOR M. Mann

SEATTLE ENGINEERING DEPARTMENT

MATERIALS LABORATORY

8398

CS 7.241

LOG OF TEST BORING

DATE 7-24-73 HOLE NO. [redacted]

PROJECT PARK DEPT. CHEASTY GRD. ELEV.

LOCATION PER PLAN 62' South of #3

STRATA	DEPTH	SAMPLE NO.	BLOW COUNT	STD. PEN.	DESCRIPTION OF MATERIAL: COMPOSITION	CONSISTENCY	MOISTURE	COLOR	WATER LEVEL
Very soft clayey FILL					CLAY - SILT		MOIST	GRAY	
	5	A	1 3 5	8	CLAY - SILT JUMBLED	MED.	MOIST	GRAY	
		B	1 2 3	5	CLAY - SILT W/ SANDY DISTORTED LAYERS	SOFT	MOIST	GRAY BRN. LAYERS	
	10								
Laminated firm SAND		C	1 2 5	7	CLAY - SILT	MED.	MOIST	GRAY	
	15	C1			4" SILTY SAND W/ GRAVEL TRACE ORGANIC		"	BLK	
					4" SAND W/ TRACE SILT, CHARCOAL		"	BRN.	
		D	1 5 10	15	3" SILTY SAND TRACE GRAVEL		MOIST	BRN.	
					3" SAND W/ SILT	FIRM	"	BRN	
	20	D1			CLEAN SAND		"	BRN	
					SILTSTONE			GRAY	
					COARSE SAND			GRAY	
					HARD DRILLING @ 21.5'				
Compact silty SAND with gravel		E	15 25 26	51	10" SILTY SAND W/ TRACE GRAVEL	V. COMP	MOIST	BRN.	
	25	E1			8" SILTY SAND & GRAVEL		MOIST	GRAY	
		F	5 26 25	51	SAND W/ TRACE SILT & GRAVEL	V. COMP	MOIST	GRAY	
	30				SILTY SAND LAYER NEAR TIP.				

No water 7-27-73

PIEZO. INSTALLED 7-24-73 SAND IN TIP

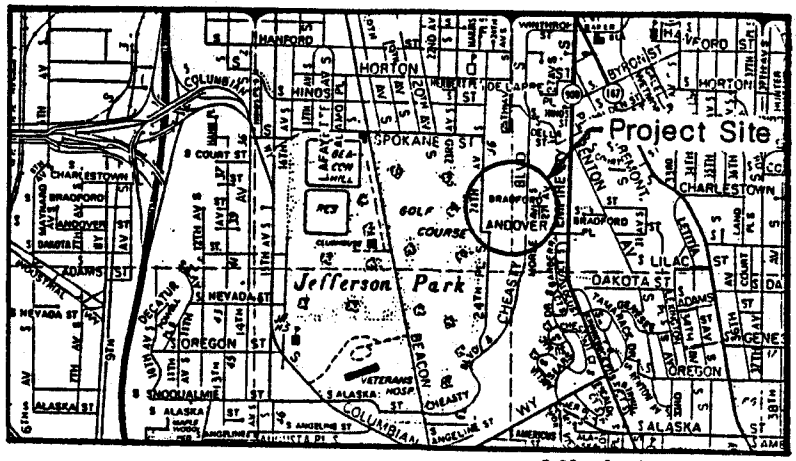
BOTTOM 7-24-73

INSPECTOR M Mace

1986 HART CROWSER 003726

Site and Exploration Plan

3726



Vicinity Map

Exploration Location and Number

TP-2	Hart Crowser Test Pit Current Study
B-1	Hart Crowser Boring Current Study
33	City of Seattle Boring, 1972 Study
MH-1	Proposed Sewer and ManHole Location
	Edge of Pavement
	Survey Reference Line

1. Base map based on Preliminary Map by Horton Dennis & Associates, dated November 21, 1986.
2. Sewer location from J.M. Montgomery preliminary plans dated January 9, 1987.

0 100 200

Scale in Feet

J-1829 December 1986

HART-CROWSER & associates inc.

Figure 1

10801

10801

Boring Log B-1

SOIL DESCRIPTIONS

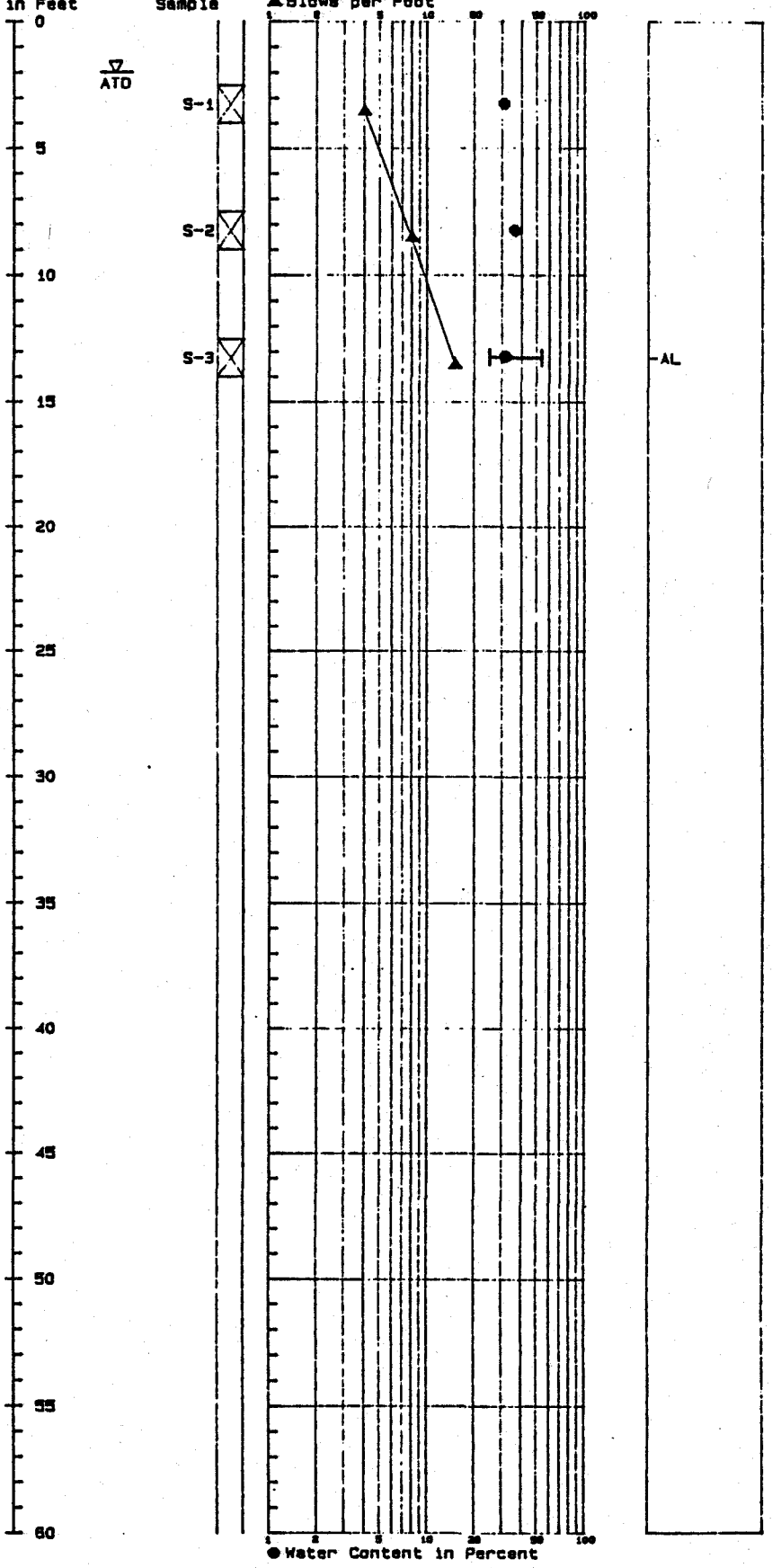
Ground Surface Elevation in Feet 214

(Loose), moist, brown, sandy SILT with organics. (TOPSOIL)

Medium stiff, wet, brown, silty CLAY

Stiff, wet, blue-gray, silty CLAY.

Bottom of Boring at 14.0 Feet.
Completed 11/4/86.



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

J-1823 November 1986

HART-CROWSER & associates, inc.

Figure A-2

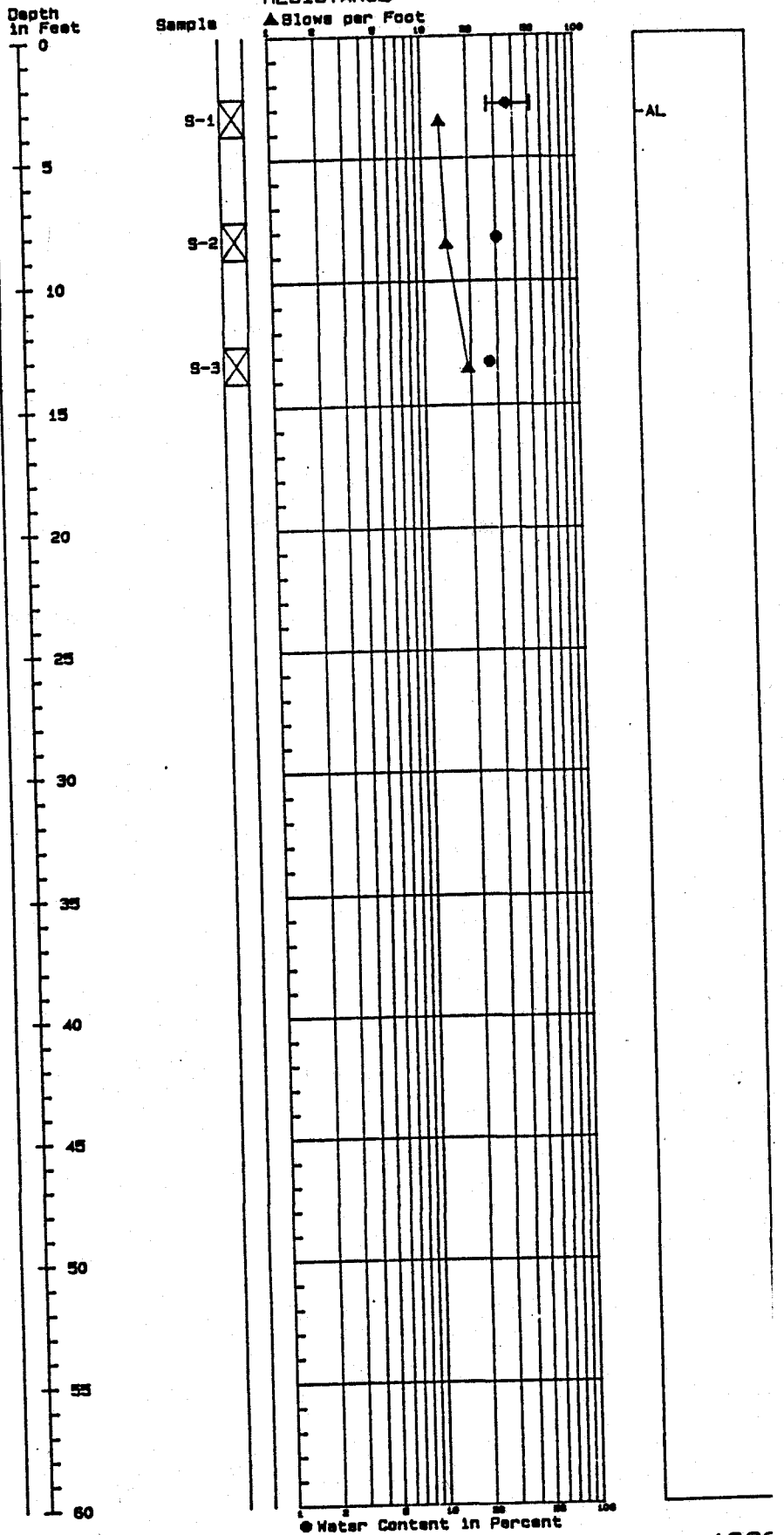
10802

Boring Log B-2

SOIL DESCRIPTIONS

Ground Surface Elevation in Feet 195

(Loose), wet, brown, sandy SILT with organics. (TOPSOIL)
Stiff, moist to wet, brown, silty CLAY.
Stiff to very stiff, wet, blue-gray, silty CLAY.
Bottom of Boring at 14.0 Feet. Completed 11/4/86.



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

J-1829 November 1986

HART-CROWSER & associates, inc

Figure A-3

10802

Boring Log B-3

SOIL DESCRIPTIONS

Ground Surface Elevation in Feet 177

(Loose), wet, brown, sandy SILT with organics. (TOPSOIL)

Medium stiff to stiff, wet, mottled orange-brown, silty CLAY.

Medium stiff, wet, brown, silty CLAY.

Bottom of Boring 14.0 Feet.
Completed 11/4/86.

Depth in Feet

0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60

Sample

S-1, S-2, S-3

STANDARD PENETRATION RESISTANCE

▲Blows per Foot

1, 5, 8, 10, 30, 50, 100

● Water Content in Percent

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

J-1829 November 1986

HART-CROWSER & associates, inc.

10803 Figure A-4

Test Pit Log TP-1

Sample	Water Content Percent	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS
				Ground Surface Elevation in Feet 243
			0	(Loose), damp, brown, sandy SILT with organics. (TOPSOIL)
S-1	11		2	(Stiff to very stiff), damp to moist, light brown, slightly sandy SILT with occasional cobbles and boulders.
S-2	16		4	
S-3	8	GS	5	(Medium dense to dense), damp, brown, slightly gravelly, silty SAND with occasional cobbles.
			6	Becomes cleaner and less gravelly with depth.
S-4	16	AL	7	(Hard), damp, light brown, slightly sandy SILT with occasional roots.
			9	Bottom of Test Pit at 9 Feet. Completed 11/4/86.
			10	Note: Easy excavation to 2-foot-depth and moderate from 2 to 9-foot-depth. No noticeable groundwater seepage. Minor side caving.
			11	
			12	
			13	
			14	
			15	

Test Pit Log TP-2

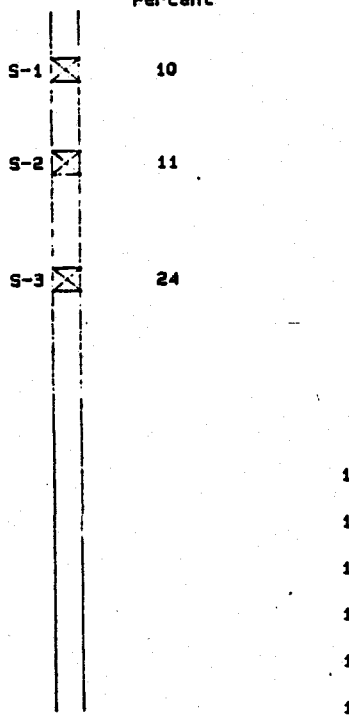
Sample	Water Content Percent	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS
				Ground Surface Elevation in Feet 239
			0	(Medium stiff to soft), moist, sandy SILT with abundant debris (brick, concrete, stones). (FILL)
S-1	5		2	(Medium dense), damp, brown, slightly silty to silty SAND with occasional gravel (1-inch-diameter) and cobbles (3 to 6-inch-diameter).
S-2	4	GS	5	(Medium dense), damp, brown, poorly graded, fine SAND with occasional gravel and cobbles.
			11	Bottom of Test Pit at 11 Feet. Completed 11/4/86.
			12	Note: Moderate excavation. Minor side caving. No noticeable groundwater seepage.
			13	
			14	
			15	

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water conditions, if indicated, are at time of excavation. Conditions may vary with time.

J-1829 November 1986
HART-CROWSER & associates, inc.
Figure A-5

10803

Test Pit Log TP-3



Depth in Feet

SOIL DESCRIPTIONS

Ground Surface Elevation in Feet 237

0 – (Medium dense), moist to wet, brown-gray, gravelly, very silty SAND to gravelly, sandy SILT with occasional cobbles and debris (concrete, clay pipe). (FILL)

3 – (Soft to medium stiff), wet, gray, gravelly, sandy SILT with occasional debris (wood, roots). (FILL)

4 – Petroleum odor - like heating oil.

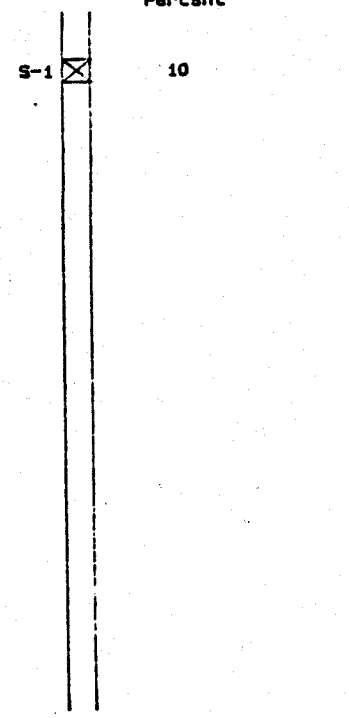
6 – (Loose), damp to moist, brown, sandy SILT with organics. (TOPSOIL)

7 – (Medium dense), damp, brown, slightly silty to clean, fine SAND with some gravel and occasional cobble.

10 – Bottom of Test Pit at 10 Feet.
Completed 11/4/86.

Note: Moderate excavation. No noticeable groundwater seepage. Minor side caving.

Test Pit Log TP-4



Depth in Feet

SOIL DESCRIPTIONS

Ground Surface Elevation in Feet 243

0 – (Loose), moist, brown, silty SAND with organics. (TOPSOIL)

1 – (Medium dense), moist, brown, poorly graded, fine SAND with occasional gravel and cobbles.

10 – Bottom of Test Pit at 10 Feet.
Completed 11/4/86.

Note: Moderate excavation. No noticeable groundwater seepage. Minor side caving.

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water conditions, if indicated, are at time of excavation. Conditions may vary with time.

J-1829 November 1986
HART-CROWSER & associates, inc.
Figure A-6

10804

Test Pit Log TP-5

Sample	Water Content Percent	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS
				Ground Surface Elevation in Feet 226
			0–1	(Loose), moist, brown, slightly silty SAND with organics (TOPSOIL)
			1–2	
			2–3	(Medium dense), damp to moist, poorly graded, fine SAND with occasional gravel and cobbles.
			3–4	
			4–5	(Very stiff), damp, brown-gray, slightly sandy SILT with occasional gravel.
			5–6	
			6–7	Bottom of Test Pit at 6 Feet. Completed 11/4/86.
			7–8	Note: Moderate excavation. No noticeable groundwater seepage. Minor side caving.
			8–9	

Test Pit Log TP-6

Sample	Water Content Percent	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS
				Ground Surface Elevation in Feet 217
			0–1	(Loose), damp, dark brown, sandy SILT with organics. (TOPSOIL)
			1–2	(Medium dense), moist, brown SAND.
			2–3	(Stiff), moist, brown-gray, slightly sandy SILT with occasional gravel.
S-1	45		3–4	
			4–5	
			5–6	
			6–7	
			7–8	(Very stiff), moist, gray, very silty, fine SAND.
S-2	19	GS	8–9	

Bottom of Test Pit at 9 Feet.
Completed 11/4/86.
Note: Moderate excavation. No noticeable groundwater seepage. Minor side caving.

