Attachment A
Geotechnical Report

Geotechnical Engineering Services

University of Washington
ASUW Shell House
Seattle, Washington

for
University of Washington

August 5, 2024

GeoEngineers
Earth Science + Technology

Geotechnical Engineering Services

University of Washington
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GeoEngineers

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File No. 0183-139-00

August 5, 2024

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1.0 INTRODUCTION

This report presents the results of GeoEngineers, Inc.'s (GeoEngineers) geotechnical engineering services for the proposed renovation of the ASUW Shell House located along Union Bay and southeast of Husky Stadium at the University of Washington (UW) Seattle campus. The project site is bounded by Walla Walla Road to the north, Lake Washington (Union Bay) to the east and south, and Walla Walla Lane to the west. The location of the site and general configuration of the existing Shell House is shown in the Vicinity Map and Site Plan, Figures 1 and 2, respectively.

1.1. Project Description

We understand that the project will consist of the renovation of the existing Shell House to address code-related improvements required by a change of occupancy from a storage facility to assembly occupancy and program-related enhancements. Required code upgrades consist of structural stabilization, site work, accessibility improvements, utility infrastructure, building envelope thermal insulation, heating and ventilation, fire and life safety, restrooms and stabilizing the existing hangar doors. The UW is planning to restore the Pocock boat building workshop, which is a mezzanine inside of the Shell House. The Shell House will be used as an event space for the UW in the future. Associated improvements outside of the Shell House include new hardscape elements, utilities, landscaping and stormwater management facilities. A new dock and pedestrian path may be completed as part of the project on the southeast and north sides of the Shell House, respectively. Short retaining walls associated with the pedestrian pathway improvements will be required at the north end of the project.

The existing Shell House is supported on shallow spread footings constructed near existing site grades. A conventional slab-on-grade exists inside of the building and supports columns for the existing Pocock boat building workshop. We understand that micropiles will be utilized to support the Shell House structure and will tie into the existing shallow spread footings. Small diameter driven steel pipe piles will be used to support new columns for the Pocock mezzanine. The existing Pocock columns will be supported on shallow spread footings. Structural ties via a new slab-on-grade cast over the existing slab-on-grade will be used to mitigate potential lateral spreading.

1.2. Purpose and Scope

The purpose of our services is to evaluate soil and groundwater conditions as a basis for developing design criteria for the geotechnical aspects of the ASUW Shell House project. Field explorations and laboratory testing were performed to identify and evaluate subsurface conditions at the site to develop engineering recommendations for use in design of the project. Our services were performed in general accordance with our contract with the UW for Project No. 206756.

2.0 FIELD EXPLORATIONS AND LABORATORY TESTING

Subsurface conditions were evaluated by reviewing existing explorations previously performed by others in the project area and through a field exploration program that consisted of completing hollow-stem auger borings, cone penetration tests (CPTs), foundation potholes and test pits for infiltration testing. The approximate locations of the existing and recently completed explorations are shown in Figure 2.

2.1. Field Explorations

Two hollow-stem auger borings (GEI-1 and GEI-2) were drilled and sampled, and five CPTs (CPT-1 through CPT-5) were completed around the building. Some of the CPT locations required more than one attempt to obtain the necessary subsurface information. Three test pits (TP-1 through TP-3) were excavated and sampled as part of the infiltration assessment at the site. In addition, four potholes (PH-1 through PH-4) were completed to assess existing foundation conditions.

The borings were advanced to depths of about 35½ and 41 feet below the ground surface (bgs). The CPTs were advanced to depths ranging from about 6½ to 16 feet bgs. Pore water dissipation testing and seismic shear save velocity testing were completed in some of the CPTs to measure groundwater levels and determine shear wave velocities of the subsurface soils. The test pits were excavated to depths ranging from 5 to 7½ feet bgs and infiltration tests were completed within the pits to determine preliminary infiltration rates. The potholes were completed to depths of about 2 to 2½ feet bgs in order to expose and assess portions of the existing foundations and subgrade soils.

A description of the field exploration program and logs of the borings, test pits, potholes and CPTs are presented in Appendix A.

2.2. Laboratory Testing

Soil samples obtained from the borings and test pits were transported to our laboratory and evaluated to confirm or modify field classifications, as well as to evaluate engineering properties of the soil. Representative samples were selected for laboratory testing consisting of moisture content, organic content, percent passing the U.S. No. 200 sieve (%F) and sieve analyses. The tests were performed in general accordance with test methods of the ASTM International (ASTM) or other applicable procedures. Representative samples were also submitted to a subcontracted laboratory for Cation Exchange Capacity (CEC) testing as determined by U.S. Environmental Protection Agency (EPA) 9081 test method. A brief discussion of the laboratory tests and test results is included in Appendix B.

2.3. Previous Studies

The logs of selected explorations from previous studies in the project vicinity were reviewed and the approximate location of relevant explorations are shown in Figure 2. Logs of previous explorations referenced for this study are presented in Appendix C.

3.0 SITE DESCRIPTION

3.1. Surface Conditions

The site is currently occupied by the ASUW Shell House and surrounding landscaping consisting of grass, trees and shrubs. A small asphalt parking lot and access road is located adjacent to the north side of the Shell House, while a gravel parking lot exists on the west side. The ground surface slopes down gradually from approximately Elevation 25 to 27 feet on the north/northwest side of the site to Elevation 18 to 20 feet along the Union Bay shoreline and Montlake Cut on the south/southeast side of the site.

3.2. Site Geology

We reviewed the Geologic Map of Northeastern Seattle (Part of the Seattle North 7.5'x15' Quadrangle), King County (Booth et al. 2009). The soils across most of the campus upslope and west of Montlake Boulevard and Husky Stadium are mapped as glacial till, which generally consists of dense to very dense silty sand with gravel, cobbles and occasional boulders deposited below glaciers. Glacial till commonly includes an upper medium dense weathered zone.

The lower slope on the east side of the campus near Montlake Boulevard is mapped as advance outwash and pre-Fraser deposits. Advance outwash generally consists of dense to very dense well sorted sand and gravel which were glacially overridden. Pre-Fraser deposits generally consist of very dense interbedded sand, gravel, silt and widely sorted sediment that was deposited prior to the last glaciation and subsequently consolidated by glaciers.

The area roughly east of Montlake Boulevard, and a majority of the area that Husky Stadium currently occupies, is mapped as peat and artificial fill. The highly compressible peat was deposited in the shallow water of Union Bay, and these soils were exposed when the level of Lake Washington was dropped after the completion of the Ballard Locks. The Montlake (Ravenna) landfill was operated north of Husky Stadium and the UW Intramural Activities Building (IMA) from about 1926 to 1966, and landfill materials were placed on top of the soft peat deposits. Artificial fill is mapped through the area and is associated with previous development of this portion of the campus.

Soils in the immediate vicinity of the ASUW Shell House are mapped as peat deposits. Glacial till is mapped directly west of the gravel parking area on the west side of the Shell House. Artificial fill is mapped directly north of the asphalt pavement parking lot on the north side of the Shell House.

3.3. Geologic Hazards

Our assessment of the geologic hazards at the site includes reviewing the environmentally critical areas (ECAs) geographic information system (GIS) map defined by the City of Seattle Department of Construction and Inspections (SDCI). Based on our review, the site is located in liquefaction prone and peat settlement prone areas. Steep slopes are mapped directly north of the asphalt parking lot on the north side of the Shell House. The ECAs are shown in Figure 3. Further discussion on these ECAs is presented in Section 4.2.

3.4. Subsurface Conditions

3.4.1. Soil Conditions

Our understanding of subsurface soil conditions is based on the results of our recently completed explorations and on our review of existing geotechnical information from previous studies in the vicinity of the site. Our interpretation of the subsurface conditions is presented in Figures 4 through 6, Cross Sections A-A' through C-C', respectively.

In general, the soils below the site consist of shallow fill underlain by alluvium, glacial till or both, and the subsurface conditions under the Shell House vary considerably. The northeast and south/southwest sides of the building appear to be located over relatively dense and shallow glacial till, while the northwest/west and southeast areas indicate the presence of alluvial soils (with or without peat). The thickness of the alluvium varies significantly across the site, ranging from 0 to about 12½ feet. It appears that some sort of

old buried channel/swale trends in the northwest-southeast direction below the Shell House. When the Ballard Locks were built between 1911 to 1917, the level of Lake Washington dropped. The site was then developed (Shell House was built in 1918) and fill was placed over the channel/swale to create a relatively flat site. A summary of the soil conditions is presented below.

- **Topsoil/Sod:** Approximately 2 to 12 inches of sod and topsoil was observed in explorations completed around the Shell House, although about 2½ feet of topsoil was noted in boring AB-02.
- **Gravel Surfacing:** About 3 inches of gravel surfacing was observed in TP-2 in the gravel parking area west of the Shell House.
- **Asphalt and Base Course:** Asphalt pavement associated with the parking lot north of the Shell House is about 1½ inches thick with an underlying base course consisting of sand and gravel that is about 2 inches thick in boring GEI-1.
- **Fill:** Approximately 2½ to 7 feet of fill was observed across the site. The fill is associated with past grading and generally consists of loose to medium dense silty sand with various amounts of gravel and organic matter. Medium stiff silt with sand, and gravel with variable sand and silt was observed within the fill in some explorations.
- **Alluvium:** Alluvial deposits were observed in most of the explorations completed at the site. The alluvium ranges from 0 to 12½ feet thick and generally consists of loose to medium dense sand with variable silt content and occasional organic matter. Peat was encountered within the alluvium at approximately 3¾, 4½ and 5 feet bgs in TP-1, GEI-2, and AB-03, respectively. The peat ranges from approximately 1 to 7½ feet thick.
- **Glacial Till:** Explorations AB-02, CPT-4, CPT-4A, CPT-4B, CPT-3A, and ACPT-04 encountered glacial till directly below the fill. The remaining explorations, except for the shallow potholes and TP-2 and TP-3, encountered glacial till below the fill and alluvium. The glacial till generally consists of dense to very dense silty sand with variable gravel and very stiff to hard silt and clay with variable sand and gravel content. Although not encountered in the explorations, cobbles and boulders are commonly encountered in glacial deposits.

3.4.2. Groundwater Conditions

Our understanding of groundwater conditions is based on groundwater measurements recorded at the time of drilling in the borings and from groundwater observations made in the test pits when they were excavated. Pore water dissipation tests were completed in some CPTs, however; in our experience, these results can be misleading if the soils have a high fines content, which the Shell House soils have.

Groundwater varies across the site given the variable soil conditions and depth to glacial till. The groundwater within the alluvium is interpreted to be the regional groundwater table and is hydraulically connected with Lake Washington at the southeast corner of the site. Based on the explorations, the regional groundwater table within the alluvium ranges from approximately Elevation 15½ to 18½ feet, which roughly corresponds to the ordinary high water (OHW) mark of Lake Washington at Elevation 18.9 feet. Groundwater levels within the alluvium will fluctuate with the lake level, season, precipitation and other factors.

Perched water was observed where the glacial till is relatively shallow. The perched water was generally observed at the contact between the glacial till and the overlying loose soils, and within more permeable layers within the native glacial till. Groundwater seepage is expected to be perched on and within the glacial till and fill soils, and will fluctuate as a result of season, precipitation and other factors.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1. Summary

A summary of the primary geotechnical considerations is provided below. The summary is prepared for introductory purposes only and should be used in conjunction with the complete recommendations presented in this report.

- The site is located within peat settlement prone and liquefaction prone critical areas. Steep slopes are mapped on the slope directly north of the asphalt parking lot on the north side of the Shell House.
- The site is designated Site Class F, per the 2017 version of Seismic Evaluation and Retrofit of Existing Buildings (ASCE 41-17), which refers to the 2016 version of Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE 7-16) Chapter 20, due to the presence of potentially liquefiable soils on site. Site response analysis is required to determine the seismic parameters for buildings on Site Class F sites; however, because the fundamental period of the Shell House is less than ½ second, code-based parameters may be used through an exception in the code. As a result, the site is best designated as Site Class E based on the standard penetration test (SPT) blowcounts obtained in the borings and the shear wave velocity testing completed in the CPTs.
- Based on Newmark slope stability analyses completed for our lateral spreading evaluation along Cross Section C-C', we estimate that lateral spreading will be less than 12 inches during the design earthquake. Estimates based on the boring and CPTs indicate that liquefaction-induced settlement under the building will range from 0 to 2¼ inches.
- Potential significant total and differential static settlement may occur in the highly compressible peat deposits. We estimate that settlement for conventional footings supporting the mezzanine will be approximately ¾ to 2 inches for primary consolidation and approximately 2 inches of additional long-term secondary compression (about 2¾ to 4 inches total). The addition of a new 4-inch slab on top of the existing slab should perform roughly the same as the existing slab; however, our analyses indicate that the peat may still settle up to 2 inches long-term due to secondary compression.
- We understand the existing shallow spread footings for the Shell House will be supported on micropiles to mitigate potential static and liquefaction-induced settlement. The micropiles should be at least 6 inches in diameter and should extend a minimum of 5 feet into the glacial till. The micropiles should be designed using a maximum allowable load transfer of 4, 5 and 6 kips per foot within the glacial till for 6-, 8- and 10-inch-diameter micropiles, respectively. Allowable axial capacities should be limited to 150 kips.
- New Pocock mezzanine columns will be supported on small diameter driven steel pipe piles to mitigate static and liquefaction-induced settlement. The piles should be driven at least 5 feet into the underlying glacial till, or until practical refusal is achieved. The pipe piles may be designed for a maximum allowable axial capacity of 4 and 6½ kips for 2- and 3-inch-diameter pipe piles, respectively.

- Existing Pocock mezzanine columns supported on the existing slab will be reconstructed to be supported on isolated shallow spread footings. The column footings should be founded on a 2-foot-thick pad of properly placed and compacted structural fill and may be designed using a maximum allowable bearing pressure of 1,500 pounds per square foot (psf).
- Site retaining walls should be evaluated using an equivalent fluid density of 35 pounds per cubic foot (pcf) provided the walls will not be restrained against rotation when backfill is placed. If the walls will be restrained from rotation, we recommend using an equivalent fluid density of 55 pcf. For unrestrained walls with backfill sloping up at 2H:1V, the design lateral earth pressure should be increased to 55 pcf, while restrained walls with a 2H:1V sloping backfill should be designed using an equivalent fluid density of 75 pcf.
- Alluvial soils and silty fill soils should not be considered for reuse as structural fill and should be exported, unless used in landscape areas.
- We recommend that the infiltrating facilities near TP-2 and TP-3 be designed using a long-term infiltration rate of 1.3 and 0.25 inches per hour, respectively, in accordance with the 2021 City of Seattle *Stormwater Manual* (CSSM).

Our specific geotechnical recommendations are presented in the following sections of this report.

4.2. Environmentally Critical Areas

Based on review of SDCIs GIS map, the site is located in peat settlement prone and liquefaction prone ECAs. Steep slope ECAs are mapped on the slope directly north of the asphalt parking lot on the north side of the Shell House. The ECAs are shown in Figure 3.

4.2.1. Peat Settlement Prone ECA

The peat settlement prone ECA is associated with historic peat deposits from Lake Washington. Based on the explorations, peat is likely present below the Shell House, especially near the southeast corner of the building.

In our opinion, the use of deep foundations consisting of micropiles and small diameter driven steel pipe piles to support the building and new mezzanine columns will help mitigate the risk of settlement due to the peat and alluvial deposits. Existing grades will not change significantly around the Shell House as part of planned improvements; therefore, loading conditions of the peat will remain essentially the same and the improvements around the building should not induce significant additional settlement of the peat. Additionally, the existing Pocock mezzanine columns that will be reconstructed on isolated shallow footings will not significantly change loading conditions and therefore should not induce significant additional settlement of the peat, if located below the footings. If the recommendations in this report are followed for deep foundations, shallow foundations, subgrade preparation and backfill placement and compaction, the improvements should not significantly impact the peat any more than the existing conditions already do. Potential peat settlement is discussed further in Section 4.4.

4.2.2. Liquefaction Prone ECA

The liquefaction prone ECA is associated with alluvial deposits that were encountered in the explorations at the site. The existing shallow foundations that support the superstructure of the building as well as new columns of the Pocock mezzanine will be designed to be supported on deep foundations extending down to dense native glacial till. In our opinion, the deep foundations will mitigate the risk of liquefaction-induced settlement from impacting the structure. The slab-on-grade (placed over the existing slab) does not need to be designed as a structural slab provided estimated liquefaction-induced settlement can be tolerated. We understand the existing Pocock mezzanine columns that will now be supported on shallow footings will be designed for the estimated liquefaction-induced settlement on the north side of the building. Liquefaction is discussed in more detail in Section 4.3.2.

4.2.3. Steep Slope ECA

SDCI designates slopes as "steep slopes" when they are inclined at greater than 40 percent and more than 10 feet in height. Steep slopes are subject to a 15-foot buffer from the top and toe of the slope. Two steep slopes are mapped directly north of the parking lot on the north side of the Shell House. Both mapped steep slopes are relatively small and located on either side (one on the east and one on the west) of the asphalt walkway that traverses up the slope.

The ASUW Shell House is located outside of the 15-foot buffer of both mapped steep slopes and is about 55 feet away from the steep slope on the west side of the walkway and about 70 feet away from the steep slope on the east side of the walkway. There will be some hardscape improvements, including parking lot improvements and the new pedestrian path, that fall within the steep slope and steep slope buffers; therefore, the project will need to be designed in accordance with the City of Seattle requirements, as follows:

- Development of steep slope areas should follow Seattle Municipal Code (SMC) 25.09.090, which states that "development is prohibited on steep slope erosion hazard areas, unless the applicant demonstrates that the provisions of subsections 25.09.070C, 25.09.070.D, 25.09.090.B.2, 25.09.090.D, 25.09.090.E, or 25.09.090.F apply, or the slope is on a parcel in a Downtown zone or high-rise zone."

  In our opinion, the provisions of subsection 25.09.090.B.2 apply. The steep slopes are less than 20 feet in vertical rise and are 30 feet or more from other steep slope erosion hazard areas. In addition, a majority of the hardscape improvements in the parking lot that fall within the 15-foot buffer and a portion of the new pedestrian path occur within the footprint of existing lawfully constructed paved areas.

  In our opinion, the proposed improvements will not adversely impact the steep slopes, provided the recommendations regarding earthwork and erosion control are followed in this report.