Test Pit Log TP-7

Sample	Water Content Percent	Lab Tests	Depth in Feet	SOIL DESCRIPTIONS
				Ground Surface Elevation in Feet 233
			0–1	(Loose), moist, dark brown, sandy SILT with organics. (TOPSOIL)
			1–2	
			2–3	(Medium dense), damp to moist, brown, poorly graded, fine SAND with occasional gravel and cobble.
			3–4	
			4–5	
			5–6	
			6–7	Bottom of Test Pit at 6 Feet. Completed 11/4/86.
			7–8	Note: Moderate excavation. No noticeable groundwater seepage. Minor side caving.
			8–9	

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Ground water conditions, if indicated, are at time of excavation. Conditions may vary with time.

J--1829 November 1986
HART-CROWSER & associates, inc.
Figure A-7

10804

CB 7.241

MATERIALS LABORATORY

1 OF 2

LOG OF TEST BORING

DATE 9-14-72

HOLE NO. 32

PROJECT NIP 13-9

GRD. ELEV.

LOCATION MOOSE AVE S. & S. BRADFORD 20ES. & E

STRATA	DEPTH	SAMPLE NO.	BLOW COUNT	STD. PEN.	DESCRIPTION OF MATERIAL: COMPOSITION	CONSISTENCY	MOISTURE	COLOR	WATER LEVEL
					BRN CLAYEY SILT				
	5	A	1 3 5	8	SILT W/ CLAY	MED	MOIST TO WET	BRN	
	10	B	3 5 3	8	SILTY SAND W/	LOOSE	MOIST TO WET	BRN	
					SILT LAYERS			BRN	
	15	C	1 3 4	7	SILT W/CLAY LUMP	MED	MOIST TO WET	BRN	
LOOSE TO MEDIUM CLAY	20	D	2 4 5	9	SILT	LOOSE	MOIST TO WET	BRN	
	25	E	2 4 7	11	SILT	FIRM	MOIST TO WET	BRN	9-15-72 ∇ 2'
	30	F	2 3 5	8	CLAYEY SILT W/	MED	MOIST	GRAY	
					CLAY LUMP				

INSPECTOR

10805

J.L.D. Cocite

J-1829 Figure A-8

Sheet 1 of 2

CS 7.241

MATERIALS LABORATORY

2 of 2

LOG OF TEST BORING

DATE 9-14-72

HOLE NO. 32

PROJECT NIP 13-9

GRD. ELEV.

LOCATION MORSE AVE S & S. BRADFORD

STRATA	DEPTH	SAMPLE NO.	BLOW COUNT	STD. PEN.	DESCRIPTION OF MATERIAL				WATER LEVEL
					COMPOSITION	CONSISTENCY	MOISTURE	COLOR	
MED CLAY SILT	35	G	2 4 5	9	CLAY-SILT W/ CLAY LUMPS (DISTURBED)	MED	MOIST	GRAY	
									SAND
	10	H	2 5 8	13	CLAY-SILT W/ CLAY LUMPS	MED	MOIST	GRAY	

10805

INSPECTOR H.W. Kokter

J-1829 Figure A-8

Sheet 2 of 2

CB 7.241

LOG OF TEST BORING

DATE 8-28-72 HOLE NO. 3.3

PROJECT NIP 13-9 GRD. ELEV.

LOCATION CHEMICAL BLDG. & S. BRADFORD 42° N & EXISTING

STRATA	DEPTH	SAMPLE NO.	BLOW COUNT	STD. PEN.	DESCRIPTION OF MATERIAL: COMPOSITION	CONSISTENCY	MOISTURE	COLOR	WATER LEVEL
LOOSE SILTY SAND									
					BRN SILTY SAND W/ GRAVEL				
	5	A	2 1 1	2	SILTY FINE SAND	LOOSE	MOIST	BRN	
					W/ TRACE ORGANIC				
					& SILT LAYERS				
	10	B	3 5	7 12	FINE SAND W/	FIRM	MOIST	BRN	9-8-72 9-7-72
					TRACE GRAVEL				
LOOSE TO FIRM FINE SANDS, WATER BEARING	15	C	3 5	6 11	SAND FINE-MED	FIRM	WET	BRN	
					W/ TRACE GRAVEL				
					& SILTY LAYERS				
	20	D	0 3	4 7	SAND FINE	LOOSE	SAT	BRN	8-29-72
					12" FINE SAND		SAT	BRN	
MED CLAY-SILT	25	E	1 7	8 15	CLAY-SILT	MED	MOIST	BRN GRAY	8-28-72
									SAND
	30	F	3 7	8 15	CLAY-SILT	MED	MOIST	GRAY	

INSPECTOR H. NAKATA

10806

J-1829 Figure A-9

2000 ECI A 1.58 EARTH GEOTECH 010246
RAINIER VISTA DEVELOPMENT

10246

GEOTECHNICAL ENGINEERING STUDY
PROPOSED RAINIER VISTA REDEVELOPMENT
MARTIN LUTHER KING JR. WAY SOUTH
SEATTLE, WASHINGTON

2205127
732097 E-9334
145

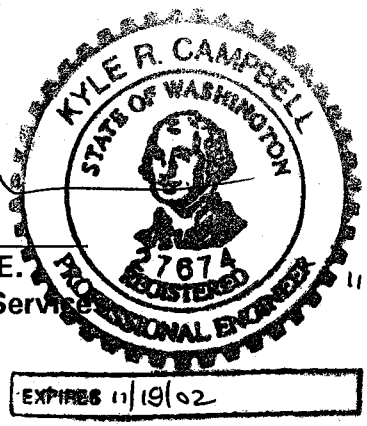
03/23

November 3, 2000

PREPARED FOR
SEATTLE HOUSING AUTHORITY
C/O TONKIN HOYNE LOKAN

FOR: Kristina M. Weller, P.E.
Project Engineer

Kyle R. Campbell, P.E.
Manager of Geotechnical Services



11/3/00

EXPIRES 11/19/02

Earth Consultants, Inc.
1805 - 136th Place Northeast, Suite 201
Bellevue, Washington 98005
(425) 643-3780
Toll Free 1-888-739-6670

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GEOTECHNICAL ENGINEERING STUDY
PROPOSED RAINIER VISTA REDEVELOPMENT
MARTIN LUTHER KING JR. WAY SOUTH
SEATTLE, WASHINGTON

E-9334

INTRODUCTION

General

This report presents the results of the geotechnical engineering study completed by Earth Consultants, Inc. (ECI) for the proposed Rainier Vista Redevelopment in Seattle, Washington. The general location of the site is shown on the Vicinity Map, Plate 1. The purpose of this study was to explore the subsurface conditions at the site and based on the conditions encountered to develop geotechnical recommendations for the proposed site development.

Project Description

We understand it is planned to redevelop the southern portion of the site with five and six story residential buildings with underground parking, a three story school northeast of the intersection of MLK Way South and South Oregon and two to three story townhouses on the remainder of the site. The buildings currently on site will be demolished as part of the project. The existing roadways will also be relocated as part of the project.

At the time our study was performed, the site, proposed building locations, and our exploratory locations were approximately as shown on the Boring Location Plan, Plate 2.

If the above design criteria are incorrect or change, we should be consulted to review the recommendations contained in this report. In any case, ECI should be retained to perform a general review of the final design.

SITE CONDITIONS

Surface

The subject site is located on both sides of Martin Luther King (MLK) Jr. Way South from Barberry Court South to South Alaska Street (see Plate 1, Vicinity Map). The site is bordered on the north and east by residential developments, on the south by retail and residential developments and on the west by a slope that is part of the Cheasty Greenbelt.

Southwest Section: Test pits TP-1, TP-2, TP-3 and TP-4 and boring B-7 are located on the southwest portion of the site. In our borings and test pits we encountered interbedded loose to medium dense silty sand and sandy silt (SM and ML) to the depth of the test pits and to about eleven (11) feet below grade in our boring. Very dense silty sand was encountered at about eleven (11) feet below grade in our boring.

Toe of Western Slope: Borings B-3, B-4, B-5 and B-6 were drilled at the toe of the slope on the west side of the site. In borings B-3 and B-4, we encountered twelve (12) to eighteen (18) feet of interbedded loose to medium dense silty sand, sandy silt, fat clay, and poorly graded sand with silt (SM, ML, CH and SP-SM). Lean clay and silt (CL and ML) with some water bearing sand lenses was encountered below the interbedded layers to the depth of our explorations. In boring B-5, we encountered fourteen (14) feet of elastic silt (MH) underlain by silty sand, sandy silt and poorly graded sand with silt (SM, ML and SP-SM). In boring B-6, we encountered medium dense to very dense silty sand with some gravel (SM).

Central and North Portion: Test pits TP-5, TP-6, TP-7, TP-8, TP-9, TP-14 and TP-15 were excavated in this area. We encountered one to four feet of fill in test pits TP-7, TP-14 and TP-15 consisting of silty sand and sandy silt (SM and ML). The fill or topsoil is underlain by medium dense to very dense silty sand with variable amounts of gravel.

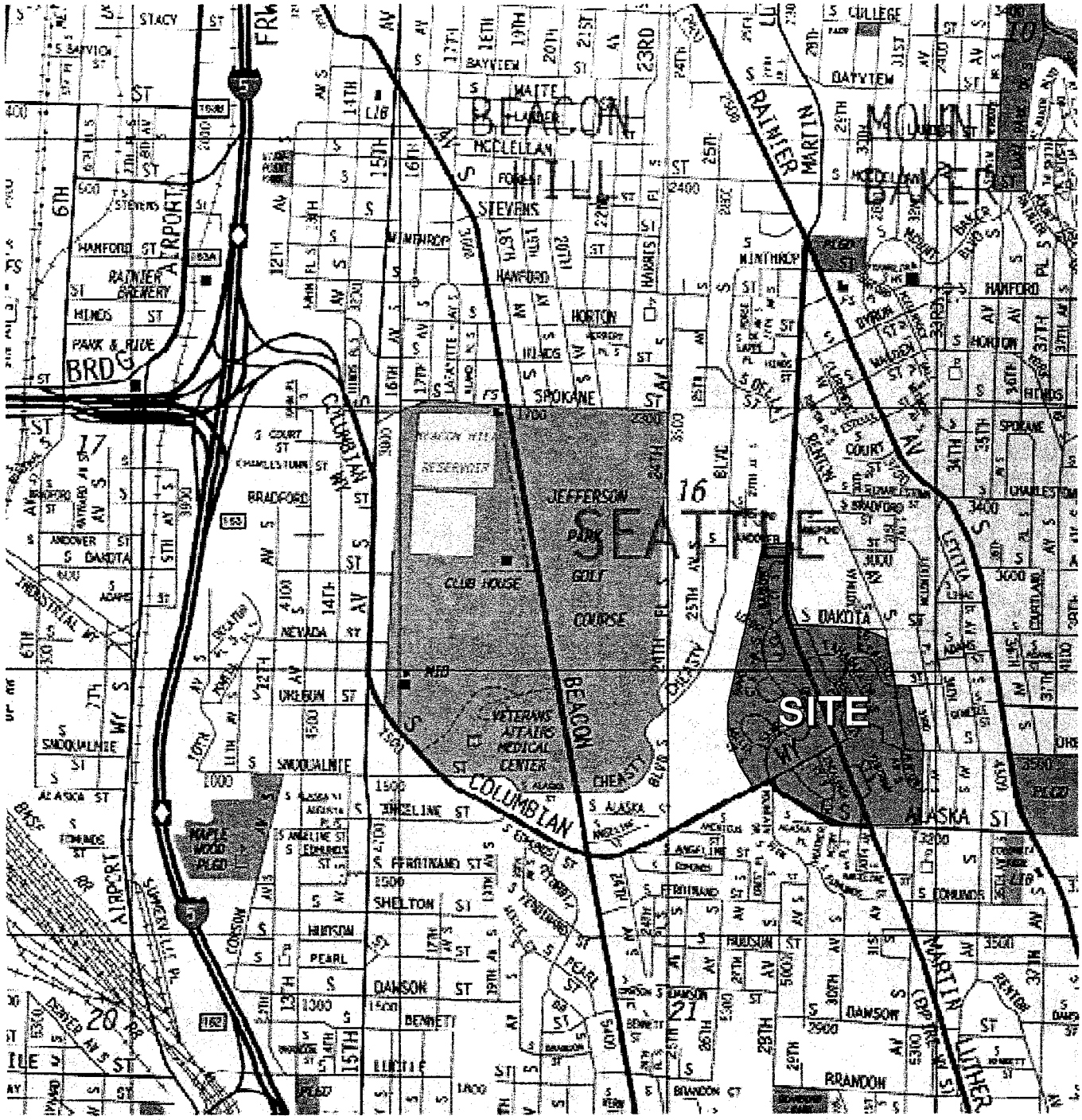
Eastern Portion: Test Pits TP-10, TP-11 and TP-13 were located on the eastern sloped portion of the site. We encountered layered medium dense to dense silty sand, silt and medium stiff to hard clay.

Groundwater

Groundwater seepage was observed while drilling in boring B-2 at thirteen (13) feet, boring B-3 at ten feet, boring B-4 at nineteen (19) feet, boring B-6 at four feet and boring B-7 at six feet below grade and are shown on the boring logs.

Since the groundwater levels did not have time to stabilize, slotted three-quarter inch standpipes were installed in Borings B-4, B-5 and B-6 along the toe of the slope on the west side of the site. A reading, taken eight days after the completion of the borings, is also shown on the boring logs.

Slight groundwater seepage was encountered in our test pits TP-2 and TP-3 at eight and nine feet below existing grade and are shown on the test pit logs.



Reference:
Puget Sound Area
King County / Map 595
By Thomas Brothers Maps
Dated 2000

NOTE: This plate may contain areas of color. ECI cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

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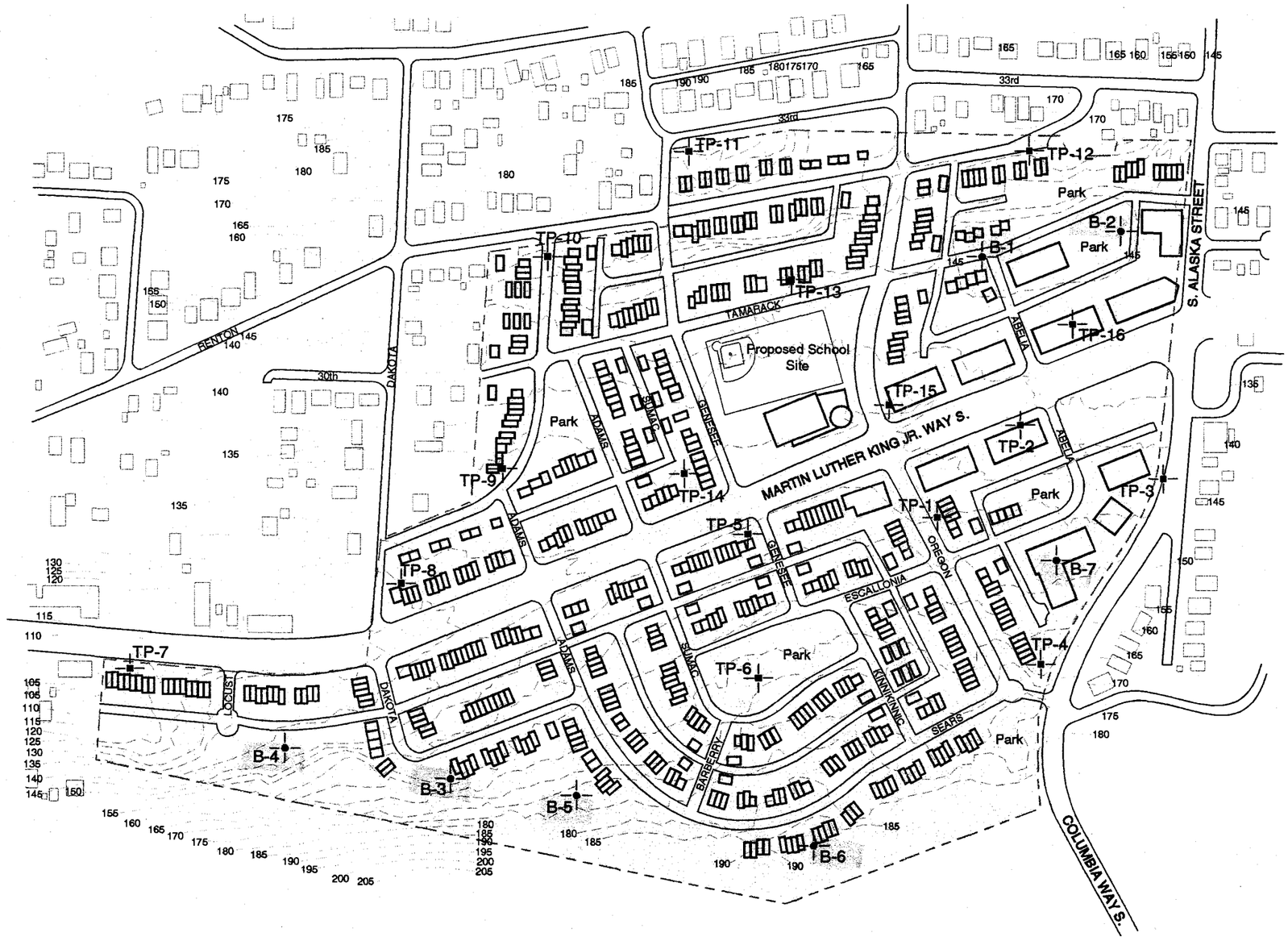
Vicinity Map
Proposed Rainier Vista
Seattle, Washington

Drwn. GLS	Date Oct. 2000	Proj. No. 9334
Checked KMW	Date 10/6/00	Plate 1



Approximate Scale

0 150 300 600ft.

LEGEND

B-1 – Approximate Location of ECI Boring, Proj. No. E-9334, Sept. 2000

TP-1 – Approximate Location of ECI Test Pit, Proj. No. E-9334, Sept. 2000

Subject Site

Proposed Building

Existing Building

NOTE: This plate may contain areas of color. ECI cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

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Boring and Test Pit Location Plan
Rainier Vista
Seattle, Washington

Drwn. GLS	Date Oct. 2000	Proj. No. 9334
Checked KMW	Date 10/10/00	Plate 2

APPENDIX A
FIELD EXPLORATION
E-9334

Our field exploration was performed on September 25, 26 and 28, 2000. Subsurface conditions at the site were explored by drilling seven borings and excavating sixteen (16) test pits to a maximum depth of thirty one and one half (31.5) feet below the existing grade. The borings were drilled by Boretec, Inc. subcontracted to ECI, using a B-24 limited access drill. The test pits were excavated by Northwest Excavating subcontracted to ECI, using a rubber-tired backhoe

Approximate boring and test pit locations were determined by interpolating from site features. Approximate boring elevations were determined by locating on the site plan. The locations and elevations of the borings and test pits should be considered accurate only to the degree implied by the method used. These approximate locations are shown on the Boring and Test Pit Location Plan, Plate 2.

The field exploration was continuously monitored by a engineer from our firm who classified the soils encountered, maintained a log of each boring, obtained representative samples, measured groundwater levels, and observed pertinent site features. Samples were visually classified in accordance with the Unified Soil Classification System, which is presented on Plate A1, Legend. Representative soil samples were placed in closed containers and returned to our laboratory for further examination and testing.

Logs of the borings are presented on Plates A2 through A12. The final logs represent our interpretations of the field logs and the results of the laboratory examination and tests of field samples. The stratification lines on the logs represent the approximate boundaries between soil types. In actuality, the transitions may be more gradual.

The borings were drilled using hollow stem augers. In each boring, Standard Penetration Tests (SPT) were performed at selected intervals in general accordance with ASTM Test Designation D-1586. The split spoon samples were driven with a one hundred forty (140) pound hammer freely falling thirty (30) inches. The number of blows required to drive the last twelve (12) inches of penetration are called the "N-value". This value helps to characterize the site soils and is used in our engineering analyses. These results are recorded on the boring and test pit logs at the appropriate sample depths.

Test Pit Logs are presented on Plates A13 through A30. The final logs represent our interpretations of the field logs and the results of the laboratory tests of field samples. The stratification lines on the logs represent the approximate boundaries between soil types. In actuality, the transitions may be more gradual. The consistency of the soil shown on the logs was estimated based on the effort required to excavate the soil, the stability of the trench walls, and other factors.

Boring Log

Project Name: Rainier Vista				Sheet 1 of 2
Job No. 9334	Logged by: KMW	Start Date: 9/25/00	Completion Date: 9/25/00	Boring No.: B-1
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: 145'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft. Sample	USCS Symbol	Surface Conditions:
				1	SP-SM	Gray poorly graded SAND with silt, dense, moist (Fill)
				2		
	12.6	28		3	SM	Gray silty SAND, medium dense, moist
				4		
	17.1	3		5		-very loose and wet
				6		
				7		
	27.2	2		8		
				9		-grades with peat interbeds
	30.6			10		
		7		11	CH	Gray fat CLAY, medium stiff, moist
				12		
	14.8	25		13		-very stiff
				14		
LL=53 PL=25 PI=28	22.8	19		15		
				16		
				17		
	15.4	48		18		-hard
				19		

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Boring Log
Rainier Vista
Seattle, Washington

Proj. No. 9334	Dwn. GLS	Date Nov. 2000	Checked KMW	Date 11/1/00	Plate A2

BORING LOG 9334.GPJ ECI.GDT 11/2/00

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista				Sheet 1 of 1
Job No. 9334	Logged by: KMW	Start Date: 9/25/00	Completion Date: 9/25/00	Boring No.: B-2
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: 145'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions:
				1		SP-SM	Brown poorly graded SAND with silt, medium dense, moist (Fill)
	14.5	9		2		SM	Brown silty SAND, loose to medium dense, moist to wet
				3			-39% fines
	26.7	12		4			
				5			
				6		PT	Brown sandy PEAT, loose, moist
	52.1	5		7			-decreasing sand content
				8			
	19.7			9		CL	Gray lean CLAY with poorly graded sand lenses, medium stiff, moist
	29.0	8		10			
				11		CH	Brown and gray fat CLAY, medium stiff, moist
	20.3	27		12			
				13		SM	Brown silty SAND with gravel, medium dense, wet
	12.6	34		14			
				15			
				16			-completely weathered granite lens or rock
				17		ML	Brown SILT, dense, moist
	34.8	50/5"		18		SS	Gray moderately weathered SANDSTONE, hard
							Boring terminated at 18.5 feet below existing grade. Groundwater seepage encountered at 13.0 feet during drilling.

BORING LOG 9334.GPJ ECI.GDT 11/2/00

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Boring Log
Rainier Vista
Seattle, Washington

Proj. No. 9334	Dwn. GLS	Date Nov. 2000	Checked KMW	Date 11/1/00	Plate A4

Boring Log

Project Name: Rainier Vista				Sheet 2 of 2
Job No. 9334	Logged by: KMW	Start Date: 9/25/00	Completion Date: 9/25/00	Boring No.: B-3
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: 154'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
	15.6	46		21		CL	Gray lean CLAY, hard, moist
	17.9	78/11"		22 23 24			Boring terminated at 24.0 feet below existing grade. Groundwater seepage encountered at 10.0 feet during drilling.

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Boring Log
Rainier Vista
Seattle, Washington

Proj. No. 9334	Dwn. GLS	Date Nov. 2000	Checked KMW	Date 11/1/00	Plate A6

BORING LOG 9334.GPJ ECI.GDT 11/2/00

Boring Log

Project Name: Rainier Vista				Sheet 2 of 2
Job No. 9334	Logged by: KMW	Start Date: 9/25/00	Completion Date: 9/25/00	Boring No.: B-4
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: 138'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft. Sample	USCS Symbol	
	21.5	9		21	CL	Gray lean CLAY with water bearing sand lenses, medium stiff, moist to wet
	37.4	7		22, 23, 24		
	31.3	7		25, 26, 27, 28		
	20.4	29		29, 30, 31	CL	Gray CLAY, very stiff to hard, moist
						Boring terminated at 31.5 feet below existing grade. Groundwater seepage encountered at 19.0 feet during drilling. 3/4" PVC standpipe installed to bottom of boring. Lower 10.0 feet slotted. Boring backfilled with sand and bentonite.

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Boring Log
Rainier Vista
Seattle, Washington

Proj. No. 9334	Dwn. GLS	Date Nov. 2000	Checked KMW	Date 11/1/00	Plate A8

BORING LOG 9334.GPJ ECI.GDT 11/2/00

Boring Log

Project Name: Rainier Vista				Sheet 2 of 2
Job No. 9334	Logged by: KMW	Start Date: 9/25/00	Completion Date: 9/25/00	Boring No.: B-5
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: 172'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft. Sample	USCS Symbol	
		50/0"				Boring terminated at 20.0 feet below existing grade. No groundwater encountered during drilling. 3/4" PVC standpipe installed to bottom of boring. Lower 5.0 feet slotted. Boring backfilled with sand and bentonite. No water observed in well on 10/10/00.

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Boring Log
Rainier Vista
Seattle, Washington

Proj. No. 9334	Dwn. GLS	Date Nov. 2000	Checked KMW	Date 11/1/00	Plate A10

BORING LOG 9334.GPJ ECI.GDT 11/2/00

Boring Log

Project Name: Rainier Vista				Sheet 1 of 1
Job No. 9334	Logged by: KMW	Start Date: 9/25/00	Completion Date: 9/25/00	Boring No.: B-7
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation:		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions:
				1		ML	Reddish brown and gray sandy SILT, medium dense, moist
	27.0	11		2			
				3			
				4			
	18.5			5			
		12		6		SM	Brown silty SAND, loose to medium dense, wet
				7		SM	Gray silty SAND, loose to medium dense, wet
	16.3			8			
		10		9			-20% fines
				10			
	15.4			11			
		17		12		SM	Brown silty SAND, very dense, moist to wet
	15.2			13			
		53		14			
				15			
	16.4			16			
		60					Boring terminated at 16.5 feet below existing grade. Groundwater seepage encountered at 6.0 feet during drilling.

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Boring Log
Rainier Vista
Seattle, Washington

Proj. No. 9334	Dwn. GLS	Date Nov. 2000	Checked KMW	Date 11/1/00	Plate A12

BORING LOG 9334.GPJ ECI.GDT 11/2/00

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Test Pit Log

Project Name: Rainier Vista			Sheet 1 of 1
Job No. 9334	Logged by: KMW	Date: 9/28/00	Test Pit No.: TP-2
Excavation Contactor: NW Excavating			Ground Surface Elevation:
Notes:			

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Depth of Topsoil & Sod 4"
			1		ML	Brown sandy SILT, medium dense, moist (Fill)
	31.3		2		ML	Dark brown sandy SILT with organics and wood pieces, loose, moist (Fill)
			3			
			4		SM/ML	Gray silty SAND and sandy SILT, loose, moist to wet
	22.5		5			
			6		SM	Reddish brown silty SAND, loose, moist to wet
			7			
			8		SM	Gray silty SAND, loose, moist to wet
			9		CL	Gray lean CLAY, medium stiff, moist
			10			Test pit terminated at 10.0 feet below existing grade. Slight groundwater seepage encountered at 8.0 feet during excavation.

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Test Pit Log
Rainier Vista
Seattle, Washington

Proj. No. 9334	Dwn. GLS	Date Nov. 2000	Checked KMW	Date 11/2/00	Plate A14

TEST PIT LOG 9334.GPJ ECI.GDT 11/3/00

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Test Pit Log

Project Name: Rainier Vista			Sheet 1 of 1
Job No. 9334	Logged by: KMW	Date: 9/28/00	Test Pit No.: TP-4
Excavation Contactor: NW Excavating			Ground Surface Elevation:
Notes:			

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Depth of Topsoil & Sod 4"
			1		SM	Brown silty SAND with gravel, dense, moist (Fill)
			2			
			3			
	14.6					-25% fines
			4		ML	Dark brown SILT, loose, moist (Relic Topsoil)
					SM	Brown silty SAND with gravel, medium dense, moist
			5			
			6			
	9.1					
			7			
			8			Test pit terminated at 8.0 feet below existing grade. No groundwater encountered during excavation.

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Test Pit Log
Rainier Vista
Seattle, Washington

Proj. No. 9334	Dwn. GLS	Date Nov. 2000	Checked KMW	Date 11/2/00	Plate A16

TEST PIT LOG 9334.GPJ ECI.GDT 11/3/00

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Test Pit Log

Project Name: Rainier Vista			Sheet 1 of 1
Job No. 9334	Logged by: KMW	Date: 9/28/00	Test Pit No.: TP-6
Excavation Contactor: NW Excavating			Ground Surface Elevation:
Notes:			

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Depth of Topsoil & Sod 4"
	4.2		1 2 3 4		SM	Brown silty SAND, medium dense, dry to moist
	1.5		5 6 7		SP-SM	Gray poorly graded SAND with silt and gravel, medium dense, moist -dense Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation.

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Test Pit Log
Rainier Vista
Seattle, Washington

Proj. No. 9334	Dwn. GLS	Date Nov. 2000	Checked KMW	Date 11/2/00	Plate A18

TEST PIT LOG 9334.GPJ ECI.GDT 11/3/00

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Test Pit Log

Project Name:				Sheet	of
Rainier Vista				1	1
Job No. 9334	Logged by: KMW	Date: 9/28/00	Test Pit No.: TP-8		
Excavation Contactor: NW Excavating			Ground Surface Elevation:		
Notes:					

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Depth of Topsoil & Sod 4"
			1		ML	Brown sandy SILT, dense, moist
	7.1		3		SM	Brown silty SAND, dense, moist
			5		SM	Brown silty SAND with gravel, very dense, moist
			7			Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation.

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Test Pit Log
Rainier Vista
Seattle, Washington

Proj. No. 9334	Dwn. GLS	Date Nov. 2000	Checked KMW	Date 11/2/00	Plate A20

TEST PIT LOG 9334.GPJ ECI.GDT 11/3/00

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Test Pit Log

Project Name: Rainier Vista			Sheet 1 of 1
Job No. 9334	Logged by: KMW	Date: 9/28/00	Test Pit No.: TP-10
Excavation Contactor: NW Excavating			Ground Surface Elevation:
Notes:			

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Depth of Topsoil & Sod 6"
			1		ML	Brown SILT, dense, moist
	17.0		2		CL	Brown gray CLAY, hard, moist
			3			
			4			
			5			
			6			
			7			Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation.

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Test Pit Log
Rainier Vista
Seattle, Washington

Proj. No.	Dwn.	Date	Checked	Date	Plate
9334	GLS	Nov. 2000	KMW	11/2/00	A22

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

TEST PIT LOG 9334.GPJ ECI.GDT 11/3/00

Test Pit Log

Project Name: Rainier Vista			Sheet 1 of 1
Job No. 9334	Logged by: KMW	Date: 9/28/00	Test Pit No.: TP-12
Excavation Contactor: NW Excavating			Ground Surface Elevation:
Notes:			

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Depth of Topsoil & Sod 4"
			1		SM	Brown silty SAND with gravel, dense, moist, phone line at 18", no damage, stopped digging
						Test pit terminated at 1.5 feet below existing grade. No groundwater encountered during excavation.

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Test Pit Log
Rainier Vista
Seattle, Washington

Proj. No. 9334	Dwn. GLS	Date Nov. 2000	Checked KMW	Date 11/2/00	Plate A24

TEST PIT LOG 9334.GPJ ECI.GDT 11/3/00

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Test Pit Log

Project Name: Rainier Vista			Sheet 1 of 1
Job No. 9334	Logged by: KMW	Date: 9/28/00	Test Pit No.: TP-14
Excavation Contactor: NW Excavating			Ground Surface Elevation:
Notes:			

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Depth of Topsoil & Sod 6"
			1		ML	Brown sandy SILT, dense, moist (Fill)
			2			
			3			
			4			
	11.4		5		SM	Brown silty SAND, medium dense, moist
			6			
			7		SM	Gray silty SAND with gravel, dense, moist
			8			Test pit terminated at 8.0 feet below existing grade. No groundwater encountered during excavation.

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Test Pit Log
Rainier Vista
Seattle, Washington

Proj. No. 9334	Dwn. GLS	Date Nov. 2000	Checked KMW	Date 11/2/00	Plate A26

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

TEST PIT LOG 9334.GPJ ECI.GDT 11/3/00

Test Pit Log

Project Name:			Sheet	of
Rainier Vista			1	1
Job No. 9334	Logged by: KMW	Date: 9/28/00	Test Pit No.: TP-16	
Excavation Contactor: NW Excavating			Ground Surface Elevation:	
Notes:				

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Depth of Topsoil & Sod 6"
	6.2		1		SM	Brown silty SAND, medium dense, moist (Fill)
			2			
			3			
			4		CL	Gray lean CLAY with sandy lenses, medium stiff, moist
			5			
			6			
			7		SM	Gray silty SAND, medium dense, moist to wet
			8			
			9			Test pit terminated at 9.0 feet below existing grade. No groundwater encountered during excavation.

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Test Pit Log
Rainier Vista
Seattle, Washington

Proj. No. 9334	Dwn. GLS	Date Nov. 2000	Checked KMW	Date 11/2/00	Plate A28

TEST PIT LOG 9334.GPJ ECI.GDT 11/3/00

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

APPENDIX B
LABORATORY TEST RESULTS
E-9334

Proj. No. 9334 | Drwn. GLS | Date Nov. '00 | Checked KMW | Date 11/1/00 | Plate B2