- Grading at the site is restricted to occur between October 31 and April 1 per SMC 25.09.060.G and Director's Rule 26-2015, unless a Grading Season Extension Letter is granted by the Director.

4.3. Earthquake Engineering

We evaluated the site for seismic hazards including liquefaction, lateral spreading, fault rupture and earthquake-induced landsliding.

4.3.1. ASCE 41-17 Seismic Design Information

The site is designated as Site Class F, per the 2017 version of *Seismic Evaluation and Retrofit of Existing Buildings* (ASCE 41-17), which refers to the 2016 version of *Minimum Design Loads and Associated Criteria for Buildings and Other Structures* (ASCE 7-16) Chapter 20, due to the presence of potentially liquefiable soils on site. Generally, site response analysis is required to determine the seismic design parameters for buildings on Site Class F sites. However, ASCE 7-16 Section 20.3.1 provides an exception for structures that have fundamental periods of vibration less than or equal to ½ second, whereby a site class is permitted to be determined per ASCE 7-16 Section 20.3 and the corresponding values of F_a and F_v determined per ASCE 7-16 Section 11.4. We understand that the fundamental period of the building is less than ½ second based on discussions with the project structural engineer; therefore, we adopted this exception.

The site is best categorized Site Class E based on the subsurface data from our borings and CPTs. For Site Class E, we recommend the following ASCE 41-17 seismic parameters for Hazard Level BSE-2N, which correspond to risk-targeted maximum-considered earthquake (MCE_R) ground motions. The seismic parameters listed in Table 1, as developed per ASCE 41-17 Supplement 1 and ASCE 7-16 Supplement 3 Section 11.4.8, may be used.

TABLE 1. ASCE 41-17 BSE-2N SEISMIC PARAMETERS

ASCE 41-17 Parameter[1]	Recommended Value
Site Class	F
Short-period mapped spectral response acceleration, S_S (g)	1.316
Long-period mapped spectral response acceleration, S_1 (g)	0.457
Short-period site coefficient, F_a	1.20[2]
Long-period site coefficient, F_v	2.286
Design short-period spectral acceleration adjusted for site class, S_{XS} (g)	1.579
Design Long-period spectral acceleration adjusted for site class, S_{X1} (g)	1.045

Notes:

1. Parameters developed for Site Class E based on latitude 47.6477 and longitude -122.3000 using the Applied Technology Council (ATC) Hazards online tool (https://hazards.atcouncil.org/).
2. Per ASCE 7-16 Supplement 3 Section 11.4.8 Item 2

4.3.2. Liquefaction Potential

Liquefaction refers to the condition by which vibration or shaking of the ground, usually from earthquake forces, results in the development of excess pore pressures in saturated soils with subsequent loss of strength in the deposit of soil so affected. In general, soils that are susceptible to liquefaction include very loose to medium dense, clean to silty sands that are below the water table.

The evaluation of liquefaction potential is a complex procedure and depends on numerous site parameters, including soil grain size, soil density, site geometry, static stresses and the design ground acceleration. Typically, the liquefaction potential of a site is evaluated by comparing the cyclic shear stress ratio (CSR), which is the ratio of the cyclic shear stress induced by an earthquake to the initial effective overburden stress, to the cyclic resistance ratio (CRR), which is the soils resistance to liquefaction. We evaluated the liquefaction triggering potential (NCEER 1998 with Cetin correction factor, Youd, et al. 2001; Boulanger

and Idriss 2014; NCHRP 2007) and liquefaction-induced settlement (Tokimatsu and Seed 1987; Ishihara and Yoshimine 1992) for soil conditions in each of the CPTs and borings that we completed at the site as well as for some of the previous borings. These methods predict the potential for 0 to 2¼ inches of free-field liquefaction-induced settlement across the site for the design earthquake event. The magnitude of liquefaction-induced ground settlement will vary as a function of the characteristics of the earthquake (earthquake magnitude, location, duration and intensity) and the soil and groundwater conditions.

In our opinion, the use of micropiles and steel pipe piles to support the building and new mezzanine columns will effectively mitigate the risk of liquefaction-induced settlement, provided the piles are embedded in the underlying very dense/hard glacial till. Existing mezzanine columns supported on shallow foundations should be designed such that liquefaction-induced differential settlements can be tolerated.

4.3.3. Ground Rupture

Historically, the engineering community considers I-90 as the approximate northern limit of the Seattle Fault Zone, and recent studies suggest strands of the fault may be located as far south as the Newcastle area. The site is located approximately 4½ miles north of the United States Geological Survey (USGS) mapped location of the Seattle Fault Zone (USGS 2006). Bedrock is mapped to be on the order of 1,000 feet below the site (Yount 1985). Given the distance of the closest inferred location of the Seattle Fault Zone, the thickness of glacially consolidated soils above the fault, and the infrequent recurrence interval (thought to be on the order of 1,000 years), it is our opinion the probability of damaging fault rupture on the site is low and does not warrant specific design considerations.

4.3.4. Lateral Spreading

Lateral spreading involves lateral displacements of large volume of liquefied soil. Lateral spreading can occur on near-level ground as blocks of surface soil are displaced relative to adjacent blocks. Lateral spreading also occurs as blocks of surface soils are displaced towards a nearby slope or free face by movement of underlying liquefied soil. The subsurface conditions at the Shell House vary considerably and it appears that there is some sort of old buried channel/swale that trends in the northwest/southeast direction below the site. The relatively shallow glacial till observed in the explorations on the south side of the shell house will prevent lateral spreading from occurring to the south into the Montlake Cut. Instead, lateral spreading during earthquakes could occur to the southeast along the old channel/swale into Union Bay.

A bathymetric survey was completed on the south side of the site along the Montlake Cut, and a former bathymetric survey was completed on the east side of the site along Union Bay for a previous UW project. The bathymetric surveys were combined with the recently completed topographic survey to analyze lateral spreading at the site. The critical lateral spreading cross section, Cross Section C-C', was cut for our lateral spreading analysis.

Earthquake-induced lateral ground deformations were evaluated by performing slope stability analyses and simplified Newmark analyses for the code-based design earthquake. The mean and mode earthquakes were analyzed per the deaggregation.

Slope stability analyses were completed on Cross Section C-C' using the Limit Equilibrium Method (LEM) with the commercial software, Slope/W, developed by GEO-SLOPE International, Ltd. Existing conditions were analyzed in our slope stability models. The lateral ground deformation of concern is mainly induced by earthquakes; therefore, the seismic (pseudo-static) and post-earthquake conditions are the two critical situations that were evaluated in our slope stability analyses.

Soil properties that were used in the slope stability analyses are listed in the slope stability figures. We assumed that liquefaction occurs during the earthquake; therefore, in pseudo-static and post-earthquake conditions, residual friction angles were used in the liquefied soils; 80 percent of static strengths were used in the soils above the groundwater table; and full static strengths were used in the glacial till. We assumed that the peat would not liquefy but would experience strain softening and therefore the residual strengths of the peat were also used for our analyses. A surcharge load of 200 pounds per square foot (psf) was applied within the building footprint.

It is unclear whether the peat extends below the Shell House as there are no explorations completed within the footprint of the building. Therefore, we completed sensitivity analyses assuming that: (1) peat extends below the building and (2) peat does not extend below the building.

The soil parameters and results of our analyses are shown in Figures 7 through 9. Based on our analyses, there will be no flow failure within the building footprint during the post-earthquake conditions since the factor of safety (FOS) against slope instability is greater than 2.4 along the slip surfaces going through the building as shown in Figure 7. Figures 8 and 9 present the results from the sensitivity analysis for different peat conditions under the pseudo-static condition.

We estimate that the earthquake-induced lateral ground deformation will be about 11.8 inches, which is lower than the 12 inches specified per ASCE 7-16 Table 12.13.-2 for Risk Category III structures. Therefore, the building may be structurally tied together with structural ties and the building will "float" on the laterally displaced soil and remain intact.

4.3.5. Landslides

Because of the location of the building and the relative flat topography that surrounds it, it is our opinion that landsliding as a result of strong ground shaking is unlikely at this site.

4.4. Static Settlement

Based on our experience in the site vicinity and on similar projects, as well as the results of our static settlement analyses, there is a potential for large total and differential static settlement at the site in the peat deposits, especially under the southeast portion of the building.

The peat that underlies the site is highly compressible and varies in thickness. In addition, peat will continue to experience secondary compression over the design life of the building and under new loads. The peat compresses not only in response to applied loads, but also as a result of decomposition of organic matter. The rate at which the organic material within the peat decays depends on numerous factors, including but not limited to the organic content, depth below the ground surface, amount of oxygen the peat is exposed to, and whether the peat is below the groundwater table.

Primary consolidation begins when a load is applied and continues as excess pore pressures that are caused because of the applied load slowly dissipate over time. After primary consolidation is completed, which can take years, secondary compression occurs. Secondary compression is deformation of soil due to the reorientation of the soil structure and typically occurs in fine-grained and organic soils. Secondary compression occurs at a much slower rate than primary consolidation and can take decades to fully settle.

If loading of the peat is not changed (i.e. grades at the site stay the same and no new structures/loads are added at the ground surface) then primary consolidation will not be induced and the peat will not be impacted, other than continuing on with secondary compression. That is not to say that the peat will not settle over time, just to say that no additional settlement will be induced due to new loads. However, the peat will continue to settle over time from decaying organic matter and associated secondary compression.

We analyzed a 2-foot by 2-foot and 3-foot by 3-foot spreading footing for the mezzanine using bearing capacities of 1,000 and 1,500 psf. Our analysis assumed that a 2-foot-thick structural fill pad would be placed and compacted below the footing for support. We also analyzed the addition of a new 4-inch slab on top of the existing slab of the Shell House. All cases were analyzed for two general subsurface conditions: alluvial deposits with no peat (conditions observed in GEI-1) and alluvial deposits with peat (conditions observed in GEI-2).

Based on our analyses, we estimate that primary and secondary consolidation for footings overlying the subsurface conditions represented by boring GEI-1 will be less than ½-inch. However, we estimate that settlement for footings overlying the subsurface conditions represented by boring GEI-2 will be approximately ¾ to 2 inches for primary consolidation and approximately 2 inches of additional long-term secondary compression (about 2¾ to 4 inches of total settlement).

The addition of a new 4-inch slab on top of the existing slab should perform roughly the same as the existing slab (i.e. primary consolidation is relatively low); however, our analyses indicate that the peat may still settle up to 2 inches long-term due to secondary compression. Therefore, there is a potential for differential settlement to occur under the building footprint where peat is located.

The existing Pocock mezzanine columns that will be supported on new shallow spread footings are located on the north end of the building. Peat was not observed in explorations located along the north side of the building, and therefore, we do not anticipate significant differential settlement to occur along the north end of the building.

It is difficult to determine where the additional secondary compression will occur because it depends primarily on where the peat exists. The new slab-on-grade placed over the existing slab-on-grade does not need to be designed as a structural slab provided that secondary compression can be tolerated (i.e. the slab is allowed to settle/crack during settlement of the peat). The existing Pocock mezzanine columns should be designed to account for potential static induced settlement.

4.5. Shallow Foundations

We understand that the existing Pocock mezzanine columns are currently supported on the existing slab and will be redesigned to be supported on individual shallow foundations. These footings should be founded on at least 2 feet of properly placed and compacted structural fill.

4.5.1. Allowable Bearing Pressure

Construction of shallow spread footings will require removal of the upper 2 feet of existing soil from below the foundations and replacement with properly placed and compacted structural fill. The structural fill should extend beyond the edges of the foundations by a distance of at least 2 feet. An allowable bearing pressure of 1,500 pounds per square foot (psf) is recommended for the design of shallow spread foundations prepared as recommended. The allowable soil bearing pressure applies to the total of dead and long-term live loads and may be increased by up to one-third for wind or seismic loads.

4.5.2. Settlement

Static and liquefaction-induced settlement of the shallow spread footings are discussed in sections 4.4 and 4.3.2, respectively.

4.5.3. Lateral Resistance

Lateral foundation loads on shallow foundations may be resisted by passive resistance on the sides of the foundations and by friction along the base of the foundations. Frictional resistance may be computed using a coefficient of friction of 0.35 applied to vertical dead-load forces. The passive pressure can be estimated using an equivalent fluid density of 300 pcf (triangular distribution) for foundations that are poured directly against/surrounded by properly placed and compacted structural fill.

The above coefficient of friction and passive equivalent fluid density values incorporate a factor of safety of about 1.5.

4.5.4. Construction Considerations

We recommend that the condition of foundation subgrade areas be observed by GeoEngineers to confirm that subsurface conditions are as anticipated, and that subgrade has been prepared in accordance with our recommendations.

4.6. Deep Foundations

Unsuitable soils consisting of fill and alluvium exist below the Shell House. We anticipate that competent glacial till is present approximately 2½ to 18 feet below existing site grades. Estimated liquefaction-induced settlement from the design-level earthquake will impact the building if it is not supported on deep foundations. Static settlement due to compression of the alluvium (especially the peat) will also impact the building, if it is not supported on deep foundations.

In our opinion, helical piles are not a suitable option for support of the existing shallow foundations because it will be difficult to embed these piles into the very dense glacial till. Helical piles are installed similarly to a screw and embedding them into the very dense glacial till to a depth deep enough to provide adequate compression and tensile capacities is likely not feasible. Similarly, small diameter driven steel pipe piles will likely not be able to be driven deep enough into the dense glacial till to develop the required uplift capacities. Micropiles are a suitable option for support of the existing shallow foundations as they are drilled and can be embedded the necessary depths into the glacial till to develop the required capacities. They can also be installed in the low overhead areas that will be required inside of the Shell House.

We understand the new columns for the Pocock mezzanine needs support for compression (gravity) loads and that uplift and lateral capacities are not required. Small-diameter driven steel pipe piles can be used to support the new columns of the mezzanine. The piles should extend through the fill and alluvium and be embedded into the underlying glacial till. Recommendations for micropiles and steel pipe piles are provided in the following sections.

4.6.1. Micropiles

Micropiles may be used for support of the existing shallow foundations that support the superstructure of the Shell House. Micropiles are high capacity, small diameter (typically on the order of 6 to 10 inches in diameter), drilled and grouted piles. Micropiles are constructed by drilling a hole, placing reinforcement and grouting the hole. When installing within loose fill or alluvium, or where groundwater exists, temporary casing is typically required to prevent caving during installation but removed after placement of the grout and reinforcement or left in to act as permanent casing to prevent buckling. Reinforcement generally consists of a large steel reinforcing bar installed down the center. Structural detailing at the tops of the piles is made to connect to the foundation. The grouting method used to construct the micropiles has a significant impact on capacity. Micropiles installed by gravity grouting have lower capacities, and micropiles installed by pressure grouting or post-grouting (two-stage grouting process) can achieve much higher capacities.

Micropiles are generally cost-effective where high load capacities are required, and limited access is available. The construction methodology and equipment have a large influence on the micropile capacity, and, as a result, micropiles are typically design-build foundation elements. The micropile contractor can modify its equipment and grouting techniques to achieve the required pile capacity. A pile load test program is recommended to be completed to confirm that the required pile capacities have been achieved.

4.6.1.1. Axial Capacity

Axial load capacity in compression and tension will be developed primarily from side frictional resistance in the glacial till deposits located beneath the fill and alluvium. We recommend that the diameter of the micropiles be at least 6 inches and extend a minimum of 5 feet into the glacial till. We recommend micropiles be designed with an allowable load transfer of 4, 10, and 12 kips per foot within the glacial till for 6-, 8- and 10-inch-diameter micropiles, respectively. The load transfer may be applied in both compression and tension. Allowable axial capacities are recommended to be limited to 150 kips.

Load transfer in the fill and alluvium should be neglected. Fill and alluvium depths below the site vary significantly, but are as deep as about 18 feet below existing site grades based on the results of explorations in the project area. A downdrag load of 5, 6½ and 8 kips should be subtracted from the allowable axial capacity for 6-, 8- and 10-inch-diameter micropiles, respectively, due to the potential liquefaction of the fill and alluvium during the design earthquake.

Allowable pile capacities were evaluated based on Allowable Stress Design (ASD) and are for combined dead plus long-term live loads and may be increased by one-third when considering design loads of short duration such as seismic forces. The allowable capacities are based on the strength of the supporting soils and include a FOS of 2. The capacities apply to single piles. We recommend a minimum pile spacing of 3 feet. In our opinion, if piles are spaced at least 3 feet on center, no reduction of axial capacity for group action is needed.

The final design load transfer value should be determined by the specialty pile contractor for the proposed installation and grouting methods. A permanent steel casing around the outside of the micropile should be installed to prevent buckling. The permanent steel casing should be embedded 2 feet into the glacial till.

Lateral Capacity

Lateral loads can be resisted by passive soil pressure on the vertical piles and by the passive soil pressures on the pile cap. Because of the potential separation between the pile-supported foundation components and the underlying soil from settlement, base friction along the bottom of the pile cap should not be included in calculation for lateral capacity.

We evaluated the lateral pile capacity for 6-, 8- and 10-inch-diameter micropiles using LPILE v2019 by Ensoft, Inc. Evaluations for the lateral pile capacities were completed for liquefied soil conditions/seismic loading. Liquefied soil parameters were modeled in LPILE by applying P-multipliers for the liquefiable soils. P-multipliers for the liquefied soil were developed based on the average $(N_1)_{60cs}$ for the alluvium deposits per the 2022 Washington State Department of Transportation (WSDOT) Geotechnical Design Manual (GDM).

Pile shear and bending moments were evaluated as described above by controlling lateral deflections at the top of the pile. LPILE runs were completed for deflections of ½ and 1 inch for both fixed- and free-head conditions. Plots from LPILE of deflection vs depth, shear force vs depth, and bending moment vs depth are provided in Figures 10 through 12. The recommended design parameters for the primary soil units are summarized in Table 2. The structural engineer may use the recommended design LPILE soil parameters to evaluate lateral pile capacities for other loading conditions or pile sizes.

TABLE 2. LATERAL PILE DESIGN PARAMETERS

Soil Unit	Approximate Depth to Bottom of Soil Unit (ft)	LPILE Soil Model	Effective Unit Weight (pcf)	Friction Angle (degrees)	LPILE Soil Modulus, k (pci)	P-Multiplier	Undrained Cohesion (psf)	E50
Fill/ Alluvium	3.0	Sand (Reese)	120.0	32	65	-	-	-
Fill/ Alluvium (below GWT)	15.5	Sand (Reese)	57.6 (below GWT)	32	20	0.1	-	-
Glacial Till	100.0	Silt (cemented c-phi)	130.0	40	125	-	200	0.004

Notes:
pcf – pounds per cubic foot
pci – pounds per cubic inch

Piles spaced closer than five pile diameters apart will experience group effects that will result in a lower lateral load capacity for trailing rows of piles with respect to leading rows of piles for an equivalent deflection. We recommend that the lateral load capacity for piles in a pile group spaced less than five pile diameters apart be reduced in accordance with the factors in Table 3.