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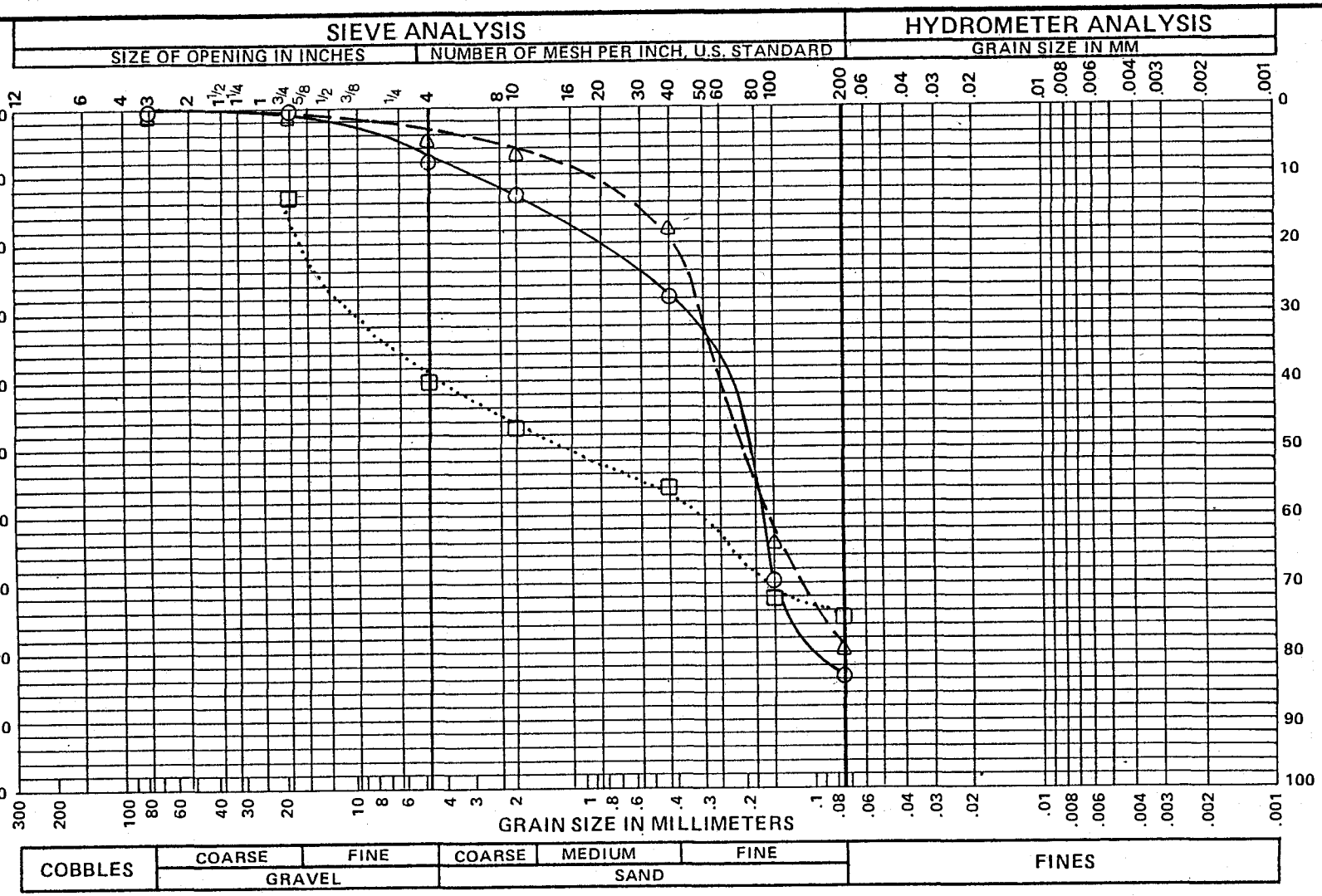
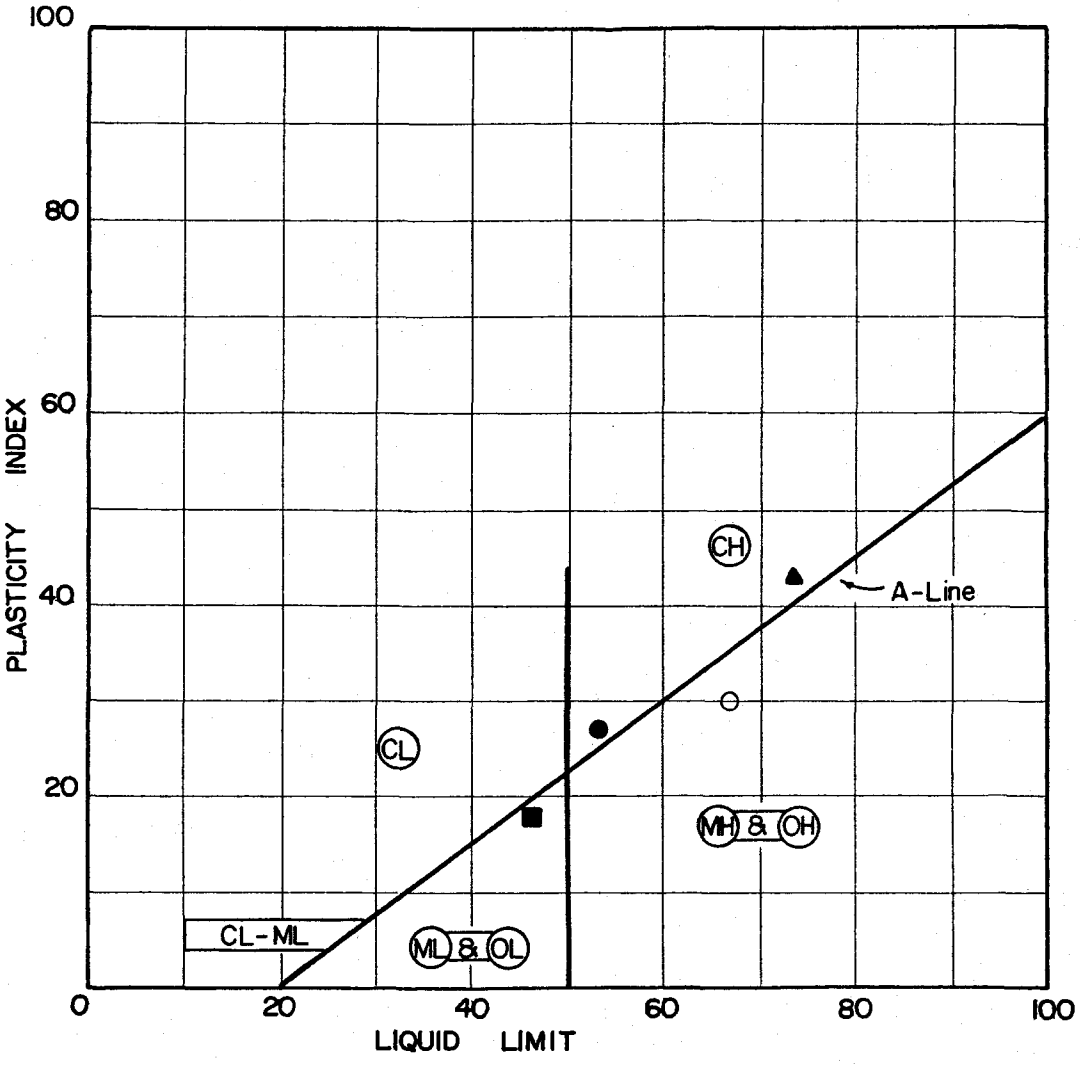
GRAIN SIZE ANALYSES
Rainier Vista
Seattle, Washington



KEY	Boring or Test Pit No.	DEPTH (ft.)	USCS	DESCRIPTION	Moisture Content (%)	LL	PL
○———	B-6	10	SM	Gray silty SAND	14.4	---	---
△– – –	B-7	7.5	SM	Gray silty SAND	16.3	---	---
□·····	TP-4	3	SM	Brown silty SAND with gravel	14.6	---	---



Key	Boring/ Test Pit	Depth (ft.)	Soil Classification	USCS	L.L.	P.L.	P.I.	Natural Water Content
●	B-1	15	Brown fat CLAY	CH	52.9	25.1	27.8	22.8
▲	B-3	5	Brown fat CLAY	CH	73.8	32.5	41.3	40.8
■	B-4	12.5	Gray SILT	ML	47.6	29	18.6	32.5
○	B-5	5	Gray SILT	MH	67.8	27.8	30	29.9

Earth Consultants Inc.
Geotechnical Engineers, Geologists & Environmental Scientists

Atterberg Limits Test Data

Rainier Vista
Seattle, Washington

Proj. No. 9334	Date Nov.'00	Plate B4

2000 HEMPHILL 006059

2001934
715305

4030 25th Avenue S

145

6059

4/4

HEMPHILL

CONSULTING ENGINEERS

GEOTECHNICAL ENGINEERING

FOR THE

DURDEN RESIDENCE

Located at
4030 25TH Avenue S
Seattle, Washington

Project Number 2470

14 February 2000

4041 WEST LAKE SAMMAMISH PARKWAY SOUTHEAST • BELLEVUE • WASHINGTON • 98008
PHONE 425 644 1080 FAX 425-643-3429 dchemphill@msn.com

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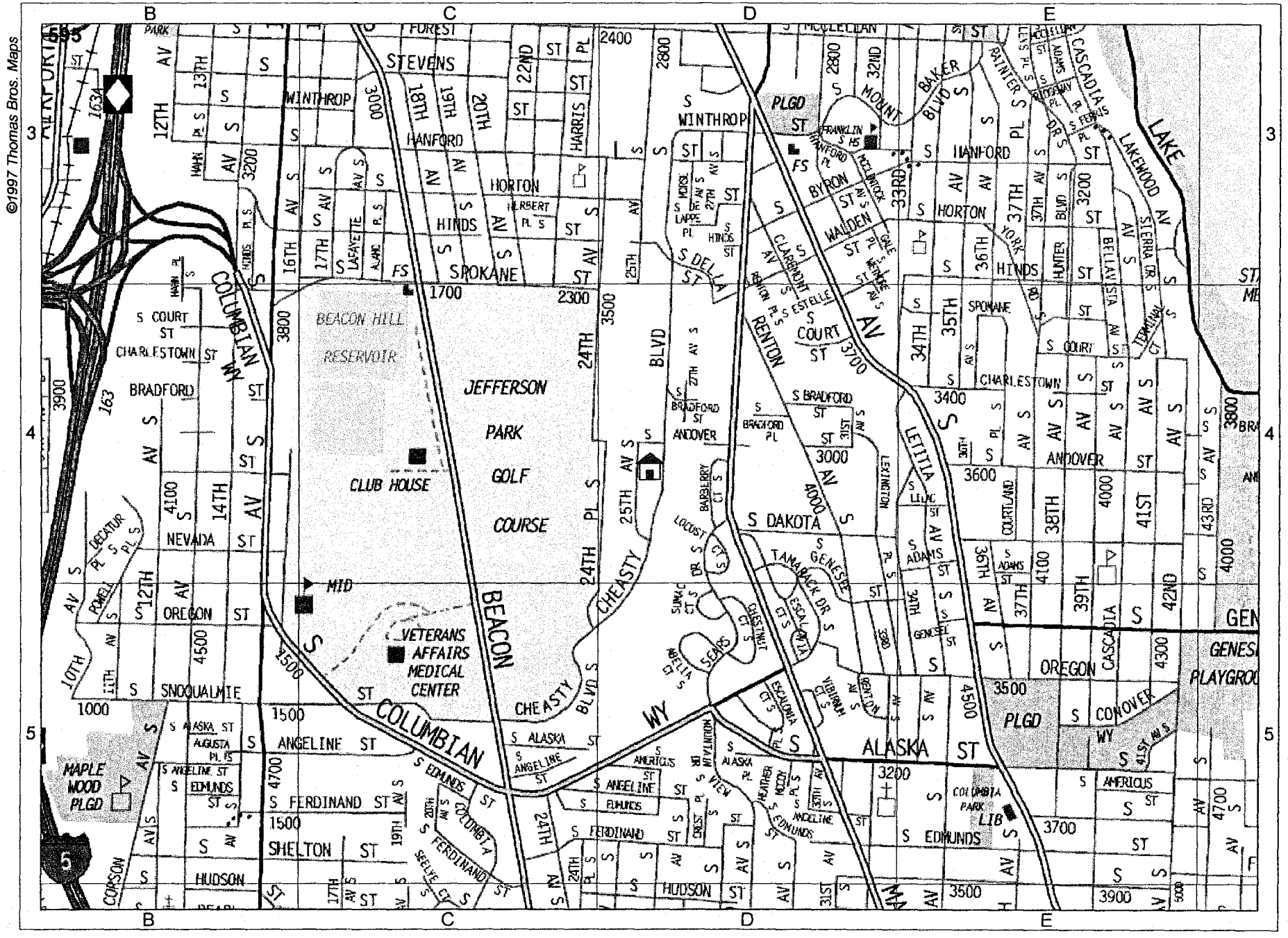


4030 S 25th Av, Seattle, 98108, Page & Grid 595 D4

FIGURE 4 GEOLOGIC MAP

FIGURE 7 TEST PIT LOCATIONS

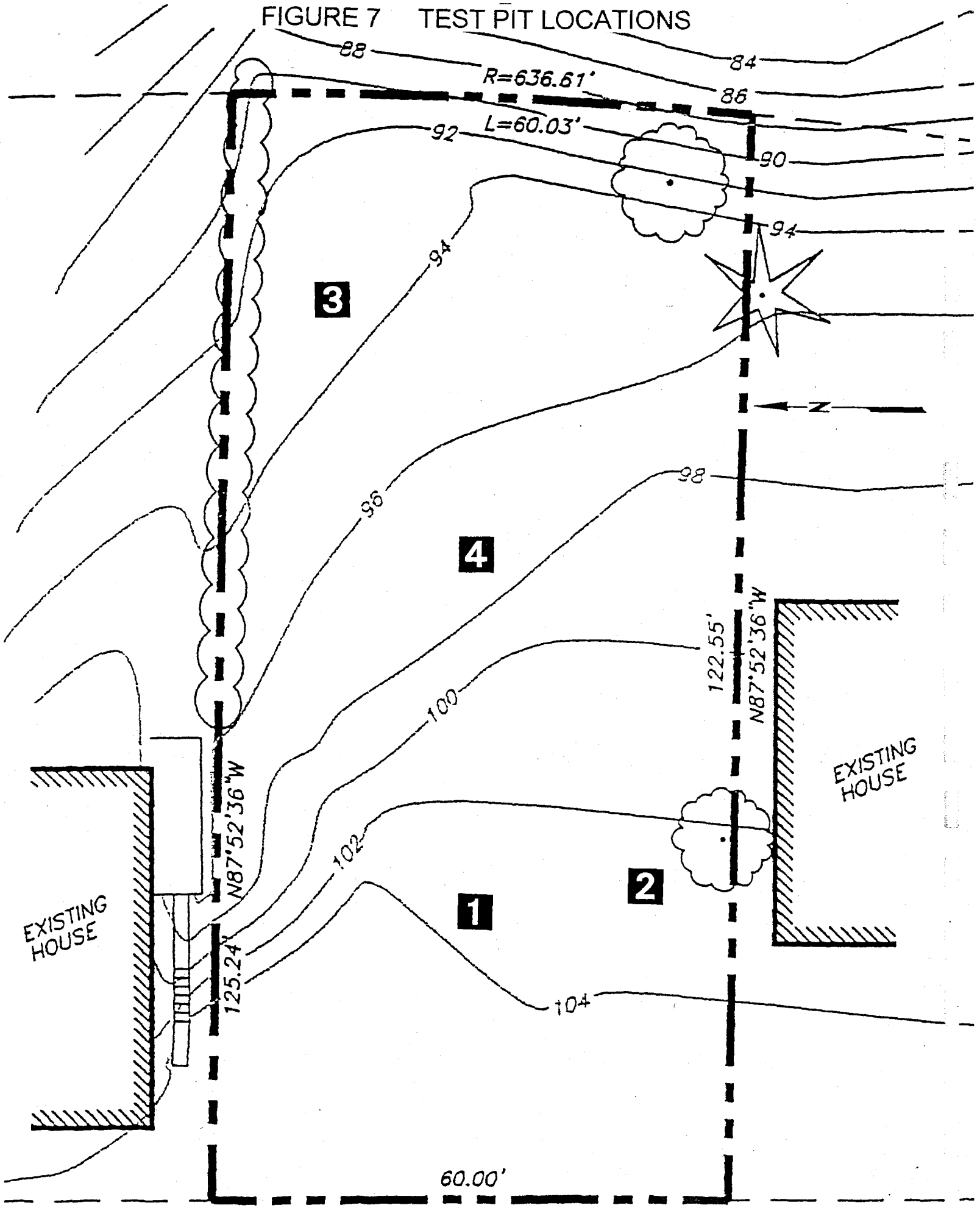


FIGURE 8 TEST PIT LOGS

DEPTH	TP-1	TP-2	TP-3	TP-4	DEPTH
1	GRAY BROWN MEDIUM DENSE SILTY FINE SAND	GRAY BROWN MEDIUM DENSE SILTY FINE SAND	GRAY BROWN DENSE SILTY SAND	GRAY BROWN DENSE SILTY SAND	1
2					2
3					3
4					4
5				GRAY STIFF GRACTURED SILTY CLAY	5
6			BLACK MEDIUM DENSE SANDY SILT ==========		6
7		DARK GRAY SILT		==========	7
8	GRAY BROWN VERY DENSE GLACIAL TILL ==========	GRAY DENSE SILTY SAND ==========			8
9					9
10					10
11					11
12					12

NOTES : 1. NO GROUNDWATER OBSERVED

2. HEAVY RAINFALL DURING and PRIOR to INVESTIGATION

LEGEND

---------- ESTIMATED LOCATION of CHANGE of SOILS

———— KNOWN LOCATION of CHANGE of SOILS

========== BOTTOM of TEST PIT

▽ TOP of GROUNDWATER

HEMPHILL

2001 GOLDER

Golder Associates Inc.

18300 NE Union Hill Road, Suite 200
Redmond, WA 98052-3333
Telephone (425) 883-0777
Fax (425) 882-5498

Golder Associates

7828

43/43

FINAL REPORT

CENTRAL LINK LIGHT RAIL
GEOTECHNICAL DESIGN INVESTIGATION
DESIGN SEGMENTS 730 & 740
SOUTH HINDS STREET TO SOUTH NORFOLK STREET
M. L. KING JR WAY

May 2001

Prepared for:

Central Puget Sound Regional Transit Authority

Prepared by:

Golder Associates Inc.
and
Terra Associates, Inc.

ROBERT PLUM STATE OF WASHINGTON 17521 REGISTERED PROFESSIONAL ENGINEER

Robert L. Plum, P.E.
Principal
Golder Associates Inc.
EXPIRES 8.8.02

5-1-01

Theodore J. Schepper, P.E.
Principal
Terra Associates, Inc.
EXPIRES 6/18/03

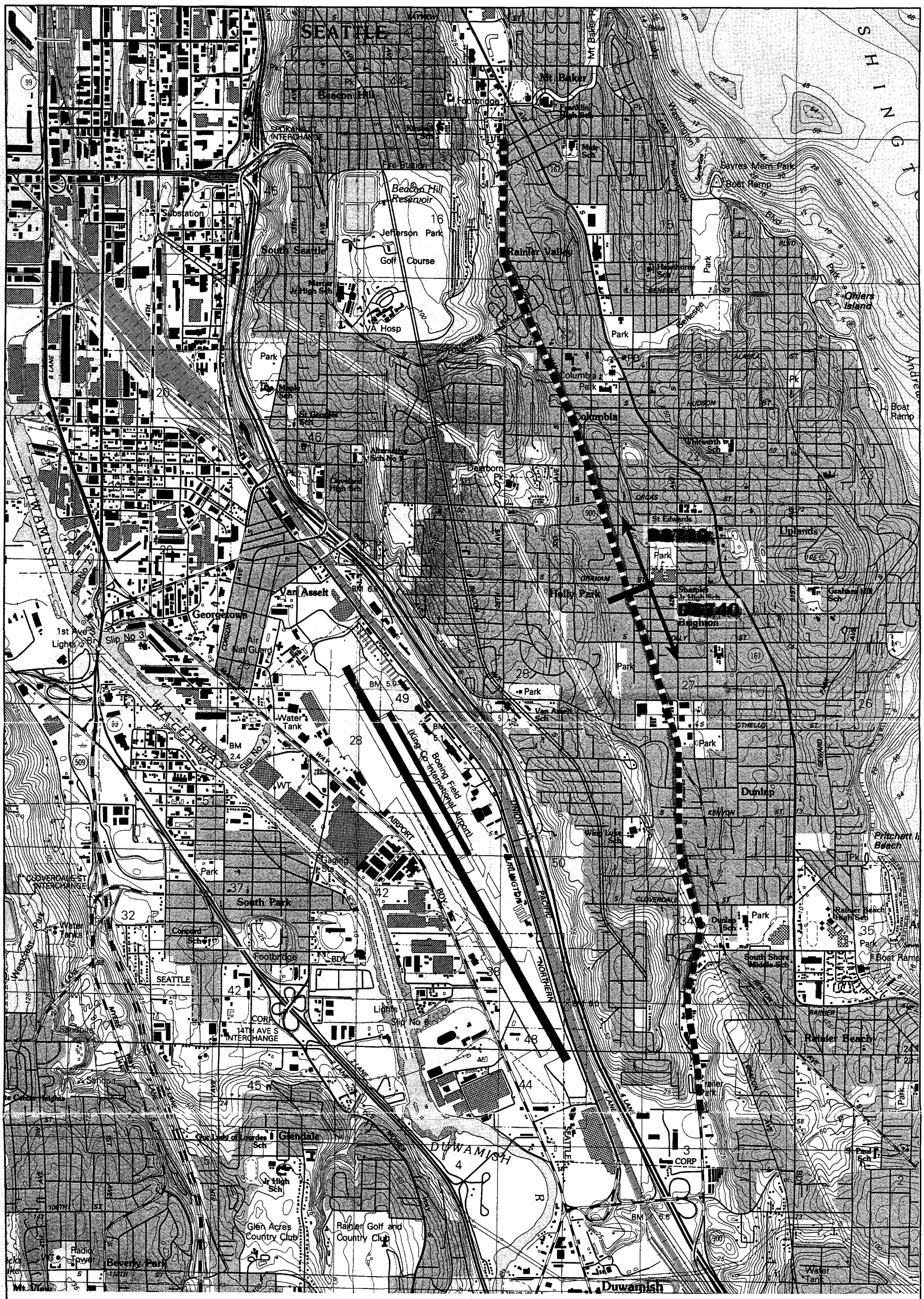
THOMAS J. BYERS STATE OF WASHINGTON 35173 REGISTERED PROFESSIONAL ENGINEER

Thomas J. Byers, P.E.
Senior Engineer
Golder Associates Inc.
EXPIRES 12/15/01

David P. Findley, P.G.
Associate Engineering Geologist
Golder Associates Inc.