TABLE 3. SHAFT P-MULTIPLIERS, P_M, FOR MULTIPLE ROW SHADING

Shaft Spacing (in terms of shaft diameter)[1]	P-Multipliers, P_m[2, 3]		
	Row 1 (leading row)	Row 2 (1st trailing row)	Row 3 and higher (2nd trailing row)
3D	0.8	0.4	0.3
5D	1.0	0.85	0.7

Notes:

1. The P-multipliers in the table above are a function of the center to center spacing of shafts in the group in the direction of loading expressed in multiples of the shaft diameter, D.
2. The values of P_m were developed for vertical shafts only per 2017 AASHTO LRFD Table 10.7.4-1.
3. The P-multipliers are dependent on the shaft spacing and the row number in the direction of the loading to establish values of P_m for other shaft spacing values, interpolation between values should be conducted.

The WSDOT GDM does not require that the reduction in P-multiplier for group effects be combined with the P-multiplier for liquefied soil conditions.

We recommend that the passive soil pressure acting on the pile cap be estimated using an equivalent fluid density of 350 pounds per cubic foot (pcf) where the soil adjacent to the foundation consists of adequately compacted structural fill. This passive resistance value includes a factor of safety of 1.5 and assumes a minimum lateral deflection of 1 inch to fully develop the passive resistance. Deflections that are less than 1 inch will not fully mobilize the passive resistance in the soil.

Pile Settlement

We estimate that the post-construction settlement of micropile foundations, designed and installed as recommended, will be on the order of ½-inch or less. Maximum differential settlement should be less than about one-half of the post-construction settlement. Most of this settlement will occur rapidly as load are applied.

4.6.1.2. Installation Recommendations

We recommend that all micropiles be installed by a competent foundation contractor experienced with this type of construction. All micropiles should be drilled with straight drilling equipment with sufficient torque to penetrate through the very dense glacial till. Drilling mud should not be used unless approved by GeoEngineers before the start of construction.

After the hole is drilled to the planned depth, all cuttings must be removed from the hole, either mechanically or by using pressurized air. Water should not be used to remove cuttings from the hole. The installation of each micropile should be observed by a representative from GeoEngineers. If the hole is within tolerance with respect to location, depth and verticality, it should be grouted immediately using a proper grout mix. After the grouting is completed, properly sized steel bars should be installed with centering devices.

4.6.1.3. Test Pile Program

We recommend that a test pile program be established to confirm that the required capacities of micropile foundations have been achieved. We recommend that at least one sacrificial pile load test be completed. Tension load tests should be completed in general accordance with ASTM D3689 Section 8 Procedure for Standard Test Methods for Deep Foundations Under Static Axial Tensile Load.

Pile load testing should be completed using a load frame capable of distributing large test loads into the near-surface soils without damaging existing structural elements or below-slab utilities. The large test loads frequently cause damage to slabs-on-grade and other nearby improvements, and the location of pile load tests should be reviewed during the design phase to minimize impacts to existing improvements.

4.6.2. Steel Pipe Piles

We recommend the new columns of the Pocock mezzanine be supported on 2- or 3-inch-diameter driven steel pipe piles to support the gravity loads. The 2-inch-diameter steel pipe piles can be installed with a handheld jackhammer, which may be beneficial considering the overhead clearance requirements inside of the Shell House. The 3-inch-diameter piles require a larger hammer that is typically mounted to a small excavator. In addition, 2-inch-diameter pipe piles do not require ASTM load testing, per SDCI Director's Rule 10-2009.

We recommend that the 2- or 3-inch-diameter driven steel pipe piles be installed using pneumatic impact equipment capable of penetrating a sufficient depth to develop the design loads. McDowell Northwest Pile King of Kent, Washington has equipment capable of installing this type of pile. We recommend that the pipe piles be designed for a maximum allowable axial capacity of 4 and 6½ kips for 2- and 3-inch-diameter pipe piles, respectively (FOS of at least 2). These loads may be increased by one-third during seismic conditions. The allowable axial capacities include downdrag loading due to the potential liquefaction of the fill and alluvium during the design earthquake.

We estimate total foundation settlements of less than ½ inch will develop for properly installed pipe piles. We recommend that a static load test be completed on at least two 3-inch-diameter pipe piles to verify actual capacity (locations of the test piles to be selected by GeoEngineers). The load test should be completed in accordance with ASTM D1143-81. The 2-inch-diameter pipe piles do not require load testing. The pipe pile spacing should be determined by the project structural engineer.

The piles should be embedded at least 5 feet into the underlying glacial till deposits or until practical refusal criteria is achieved. The practical refusal criteria depends on the hammer weight and model. For preliminary planning, we recommend that the pipe piles be driven to the practical refusal criteria listed in Table 4. Pile installation should be observed by a representative of GeoEngineers and the actual refusal criteria verified by the load tests.

TABLE 4. PRACTICAL REFUSAL CRITERIA (2- AND 3-INCH PILES)

Hammer Type	Hammer Weight (pounds)	Refusal Criteria (seconds/inch)	
		2-inch Pipe Pile	3-inch Pipe Pile
Jackhammer	90	60	N/A
Rhino (PD-140)	140	60	N/A
TB-225	600	3	12
TB-325	850	N/A	10
TB-425	1,100	N/A	6

4.7. Footing Drains

We recommend that perimeter footing drains be installed around the building. The perimeter drains should be installed at the base of the existing exterior footings. The perimeter drains should be provided with cleanouts and should consist of at least 4-inch-diameter perforated pipe placed on a 3-inch bed of, and surrounded by, 6 inches of drainage material enclosed in a non-woven geotextile fabric such as Mirafi 140N (or approved equivalent) to prevent fine soil from migrating into the drain material. We recommend against using flexible tubing for footing drainpipes. The perimeter drains should be sloped to drain by gravity, if practicable, to a suitable discharge point, preferably a storm drain. We recommend that the cleanouts be covered and be placed in flush mounted utility boxes. Water collected in roof downspout lines must not be routed to the footing drain lines.

4.8. Floor Slabs

We understand that a new 4-inch slab will be cast over the existing slab and that structural ties (rebar) will be placed in the new slab to structurally tie the building together. Potential settlement that may affect the slab-on-grade of the building include liquefaction-induced settlement and static-induced settlement.

As discussed in Sections 4.2.2 and 4.3.2, the alluvium and fill located beneath the water table are susceptible to liquefaction during the design-level earthquake. Liquefaction-induced free-field ground settlement of these potentially liquefiable soils is estimated to range from 0 to 2¼ inches during the design-level earthquake. Therefore, there is a potential for differential settlement to occur under the building footprint.

In addition to liquefaction-induced settlement, static-induced settlement could impact the slab-on-grade, as discussed in Sections 4.2.1 and 4.4. The alluvium contains peat of varying thickness that is highly compressible and subject to compression and decomposition. Based on our analyses, casting a new slab over the existing slab will not significantly impact the primary consolidation of the peat and the new slab should perform similar to the existing slab. However, our analyses indicate that the peat may settle up to 2 inches long-term due to secondary compression. Therefore, there is a potential for differential settlement to occur under the building footprint where the peat is located.

The micropiles and steel pipe piles that the building will be supported on will effectively mitigate the risk of liquefaction-induced and static-induced settlement to the superstructure of the building, provided the recommendations in this report are followed. If it is determined that liquefaction-induced and static-induced settlements can be tolerated (i.e. the slab is allowed to settle/crack during a design-level earthquake or during static settlement of the soil), the floor slab does not need to be designed as a structural slab. Based on discussions with the design team, we understand that the estimated differential settlement is tolerable, and it is not a life safety concern.

4.9. Retaining Walls

We understand that retaining walls will be necessary on the northern portion of the site as part of the planned hardscape improvements. The following recommendations should be used in design/construction of retaining structures that are used to achieve grade changes.

4.9.1. Design Parameters

The lateral soil pressures acting on conventional cast-in-place subsurface walls will depend on the nature, density and configuration of the soil behind the wall and the amount of lateral wall movement that can occur as backfill is placed. Lateral earth pressures for design of retaining walls should be evaluated using an equivalent fluid density of 35 pcf provided that the walls will not be restrained against rotation when backfill is placed. If the walls will be restrained from rotation, we recommend using an equivalent fluid density of 55 pcf. Walls are assumed to be restrained if top movement during backfilling is less than H/1000, where H is the wall height. These lateral soil pressures assume that the ground surface behind the wall is horizontal. For unrestrained walls with backfill sloping up at 2H:1V, the design lateral earth pressure should be increased to 55 pcf, while restrained walls with a 2H:1V sloping backfill should be designed using an equivalent fluid density of 75 pcf. These lateral soil pressures do not include the effects of surcharges such as floor loads, traffic loads or other surface loading. Surcharge effects should be included as appropriate. Potential impacts to adjacent structures (i.e. existing buildings) should also be evaluated by the structural engineer. Retaining walls should also include seismic earth pressures. Seismic earth pressures should be included as a rectangular distribution determined using 7H in psf, where H is the wall height.

If vehicles can approach the tops of walls to within half the height of the wall, a traffic surcharge should be added to the wall pressure. For car parking areas, the traffic surcharge can be approximated by the equivalent weight of an additional 1 foot of soil backfill (about 125 psf) behind the wall. For delivery truck parking areas and access driveway areas, the traffic surcharge can be approximated by the equivalent weight of an additional 2 feet (250 psf) of soil backfill behind the wall. Other surcharge loads, such as from foundations, construction equipment or construction staging areas, should be considered on a case-by-case basis. Positive drainage should be provided behind below-grade walls and retaining structures as discussed below.

These recommendations assume that any retaining walls at this project will be provided with wall drainage. The values for soil bearing, frictional resistance and passive resistance presented above for foundation design are applicable to retaining wall design. Walls located in level ground areas should be founded at a depth of 18 inches below the adjacent grade.

4.9.2. Drainage

To reduce the potential for hydrostatic water pressure buildup behind the retaining walls, we recommend that the walls be provided with adequate drainage. Wall drainage can be achieved by using free draining wall drainage material with perforated pipes to discharge the collected water.

Wall drainage material may consist of Mineral Aggregate Type 5 (1-inch washed gravel) or Type 9 (⅜-inch washed gravel) per City of Seattle Standard Specification 9-03.14 surrounded with a non-woven geotextile fabric such as Mirafi 140N (or approved equivalent), or imported gravel borrow (Type 17) with less than 5 percent fines may be used in conjunction with a geocomposite wall drainage layer. The zone of wall drainage material should be 2 feet wide and should extend from the base of the wall to within 1 foot of the ground surface. The wall drainage material should be covered with at least 1 foot of less permeable material, such as the on-site silty sand that is properly moisture conditioned and compacted. A geotextile separator, such as Mirafi 140N, should be placed over the top of the wall drainage material prior to backfill being placed.

A 4-inch-diameter perforated drain pipe should be installed within the free-draining material at the base of each wall. We recommend using either heavy-wall solid pipe (SDR-35 PVC) or rigid corrugated polyethylene pipe (ADS N-12, or equal). We recommend against using flexible tubing for the wall drain pipe. If gravel borrow is used against the wall in conjunction with a geocomposite wall drainage layer, then the drainage pipe at the base of the wall should be surrounded with at least 12 inches of Mineral Aggregate Type 5 or Type 9 that is wrapped with a nonwoven geotextile filter fabric such as Mirafi 140N (or approved equivalent).

The pipes should be laid with minimum slopes of one-quarter percent (if possible) and discharge into the storm water collection system to convey the water off site. The pipe installations should include a cleanout riser with cover located at the upper end of each pipe run. The cleanouts could be placed in flush mounted access boxes.

4.10. Earthwork

Based on the subsurface soil conditions encountered in the explorations, we anticipate that the soils at the site may be excavated using conventional heavy-duty construction equipment. Cobbles and debris were not observed in the fill material, however; fill can contain cobbles and debris. Accordingly, the contractor should be prepared to deal with cobbles and debris, if encountered. Wood was observed in the native alluvial soils and within the fill; therefore, the contractor should also be prepared to deal with wood materials, if encountered.

The fill contains sufficient fines (material passing the U.S. standard No. 200 sieve) to be highly moisture-sensitive and susceptible to disturbance, especially when wet. Ideally, earthwork should be undertaken during extended periods of dry weather when the surficial soils will be less susceptible to disturbance and provide better support for construction equipment. Dry weather construction will help reduce earthwork costs and increase the potential for using the drier on-site soils as structural fill.

Trafficability on the site is not expected to be difficult during dry weather conditions. However, the fill and native soils will be susceptible to disturbance from construction equipment during wet weather conditions and pumping and rutting of the exposed soils under equipment loads may occur.

4.10.1. Clearing and Site Preparation

Areas to be developed or graded should be cleared of surface and subsurface deleterious matter including any debris, shrubs, trees and associated stumps and roots. Graded areas should be stripped of organic soils. Based on the explorations, we anticipate that up to approximately 12 inches of stripping is needed to remove the sod and topsoil in the grass covered areas. Approximately 1.5 inches of asphalt pavement was observed in the parking area and roadway to the north of the building.

The organic soils can be stockpiled and used later for landscaping purposes or may be spread over disturbed areas following completion of grading. If spread out, the organic strippings should be in a layer less than 1-foot thick, should not be placed on slopes greater than 3H:1V (horizontal to vertical) and should be track-rolled to a uniformly compacted condition. Materials that cannot be used for landscaping or protection of disturbed areas should be removed from the project site.

4.10.2. Subgrade Preparation

Prior to placing new fills, pavement base course materials or gravel below on-grade floor slabs, subgrade areas should be proof rolled (or probed) to locate any soft or pumping soils. Proof rolling can be completed using a piece of heavy tire-mounted equipment such as a loaded dump truck. During wet weather, the exposed subgrade areas should be probed to determine the extent of soft soils. If soft or pumping soils are observed, they should be removed and replaced with structural fill.

If deep pockets of soft or pumping soils are encountered outside the building area, it may be possible to limit the depth of overexcavation by placing a non-woven geotextile fabric such as TenCate Mirafi 500X (or equivalent) on the overexcavated subgrade prior to placing structural fill. The geotextile will provide additional support by bridging over the soft material and will help reduce fines contamination into the structural fill.

After completing the proof rolling, the subgrade areas should be recompacted to a firm condition. The degree of compaction that can be achieved will depend on when the construction is performed. If the work is performed during dry weather conditions, we recommend that all subgrade areas be recompacted to at least 95 percent of the maximum dry density (MDD) in accordance with the ASTM D 1557 test procedure (modified Proctor). If the work is performed during wet weather conditions, it may not be possible to recompact the subgrade to 95 percent of the MDD. In this case, we recommend that the subgrade be compacted to the extent possible without causing undue heaving or pumping of the subgrade soils.

Subgrade disturbance or deterioration could occur if the subgrade is wet and cannot be dried. If the subgrade deteriorates during proof rolling or compaction, it may become necessary to modify the proof rolling or compaction criteria or methods.

4.10.3. Structural Fill

All fill, whether existing on-site fill soil or imported soil, that will support foundations or pavement areas, or be placed against foundations and retaining walls or in utility trenches should generally meet the criteria for structural fill presented below. The suitability of soil for use as structural fill depends on its gradation and moisture content.

Materials

We recommend specifying materials using Section 9-03.14 of the 2023 City of Seattle Standard Specifications (Seattle Mineral Aggregate). Structural fill material quality varies depending upon its use as described below:

1. Structural fill placed below all structures and pavement elements, behind below-grade walls (outside of the drainage zone) and during wet weather conditions should consist of Settle Mineral Aggregate Type 17.
2. Structural fill placed to backfill utility trenches may consist of suitable on-site fill soils provided the soils are moisture conditioned for the required compaction. On-site fill soils may be suitable for use as structural fill during dry weather conditions in areas needing 90 percent compaction. The existing soil will require moisture conditioning prior to use as structural fill. If structural fill is placed during wet weather, it should consist of Seattle Mineral Aggregate Type 17. On-site alluvial soils and peat should not be planned for reuse as structural fill.

3. Drainage material placed immediately outside below-grade walls (drainage zone) should meet the requirements of Mineral Aggregate Type 5, Type 9 or Type 17 (when used in conjunction with geocomposite wall drainage layer).
4. Structural fill placed for footing drains around the building perimeter should conform to Seattle Mineral Aggregate Type 5.
5. Structural fill placed as crushed surfacing base course (CSBC) below pavements should conform to Seattle Mineral Aggregate Type 2.

Reuse of On-site Soils

The fill soils contain a high percentage of fines and will be sensitive to changes in moisture content and difficult to handle and compact during wet weather.

The fill soils are expected to be suitable for use as structural fill in areas requiring compaction outside the building footprint to at least 90percent of MDD (per ASTM D 1557), provided the work is accomplished during the normally dry season (June through September) and that the soil can be properly moisture conditioned. Imported structural fill consisting of sand and gravel (Type 17) should be planned under all building elements, especially if construction occurs during wet weather. On-site alluvial soils and peat, or high silt content soils, should not be reused as structural fill.

The contractor should plan to cover and maintain all fill stockpiles with plastic sheeting if it will be used as structural fill. The reuse of on-site soils is highly dependent on the skill and cooperation of the contractor and schedule, and we will work with the design team and contractor to maximize the reuse of on-site soils during the wet and dry seasons.

Fill Placement and Compaction Criteria

Structural fill should be mechanically compacted to a firm, non-yielding condition. Structural fill should be placed in loose lifts not exceeding 12 inches in thickness when using heavy compaction equipment and not more than 6 inches when using hand operated compaction equipment. The actual thickness will be dependent on the structural fill material used and the type and size of compaction equipment. Each lift should be moisture conditioned to within about 2 percent of the optimum moisture content to achieve proper compaction to the specified density before placing subsequent lifts. Compaction of all structural fill at the site should be in accordance with the ASTM D 1557 (modified proctor) test method. Structural fill should be compacted to the following criteria:

1. Structural fill placed below and against foundations should be compacted to 95 percent of the MDD.
2. Structural fill placed behind retaining walls should be compacted to between 90 to 92 percent of the MDD. Care should be taken when compacting fill near the face of retaining walls to avoid over-compaction and hence, overstressing the walls. Hand operated compactors should be used within 5 feet behind the wall. The upper 2 feet of fill below sidewalk or pavement areas should also be compacted to at least 95 percent of the MDD. The contractor should keep all heavy construction equipment away from the top of retaining walls a distance equal to half the height of the wall, or at least 5 feet, whichever is greater.

3. Structural fill in new pavement and hardscape areas, including utility trench backfill, should be compacted to at least 90 percent of the MDD, except that the upper 2 feet of fill below final subgrade should be compacted to at least 95 percent of the MDD as shown in Figure 13, Compaction Criteria for Trench Backfill.
4. Non-structural fill, such as fill placed in landscape areas, should be compacted to at least 90 percent of the MDD.

Weather Considerations

Disturbance of near surface soils should be expected if earthwork is completed during periods of wet weather. During dry weather, the soils will: (1) be less susceptible to disturbance; (2) provide better support for construction equipment; and (3) be more likely to meet the required compaction criteria.

The wet weather season generally begins in October and continues through May in Western Washington; however, periods of wet weather may occur during any month of the year. For earthwork activities during wet weather, we recommend that the following steps be taken:

- The ground surface in and around the work area should be sloped so that surface water is directed away from the work area. The ground surface should be graded so that areas of ponded water do not develop. Measures should be taken by the contractor to prevent surface water from collecting in excavations and trenches. Measures should be implemented to remove surface water from the work area.
- Earthwork activities should not take place during periods of moderate to heavy precipitation.
- Slopes with exposed soils should be covered with plastic sheeting.
- The contractor should take necessary measures to prevent on-site soils and soils to be used as fill from becoming wet or unstable. These measures may include the use of plastic sheeting, sumps with pumps and grading. The site soils should not be left uncompacted and exposed to moisture. Sealing the surficial soils by rolling with a smooth-drum roller prior to periods of precipitation will help reduce the extent that these soils become wet or unstable.
- The contractor should cover all soil stockpiles that will be used as structural fill with plastic sheeting.
- Construction traffic should be restricted to specific areas of the site, preferably areas that are surfaced with the existing asphalt or working pad materials not susceptible to wet weather disturbance.
- Construction activities should be scheduled so that the length of time that soils are left exposed to moisture is reduced to the extent practical.

Routing of equipment on the fill subgrade soils during the wet weather months will be difficult and the subgrade will likely become highly disturbed and rutted. In addition, a significant amount of mud can be produced by routing equipment directly on the existing fill soils in wet weather. Therefore, to protect the subgrade soils and to provide an adequate wet weather working surface for the contractor's equipment and labor, we recommend that the contractor protect exposed subgrade soils with crushed rock or asphalt-treated base (ATB).

4.10.4. Temporary Cut Slopes

The stability of open-cut slopes is a function of soil type, groundwater seepage, slope inclination, slope height and nearby surface loads. The use of inadequately designed open cuts could impact the stability of adjacent improvements/work areas, affect existing utilities and could endanger personnel.

Temporary unsupported cut slopes more than 4 feet high may be inclined at 1.5H:1V maximum steepness in the existing fill and alluvium and 1H:1V in the glacial till. If significant seepage is present on the cut face, then the cut slopes may have to be flattened. However, temporary cuts should be discussed with the geotechnical engineer during final design development to evaluate suitable cut slope inclinations for the various portions of the excavation.

The above guidelines assume that surface loads such as traffic, construction equipment, stockpiles or building supplies will be kept away from the top of the cut slopes a sufficient distance so that the stability of the excavation is not affected. We recommend that this distance be at least 5 feet from the top of the cut for temporary cuts made at 1.5H:1V or flatter, and no closer than a distance equal to one half the height of the slope for cuts made at 1H:1V.

Temporary cut slopes should be planned such that they do not encroach on a 1H:1V influence line projected down from the edges of nearby or planned foundation elements, including the existing foundations of the Shell House.

Water that enters the excavation must be collected and routed away from prepared subgrade areas. We expect that this may be accomplished by installing a system of drainage ditches and sumps along the toe of the cut slopes. Some sloughing and raveling of the cut slopes should be expected. Temporary covering, such as heavy plastic sheeting with appropriate ballast, should be used to protect these slopes during periods of wet weather. Surface water runoff from above cut slopes should be prevented from flowing over the slope face by using berms, drainage ditches, swales or other appropriate methods.

If temporary cut slopes experience excessive sloughing or raveling during construction, it may become necessary to modify the cut slopes to maintain safe working conditions. Slopes experiencing problems can be flattened, regraded to add intermediate slope benches, or additional dewatering can be provided if the poor slope performance is related to groundwater seepage.

Because the contractor has control of the construction operations, the contractor should be made responsible for the stability of cut slopes, as well as the safety of excavations. Shoring and temporary slopes must conform to applicable local, state, and federal safety regulations.

4.10.5. Permanent Cut and Fill Slopes

We recommend that permanent cut or fill slopes be constructed at inclinations of 2H:1V or flatter, and be blended into existing slopes with smooth transitions. To achieve uniform compaction, we recommend that fill slopes be overbuilt slightly and subsequently cut back to expose well compacted fill.

To reduce erosion, newly constructed slopes should be planted or hydroseeded shortly after completion of grading. Until the vegetation is established, some sloughing and raveling of the slopes should be expected. This may necessitate localized repairs and reseeding. Temporary covering, such as clear heavy plastic sheeting, jute fabric, or erosion control blankets (such as American Excelsior Curlex 1 or North American Green SC150) could be used to protect the slopes during periods of rainfall.

4.10.6. Utility Trenches

Trench excavation, pipe bedding, and trench backfilling should be completed using the general procedures described in the 2024 WSDOT Standard Specifications or other suitable procedures required by the City of Seattle or specified by the project civil engineer. The fill soils encountered at the site are generally of low corrosivity based on our experience in the Puget Sound area; however, the alluvium and peat soils have a moderate to high potential for corrosion.

Utility trench backfill should consist of structural fill and should be placed in loose lifts not exceeding 12 inches in thickness when using heavy compaction equipment and not more than 6 inches when using hand operated compaction equipment such that adequate compaction can be achieved throughout the lift. Each lift must be compacted prior to placing the subsequent lift. Prior to compaction, the backfill should be moisture conditioned to within 2 percent of the optimum moisture content, if necessary. The backfill should be compacted in accordance with the criteria discussed above. Figure 13 illustrates recommended trench compaction criteria under pavement and non-structural areas.

4.10.7. Sedimentation and Erosion Control

In our opinion, the erosion potential of the on-site soils is low to moderate. Construction activities including stripping and grading will expose soils to the erosional effects of wind and water. The amount and potential impacts of erosion are partly related to the time of year that construction actually occurs. Wet weather construction will increase the amount and extent of erosion and potential sedimentation.

Erosion and sedimentation control measures may be implemented by using a combination of interceptor swales, straw bale barriers, silt fences and straw mulch for temporary erosion protection of exposed soils. All disturbed areas should be finish graded and seeded as soon as practicable to reduce the risk of erosion. Erosion and sedimentation control measures should be installed and maintained in accordance with the requirements of the City of Seattle.

4.11. Drainage Considerations

All paved and landscaped areas should be graded so that surface drainage is directed away from the building to appropriate catch basins.

Water collected in roof downspout lines must not be routed to the footing drain lines. Collected downspout water should be routed to appropriate discharge points in separate pipe systems.

4.12. Infiltration Considerations

We understand that stormwater at the site will be managed through a combination of permeable pavement and/or compost-amended vegetated filter strips (CAVFS). The infiltration facilities will be designed in accordance with the 2021 CSSM.

4.12.1. Infiltration Testing

Two small-scale pilot infiltration tests (PITs) and one simple infiltration test (SIT) were performed at the project site in the general vicinity of proposed permeable pavements and/or CAVFS, following the general guidance provided in Volume 3 and Appendix D of the 2021 CSSM. The location of the two PITs (TP-1 and TP-2) and one SIT (TP-3) are presented in Figure 2. The results of the infiltration tests are discussed in Appendix D.

As described in the CSSM, measured infiltration rates are reduced using correction factors to determine the design infiltration rates. A correction factor (CF) is applied to the measured infiltration rate to calculate the design infiltration rate, as follows:

Design Infiltration Rate = Measured Infiltration Rate x CF

The measured infiltration rate, CF, and design infiltration rate are summarized in Table 5.

TABLE 5. INFILTRATION RATES FROM PILOT INFILTRATION TESTING

Test Location	Test Type	Test Depth (feet bgs)	Measured Infiltration Rate (in/hr)	Design Infiltration Rate (in/hr)
TP-1	Small Pilot Infiltration Test	4	0	0
TP-2	Small Pilot Infiltration Test	2	2.6	1.3
TP-3	Simple Infiltration Test	2	0.5	0.25

Notes:
in/hr = inches per hour; CF = correction factor
Design infiltration rate = Measured infiltration rate x Correction factor (0.5)

In accordance with the CSSM, a correction factor of 0.5 must be used for all projects unless a lower value is warranted by site conditions, as recommended and documented by a licensed professional, and shall not be lower than 0.2. Based on the type and number of tests completed, as well as the size of the area to be infiltrated, a correction factor of 0.5 was used, resulting in an estimated design infiltration rate of 0, 1.3 and 0.25 inches per hour at TP-1, TP-2 and TP-3, respectively.

4.12.2. Laboratory Results

Organic content and CEC results are summarized in Table 6.

TABLE 6. RESULTS OF ORGANIC CONTENT AND CATION EXCHANGE CAPACITY TESTING

Location	Sample Depth (feet bgs)	Organic Content (%)	Cation Exchange Capacity, CEC (meq/100g)
TP-1	4	0.8	7.7
TP-2	2	8.6	8.6

Notes:
% = percent by weight of organic matter in the soil
meq/100g = milliequivalents per 100 grams of soil

4.13. Pavement Recommendations

4.13.1. Subgrade Preparation

We recommend the subgrade soils in new pavement areas be prepared and evaluated as described in Section 4.10.2. All new pavement and hardscape areas should be supported on subgrade soils that have been proof rolled or probed, and approved by the geotechnical engineer. If the exposed subgrade soils are loose or soft, it may be necessary to excavate localized areas and replace them with structural fill or gravel base course. Pavement subgrade conditions should be observed during construction and prior to placing the base course materials in order to evaluate the presence of zones of unsuitable subgrade soils and the need for over-excavation and replacement of these zones.

4.13.2. Hot-Mix Asphalt Pavement

In light-duty pavement areas (e.g., automobile parking), we recommend a pavement section consisting of at least a 2.5-inch thickness of ½-inch hot-mix asphalt (HMA) (PG 58-22) per City of Seattle Standard Specifications Sections 5-04, 9-03 and 9-03.8, over a 4-inch thickness of densely compacted CSBC per Mineral Aggregate Type 2, City of Seattle Standard Specification 9-03.14.

In heavy-duty pavement areas (e.g., truck traffic areas, materials delivery), we recommend a pavement section consisting of at least a 4-inch thickness of ½-inch HMA (PG 58-22) over a 6-inch thickness of densely compacted CSBC. Pavement sections may be reduced depending on the specific loading demand. Note that the heavy-duty pavement sections are not intended for bus traffic. More robust pavement recommendations can be provided as needed.

The base course in both light-duty and heavy-duty areas should be compacted to at least 95 percent of the MDD (ASTM D 1557). We recommend that a proofroll of the compacted base course be observed by the geotechnical engineer of record prior to paving. Soft or yielding areas observed during proofrolling may require over-excavation and replacement with compacted structural fill.

4.13.3. Portland Cement Concrete Pavement

Portland cement concrete (PCC) sections should be considered for trash enclosure areas and where other concentrated heavy loads may occur. We recommend that these pavements consist of at least 6 inches of PCC over 6 inches of CSBC. A thicker concrete section may be needed based on the actual traffic data. If the concrete pavement will have doweled joints, we recommend that the concrete thickness be increased by an amount equal to the diameter of the dowels. The base course should be compacted to at least 95 percent MDD.

We recommend PCC pavements incorporate construction joints and/or crack control joints spaced maximum distances of 12 feet apart, center-to-center, in both the longitudinal and transverse directions. Crack control joints may be created by placing an insert or groove into the fresh concrete surface during finishing, or by sawcutting the concrete after it has initially set-up. We recommend the depth of the crack control joints be approximately one-fourth the thickness of the concrete; or about 1.5 inches deep for the recommended concrete thickness of 6 inches. We also recommend the crack control joints be sealed with an appropriate sealant to help restrict water infiltration into the joints.

4.13.4. Asphalt-Treated Base

If pavements are constructed during the wet seasons, consideration may be given to covering the areas to be paved with asphalt-treated base (ATB) for protection. Light-duty pavement areas should be surfaced with at least 3 inches of ATB, and heavy-duty pavement areas should be surfaced with at least 6 inches of ATB. Prior to placement of the final pavement sections, we recommend the ATB surface be evaluated and areas of ATB pavement failure be removed and the subgrade repaired. If ATB is used and is serviceable when final pavements are constructed, the CSBC can be eliminated, and the design PCC or asphalt concrete pavement thickness can be placed directly over the ATB. The contractor may need to increase the thickness of these recommended ATB sections based on planned heavy equipment and construction traffic loading.

4.14. Recommended Additional Geotechnical Services

Throughout this report, recommendations are provided where we consider additional geotechnical services to be appropriate. These additional services are summarized below:

- GeoEngineers should be retained to review the project plans and specifications when complete to confirm that our design recommendations have been implemented as intended and submit a review letter to the City of Seattle as required.
- During construction, GeoEngineers should observe temporary cut slopes, observe installation and testing of deep foundations, observe overexcavation of unsuitable soils, evaluate the suitability of foundation, floor slab and pavement subgrades, observe installation of subsurface drainage measures, observe and test structural backfill including wall and trench backfill and provide a summary letter of our construction observation services. The purposes of GeoEngineers construction phase services are to confirm that the subsurface conditions are consistent with those observed in the explorations and other reasons described in Appendix E.

5.0 LIMITATIONS

We have prepared this report for use by the UW and members of the design team for use in design of this project.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Any electronic form, facsimile or hard copy of the original document (email, text, table and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

Please refer to Appendix E for additional information pertaining to use of this report.

6.0 REFERENCES

American Association of State Highway and Transportation Officials (AASHTO). 2017. "AASHTO LRFD Bridge Design Specifications."

Applied Technology Council, "Hazards by Location" accessed via: https://hazards.atcouncil.org/#/.

ASCE 7-16, 2016, "Minimum design loads for buildings and other structures."

ASCE 41-17, 2017, "Seismic Evaluation and Retrofit of Existing Buildings."

Aspect Consulting, LLC, "University of Washington, Waterfront Activities Center Dock Facility Renovation Project, Seattle, Washington," dated March 13, 2024.

Bray, J. D. and T. Travasarou. 2007. "Simplified procedure for estimating earthquake-induced deviatoric slope displacements," Journal of Geotechnical and Geoenvironmental Engineering, 133(4), pp. 381–392. doi: 10.1061/(ASCE)1090-0241(2007)133:4(381).

Bray, J.D., J. Macedo and T. Travasarou. 2018. "Simplified procedure for estimating seismic slope displacement for subduction zone earthquakes," Journal of Geotechnical and Geoenvironmental Engineering, 144(3): 04017124.

City of Seattle, 2022, Seattle Department of Construction & Inspections GIS website, accessed via: h http://seattlecitygis.maps.arcgis.com/apps/webappviewer/index.html?id=f822b2c6498c4163b0cf908e2241e9c2.

City of Seattle, 2023. "Standard Specifications for Road, Bridge and Municipal Construction."

City of Seattle, 2023. "Seattle Municipal Code," ordinances codified through January 26, 2023.

Ensoft, Inc., 2019, LPILE v.2019.11.02.

Idriss, I.M. and R.W. Boulanger. 2008. "Soil Liquefaction during Earthquakes." Monograph MNO-12, Earthquake Engineering Research Institute, Oakland, CA, 261pp.

International Code Council, 2015, "International Building Code."

Ishihara, K., and Yoshimine, M. 1992. "Evaluation of Settlements in Sand Deposits Following Liquefaction During Earthquakes," Soils and Foundations, 32(1), pp. 173-188.

Tokimatsu, K. and Seed, H.B. 1987. "Evaluation of Settlements in Sands Due to Earthquake Shaking," Journal of Geotechnical Engineering, ASCE, 113(GT8), pp. 861-878.

Troost, K.G., Booth, D.B. and Shimel, S.A., 2009, "Geologic Map of Northeastern Seattle (Part of the Seattle North 7.5'x15' Quadrangle), King County" City of Seattle, Department of Earth and Space Sciences, University of Washington, Pacific Northwest Center for Geologic Mapping Studies, U.S. Geological Survey.

United States Geological Survey, "Earthquake Hazards Program, Unified Hazard Tool" accessed via: https://earthquake.usgs.gov/hazards/interactive/.

Washington State Department of Transportation, Geotechnical Design Manual, 2022.

Washington State Department of Transportation, 2024, "Standard Specifications for Road, Bridge and Municipal Construction."

Youd, et al., "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils," Journal of Geotechnical and Geoenvironmental Engineering, ASCE, October 2001, pp. 817-833.

Yount, James C., Map showing depth to bedrock in the Seattle 30 by 60 quadrangle, Washington: U.S. Geological Survey miscellaneous field studies, map MF-1692. 1985.