May, 2001

003-1112.5300
0501 Final Report



Ref: Seattle South
1:25,000
Topographic - Bathymetric map.
USGS (1983)

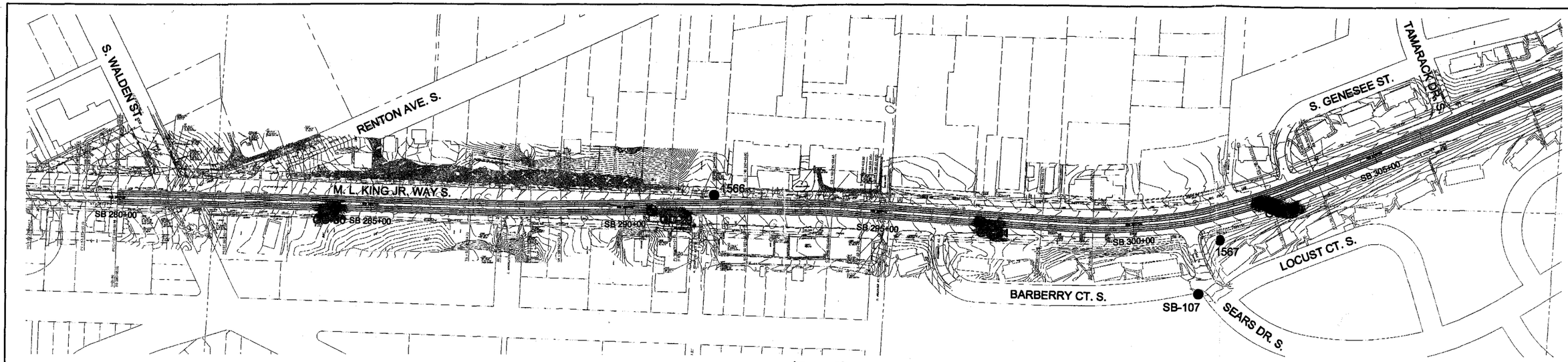
FIGURE **1**

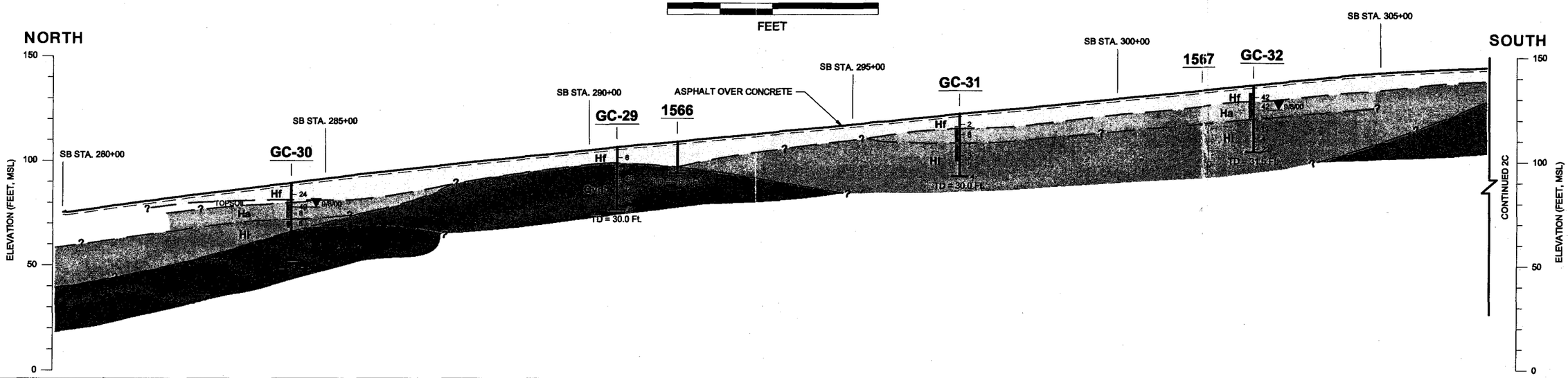
SEGMENTS 730 & 740 PROJECT LOCATION

SOUND TRANSIT SEGMENT 3/WA

PROJECT NO. 003 1112.5102 DRAWING NO. 94496 DATE 11/3/00 DRAWN BY JSR

Golder Associates





EXPLANATION

GC-1

GEOLOGIC SYMBOL - Hb/He

GROUNDWATER LEVEL - DATE MEASURED IN PARENTHESIS 1/1/00

Hb/He

Qgmd

"N" VALUE

STRATIGRAPHIC CONTACT, DASHED LINE WHERE APPROXIMATE.

PIEZOMETER - MONITOR INTERVAL

GC-27 Exploratory Borings this Investigation

1566 Exploratory Borings by Others

Sound Transit Geotechnical Database Boring Number

Hf: Fill

Ha: Alluvium

Hl: Lacustrine Deposits

Qvat: Vashon Ablation Till

Qvro: Vashon Recessional Outwash

Qvrl: Vashon Recessional Lacustrine Deposits

Qvgl: Vashon Glaciolacustrine Deposits

Qgmd: Glaciomarine Drift

SANDSTONE / SILTSTONE/CLAYSTONE

Tss: Tertiary Undifferentiated Sedimentary Rocks, Primarily Siltstone and Sandstone. Late Miocene to Middle Eocene

SPECIAL NOTE:
Data concerning the various strata have been obtained at exploration locations only. The interpretation between these locations has been inferred from geological evidence and so may vary from that shown.

FIGURE **2B**

EXPLORATION PLAN AND CROSS-SECTION A-A'

STA. SB 280+00 TO 305+00

CENTRAL PUGET SOUND/SOUND TRANSIT SEGMENT 3/WA

Golder Associates

bclark|K:\Projects\2000\0031112\5102\730-720\93381.dwg|4-9-1 10:16|x:xr-730,xr-pr730-n,xr-htch-n|i:-

RECORD OF BOREHOLE GC-31

SHEET 1 of 2

PROJECT: Sound Transit/ / WA
PROJECT NUMBER: 003-1112
LOCATION: Segment #3

DRILLING METHOD: HSA
DRILLING DATE: 8/23/00
DRILL RIG: Mobile B-59

DATUM: Local/MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION:
INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40) / WATER CONTENT (PERCENT) W_p W W_l	NOTES WATER LEVELS GRAPHIC
0	4" I.D. HSA with SPT Autohammer	0.0 - 1.0 Asphalt/Concrete										Concrete
		1.0 - 6.0 Gravels/cobbles in drill action 1-2' Loose and very soft, moderate yellowish brown to orangish brown, mottled, non-stratified, fine to coarse sandy SILT, some fine to coarse subrounded to subangular gravel, trace charred debris, trace organics and SILTY CLAY, some fine to coarse sand, trace fine gravel, trace organics, trace charred debris, damp. (FILL) (Hf)	ML, CL, SP-SM		1.0	1	SS	2-4-3	7	0.8/1.5	■ ○	
						2	SS	1-1-1	2	1.1/1.5	■	Bentonite Chips
5		6.0 - 12.0 Loose, medium gray, iron oxide stained in horizontal zones, interbedded, non-stratified to stratified, fine to medium SAND, trace silt, trace organics and SILT to CLAYEY SILT, trace fine to medium sand, trace organics, moist to wet. (ALLUVIUM) (Qa) Note: Silt interbeds decrease with depth.			6.0	3	SS	1-2-2	4	1.3/1.5	■	
			SP-SM, ML			4	SS	3-3-5	8	1.2/1.5	■ ○	1-inch PVC Riser
10												SAND
		12.0 - 30.0 Very soft to soft and very loose to loose, medium gray, laminated to faintly laminated to massive, SILT and CLAY, trace to little fine to coarse sand, trace fine subangular gravel, trace silt in lenses, wet to moist. (RECESSIONAL LACUSTRINE DEPOSIT) (Qvrl)			12.0	5	SS	2-4-3	7	1.2/1.5	■	
15			ML, CL									1-inch PVC 10-Slot Screen
						6	SS	2-2-1	3	1.5/1.5	■	
20		Log continued on next page										

1 in to 3 ft
DRILLING CONTRACTOR: Straightline
DRILLER: Mike R.

LOGGED: C. Allen
CHECKED: D. Findley
DATE:

Golder Associates

BOREHOLE RECORD BOREGC1.GPJ GLDR_WA.GDT 2/26/01

RECORD OF BOREHOLE GC-31

SHEET 2 of 2

PROJECT: Sound Transit/ / WA
PROJECT NUMBER: 003-1112
LOCATION: Segment #3

DRILLING METHOD: HSA
DRILLING DATE: 8/23/00
DRILL RIG: Mobile B-59

DATUM: Local/MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION:
INCLINATION: -90

DEPTH (ft)	BORING METHOD	DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40) / WATER CONTENT (PERCENT) W_p W W_l	NOTES WATER LEVELS GRAPHIC
20	4" I.D. HSA with SPT Autohammer	12.0 - 30.0 Very soft to soft and very loose to loose, medium gray, laminated to faintly laminated to massive, SILT and CLAY, trace to little fine to coarse sand, trace fine subangular gravel, trace silt in lenses, wet to moist. (RECESSIONAL LACUSTRINE DEPOSIT) (Qvrl) *(Continued)*	ML, CL									Bentonite Chips and Cuttings
						7	SS	1-0-2	2	1.5/1.5	■	
25												Bentonite Chips and Cuttings
						8	SS	1-1-3	4	1.5/1.5	■	
30		Boring completed at 30.0 ft.			30.0							23' ATD
35												
40												

1 in to 3 ft
DRILLING CONTRACTOR: Straightline
DRILLER: Mike R.

LOGGED: C. Allen
CHECKED: D. Findley
DATE:

Golder Associates

BOREHOLE RECORD BOREGC1.GPJ GLDR_WA.GDT 2/26/01

RECORD OF BOREHOLE GC-32

SHEET 1 of 2

PROJECT: Sound Transit/ / WA
PROJECT NUMBER: 003-1112
LOCATION: Segment 3/MLK

DRILLING METHOD: HSA
DRILLING DATE: 8/23/00
DRILL RIG: CME-75

DATUM: Local/MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION:
INCLINATION: -90

DEPTH (ft)	BORING METHOD	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40) / WATER CONTENT (PERCENT) W_p W W_l	NOTES WATER LEVELS GRAPHIC
0	HSA	0.0 - 1.0 Concrete				1	GRAB			1.5/1.5		Concrete
		1.0 - 7.0 Compact to dense, nonstratified, orangish brown with tan lenses, fine to medium SAND, little to some subangular gravel, trace silt, damp. (FILL) (Hf)	SP-SM		1.0	2	SS	5-8-11	19	1.3/1.5	○	Bentonite Chips 1-inch PVC riser
5						3	SS	15-20-22	42	0.7/1.5		
		7.0 - 21.0 Dense, stratified, orange-brown, silty fine to medium SAND, interbedded with tan fine sandy silt and clayey silt and fine to medium sand layers/lenses, moist to wet. (ALLUVIUM) (Ha)			7.0	4	SS	7-7-12	19	1.0/1.5		
10						5	SS	13-20-22	42	0.7/1.5		10/20 Silica Sand 1-inch 10-slot PVC Screen
			SM, ML-CL SP-SM			6	SS	15-17-20	37	1.0/1.5		
15						7	SS	16-29-30	>50	1.5/1.5	>	
20		Log continued on next page										

1 in to 3 ft
DRILLING CONTRACTOR: Ramlo Drilling
DRILLER: Charlie

LOGGED: M. Stiehler
CHECKED: D. Findley
DATE:

Golder Associates

BOREHOLE RECORD BOREGC1.GPJ GLDR_WA.GDT 2/26/01

9/8/00

RECORD OF BOREHOLE GC-32

SHEET 2 of 2

PROJECT: Sound Transit/ / WA
PROJECT NUMBER: 003-1112
LOCATION: Segment 3/MLK

DRILLING METHOD: HSA
DRILLING DATE: 8/23/00
DRILL RIG: CME-75

DATUM: Local/MSL
AZIMUTH: N/A
COORDINATES: not surveyed

ELEVATION:
INCLINATION: -90

DEPTH (ft)	BORING METHOD	DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40) / WATER CONTENT (PERCENT) W_p W W_l	NOTES WATER LEVELS / GRAPHIC
20	HSA		SM, ML-CL SP-SM			8	SS	5-5-6	11	1.5 / 1.5	■	
		21.0 - 31.5 Compact with loose zones, stratified, gray, silty fine SAND interbedded with fine sandy SILT and trace CLAYEY SILT, moist. (LACUSTRINE DEPOSIT) (HI)			21.0							Bentonite Chips →
25		Soft, gray, laminated SILTY CLAY, interbedded with thin fine sand layers from 25.5' to ~28'	SM, CL-ML			9	SS	2-2-2	4	1.5 / 1.5	■ ○	
30						10	SS	8-10-12	22	1.5 / 1.5	■	
		Boring completed at 31.5 ft.			31.5							
35												
40												

1 in to 3 ft
DRILLING CONTRACTOR: Ramlo Drilling
DRILLER: Charlie

LOGGED: M. Stiehler
CHECKED: D. Findley
DATE:

Golder Associates

BOREHOLE RECORD BOREGC1.GPJ GLDR_WA.GDT 2/26/01

2001 LSI ADAPT 014644

April 16, 2001
WA00-6172

Tandem Development Corporation
9122 Rainier Avenue South
Seattle, Washington 98119

Attention: Mr. Emiliano Fernandez

Subject: Summary of General Construction Recommendations
Field Exploration and Geotechnical Engineering Evaluation
Proposed Residence
4042 - 25th Avenue South
Seattle, Washington

Dear Mr. Fernandez:

LSI - ADAPT (ADAPT) is pleased to present the following summary of subsurface conditions and geotechnical recommendations for the proposed residence. This summary is presented for establishing general design recommendations for the development and should be used in conjunction with the geotechnical report for this project contained in our forthcoming report. Our final report will be issued within about one weeks time.

The property is characterized by an upper terrace that slopes gently to the east, with the slope steepening toward the eastern side of the property. The slope on the east side of the property had a gradient of approximately 50 percent, with an elevation change of about 10 feet. Beyond the base of the slope the gradient flattens to Cheasty Boulevard. Based upon the provided survey map, total topographic relief across the parcel is approximately 20 feet from west to east. The upper terrace portion of the site supports a manicured lawn and peripheral small trees and shrubs, and the eastern slope supports a thick growth of blackberries along with a few taller alder and maple trees. A small wooden shed resided on the central portion of the site. We observed wet near surface soil conditions at the base of the eastern slope and on the lower flat area to the east of the property line. However, we did not observe any obvious signs of slope instability at the time of our site visit.

City of Seattle Engineering Department and the Seattle Department of Construction and Land Use (DCLU) sensitive areas folios depict the slope located on the western portion of the parcel within their designated "landslide prone areas" boundaries. A review of the folios, as well as the updated 1996/97 reported landslide map at DCLU's offices revealed five slides that occurred within one-half mile of the site along the east slope of Beacon Hill, one of which appeared to be three or four addresses to the north, along 25th Avenue South. No files were available at DCLU for our review concerning these sites.

It is our understanding that single-family residential development is planned for the site. According to preliminary plans, the building footprint will cover about 2,000 square feet, and include two stories with an attached two-car garage. Based upon the proposed finished elevations, we anticipate that a significant amount of cut will be required for the proposed basement. In addition, the basement "cut" will extend to within five feet of the northern property boundary.

ADAPT's subsequently completed a subsurface assessment of the property, which included advancing two test borings on the property to depths of up to 34 feet below ground surface. Borings B-1 and B-2 disclosed loose, moist to wet, brown to dark brown silty fine sand with some gravel and organic that extended to about 9 feet (B-2) to 14 feet (B-1) bgs. The 10-11½ foot sample from B-1 showed wet black organic and brick fragments, suggesting that it may be man-placed fill. The near surface silty sands in boring B-2 may also be, in part, man-placed fill. These fill or possible fill soils were underlain in boring B-1 by damp to wet, medium stiff to very stiff, brown-tan grading to gray, silt to clayey silt that extended to the full depth explored (up to 34 feet bgs). The upper loose sands in boring B-2 were underlain by wet dense gray gravelly, silty fine sand that extended to a depth of about 18 feet bgs. These soils were underlain by very stiff or hard dark gray silt that extended the full depth explored (up to 21½ feet bgs). The lower silty or clayey silt unit in boring B-1 was massive in nature, and exhibited variable micro-fracturing throughout, but not obviously disturbed and we did not observe obvious zones of failure, such as slickensides.

Groundwater was encountered initially at a depth of 8 feet in boring B-1, and at a depth of about 22 feet after drilling was complete, and at a depth of about 14 feet in boring B-2. The shallow groundwater encountered in boring B-1 appears to be water perched above the underling silt unit, while water encountered at deeper depths in the borings may represent a more persistent near surface water table. Groundwater conditions can vary seasonally with changes in precipitation, and may fluctuate with changes in site utilization and other factors.

Conclusions and Recommendations

Based upon our visual and subsurface assessment, suitable bearing soils appear to be located between 1 to 3 feet below the proposed footing depth on the western side of the proposed structure. However, suitable bearing soils appear to be located at a depth of over 20 feet below the base of the east side of the proposed residence. Therefore, the eastern side of the structure would need to be supported by structural elements which extend into the underlying very stiff silts. This could be accomplished by the use of deep foundations such as augercast piles, or needle piles or timber piles. ADAPT's construction and foundation recommendations are forthcoming in our geotechnical site evaluation.

Based upon the site conditions encountered, we offer the following general construction recommendations:

- Temporary shoring will likely be necessary along the northern side of the cut for the proposed basement, which is proposed to be within 5 feet of the property line. The maximum anticipated excavation depth would be about 8 feet in depth. Given the generally loose nature of the upper sandy soils, we recommend, as a general guide, temporary slopes of 2H to 1V (Horizontal to Vertical) or flatter may be used for temporary cuts in the upper 9 or more feet of loose or medium dense sand soils. Portions of this temporary slope may extend onto the adjacent property to the north. Therefore, it may be necessary to obtain a temporary slope easement for usage of this property. Alternatively, temporary shoring could be utilized.

  The contractor should be allowed to implement additional protective measures beyond those outlined herein depending upon conditions disclosed in the excavation once construction is under way. It is generally not the purpose of this letter to provide specific criteria for construction methods, materials or procedures. This should be the responsibility of the contractor to verify actual ground conditions at the site and determine construction methods and procedures needed for the installation of the appropriate shoring system.

- Given the presence of the near surface fill soils and underlying silts soils encountered in boring B-1, deep foundations, such as driven piles or drilled in place augercast piles will be necessary for

14644

2006037
726800
145

October 23, 2001
LSI - ADAPT Job No. WA00-6172

City of Seattle Department of Construction and Landuse
700 Fifth Avenue, Suite 2000
Seattle, Washington 98104-1703

Attention: Mr. William Bou

Subject: Plan Review and Minimum Risk Statement
Project No. 2006037
4042 - 25th Avenue South
Seattle, Washington

Dear Mr. Bou,

LSI ADAPT (ADAPT) has reviewed the project plans provided to us for the above referenced site. Based on our review, the project plans appear to conform to the recommendations contained in our report and subsequent correspondence. Provided that the conditions and recommendations contained in our report and subsequent correspondence are satisfied during construction and use, the areas disturbed by construction will be stabilized and remain stable, and will not increase the potential for soil movement, and the risk of damage to the proposed development and from the development from soil instability will be minimal.

We have prepared this letter for use by The Engs, Tandem Development, Inc., and members of the design team, for use in the design of this project. If there are any changes in the loads, grades, locations, configurations or type of facilities to be constructed, the conclusions and recommendations presented in this letter may not be fully applicable. If such changes are made, we should be given the opportunity to review our recommendations and provide written modifications or verifications, as appropriate. Please contact us if you have any questions or require additional information.

Respectfully submitted,

LSI -ADAPT

Charles C. Cacek
Senior Engineering Geologist

Kurt W. Groesch PE
Senior Geotechnical Engineer

KURT W. GROESCH
STATE OF WASHINGTON
19166
REGISTERED
PROFESSIONAL ENGINEER
10/23
EXPIRES 6/15/02

800 Maynard Avenue South
Suite 403
Seattle, Washington 98134

LSI - ADAPT

Tel (206)-654-7045
Fax (206) 654-7048
www.lsiadapt.com

BORING LOG

LSI ADAPT
800 Maynard Avenue South, Suite 403
Seattle, Washington 98134
TEL: 206.654.7045 FAX: 206.654.7048

PROJECT : Eng Residence
LOCATION : 4042 25th Avenue South
Seattle, Washington

Job Number : WA01-6172

Boring No. : **B-1**

Tandem Development, Corporation

Elevation Reference : N/A
Ground Surface Elevation : 238 ft. a.s.d.

Well Completed : N/A
Casing Elevation : N/A

DEPTH (feet)	Description	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	OVM READING	GROUND WATER	AS-BUILT DESIGN	TESTING
0	Surface grass over loose locally medium dense, tan-gray with oxidation to dark brown, silty, fine SAND some small gravels, minor organics							
			S-1	3 2 5				
5			S-2	6 7 5				
	Damp to wet		S-3	3 2 2		▼ 04/05 2001		
10	With minor brick and wood fragments (Fill)		S-4	3 1 2				
			S-5	2 2 3				
15	Medium stiff to stiff, damp to wet, tan, clayey SILT, massive with microfractures		S-6	5 3 5				
			S-7	2 2 3				
20	Grades to gray, clayey SILT, massive with microfractured zones		S-8	4 5 7		▽ 04/05 2001		
			S-9	3 3 4				
25			S-10	4 4 6				
			S-11	3 4 5				
30								

LEGEND

- 2-Inch O. D. Split-Spoon Sample
- 1" Geoprobe
- Sample not Recovered
- ▼ DATE — Static Water Level at Drilling
- ▽ DATE — Static Water Level
- Perched Groundwater
- Grab Sample
- WTPH-D Ext. 8015 — Type of Analytical Testing Used
- NR — No Recovery
- ATD — At Time of Drilling

File Name : Boring Log.cdr

Drilling Start Date : 04/05/01

Drilling Completion Date : 04/05/01

Logged By : C.C.C.

BORING LOG

LSI ADAPT
800 Maynard Avenue South, Suite 403
Seattle, Washington 98134
TEL: 206.654.7045 FAX: 206.654.7048

PROJECT : Eng Residence
LOCATION : 4042 25th Avenue South
Seattle, Washington

Job Number : WA01-6172

Boring No. : **B-2**

Tandem Development, Corporation

Elevation Reference : N/A
Ground Surface Elevation : 244 ft. a.s.d.

Well Completed : N/A
Casing Elevation : N/A

DEPTH (feet)		SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	OVM READING	GROUND WATER	AS-BUILT DESIGN	TESTING
0	Surface grass and weeds over loose, moist to damp, brown with oxidation, silty, fine SAND, some rounded gravels and organics		S-1	2 2 2			Report	
5	Damp to wet		S-2	1 3 2				
			S-3	3 4 5				
10	Dense, wet, gray, gravelly, silty, fine SAND, with rounded gravel		S-4	15 18 18		▽ 04/05 2001		
15			S-5	12 17 17				
20	Very stiff, wet, gray SILT		S-6	12 11 11				
	Boring terminated at 21.5 feet depth							
25								
30								

LEGEND

- 2-Inch O. D. Split-Spoon Sample
- 1" Geoprobe
- Sample not Recovered
- ▼ DATE — Static Water Level at Drilling
- ▽ DATE — Static Water Level
- Perched Groundwater
- Grab Sample
- WTPH-D Ext. 8015 — Type of Analytical Testing Used
- NR — No Recovery
- ATD — At Time of Drilling

File Name : Boring Log

Drilling Start Date : 04/05/01

Drilling Completion Date : 04/05/01

Logged By : C.C.C.

BORING LOG

LSI ADAPT
800 Maynard Avenue South, Suite 403
Seattle, Washington 98134
TEL: 206.654.7045 FAX: 206.654.7048

PROJECT : Eng Residence
LOCATION : 4042 25th Avenue South
Seattle, Washington

Job Number : WA01-6172

Boring No. : **B-1**

Tandem Development, Corporation

Elevation Reference : N/A
Ground Surface Elevation : 238 ft. a.s.d.

Well Completed : N/A
Casing Elevation : N/A

DEPTH (feet)		SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNT	OVM READING	GROUND WATER	AS-BUILT DESIGN	TESTING
30	Very stiff, moist to wet, gray, clayey SILT, massive with microfracturing		S-12	6 7 9				
	No recovery		S-13	3 6 8				
	Boring terminated at 34.0 feet depth							
35								
40								
45								
50								
55								
60								

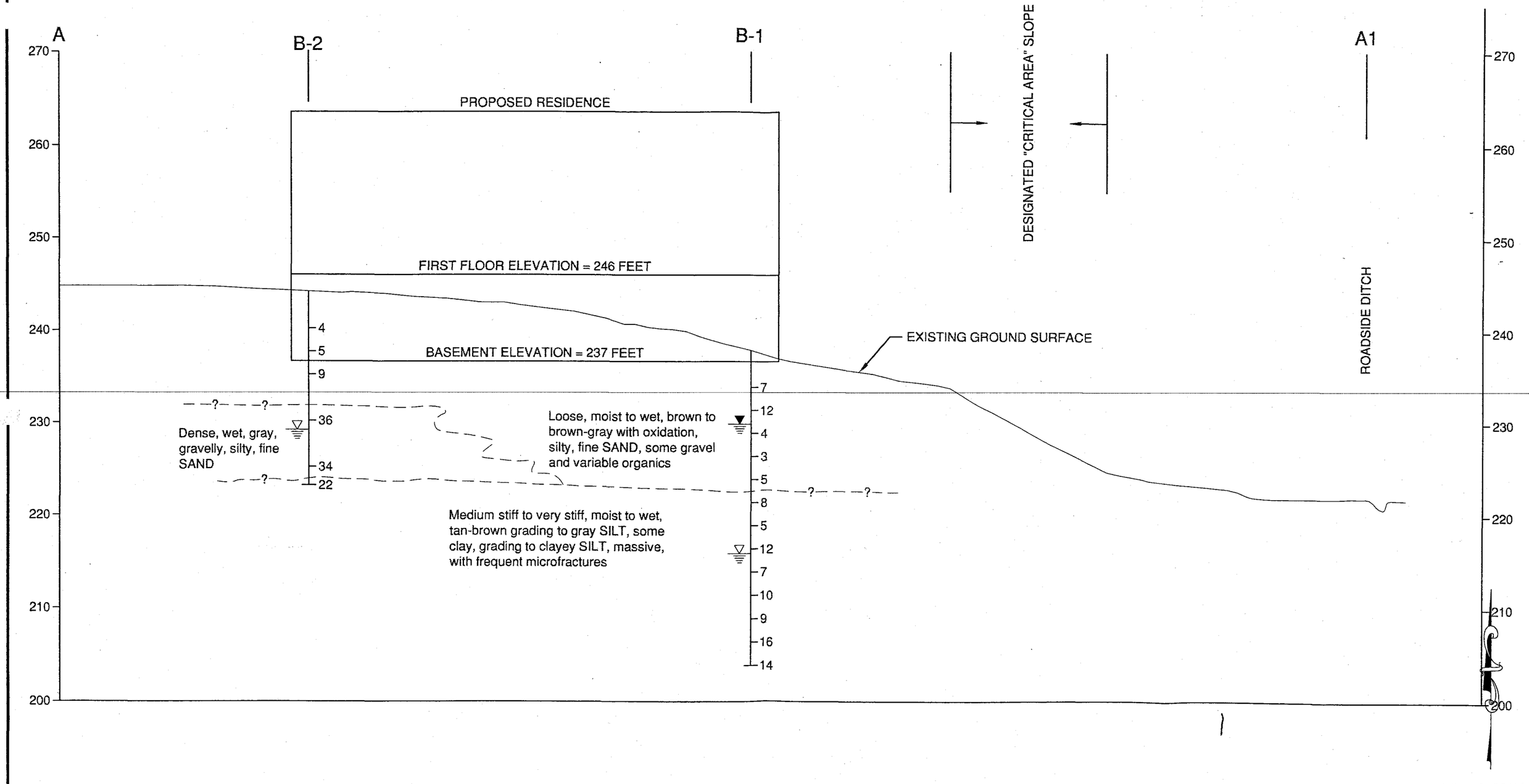
LEGEND

- 2-Inch O. D. Split-Spoon Sample
- 1" Geoprobe
- Sample not Recovered
- DATE ▼ Static Water Level at Drilling
- DATE ▽ Static Water Level
- Perched Groundwater
- Grab Sample
- WTPHD Ext. 8015 — Type of Analytical Testing Used
- NR — No Recovery
- ATD — At Time of Drilling

Drilling Start Date : 04/05/01

Drilling Completion Date : 04/05/01

Logged By : C.C.C.



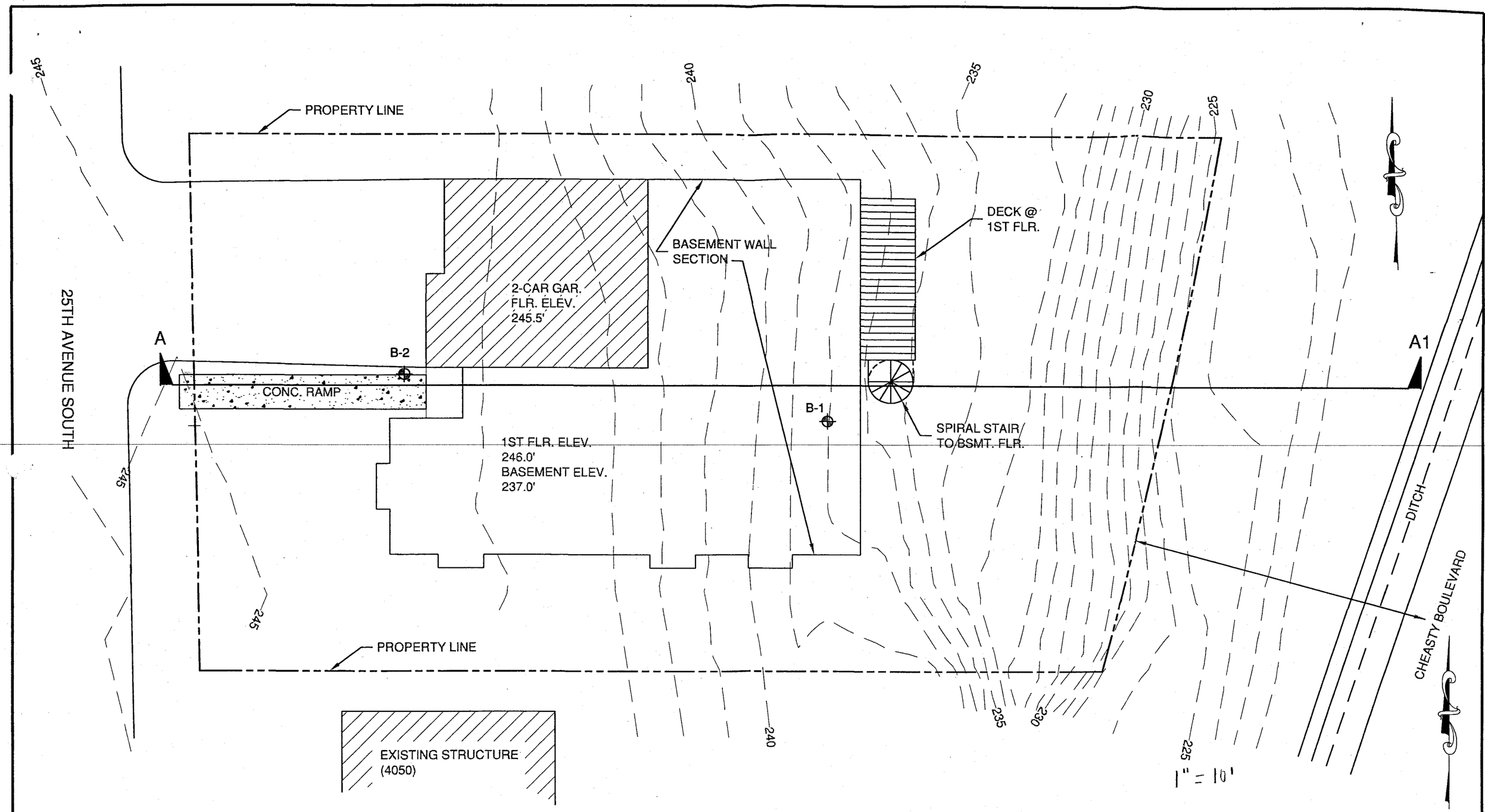
NOT TO SCALE

LSI ADAPT

800 Maynard Avenue S., Suite 403
Seattle, Washington 98134
Ph : 206.654.7045 Fax : 206.654.7048

FIGURE 3 - Geological Cross Section

Project : Eng Residence
Location : 4042 25th Avenue South
Seattle, Washington
Client : Tandem Development, Corporation
Date : 04/10/01 **Job # :** S-WA-01-6172



NOT TO SCALE

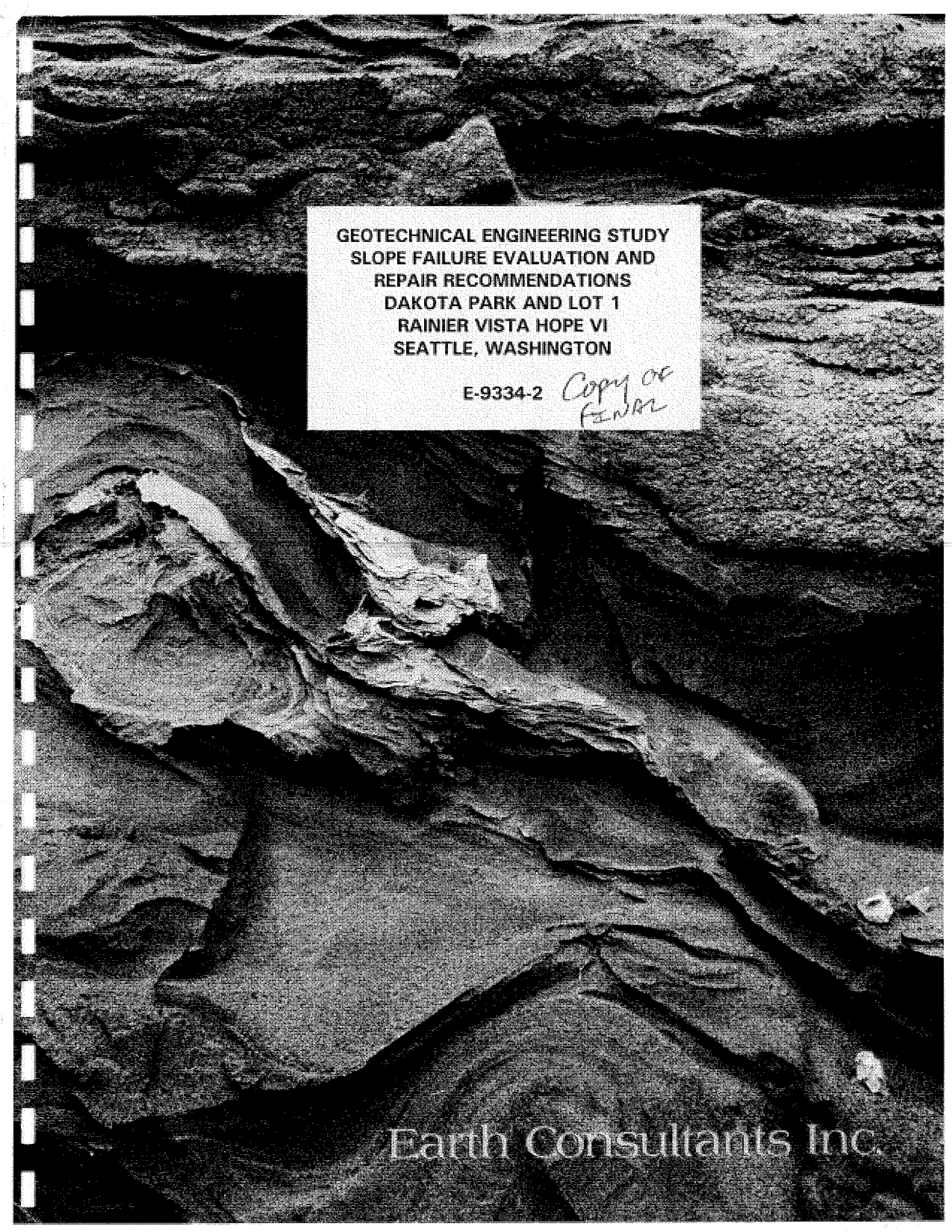
LSI ADAPT

800 Maynard Avenue S., Suite 403
Seattle, Washington 98134
Ph : 206.654.7045 Fax : 206.654.7048

FIGURE 2 - Site & Exploration Plan

Project : Eng Residence
Location : 4042 25th Avenue South
Seattle, Washington
Client : Tandem Development, Corporation
Date : 04/10/01 **Job #** : S-WA-01-6172

2004 ECI A 1.8 EARTH CONSULTANTS
DAKOTA PARK SLOPE FAILURE ENGINEERING STUDY
E-9334-2, MARCH 5, 2004



GEOTECHNICAL ENGINEERING STUDY
SLOPE FAILURE EVALUATION AND REPAIR RECOMMENDATIONS
DAKOTA PARK AND LOT 1
RAINIER VISTA HOPE VI
SEATTLE, WASHINGTON

E-9334-2 Copy of FINAL

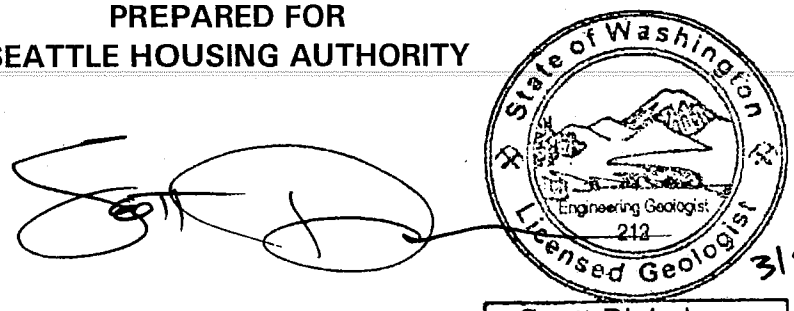
Earth Consultants Inc.