FIGURES

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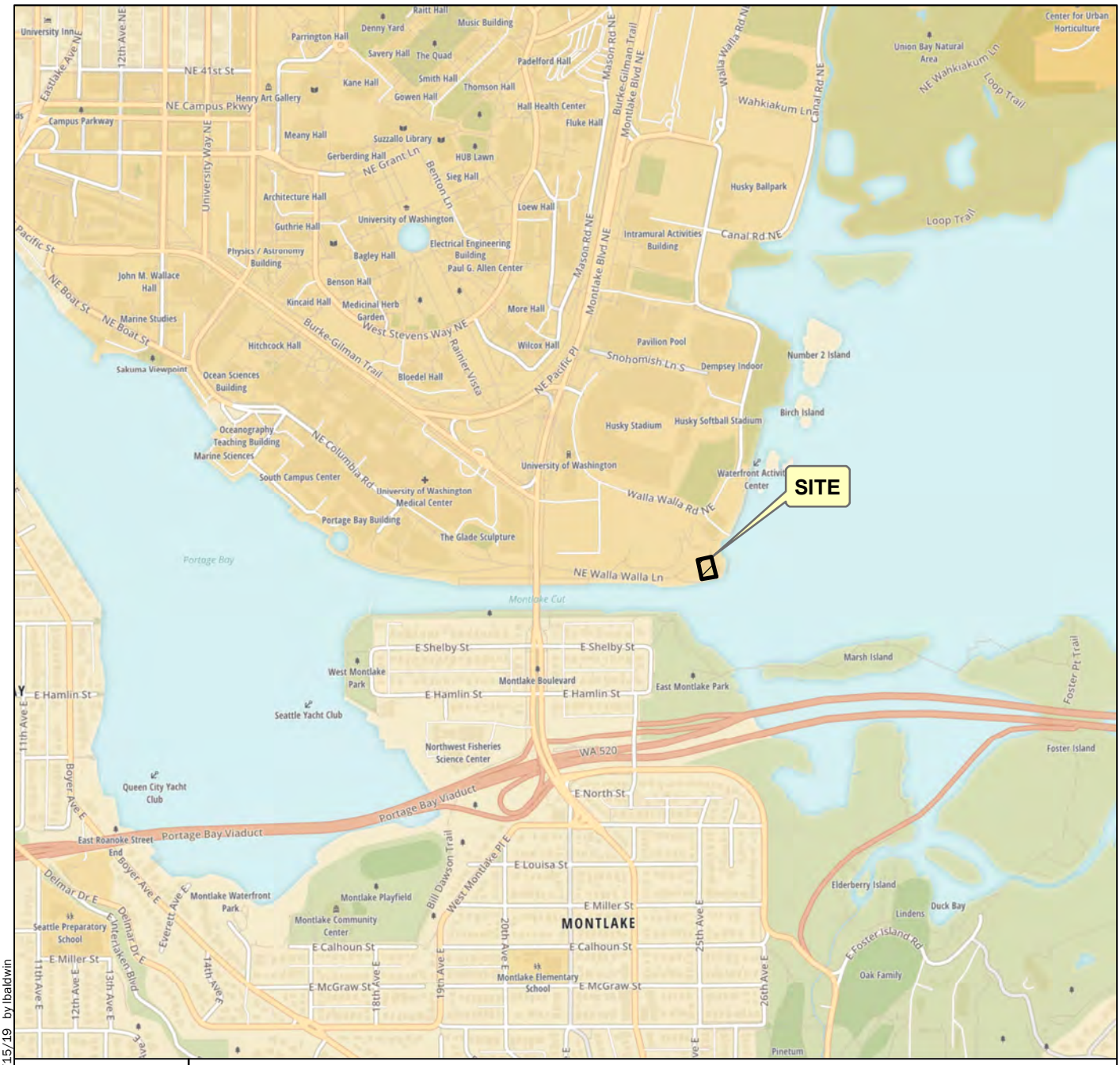

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Feet

Notes:

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

Data Source: Mapbox Open Street Map, 2016

Projection: NAD 1983 UTM Zone 10N

Vicinity Map

ASUW Shell House
Seattle, Washington

GeoEngineers

Figure 1

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Legend

- TP-1 — Test Pit by GeoEngineers, 2024
- PH-1 — Pothole by GeoEngineers, 2024
- CPT-1 — Cone Penetration Test by GeoEngineers, 2024
- GEI-1 — Boring by GeoEngineers, 2019
- ACPT-1 — Cone Penetration Test by Aspect, 2023
- AB-01 — Boring by Aspect, 2023
- A A' — Cross Section Location

Notes:

Sources:

- Survey from Bush, Roed & Hitchings, Inc., dated 10/23/23
- Bathymetric Condition Survey from AKS Engineering, dated 3/4/2024 and 7/28/2023

Coordinate System: NAD83 Washington State Planes, North Zone, US Foot

N

0 60

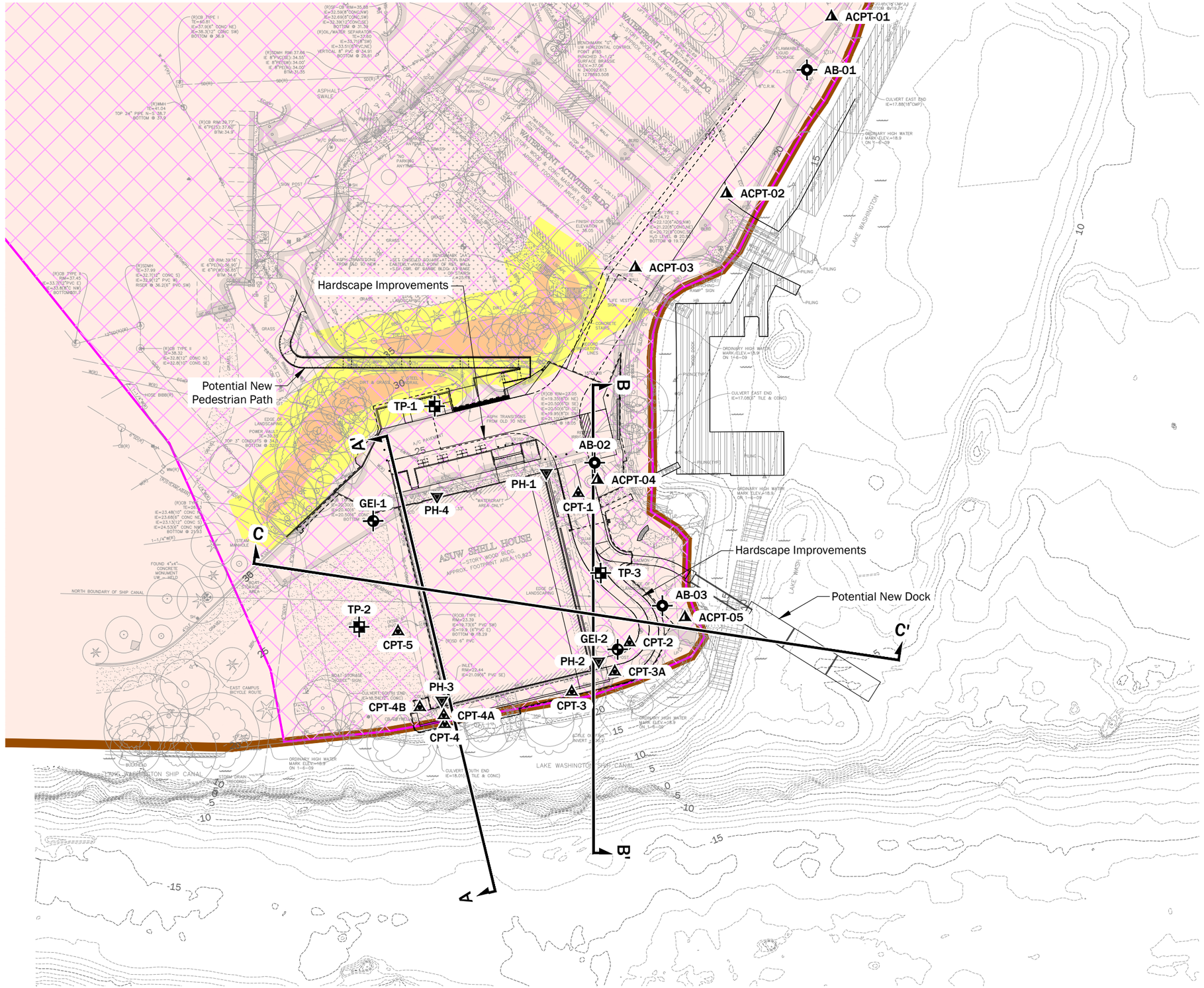
Feet

Site Plan

ASUW Shell House
Seattle, Washington

GeoEngineers

Figure 2



Legend

- TP-1 — Test Pit by GeoEngineers, 2024
- PH-1 — Pothole by GeoEngineers, 2024
- CPT-1 — Cone Penetration Test by GeoEngineers, 2024
- GEI-1 — Boring by GeoEngineers, 2019
- ACPT-1 — Cone Penetration Test by Aspect, 2023
- AB-01 — Boring by Aspect, 2023
- A — A' — Cross Section Location

Environmentally Critical Areas

- Steep Slope
- Steep Slope Buffer
- Peat Settlement Prone Area
- Liquefaction Prone Area

Notes:

Sources:

- Survey from Bush, Roed & Hitchings, Inc., dated 10/23/23
- Bathymetric Condition Survey from AKS Engineering, dated 3/4/2024 and 7/28/2023

Coordinate System: NAD83 Washington State Planes, North Zone, US Foot

N

0 60

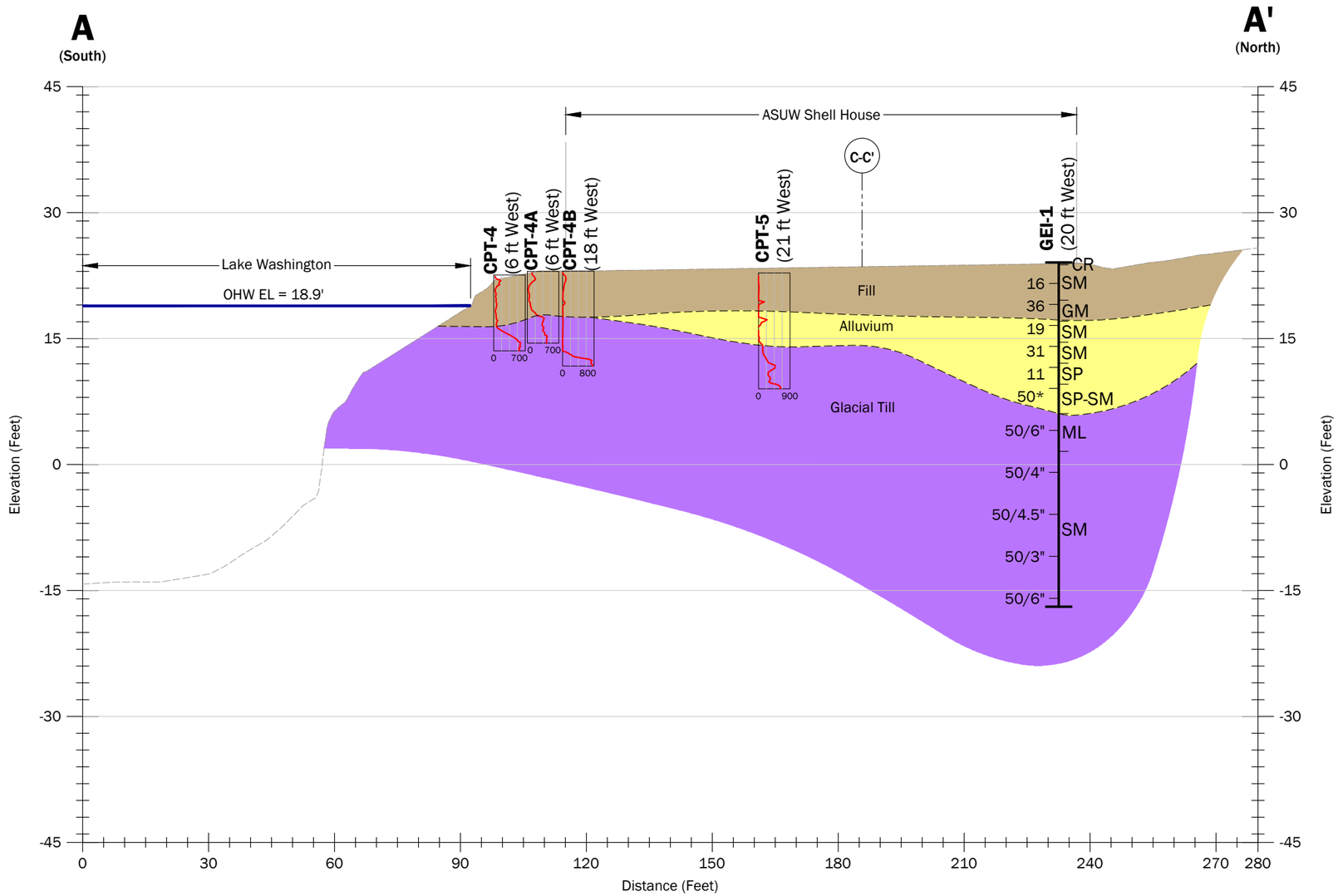
Feet

Environmentally Critical Areas

ASUW Shell House
Seattle, Washington

GeoEngineers

Figure 3



Note(s):

1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: NAVD88

Disclaimer: This figure was created for a specific purpose and project. Any use of this figure for any other project or purpose shall be at the user's sole risk and without liability to GeoEngineers. The locations of features shown may be approximate. GeoEngineers makes no warranty or representation as to the accuracy, completeness, or suitability of the figure, or data contained therein. The file containing this figure is a copy of a master document, the original of which is retained by GeoEngineers and is the official document of record.

Legend

Boring ID (Offset)
SM
20
Boring
Inferred Soil Contact
Soil Classification
Blow Count

CPT-1 (61 ft)
0 900
Cone Penetrometer Test
Tip Stress UNC (tsf)

Fill
Alluvium
Glacial Till

0 30
Horizontal Feet
0 15
Vertical Feet
Vertical Exaggeration = 2X

Cross Section A - A'

ASUW Shell House
Seattle, Washington

GeoEngineers

Figure 4

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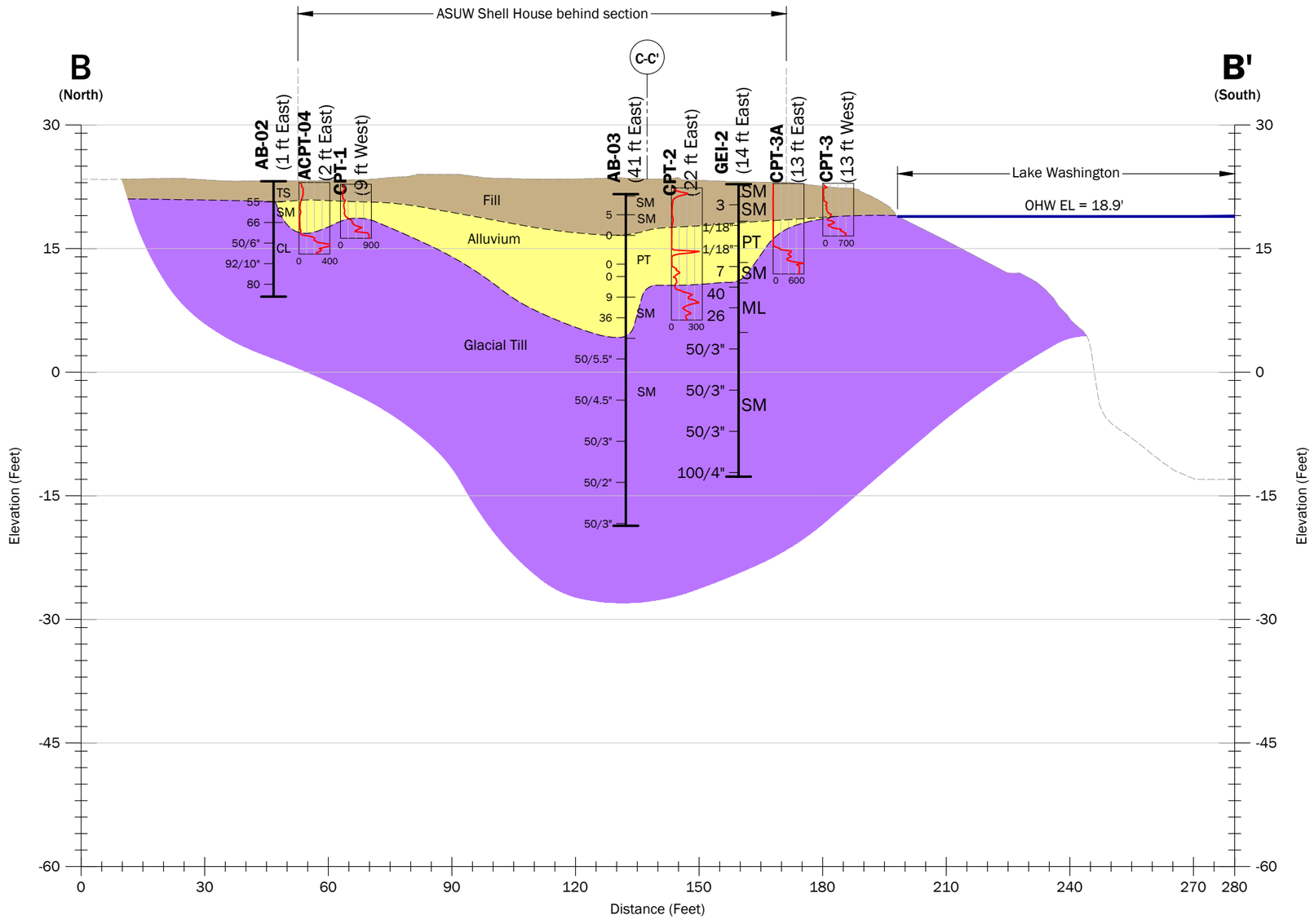

Note(s):

1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: NAVD88

Legend

Boring ID (Offset) — Boring

Inferred Soil Contact

SM — Soil Classification

20 — Blow Count

CPT-1 (61 ft) — Cone Penetrometer Test

0 900 — Tip Stress UNC (tsf)

Fill

Alluvium

Glacial Till

0 30 Horizontal Feet

0 15 Vertical Feet

Vertical Exaggeration = 2X

Cross Section B - B'