GEOTECHNICAL ENGINEERING STUDY
SLOPE FAILURE EVALUATION AND
REPAIR RECOMMENDATIONS
DAKOTA PARK AND LOT 1
RAINIER VISTA HOPE VI
SEATTLE, WASHINGTON

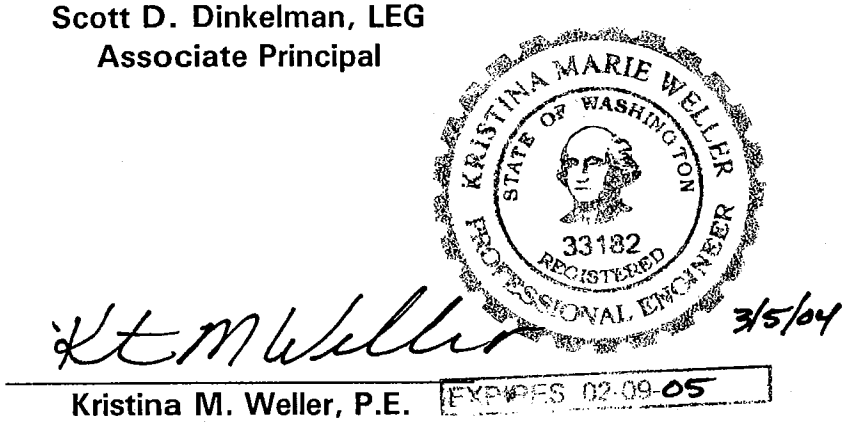
E-9334-2

March 5, 2004

PREPARED FOR
SEATTLE HOUSING AUTHORITY



Scott D. Dinkelman, LEG
Associate Principal



Kristina M. Weller, P.E.
Project Manager

Earth Consultants, Inc.
1805 - 136th Place Northeast, Suite 201
Bellevue, Washington 98005
(425) 643-3780
Toll Free 1-888-739-6670

IMPORTANT INFORMATION
ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, due in large measure to programs and publications of ASFE/ The Association of Engineering Firms Practicing in the Geosciences.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include: the general nature of the structure involved, its size and configuration; the location of the structure on the site and its orientation; physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program. To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of the report may affect its recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should not be used*:

- When the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership, or
- for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems which may develop if they are not consulted after factors considered in their report's development have changed.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by geotechnical engineers who then render an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those inferred to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact.* For this reason, *most experienced owners retain their geotechnical consultants through the construction stage*, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly-changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Geotechnical engineers' reports are prepared to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. Unless indicated otherwise, this report was prepared expressly for the client involved and expressly for purposes indicated by the client. Use by any other persons for any purpose, or by the client for a different purpose, may result in problems. *No individual other than the client should apply this report for its intended purpose without first conferring with the geotechnical engineer. No person should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.*

Earth Consultants, Inc.
Geotechnical Engineers, Geologists & Environmental Scientists
Construction Testing & ICBO / WABO Inspection Services
Established 1975

March 5, 2004

E-9334-2

Seattle Housing Authority
P.O. Box 19028
Seattle, Washington 98109-1028

Attention Mr. Jeff Saeger

Subject: **Department of Planning and Development Permit No. 735717**

Dear Mr. Saeger:

Earth Consultants, Inc. (ECI) is pleased to submit our report titled "Slope Failure Evaluation and Repair Recommendations, Dakota Park and Lot 1, Rainier Vista Hope VI Seattle, Washington". The purpose of our study was to explore the subsurface conditions in the slide area and provide recommendations for repairing the slope.

ECI previously issued a preliminary version of this study in December 2003. Subsurface soil and groundwater conditions for the preliminary study were evaluated by drilling four borings in the vicinity of the slope failure. The borings were drilled to depths ranging from twenty-six and one-half (26.5) to fifty-five (55) feet below existing grade.

In preparing this final study, and in order to assess additional movement of the slope failure that occurred after our draft study was prepared, we advanced an additional eight borings and installed four slope inclinometers and four monitoring wells.

The attached study presents a summary of our previous and most recent explorations, the results of our slope monitoring, and our finalized slope repair recommendations. Included with this report are: Sheet 1.0, Repair Plans; Sheets K1.0 and K1.1, Keystone Wall Design; and Sheets S1.10 and S2.10, Structural Plans for the soldier pile wall.

ECI appreciates this opportunity to be of service to you. If you have any questions or if ECI can be of further assistance, please call.

Respectfully submitted,

EARTH CONSULTANTS, INC.

Kristina M. Weller, P.E.
Project Manager

SDD/KMW/csm

1805 136th Place N.E., Suite 201, Bellevue, WA 98005
Bellevue (425) 643-3780 FAX (425) 746-0860 Toll Free (888) 739-6670

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ILLUSTRATIONS

APPENDICES

APPENDIX A

FIELD EXPLORATION

E-9334-2

ECI's initial field exploration was performed on October 8, 2003. Subsurface conditions at the site were explored by drilling two borings to a maximum depth of thirty one and one-half (31.5) feet below the existing grade. Inclinometers were installed the full depth of the boring. The borings were drilled by Geologic Drill subcontracted to ECI, using a trailer-mounted drill.

Two additional borings were drilled on October 30, 2003, to a maximum depth of fifty-one and one-half (51.5) feet below the existing grade. The borings were drilled by Boretec Drilling subcontracted to ECI, using a track-mounted drill.

Eight additional borings were drilled on February in the vicinity of the recent slope failure. The borings were drilled to depths ranging from twenty-six and one-half (26.5) to fifty-five (55) feet below existing grade. To further assess changing subsurface conditions within and adjacent to the active landslide area, slope inclinometer casing was installed at four of the boring locations and monitoring wells were installed at the other four locations. The slope inclinometer casing was installed to depths ranging from forty-two (42) to fifty-three (53) feet below existing grade. The monitoring wells were installed to depths ranging from ten (10) to thirty-one (31) feet below existing grade.

Approximate boring locations were determined by interpolation from site features. Boring elevations were determined by locating on the site plan provided. The locations and elevations of the borings should be considered accurate only to the degree implied by the method used. These approximate locations are shown on Sheet 1.0 of the plans submitted with this report.

The field exploration was continuously monitored by a geologist from ECI who classified the soils encountered, maintained a log of each boring, obtained representative samples, measured groundwater levels, and observed pertinent site features. Samples were visually classified in accordance with the Unified Soil Classification System which is presented on Plate A1, Legend. Representative soil samples were placed in closed containers and returned to ECI's laboratory for further examination and testing.

Logs of the borings are presented on Plates A2 through A29. The final logs represent ECI's interpretations of the field logs and the results of the laboratory examination and tests of field samples. The stratification lines on the logs represent the approximate boundaries between soil types. In actuality, the transitions may be more gradual.

The borings were drilled using hollow stem augers. In each boring, Standard Penetration Tests (SPT) were performed at selected intervals in general accordance with ASTM Test Designation D-1586. The split spoon samples were driven with a one hundred forty (140) pound hammer freely falling thirty (30) inches. The number of blows required to drive the last twelve (12) inches of penetration are called the "N-value". This value helps to characterize the site soils and is used in ECI's engineering analyses. These results are recorded on the boring logs at the appropriate sample depths.

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTION
Coarse Grained Soils	Gravel And Gravelly Soils	Clean Gravels (little or no fines)		GW gw	Well-Graded Gravels, Gravel-Sand Mixtures, Little Or No Fines
				GP gp	Poorly-Graded Gravels, Gravel-Sand Mixtures, Little Or No Fines
	More Than 50% Coarse Fraction Retained On No. 4 Sieve	Gravels With Fines (appreciable amount of fines)		GM gm	Silty Gravels, Gravel-Sand-Silt Mixtures
				GC gc	Clayey Gravels, Gravel-Sand-Clay Mixtures
	Sand And Sandy Soils	Clean Sand (little or no fines)		SW sw	Well-Graded Sands, Gravelly Sands, Little Or No Fines
				SP sp	Poorly-Graded Sands, Gravelly Sands, Little Or No Fines
More Than 50% Material Larger Than No. 200 Sieve Size	More Than 50% Coarse Fraction Passing No. 4 Sieve	Sands With Fines (appreciable amount of fines)		SM sm	Silty Sands, Sand-Silt Mixtures
				SC sc	Clayey Sands, Sand-Clay Mixtures
Fine Grained Soils	Silts And Clays	Liquid Limit Less Than 50		ML ml	Inorganic Silts & Very Fine Sands, Rock Flour, Silty-Clayey Fine Sands; Clayey Silts w/ Slight Plasticity
				CL cl	Inorganic Clays Of Low To Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean
				OL ol	Organic Silts And Organic Silty Clays Of Low Plasticity
More Than 50% Material Smaller Than No. 200 Sieve Size	Silts And Clays	Liquid Limit Greater Than 50		MH mh	Inorganic Silts, Micaceous Or Diatomaceous Fine Sand Or Silty Soils
				CH ch	Inorganic Clays Of High Plasticity, Fat Clays.
				OH oh	Organic Clays Of Medium To High Plasticity, Organic Silts
Highly Organic Soils				PT pt	Peat, Humus, Swamp Soils With High Organic Contents

Topsoil		Humus And Duff Layer
Fill		Highly Variable Constituents

The discussion in the text of this report is necessary for a proper understanding of the nature of the material presented in the attached logs.

DUAL SYMBOLS are used to indicate borderline soil classification.

C	TORVANE READING, tsf
qu	PENETROMETER READING, tsf
W	MOISTURE, % dry weight
P	SAMPLER PUSHED
*	SAMPLE NOT RECOVERED
pcf	DRY DENSITY, lbs. per cubic ft.
LL	LIQUID LIMIT, %
PI	PLASTIC INDEX

I 2" O.D. SPLIT SPOON SAMPLER

II 24" I.D. RING OR SHELBY TUBE SAMPLER

WATER OBSERVATION WELL

▽ DEPTH OF ENCOUNTERED GROUNDWATER DURING EXCAVATION

▼ SUBSEQUENT GROUNDWATER LEVEL W/ DATE

Earth Consultants Inc.
Geotechnical Engineers, Geologists & Environmental Scientists

LEGEND

Proj. No.	Date	Plate
9334-2	Feb. 2004	A1

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 1 of 3
Job No. 9334-2	Logged by: MGM	Start Date: 1/27/04	Completion Date: 1/27/04	Boring No.: B-201
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±213'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

Surface Conditions: Forest Duff

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
				1		SM	Dark brown silty SAND, very loose, wet
	18.6	3		2 3 4			-becomes brown -trace gravel
	36.7	4		5 6			-mottled , wet
						ML	Mottled brown SILT, very loose, moist to wet
	35.5	6		7 8 9			-fractured -contains small angular silt fragments in silt matrix -becomes loose
	37.2	12		10 11		ML	Brown SILT, medium dense, moist -trace interbeds of fractured silt -predominantly thinly laminated
	34.8	19		12 13 14			-6" thick layer of highly fractured silt at 12.5' -6" long vertical hairline fracture with iron oxide staining at 13.5', laminated at 13' -increase in sand content, becomes moist to wet
	31.1	20		15 16		CH	Brown fat CLAY, very stiff, moist
	32.9	9		17 18			LL=68 PL=27 PI=41 -appears to be disturbed at 18'
				19		CL	Blue gray lean CLAY, stiff, moist -thinly laminated to massive, trace hairline fractures

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

Earth Consultants Inc.
Geotechnical Engineers, Geologists & Environmental Scientists

Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A2

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 2 of 3
Job No. 9334-2	Logged by: MGM	Start Date: 1/27/04	Completion Date: 1/27/04	Boring No.: B-201
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±213'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft. Sample	USCS Symbol	
	30.8	18		21	CL	Blue gray lean CLAY, very stiff, moist
				22		-trace small gravel
						-massive
	30.2	16		23		
				24		
	32.7	15		25		
				26		
				27		
	29.5	18		28	ML	Grades to blue gray SILT, medium dense, moist
				29		-2" interbed of wet silt at 28'
	31.7	14		30		
				31		
				32		
	32.9	18		33		
				34		
	30.7	15		35		-trace small gravel
				36		-zone of increased soil moisture
						Boring terminated at 36.5 feet below existing grade. No groundwater encountered during drilling.

NOTES:
Monitoring well installed to 20.33 feet.
Borings B-201 through B-206 drilled by Boretec using a track-mounted drill rig. Borings B-207 & B-208 drilled by Geologic Drill using a Deep Rock XL trailer-mounted drill rig.
Boring elevations estimated based on topographic data shown on

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

Earth Consultants Inc.
Geotechnical Engineers, Geologists & Environmental Scientists

Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A3

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 3 of 3
Job No. 9334-2	Logged by: MGM	Start Date: 1/27/04	Completion Date: 1/27/04	Boring No.: B-201
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±213'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
							Site Plan dated 12/15/03.

Earth Consultants Inc.
Geotechnical Engineers, Geologists & Environmental Scientists

Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A4

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista Hope VI					Sheet 1 of 2
Job No. 9334-2	Logged by: MGM	Start Date: 1/27/04	Completion Date: 1/27/04	Boring No.: B-202	
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT	
Ground Surface Elevation: ±198'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite			

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft. Sample	USCS Symbol	Surface Conditions: Forest Duff
				1	SM	Brown silty fine SAND, very loose to loose, wet
	16.7	5		2 3 4		-becomes saturated
	26.5	5		5		-moderate seepage at 5'
				6	CH	Mottled brown fat CLAY, medium stiff, wet
	29.3	6		7 8 9		LL=71 PL=31 PI=40
	35.8	8		10 11 12		-becomes medium stiff to stiff -becomes moist
	35.9	16		13 14		-becomes brown, very stiff -manganese oxide staining, along laminae
	32.5	13		15 16		-becomes blue -massive -trace coarse sand granules
	33.9	11		17 18 19		

Earth Consultants Inc.
Geotechnical Engineers, Geologists & Environmental Scientists

Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A4

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 2 of 2
Job No. 9334-2	Logged by: MGM	Start Date: 1/27/04	Completion Date: 1/27/04	Boring No.: B-202
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±198'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
	37.9	12		21		CL	Blue gray lean CLAY, stiff, moist
				22			
	35.7	15		23			-becomes stiff to very stiff
				24			
	35.9	14		25			-becomes stiff
				26			
							Boring terminated at 26.5 feet below existing grade. Groundwater seepage encountered at 3.0 feet during drilling. Installed monitoring well to 20.0 feet below grade.

Earth Consultants Inc.
Geotechnical Engineers, Geologists & Environmental Scientists

Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A5

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 1 of 2
Job No. 9334-2	Logged by: MGM	Start Date: 1/28/04	Completion Date: 1/28/04	Boring No.: B-203
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±181'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

Surface Conditions: Forest Duff

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
				1		ML	Dark brown sandy SILT, very loose, wet
				2			
	24.3	3		3			-becomes reddish brown, saturated
				4			
	18.1	5		5			-trace gravel -mottled
				6			-becomes very loose to loose, moist to wet
				7			
	19.5	3		8			-6" interbed of saturated sand -becomes very loose
				9			
	40.1	5		10			-saturated sand interbed
				11		CL	Mottled brown lean CLAY, soft to medium stiff, moist
				12			
	39.2	6		13			
				14			
				15			
	17.8	17		16		SM	Brown silty SAND, medium dense, wet, trace gravel
				17		CL	Brown lean CLAY, stiff, moist
	32.7	10		18			
				19			-becomes blue gray

Earth Consultants Inc.
Geotechnical Engineers, Geologists & Environmental Scientists

Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A6

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 2 of 2
Job No. 9334-2	Logged by: MGM	Start Date: 1/28/04	Completion Date: 1/28/04	Boring No.: B-203
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±181'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
	29.4	7		21		CL	Blue gray, lean CLAY, medium stiff, moist -contains pockets of sand, appears disturbed at 21'
				22		CL	Brown lean CLAY with sand, stiff, moist
	21.7	11		23			-contains gravel -6" interbed of saturated silty sand with gravel -dark iron oxide staining
				24			
	19.3	9		25		ML	Grades to brown SILT with sand, loose, moist to wet
				26			-contains interbeds of wet, iron oxide stained sand -trace gravel
				27			
	23.2	8		28		SM	Brown silty SAND, loose, water bearing
				29			-trace gravel -25.5% fines
	15.9	20		30			
				31		ML	Brown sandy SILT, medium dense, moist
				32			-blue gray in tip of sampler -iron oxide staining, pockets of sand
	26.9	14		33		CL	Grades to blue gray lean CLAY, stiff, moist
				34			-trace sand
	20.2	68		35			-becomes hard -contains small gravel, trace fractures LL=39 PL=19 PI=20
				36			
							Boring terminated at 36.5 feet below existing grade. Groundwater seepage encountered at 8.0 and 27.5 feet during drilling. Installed monitoring well to 31.0 feet below grade.