ASUW Shell House
Seattle, Washington

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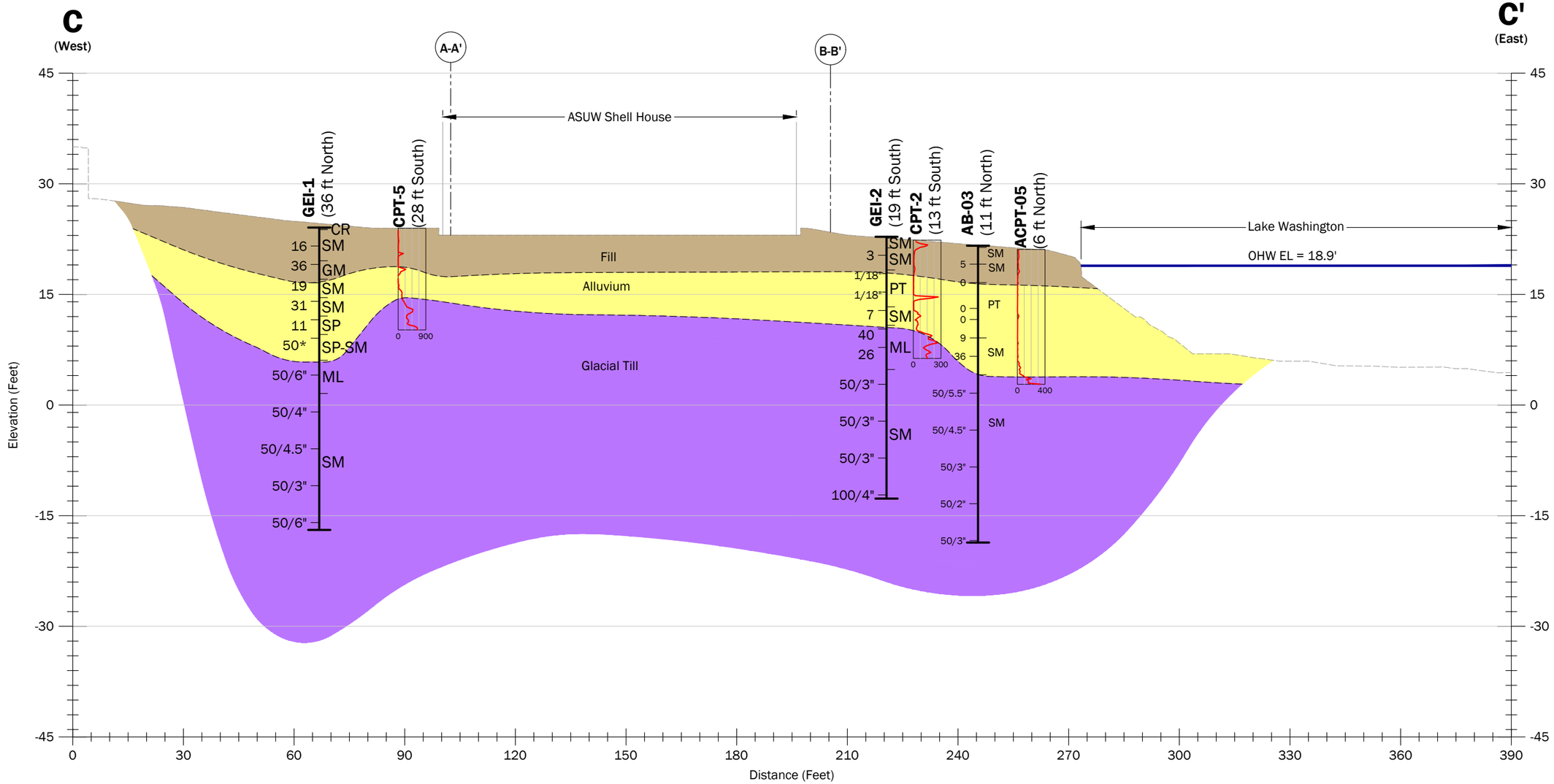
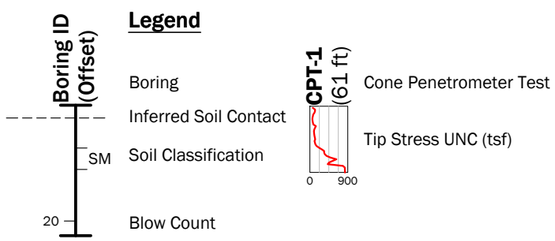
Figure 5

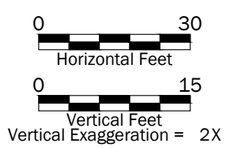


Note(s):

1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.

Datum: NAVD88





Cross Section C - C'

ASUW Shell House
Seattle, Washington

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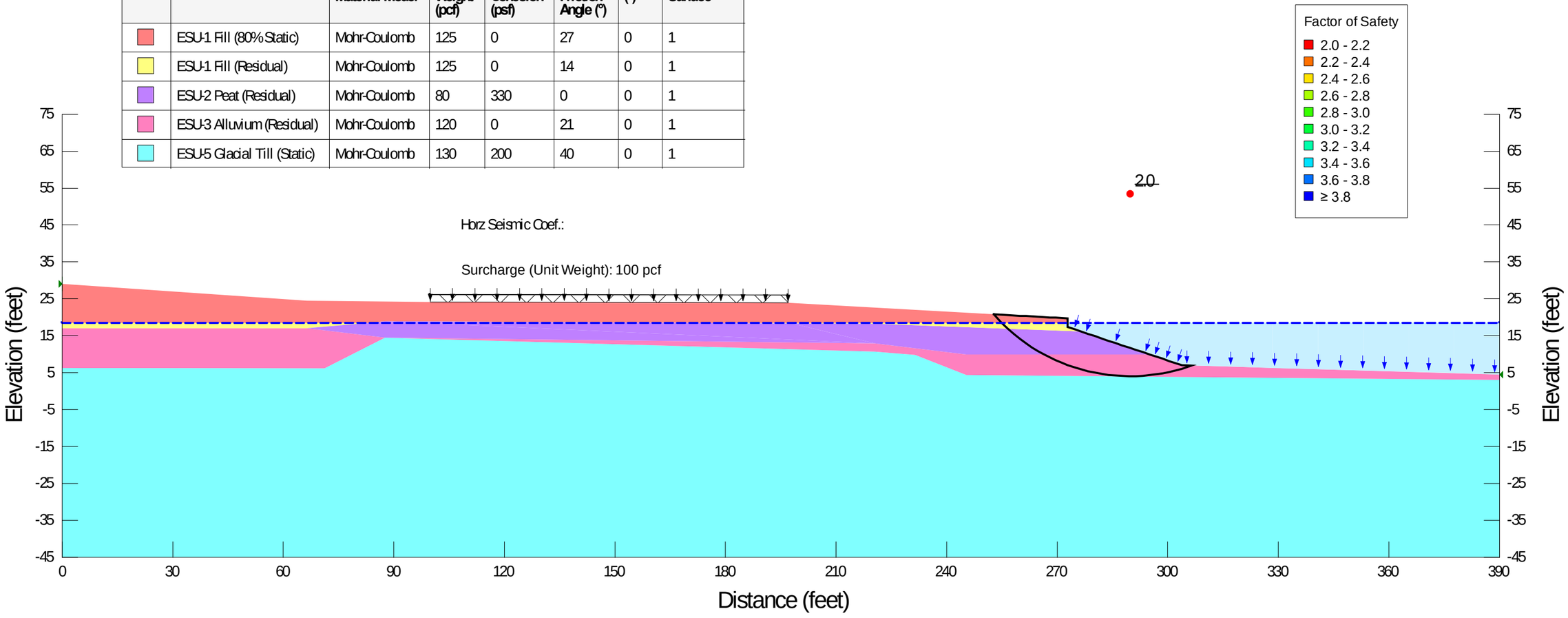
Figure 6

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	ESU-1 Fill (80% Static)	Mohr-Coulomb	125	0	27	0	1
	ESU-1 Fill (Residual)	Mohr-Coulomb	125	0	14	0	1
	ESU-2 Peat (Residual)	Mohr-Coulomb	80	330	0	0	1
	ESU-3 Alluvium (Residual)	Mohr-Coulomb	120	0	21	0	1
	ESU-5 Glacial Till (Static)	Mohr-Coulomb	130	200	40	0	1



Lateral Spreading (Post-Earthquake Condition)

ASUW Shell House
Seattle, Washington

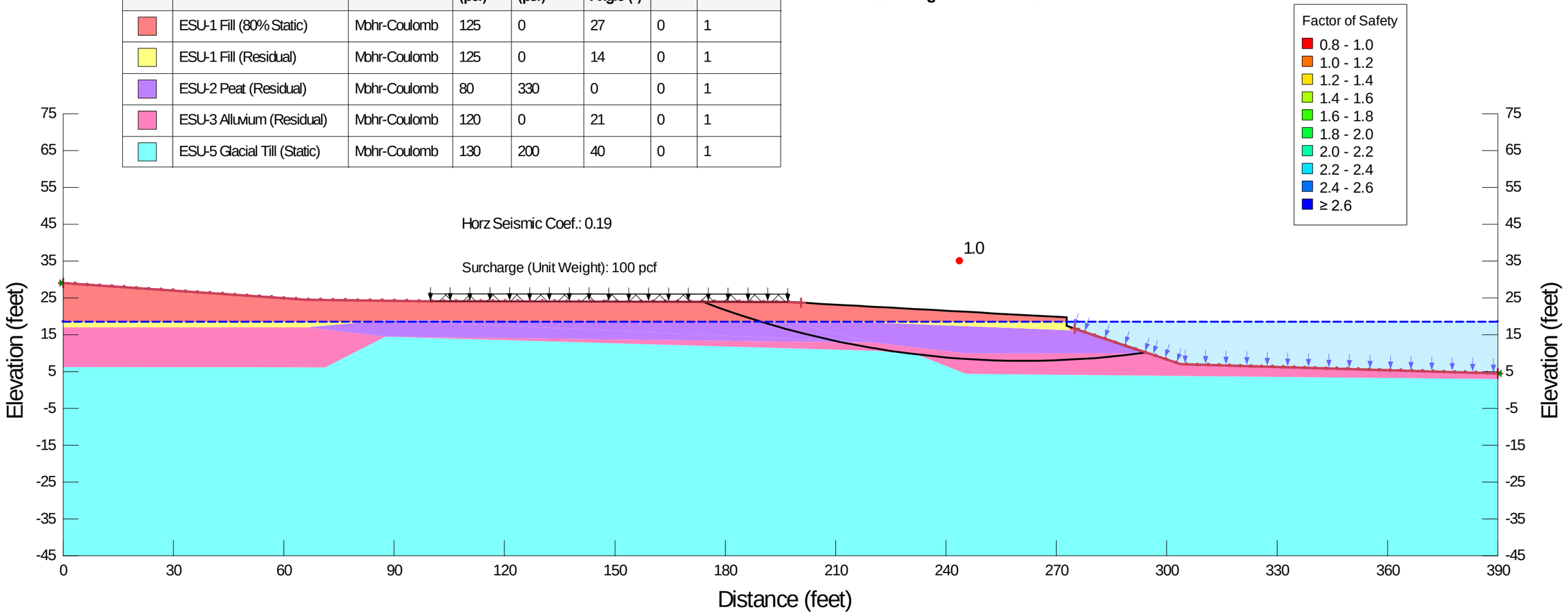
GeoEngineers

Figure 7

0183-139-00 Date: 4/1/2024

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	ESU-1 Fill (80% Static)	Mohr-Coulomb	125	0	27	0	1
	ESU-1 Fill (Residual)	Mohr-Coulomb	125	0	14	0	1
	ESU-2 Peat (Residual)	Mohr-Coulomb	80	330	0	0	1
	ESU-3 Alluvium (Residual)	Mohr-Coulomb	120	0	21	0	1
	ESU-5 Glacial Till (Static)	Mohr-Coulomb	130	200	40	0	1

- **Yield acceleration = 0.19g**
- **Lateral ground deformation ~ 11.8 inches**



Lateral Spreading (Pseudo-Static Condition)
Peat Extends Below Building

ASUW Shell House
Seattle, Washington

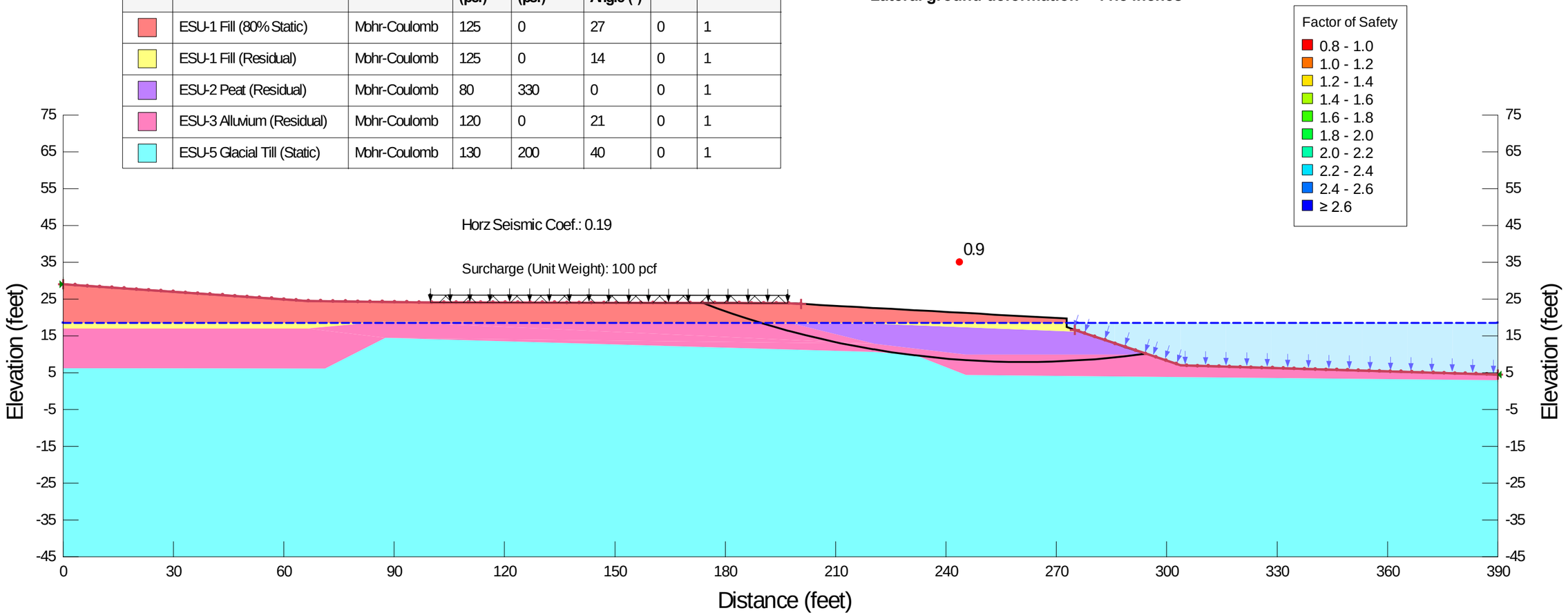
GeoEngineers

Figure 8

0183-139-00 Date: 4/1/2024

Color	Name	Slope Stability Material Model	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	ESU-1 Fill (80% Static)	Mohr-Coulomb	125	0	27	0	1
	ESU-1 Fill (Residual)	Mohr-Coulomb	125	0	14	0	1
	ESU-2 Peat (Residual)	Mohr-Coulomb	80	330	0	0	1
	ESU-3 Alluvium (Residual)	Mohr-Coulomb	120	0	21	0	1
	ESU-5 Glacial Till (Static)	Mohr-Coulomb	130	200	40	0	1

- **Yield acceleration = 0.19g**
- **Lateral ground deformation ~ 11.8 inches**



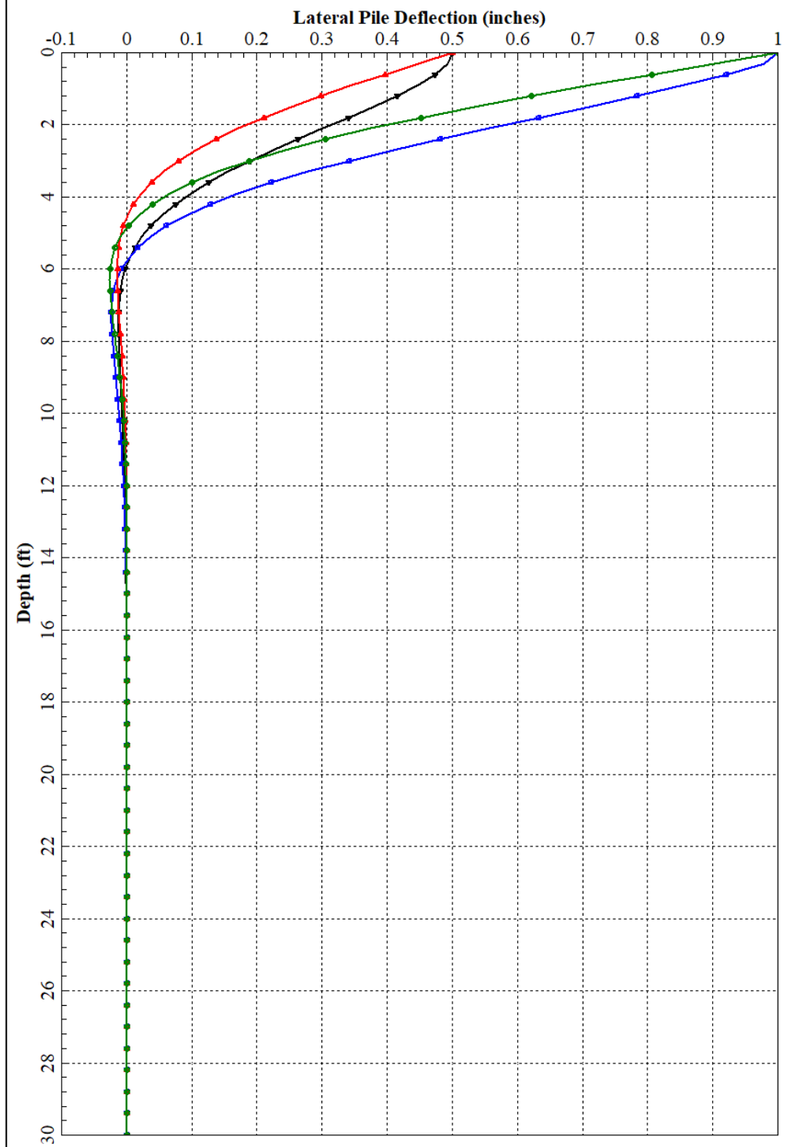
Lateral Spreading (Pseudo-Static Condition)
Peat In Front of Building

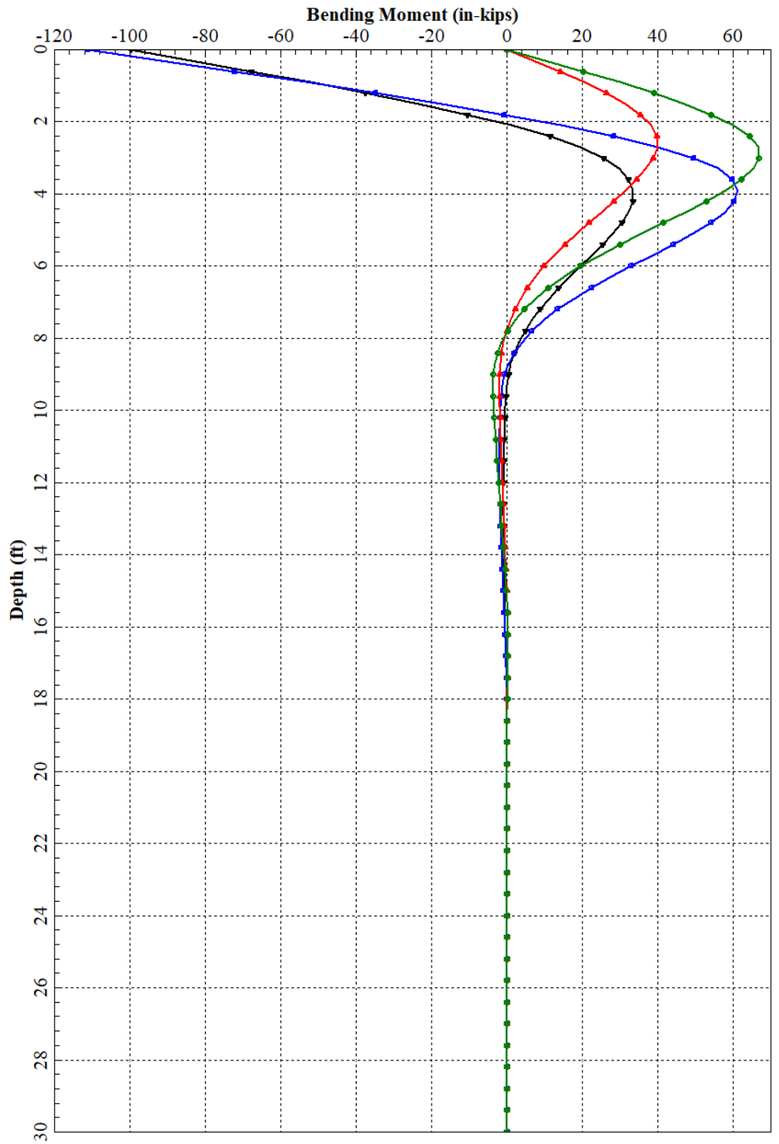
ASUW Shell House
Seattle, Washington

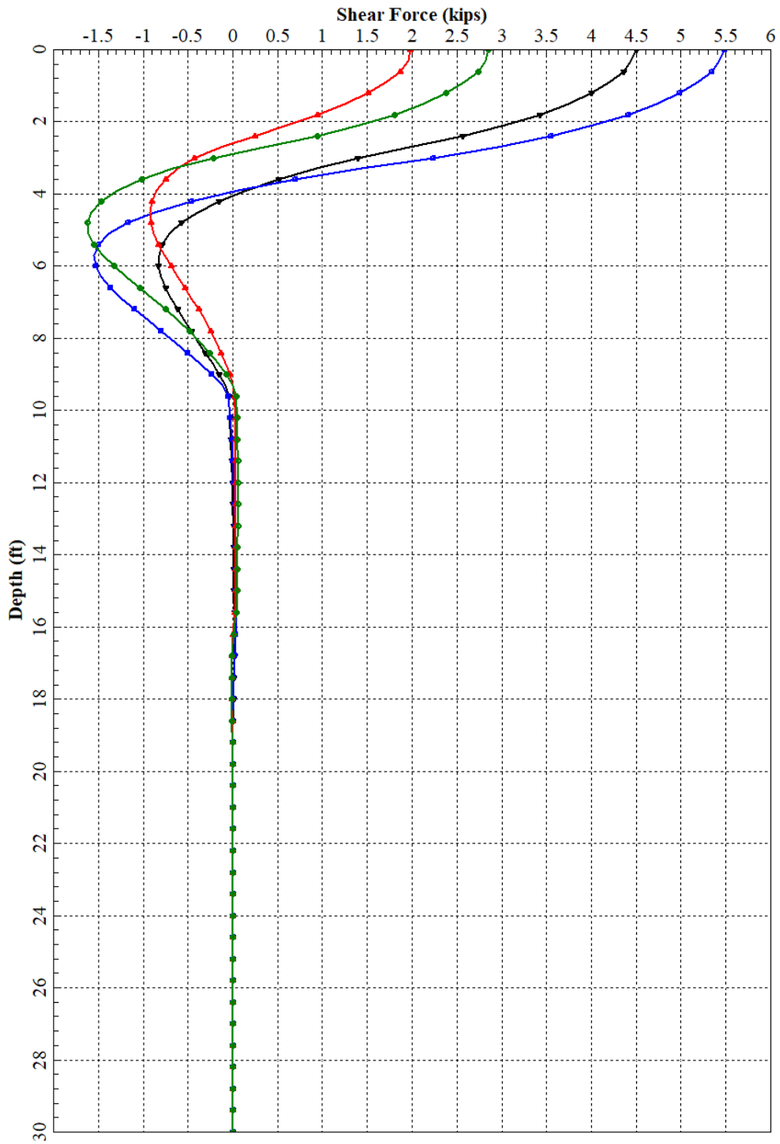
GeoEngineers

Figure 9

0183-139-00 Date: 4/1/2024







Assumptions
Pile Diameter = 6”
Head = Both (Fixed and Free)
Steel Reinforcing = 1 #18 bar
P Multiplier = 0.1 (for Liquefied Soil); None (No Group Effects)

Legend
Load Case 1 = 0.5” (Fixed Head) – Black
Load Case 2 = 1.0” (Fixed Head) – Blue
Load Case 3 = 0.5” (Free Head) – Red
Load Case 4 = 1.0” (Free Head) – Green

Reference: LPILE v2019.11.02 (Ensoft)

6-inch Micropile LPile Output Plots

ASUW Shell House
Seattle, Washington

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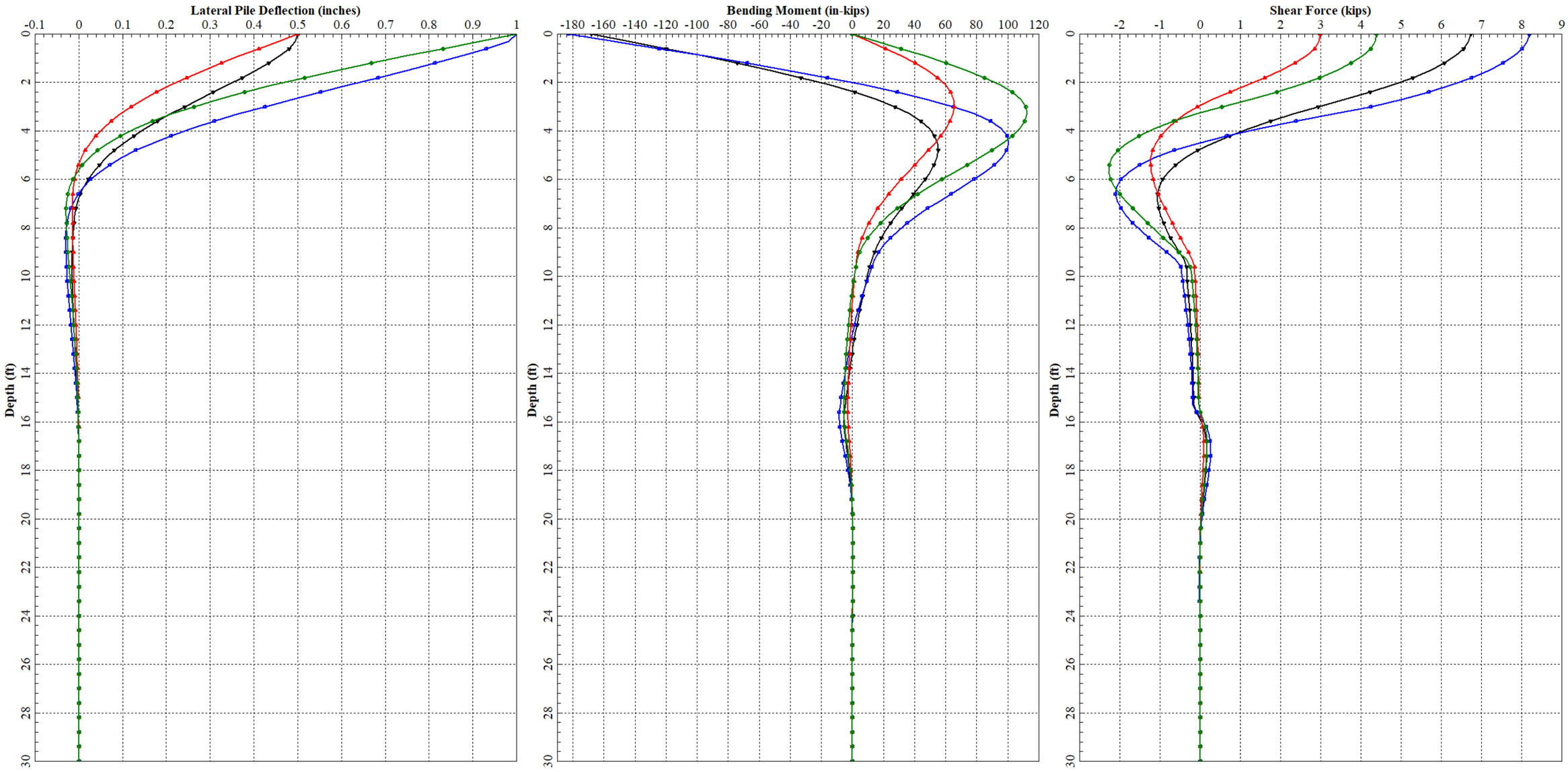
Figure 10

0183-139-00 Date Exported: 5/3/24



Assumptions
Pile Diameter = 8”
Head = Both (Fixed and Free)
Steel Reinforcing = 1 #18 bar
P Multiplier = 0.1 (for Liquefied Soil); None (No Group Effects)

Legend
Load Case 1 = 0.5” (Fixed Head) – Black
Load Case 2 = 1.0” (Fixed Head) – Blue
Load Case 3 = 0.5” (Free Head) – Red
Load Case 4 = 1.0” (Free Head) – Green

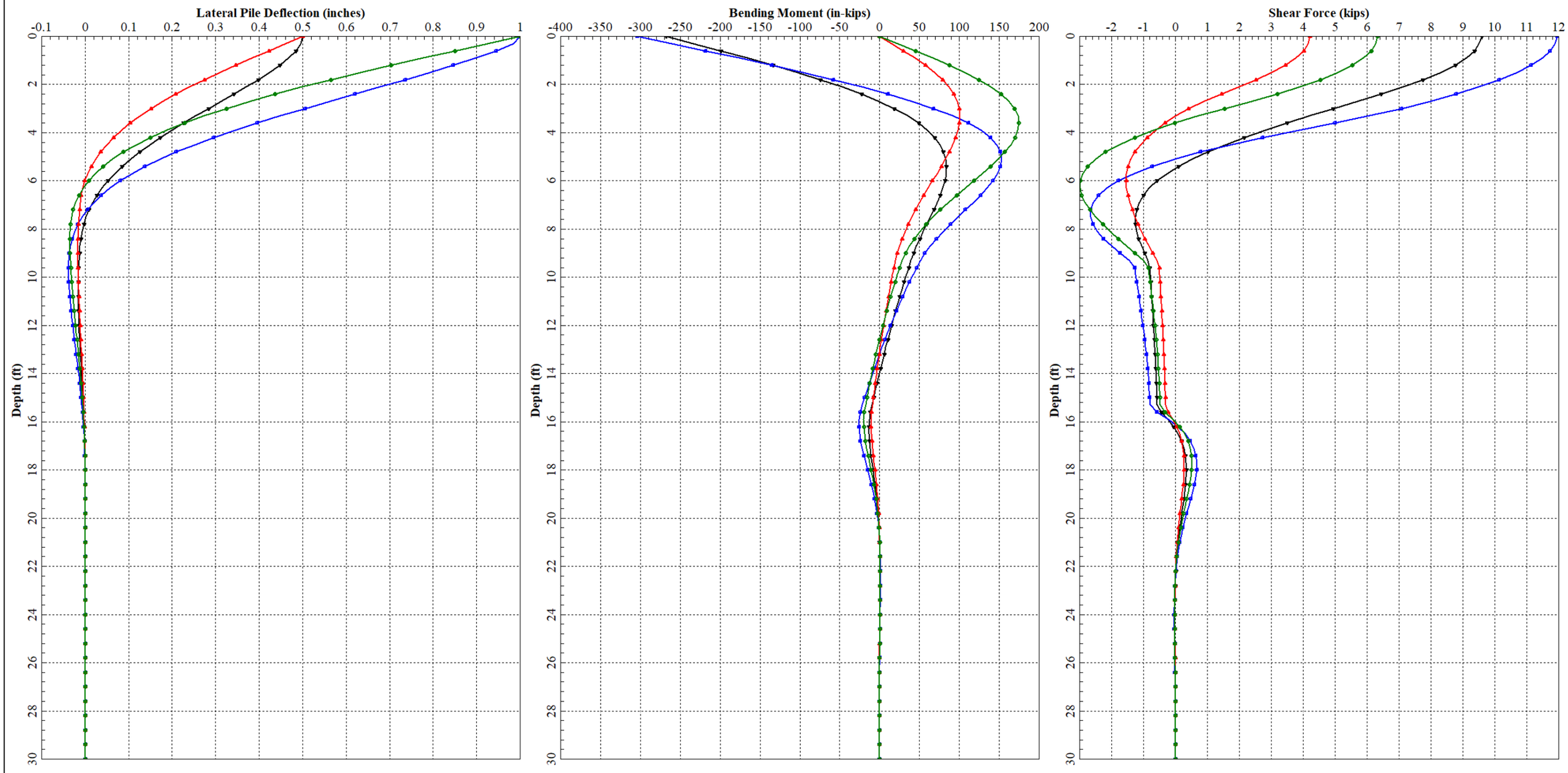
Reference: LPILE v2019.11.02 (Ensoft)

8-inch Micropile LPile Output Plots

ASUW Shell House
Seattle, Washington

GeoEngineers

Figure 11



Assumptions

Pile Diameter = 10”
Head = Both (Fixed and Free)
Steel Reinforcing = 1 #18 bar
P Multiplier = 0.1 (for Liquefied Soil); None (No Group Effects)

Legend

Load Case 1 = 0.5” (Fixed Head) – Black
Load Case 2 = 1.0” (Fixed Head) – Blue
Load Case 3 = 0.5” (Free Head) – Red
Load Case 4 = 1.0” (Free Head) – Green

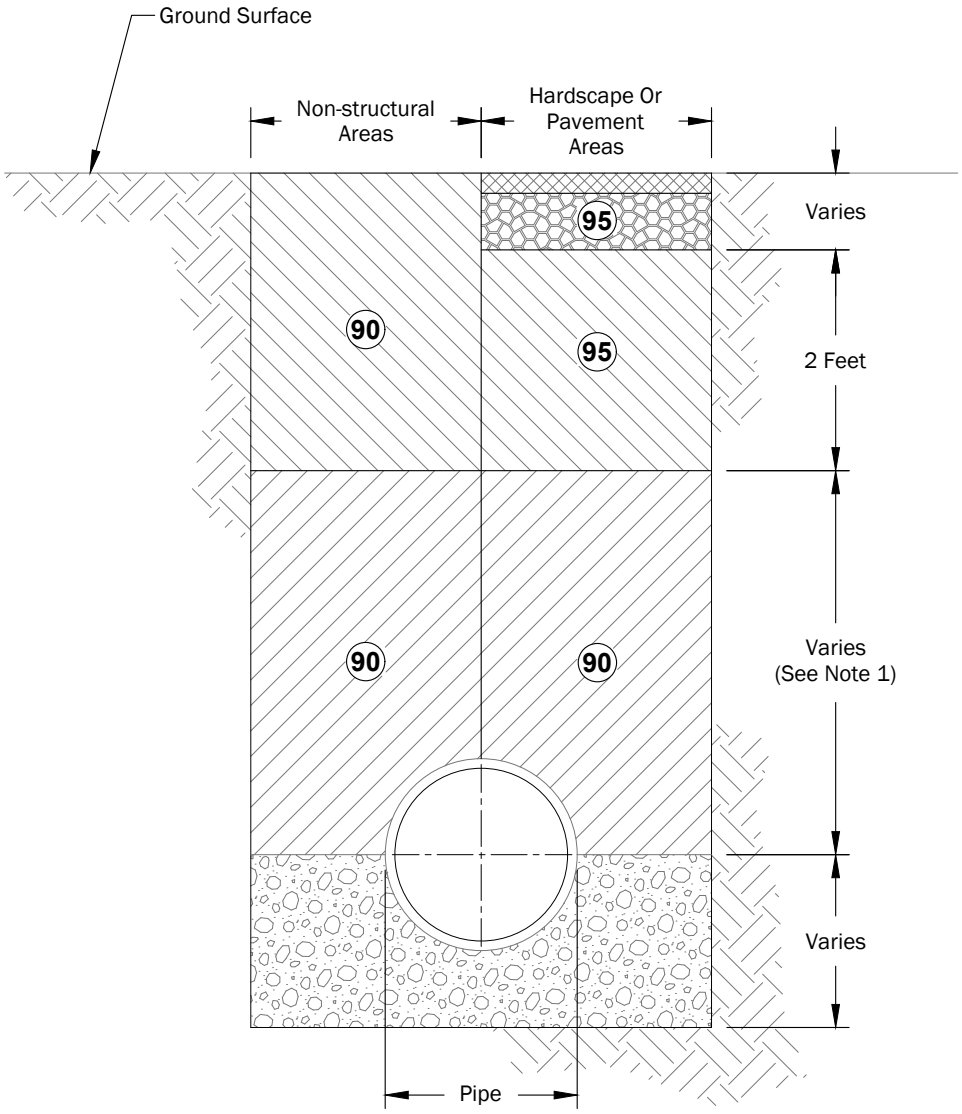
Reference: LPILE v2019.11.02 (Ensoft)

10-inch Micropile LPile Output Plots

ASUW Shell House
Seattle, Washington

GeoEngineers

Figure 12



Not To Scale

Legend

95	Recommended Compaction as a Percentage of Maximum Dry Density, by Test Method ASTM D1557 (Modified Proctor)
	Concrete or Asphalt Pavement
	Base Course
	Trench Backfill
	Pipe Bedding

Notes:

1. All backfill under building areas should be compacted to at least 95 percent per ASTM D1557.

Compaction Criteria for Trench Backfill

ASUW Shell House
Seattle, Washington

GeoEngineers

Figure 13

GeoEngineers

APPENDIX A
Field Explorations

APPENDIX A
FIELD EXPLORATIONS

Subsurface soil and groundwater conditions were evaluated through a field exploration program that consisted of drilling two borings (GEI-1 and GEI-2), excavating three test pits (TP-1 through TP-3), completing four potholes (PH-1 through PH-4) and completing eight CPTs (CPT-1 through CPT-3, CPT-3A, CPT-4 through CPT-4B, and CPT-5).