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Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A7

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 1 of 3
Job No. 9334-2	Logged by: MGM	Start Date: 1/28/04	Completion Date: 1/28/04	Boring No.: B-204
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±200'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

Surface Conditions: Forest Duff

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft. Sample	USCS Symbol	
				1	SM	Dark brown silty SAND, loose, moist to wet
				2		
				3		
				4	CH	Grades to mottled brown fat CLAY, medium stiff, moist
	38.6	6		5		
				6		-comprised of small angular clay clasts in clay matrix
				7		
				8		
				9		
	33.5	18		10		-becomes very stiff -more intact, only trace fractures -predominantly massive -blue gray in tip
				11		
				12		
				13		
				14		
	34.9	10		15		-becomes stiff -highly fractured from 15.5' - 16' LL=68 PL=30 PI=36
				16		
				17		
				18		
				19		

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

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Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A8

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 2 of 3
Job No. 9334-2	Logged by: MGM	Start Date: 1/28/04	Completion Date: 1/28/04	Boring No.: B-204
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±200'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
	38.1	11		21		CL	Blue gray lean CLAY, stiff, moist -trace fractured interbeds
	29.6	15		25		ML	Grades to blue gray SILT, medium dense, moist -trace sand laminae and small gravel -trace fractures
	32.2	14		30			
	31.4	14		35			

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Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A9

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 3 of 3
Job No. 9334-2	Logged by: MGM	Start Date: 1/28/04	Completion Date: 1/28/04	Boring No.: B-204
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±200'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
	27.1	25		41		ML	Blue gray SILT, medium dense, moist
				42			
				43			
				44			
	20.8	46		45			-trace gravel
				46			
				47			
				48			
				49			
	21.4	33		50			
				51			
							Boring terminated at 51.5 feet below existing grade. No groundwater encountered during drilling. Slope Inclinometer installed to 50.0 feet. Borehole backfilled with grout.

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Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A10

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 1 of 3
Job No. 9334-2	Logged by: MGM	Start Date: 1/29/04	Completion Date: 1/29/04	Boring No.: B-205
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±185'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

Surface Conditions: Forest Duff

General Notes	W (%)	No. Blows Ft.	Depth Ft.	USCS Symbol	
			1	ML	Dark brown sandy SILT, very loose, wet
	39.7	7	2	CL	Brown lean CLAY, medium stiff, moist
			3		
			4		
	12.3	7	5		
			6		-trace sand at 6'
	38.4	5	7		
			8		
			9		
	39.3	15	10		
			11		-california sampler used for sample at 10'
			12		
	14.6	27	13		
			14	SM	Brown silty SAND, medium dense, moist
			15		-contains gravel
	8.0	38			-15.5% fines
			16		-becomes dense
			17		
	12.6	57	18		-becomes wet
			19	SM	Grades to brown silty SAND with gravel, very dense, wet

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

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Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A11

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 2 of 3
Job No. 9334-2	Logged by: MGM	Start Date: 1/29/04	Completion Date: 1/29/04	Boring No.: B-205
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±185'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
	28.2	20		21		ML	Grades to brown SILT with sand, medium dense, moist
				22			-becomes blue gray
	31.2	9		23		CL-ML	Grades to blue gray, lean CLAY, stiff, moist
				24			
	32.4	10		25			
				26			
	32.5	12		27			
				28			
				29			
	16.5	33		30			-california sampler used for sample at 30'
				31			-trace sand, stiff to very stiff
				32			-trace subrounded gravel
	24.1	17		33			-becomes hard
				34			
	26.8	21		35			
				36			
				37			
	15.1	62		38			
				39		ML	Dark gray SILT with sand and gravel, very dense, moist

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Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A12

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 3 of 3
Job No. 9334-2	Logged by: MGM	Start Date: 1/29/04	Completion Date: 1/29/04	Boring No.: B-205
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±185'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft. Sample	USCS Symbol	
				41	CL	Gray lean CLAY, hard, moist
				42		
	13.5	90/11"		43		LL=34 PL=20 PI=14
				44		
				45		
				46		
				47		
	14.1	77		48		
						Boring terminated at 48.5 feet below existing grade. Groundwater seepage encountered at 17.5 feet during drilling. Slope Inclinometer installed to 46.0 feet below grade, borehole backfilled with grout.

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Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A13

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 1 of 3
Job No. 9334-2	Logged by: MGM	Start Date: 1/29/04	Completion Date: 1/29/04	Boring No.: B-206
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±178'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft. Sample	USCS Symbol	Surface Conditions:
				1	ML	Dark brown sandy SILT, very loose, wet
				2		
				3		-becomes brown
				4	CL	Grades to brown lean CLAY, medium stiff, moist
	41.2	6		5		
				6		-comprised of angular clay clasts in silt matrix
				7		
				8		
				9		
				10		
	32.1	57		11	SM	-california sampler used to collect sample at 10' - 11.5' Brown silty SAND with gravel, dense, wet
				12		
				13		
				14		
	18.3	19		15		-trace laminae
				16	ML	Brown sandy SILT, medium dense, moist
				17		
				18		
				19		

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Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A14

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 2 of 3
Job No. 9334-2	Logged by: MGM	Start Date: 1/29/04	Completion Date: 1/29/04	Boring No.: B-206
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±178'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
	31.0	25		21		ML	Brown sandy SILT, medium dense, wet
						SM	Brown silty fine SAND, medium dense, wet
				22			-trace gravel -pockets of poorly graded sand
				23			
				24			
	14.7	37		25			-contains gravel -contains pockets of silt and clean sand
				26			
				27		CL	Blue gray lean CLAY, very stiff, moist
				28			
				29			
	30.9	18		30			
				31			
				32			
				33			
				34			
	26.5	25		35			LL=41 PL=21 PI=20
				36			
				37			
				38			
				39			

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Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A15

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 3 of 3
Job No. 9334-2	Logged by: MGM	Start Date: 1/29/04	Completion Date: 1/29/04	Boring No.: B-206
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±178'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
	19.3					CL	Blue gray lean CLAY, hard, moist
		36		41		ML	Dark gray SILT with sand, dense, moist
				42			-trace gravel
				43			
				44			
	15.3	50/5"		45		SM	Grades to gray silty SAND with gravel, very dense, moist
							Boring terminated at 45.5 feet below existing grade. Groundwater seepage encountered at 10.5 and 20.5 feet during drilling. Slope Inclinometer installed to 42.0 feet below grade, borehole backfilled with grout.

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Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A16

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 1 of 2
Job No. 9334-2	Logged by: MGM	Start Date: 2/6/04	Completion Date: 2/6/04	Boring No.: B-207
Drilling Contactor: Geologic Drill		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±150'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

Surface Conditions: Toe of Slope

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft. Sample	USCS Symbol	
				1	SM	Brown silty SAND with gravel, medium dense, moist
				2		
	15.3	14		3		-iron oxide staining
				4		
	21.6	13		5		-becomes water bearing
				6		
				7		
	23.4	23		8		-dark reddish brown silty SAND with gravel
				9		-4" layer of water bearing, poorly graded sand at 8.5'
				9	ML	Blue gray SILT, medium dense, moist
	31.3	16		10		
				11		
				12		
	24.3	16		13		
				14		
				15	CL	Grades to lean CLAY, stiff, moist
	35.4	12		16		-trace angular clasts in clay matrix
				17		
	40.1	8		18		-becomes medium stiff to stiff
				19		-6" zone of highly fractured clay

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Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A17

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 2 of 2
Job No. 9334-2	Logged by: MGM	Start Date: 2/6/04	Completion Date: 2/6/04	Boring No.: B-207
Drilling Contactor: Geologic Drill		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±150'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
	27.8					CL	Gray lean CLAY, stiff, moist
		11		21		SM	Gray silty SAND, medium dense, water bearing
				22			
	21.0						
		7		23			-becomes loose
				24			
	25.0			25			
		10		26			
				27			
	15.9						-becomes medium dense
		16		28			
				29			
							Boring terminated at 29.0 feet below existing grade. Groundwater seepage encountered at 5.0 and 20.5 feet during drilling. Monitoring Well installed to 10.0 feet below grade.

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Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A18

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 1 of 3
Job No. 9334-2	Logged by: MGM	Start Date: 2/6/04	Completion Date: 2/6/04	Boring No.: B-208
Drilling Contactor: Geologic Drill		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±240'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

Surface Conditions: Top of Slope along Cheasty Blvd.

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
				1		SM	Brown silty SAND with gravel, very loose to loose, wet (Fill)
				2			
				3			
	16.1	4		4			-pockets of silt
				5			
				6			
				7			
				8			
	13.0	9		9			-becomes loose
				10		SM	Brown silty SAND, loose, wet
				11			
				12			
				13			
	14.9	16		14			
				15		CL	Brown lean CLAY, very stiff, moist
				16			
				17			
				18			
	34.8	7		19			-becomes medium stiff -highly fractured, mottled at 19'

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Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A19

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 2 of 3
Job No. 9334-2	Logged by: MGM	Start Date: 2/6/04	Completion Date: 2/6/04	Boring No.: B-208
Drilling Contactor: Geologic Drill		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±240'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
				21		CL	Blue gray lean CLAY, stiff, moist
				22			
				23			
	32.4	13		24			-massive
				25			
				26			
				27			
				28			
	31.0	23		29			-trace sand grains -becomes very stiff
				30			
				31			
				32			
				33			
	31.8	27		34			-3" interbed of sandy silt with gravel
				35			
				36			
				37			
				38			
	33.8	20		39			-1/8" to 1/4" thick laminae dipping at 15 degrees -contains 1/2" thick zones of fractured polished clay

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

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Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A20

Boring Log

Project Name: Rainier Vista Hope VI				Sheet 3 of 3
Job No. 9334-2	Logged by: MGM	Start Date: 2/6/04	Completion Date: 2/6/04	Boring No.: B-208
Drilling Contactor: Geologic Drill		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±240'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
	32.1	19		41 42 43 44 45 46 47 48		CL	Gray lean CLAY, very stiff, moist -thinly laminated -slight increase in sand content
	31.3	16		49 50 51 52 53		ML	Gray SILT, medium dense, moist -thinly laminated to massive
	38.8	19		54 55			Boring terminated at 55.0 feet below existing grade. Groundwater seepage encountered at 10.0 feet during drilling. Slope Inclinometer installed to 53.0 feet below grade, borehole backfilled with grout.

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Boring Log
Rainier Vista Hope VI
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date Feb. 2004	Checked MGM	Date 2/19/04	Plate A21

BORING LOG 9334-2.GPJ ECI.GDT 2/19/04

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista				Sheet 1 of 1
Job No. 9334-2	Logged by: SSR	Start Date: 10/30/03	Completion Date: 10/30/03	Boring No.: B-101
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±154'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions:
				1		SM	Brown silty SAND with gravel, medium dense, moist
	16.3	4		2 3 4			-very loose
	39.8	8		5 6		CL-CH	Brown lean CLAY, medium stiff, moist -fractured texture
	34.2	11		7 8 9			-gray
	20.2	11		10 11		SM	Gray silty fine to medium SAND, medium dense, wet -moderate seepage at 11
	11.6	54		12 13 14			-very dense
	10.2	50		15			-possible seepage at 15.5'
				16			Boring terminated at 16.0 feet below existing grade. Groundwater seepage encountered at 11.0 feet during drilling. Boring backfilled with bentonite and cuttings.

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Boring Log
Rainier Vista
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date 11/5/03	Checked KMW	Date 11/6/03	Plate A22

BORING LOG 9334-4.GPJ ECI.GDT 2/19/04

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista				Sheet 1 of 3
Job No. 9334-2	Logged by: SSR	Start Date: 10/30/03	Completion Date: 10/30/03	Boring No.: B-102
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±166'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions:
				1–5		SM	Brown silty fine to medium SAND, loose to medium dense, moist
				5–19		ML/CL	Brown silty CLAY / SILT, soft to medium stiff, moist
	29.0	4		15			-groundwater seepage at 16'

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Boring Log
Rainier Vista
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date 11/5/03	Checked KMW	Date 11/6/03	Plate A23

BORING LOG 9334-4.GPJ ECI.GDT 2/19/04

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista				Sheet 2 of 3
Job No. 9334-2	Logged by: SSR	Start Date: 10/30/03	Completion Date: 10/30/03	Boring No.: B-102
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±166'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
	25.5	6		21		ML	Gray SILT, loose, moist
				22			-silty sand layers
				23			
				24			
	30.7	11		25		CL/CH	Gray CLAY, stiff, moist
				26			
				27			
				28			
				29			
	25.8	9		30			
				31			
				32			
				33			
				34			
	17.9	50/6"		35		SM-ML	Gray silty fine to medium SAND / fine sandy SILT, very dense, moist
				36			
				37			
				38			
				39			

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Boring Log
Rainier Vista
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date 11/5/03	Checked KMW	Date 11/6/03	Plate A24

BORING LOG 9334-4.GPJ ECI.GDT 2/19/04

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Boring Log

Project Name: Rainier Vista				Sheet 3 of 3
Job No. 9334-2	Logged by: SSR	Start Date: 10/30/03	Completion Date: 10/30/03	Boring No.: B-102
Drilling Contactor: Boretec		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±166'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
	31.2	50/5"		41		CL	Gray CLAY, hard, moist to wet
				42			
				43			
				44			
				45			
		50/4"		46			
				47			
				48			
				49			
	18.1	78		50			
				51			Boring terminated at 51.5 feet below existing grade. Groundwater seepage encountered at 16.0 feet during drilling. Boring backfilled with bentonite and cuttings.

BORING LOG 9334-4.GPJ ECI.GDT 2/19/04

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Boring Log
Rainier Vista
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date 11/5/03	Checked KMW	Date 11/6/03	Plate A25

Boring Log

Project Name: Rainier Vista				Sheet 1 of 2
Job No. 9334-2	Logged by: MGM	Start Date: 10/8/03	Completion Date: 10/8/03	Boring No.: B-1
Drilling Contactor: Geologic Drill		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±167'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft. Sample	USCS Symbol	Surface Conditions:
	6.0	26		1 2 3 4 5 6	ML	Brown SILT with gravel, medium dense, moist -mottled -contains large gravel and cobbles
	12.2	18				
	16.1	11		7 8 9 10	SM	Mottled brown silty SAND, medium dense, wet -contains small gravel
	34.8	20		11 12	CL/ML	Brown silty CLAY, very stiff, moist -small pockets of clean sand, groundwater seepage
	31.3	32		13	SM	Brown silty SAND with gravel, medium dense, saturated
	19.7	33		14 15 16	ML	Brown SILT, dense, moist -4" lens of saturated sandy silt
				17	ML	Brown sandy SILT, dense, moist to wet
	12.4	85		18 19	SM	Brown silty fine SAND, very dense, saturated -becomes gray

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Boring Log
Rainier Vista
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date 11/5/03	Checked KMW	Date 11/6/03	Plate A26

BORING LOG 9334-4.GPJ ECI.GDT 2/19/04

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Boring Log

Project Name: Rainier Vista				Sheet 2 of 2
Job No. 9334-2	Logged by: MGM	Start Date: 10/8/03	Completion Date: 10/8/03	Boring No.: B-1
Drilling Contactor: Geologic Drill		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: ±167'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
	10.6	87		21		SM	Gray silty SAND, very dense, saturated
				22		ML	Blue gray SILT, very dense, moist
				23			
				24		CH	Gray fat CLAY, stiff, moist
	34.4	10		25			LL=56 PL=28 PI=28
				26			
				27			
	25.3	11		28			
				29			
				30			
	21.7	51		31		ML	Dark gray SILT with sand, very dense, moist
							Boring terminated at 31.5 feet below existing grade. Groundwater seepage encountered at 12.5 feet during drilling. Boring backfilled with bentonite and cuttings.

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Boring Log
Rainier Vista
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date 11/5/03	Checked KMW	Date 11/6/03	Plate A27

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

BORING LOG 9334-4.GPJ ECI.GDT 2/19/04

Boring Log

Project Name: Rainier Vista				Sheet 1 of 2
Job No. 9334-2	Logged by: MGM	Start Date: 10/8/03	Completion Date: 10/8/03	Boring No.: B-2
Drilling Contactor: Geologic Drill		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: 168'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft. Sample	USCS Symbol	Surface Conditions:
				1	ML	Brown sandy SILT with gravel, loose to medium dense, moist
				2	ML	Mottled brown SILT with sand, loose to medium dense, moist
				3		
				4		
				5		
	35.6	15		6	ML	Brown SILT, medium dense, moist -fractured, appears disturbed
				7		
	44.9			8	MH	Brown elastic SILT, very stiff, moist to wet
		18		9		-highly fractured -comprised of small angular clasts in fine grained matrix
	38.4			10		
		11		11		LL=58 PL=31 PI=27
				12		
	33.1			13		
		14		14		-pockets of wet sand
	31.3			15	ML	Mottled brown SILT, loose, wet
		8		16		
				17		
	17.6			18	SM	Brown silty SAND with gravel, medium dense, water bearing
		22		19		

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Boring Log
Rainier Vista
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date 11/5/03	Checked KMW	Date 11/6/03	Plate A28

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

BORING LOG 9334-4.GPJ ECI.GDT 2/19/04

Boring Log

Project Name: Rainier Vista				Sheet 2 of 2
Job No. 9334-2	Logged by: MGM	Start Date: 10/8/03	Completion Date: 10/8/03	Boring No.: B-2
Drilling Contactor: Geologic Drill		Drilling Method: HSA		Sampling Method: SPT
Ground Surface Elevation: 168'		Hole Completion: ☐ Monitoring Well ☐ Piezometer ☒ Abandoned, sealed with bentonite		

General Notes	W (%)	No. Blows Ft.	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
	15.1	54		21		SM	Brown silty SAND with gravel, very dense, water bearing -15.6% fines -6" zone of coarse sand at 20' -dark iron oxide staining at 21.5'
	24.8	9		23		CL	Blue gray silty CLAY, stiff, moist to wet LL=31 PL=18 PI=13
	19.7	15		25		CL/ML	Blue gray silty CLAY, stiff, moist to wet
	18.4	14		28		ML	Grades to gray SILT with sand, medium dense, moist to wet -1"- 2" interbeds of saturated sand
		40		31			-no recovery
							Boring terminated at 31.5 feet below existing grade. Groundwater seepage encountered at 18.0 feet during drilling. Boring backfilled with bentonite and cuttings.

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Boring Log
Rainier Vista
Seattle, Washington

Proj. No. 9334-2	Dwn. GLS	Date 11/5/03	Checked KMW	Date 11/6/03	Plate A29

BORING LOG 9334.GPJ ECI.GDT 2/19/04

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.