The locations of the explorations were estimated by taping/pacing from existing site features. The approximate locations of the explorations are shown on Figure 2. Exploration locations should be considered accurate to the degree implied by the method used. Ground surface elevations at the exploration locations were estimated based on the site topography and survey completed by Bush, Roed & Hitchings, Inc.

Borings

Borings GEI-1 and GEI-2 were completed on April 16, 2019 at the approximate locations shown in Figure 2. The borings were advanced to depths ranging from 35½ to 41 feet below ground surface (bgs). The borings were completed using a Diedrich D50 Turbo track-mounted drill rig owned and operated by Advance Drill Technologies, Inc under subcontract to GeoEngineers.

The borings were continuously monitored by a geotechnical engineer from our firm who evaluated and classified the soils encountered, obtained representative soil samples, and observed groundwater conditions. Our representative maintained a detailed log of each boring. Disturbed samples of the representative soil types were obtained from the borings using standard penetration test (SPT) sampling procedures. SPT sampling was performed using a 2-inch outside-diameter split-spoon sampler driven with a standard 140-pound hammer in accordance with ASTM International (ASTM) D 1586.

The soils encountered in the borings were typically sampled at 2½- to 5-foot vertical intervals with the SPT split spoon sampler. Samples were obtained by driving the sampler 18 inches into the soil with an automatic hammer free-falling 30 inches. The number of blows required for each 6 inches of penetration is recorded. The standard penetration resistance ("N-value") of the soil is calculated as the number of blows required for the final 12 inches of penetration (blows per foot). This value is shown on the boring logs. This resistance, or N-value, provides a measure of the relative density of granular soils and the relative consistency of cohesive soils. If the high penetration resistance encountered in the very dense soils precluded driving the total 18-inch sample interval, the penetration resistance for the partial penetration is entered on logs as follows: if the penetration is greater than 6 inches and less than 18 inches, then the number of blows is recorded over the number of inches driven; 30 blows for 6 inches and 50 for 3 inches, for instance, would be recorded as 80/9 inches. The blow counts are shown on the boring logs at the respective sample depths. The SPT is a useful quantitative tool from which soil density/consistency was evaluated.

Soils encountered in the borings were classified in the field in general accordance with ASTM D 2488, the Standard Practice for Classification of Soils, Visual-Manual Procedure, which is summarized in Figure A-1. A log of the borings are provided in Figures A-2 and A-3.

The boring logs are based on our interpretation of the field and laboratory data and indicate the various types of soil and groundwater conditions encountered. The logs also indicate the depths at which these soils or their characteristics change, although the change may be gradual.

Observations of groundwater conditions were made during drilling. The groundwater conditions encountered during drilling are presented on the boring logs. Groundwater conditions observed during drilling represent the short-term condition and may or may not be representative of the long-term groundwater conditions at the site. Groundwater conditions observed during drilling should be considered approximate.

Test Pits

Test pits TP-1 through TP-3 were completed on April 4 and 5, 2024 to depths ranging from approximately 5 to 7½ feet bgs. TP-1 and TP-2 were completed using a Takeuchi TB 138 FR rubber track-mounted mini excavator owned and operated by Kelly's Excavating under subcontract to GeoEngineers. TP-3 was completed using a shovel and post hole digger by a geologist from GeoEngineers.

The test pits were continuously monitored by a geologist from our firm who reviewed and classified the soils encountered, obtained representative soil samples, observed groundwater conditions and prepared a detailed log of each test pit. PITs were completed within TP-1 and TP-2 and a simple infiltration test was completed in TP-3 to determine infiltration rates for potential future infiltration facilities.

Disturbed samples of representative soil types were obtained at representative depths. Soils encountered in the test pits were classified in the field in general accordance with ASTM D 2488, the Standard Practice for Classification of Soils, Visual-Manual Procedure, which is summarized in Figure A-1. A log of the test pits are provided in Figures A-4 through A-6.

The test pit logs are based on our interpretation of the field and laboratory data and indicate the various types of soil and groundwater conditions encountered. The logs also indicate the depths at which these soils or their characteristics change, although the change may be gradual.

Observations of groundwater conditions were made during the excavations. The groundwater conditions encountered during excavation of the test pits are presented on the test pit logs. Groundwater conditions observed during the excavation of the test pits represent short-term conditions and may or may not be representative of the long-term groundwater conditions at the site. Groundwater conditions observed during test pit excavations should be considered approximate.

Potholes

Potholes PH-1 through PH-4 were completed on March 8, 2024 to depths of about 2 to 2½ feet below the ground surface. The potholes were completed using a vacuum truck owned and operated by Applied Professional Services (APS) under subcontract to GeoEngineers. The potholes were completed adjacent to the Shell House to expose the existing shallow foundations and confirm the conditions that the original as-built drawings show, as requested by the project team.

The potholes were continuously monitored by a representative from our firm who reviewed the soil and groundwater conditions, reviewed the shallow foundation conditions and probed subgrade soils below the shallow foundations using a ½-inch-diameter steel probe rod. Soils encountered in the test pits were classified in the field in general accordance with ASTM D 2488, the Standard Practice for Classification of Soils, Visual-Manual Procedure, which is summarized in Figure A-1. A description of each pothole is described below.

- PH-1 was completed at the northeast corner of the Shell House. The pothole exposed the existing shallow foundation at that corner of the building, and based on our observations the foundation appears to match the dimensions shown on the plans. The bottom of footing was approximately 2½ feet below adjacent site grades. Subgrade soils at the bottom of the foundation consisted of silty sand with occasional gravel, which matches the description of structural fill. We probed the subgrade soils at the base of the foundation and observed probe depths ranging from 6 to 12 inches, which indicates that the soil is in a loose condition. Standing water was visible at the bottom of the pothole, which is likely associated with the adjacent storm drain utility trench that runs east-west. Based on discussions with the project team, it is our understanding that the storm drain pipe is perforated, which may be contributing to the observed water. We did not observe any significant organic matter.
- PH-2 was completed at the southeast corner of the Shell House. The pothole exposed the existing shallow foundation at that corner of the building, and based on our observations the foundation appears to match the dimensions shown on the plans. The bottom of footing was approximately 2.3 to 2½ feet below adjacent site grades. Subgrade soils at the bottom of the foundation consisted of silty sand with occasional gravel, which matches the description of structural fill. We probed the subgrade soils at the base of the foundation and observed probe depths of about 2 to 3 inches, which indicates a medium dense condition. No standing water was visible at the bottom of the pothole. We did not observe any significant organic matter.
- PH-3 was completed at the southwest corner of the Shell House. The pothole exposed the existing shallow foundation at the corner of the building, and based on our observations the foundation appears to match the dimensions shown on the plans. The bottom of footing was approximately 2.3 to 2½ feet below adjacent site grades. Subgrade soils at the bottom of the foundation consisted of silty sand with occasional gravel, which matches the description of structural fill. We probed the subgrade soils at the base of the foundation and observed probe depths of about 2 to 3 inches, which indicates a medium dense condition. No standing water was visible at the bottom of the pothole. We did not observe any significant organic matter.
- PH-4 was completed on the northern wall of the Shell House (east of the entry door at the northwest corner). The pothole exposed a running footing beneath the north wall, and it appeared that the running footing continued in both the east and west directions. The bottom of the footing was approximately 2 feet below adjacent site grades, and there did not appear to be any base to the foundation (no “L” or “T” shape). Subgrade soils at the bottom of the foundation consisted of silty sand with occasional gravel, which matches the description of structural fill. We probed the subgrade soils at the base of the foundation and observed probe depths of about 1 to 2 inches, which indicates a medium dense condition. No standing water was visible at the bottom of the pothole. We did not observe any significant organic matter.

Cone Penetration Tests

CPT-1 through CPT-4, CPT-4A, and CPT-5 were completed on March 7, 2024. CPT-3A and CPT-4B were completed on March 22, 2024. The CPTs were advanced to depths ranging from about 6½ to 16 feet below existing site grades. The CPTs were completed using either a truck- or track-mounted CPT rig owned and operated by In Situ Engineering under subcontract to GeoEngineers.

The CPT is a subsurface exploration technique in which a small-diameter steel tip with adjacent sleeve is continuously advanced with hydraulically operated equipment. Measurements of tip and sleeve resistance allow interpretation of the soil profile and the consistency of the strata penetrated. The tip resistance, friction ratio, and pore water pressure are recorded on the CPT logs. The logs of the CPT probes are presented in Figures A-7 through A-14.

Pore water dissipation tests were conducted in CPT-1, CPT-2, CPT-3A, CPT-4B and CPT-5 to estimate groundwater levels. The dissipation tests are impacted by soils that have high fines content, which the soils at the site have (especially the glacial till and peat). The high fines content makes it difficult for the CPT instrumentation to determine the pore water dissipation rates. Groundwater conditions in the CPTs represent short-term conditions and may not be representative of long-term groundwater conditions at the site.

Seismic shear wave velocity testing was completed in CPT-1, CPT-3A, CPT-4B, and CPT-5 to determine shear wave velocities of the site soils. The shear wave velocities were used in determining the site class for the site.

Practical refusal was encountered in several of the CPTs at depths earlier than anticipated, which led to re-pushing of some of the CPTs (CPT-3A, CPT-4A and CPT-4B). CPT-3A and CPT-4B were pre-drilled to a depth of one foot below the practical refusal depth from the prior CPT. The CPT was then pushed from that depth of the pre-drill. Re-pushing of the CPTs was completed to confirm that practical refusal was due to glacially consolidated soils and not from an obstruction (such as a cobble/boulder or other debris).

SOIL CLASSIFICATION CHART

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

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

ADDITIONAL MATERIAL SYMBOLS

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

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Sampler Symbol Descriptions

Modified California Sampler (6-inch sleeve) or Dames & Moore

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

Continuous Coring

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

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

"WOH" indicates sampler pushed using the weight of the hammer.

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point load test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
UU	Unconsolidated undrained triaxial compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

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

Key to Exploration Logs

GeoEngineers

Figure A-1

Drilled Start 4/16/2019 End 4/16/2019	Total Depth (ft) 41	Logged By CWM Checked By CWM	Driller Advance Drill Technologies, Inc.	Drilling Method Hollow-stem Auger	
Surface Elevation (ft) 24 Vertical Datum NAVD88		Hammer Data Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment Diedrich D50 Turbo	
Easting (X) 1278831 Northing (Y) 239779		System Datum WA State Plane North NAD83 (feet)		See "Remarks" section for groundwater observed	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0						AC	1½ inches asphalt concrete pavement			
							CR	2 inches base course			
		10	16		1 SA		SM	Brown-gray silty fine to coarse sand with gravel (medium dense, moist) (fill)	13	15	
	5	8	36		2		GM	Gray silty fine to medium gravel with sand (dense, moist to wet)			
		10	19		3 %F		SM	Brown-gray silty fine to medium sand; slight oxidation staining (medium dense, moist to wet) (alluvium)	12	19	Groundwater observed at 8½ feet during drilling
	10	12	31		4		SM	Gray silty fine to medium sand (dense, moist to wet)			
		14	11		5 %F		SP	Gray fine to medium sand (medium dense, wet)	21	4	
	15	14	50*		6 %F		SP-SM	Gray fine to medium sand with silt (dense, wet)	17	7	*Blow counts not representative due to heave
							ML	Gray sandy silt with occasional gravel (hard, wet) (glacial till)			
	20	8	50/6"		7 %F				14	52	
							SM	Gray silty fine to medium sand with occasional gravel (very dense, moist to wet)			
	25	3	50/4"		8			Increased gravel content			
	30										

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

Log of Boring GEI-1

GeoEngineers

Project: ASUW Shell House
Project Location: Seattle, Washington
Project Number: 0183-139-00

Figure A-2
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Collected Sample	FIELD DATA: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
-10	30	4.5	50/4.5"		9						Rough drilling
	35	4	50/3"		10			Gravel layer			Rough drilling
-15	40	12	50/6"		11 MC			Increased gravel content	12		

Date:5/1/24 Path:P:\0\0183139\GINT\0183139.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_GEOTECH_STANDARD_%F_NO_GW

Log of Boring GEI-1 (continued)

GeoEngineers

Project: ASUW Shell House
Project Location: Seattle, Washington
Project Number: 0183-139-00

Figure A-2
Sheet 2 of 2

Drilled: Start 4/16/2019 End 4/16/2019	Total Depth (ft) 35.5	Logged By CWM Checked By CWM	Driller Advance Drill Technologies, Inc.	Drilling Method Hollow-stem Auger	
Surface Elevation (ft) 23 Vertical Datum NAVD88		Hammer Data Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment Diedrich D50 Turbo	
Easting (X) 1278977 Northing (Y) 239702		System Datum WA State Plane North NAD83 (feet)		See "Remarks" section for groundwater observed	

Notes:

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0						SOD	2 inches grass and sod			
							SM	Brown silty fine to medium sand (medium dense, moist) (fill)			
20		12	3		1 MC		SM	Brown silty fine to medium sand, organic matter (very loose, moist to wet)	57		
	5	13	1/18"		2A		PT	Brown-black peat with occasional sand (very loose, wet) (alluvium)			Groundwater observed at 4½ feet during drilling
					2B OC				229		OC = 29%
15		4	1/18"		3						
	10	12	7		4 %F		SM	Gray silty fine to medium sand, organic matter, slight plasticity (loose, wet)	25	29	
10		12	40		5 MC		ML	Gray silt with occasional sand (very stiff to hard, moist) (glaciolacustrine deposits)	19		
	15	14	26		6 MC			Organic matter and gravel	27		
5							SM	Gray silty fine to medium sand with gravel (very dense, moist) (glacial till)			
	20	6	50/3"		7 MC				15		
0											
	25	0	50/3"		8						Sampler bouncing on rock
-5								Sand and gravel layers			
	30										

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Topographic Survey. Vertical approximated based on Topographic Survey.

Date:5/1/24 Path:P:\0\0183139\GINT\0183139000.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_GEOTECH_STANDARD_%F_NO_GW

Log of Boring GEI-2

GeoEngineers

Project: ASUW Shell House
Project Location: Seattle, Washington
Project Number: 0183-139-00

Figure A-3
Sheet 1 of 2

Elevation (feet)	Depth (feet)	FIELD DATA: Interval Recovered (in)	FIELD DATA: Blows/foot	FIELD DATA: Collected Sample	FIELD DATA: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
-10	30	3	50/3"		9						Rough drilling
	35	4	100/4"		10						

Log of Boring GEI-2 (continued)

GeoEngineers

Project: ASUW Shell House
Project Location: Seattle, Washington
Project Number: 0183-139-00

Figure A-3
Sheet 2 of 2

Date Excavated	4/4/2024	Total Depth (ft)	7	Logged By RM Checked By BA	Excavator Kelly's Excavating Equipment Takeuchi TB 138 FR	See "Remarks" section for groundwater observed Caving not observed
Surface Elevation (ft) Vertical Datum	27 NAVD88	Easting (X) Northing (Y)	1278868 239847	Coordinate System Horizontal Datum	WA State Plane North NAD83 (feet)	

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
26	0				SOD	Approximately 6 inches of sod			
	1				ML	Gray silt with sand; moderate oxidation staining (medium stiff, moist) (fill)			
25	2		1						
24	3				GM	Gray silty fine gravel with sand (dense, moist)			
23	4		2 SA; OC				7	12	Small-scale PIT completed at 4 feet below ground surface (bgs) Organic content = 0.8% Cation Exchange Capacity = 7.7 meq/100g
22	5				SP-SM	Gray fine to medium sand with silt and gravel (dense, moist) (glacial till)			
21	6		3						Moderate groundwater seepage observed at approximately 5¾ feet bgs
20	7								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Test Pit TP-1

GeoEngineers

Project: ASUW Shell House
Project Location: Seattle, Washington
Project Number: 0183-139-00

Figure A-4
Sheet 1 of 1

Date Excavated	4/4/2024	Total Depth (ft)	7.5	Logged By RM Checked By BA	Excavator Kelly's Excavating Equipment Takeuchi TB 138 FR	See "Remarks" section for groundwater observed See "Remarks" section for caving observed

Surface Elevation (ft) Vertical Datum	24 NAVD88	Easting (X) Northing (Y)	1278823 239715	Coordinate System Horizontal Datum	WA State Plane North NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					GP	Approximately 3 inches of gravel surfacing			
					ML	Gray sandy silt with organic matter (medium stiff, moist) (fill)			Minor caving observed at approximately ½ foot bgs
23	1								
22	2	■	1 SA; OC				57	64	Small-scale PIT completed at 2 feet bgs Woody debris Organic content = 8.6% Cation Exchange Capacity = 8.6 meq/100g Slow groundwater seepage observed at approximately 2¼ feet bgs
21	3								
20	4	■	2 OC		PT	Black sandy peat (soft, moist) (alluvium)	399		Organic content = 54.4%
					SM	Gray silty fine to medium sand with occasional gravel (medium dense, moist)			
19	5								
18	6	■	3						
17	7								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Test Pit TP-2

GeoEngineers

Project: ASUW Shell House
Project Location: Seattle, Washington
Project Number: 0183-139-00

Figure A-5
Sheet 1 of 1

Date Excavated	4/4/2024	Total Depth (ft)	5	Logged By CRG Checked By BA	Excavator GeoEngineers, Inc. Equipment Hand tools	Groundwater not observed Caving not observed
Surface Elevation (ft) 23 Vertical Datum NAVD88		Easting (X) 1278967 Northing (Y) 239748		Coordinate System WA State Plane North Horizontal Datum NAD83 (feet)		

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
22	1				TS	Approximately 12 inches of topsoil			
					SM	Gray/brown silty fine to medium sand with occasional gravel (medium dense, moist) (fill)			
21	2								Simple infiltration test completed at 2 feet bgs
20	3								
19	4								
18	5								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on . Vertical approximated based on .

Log of Test Pit TP-3

GeoEngineers

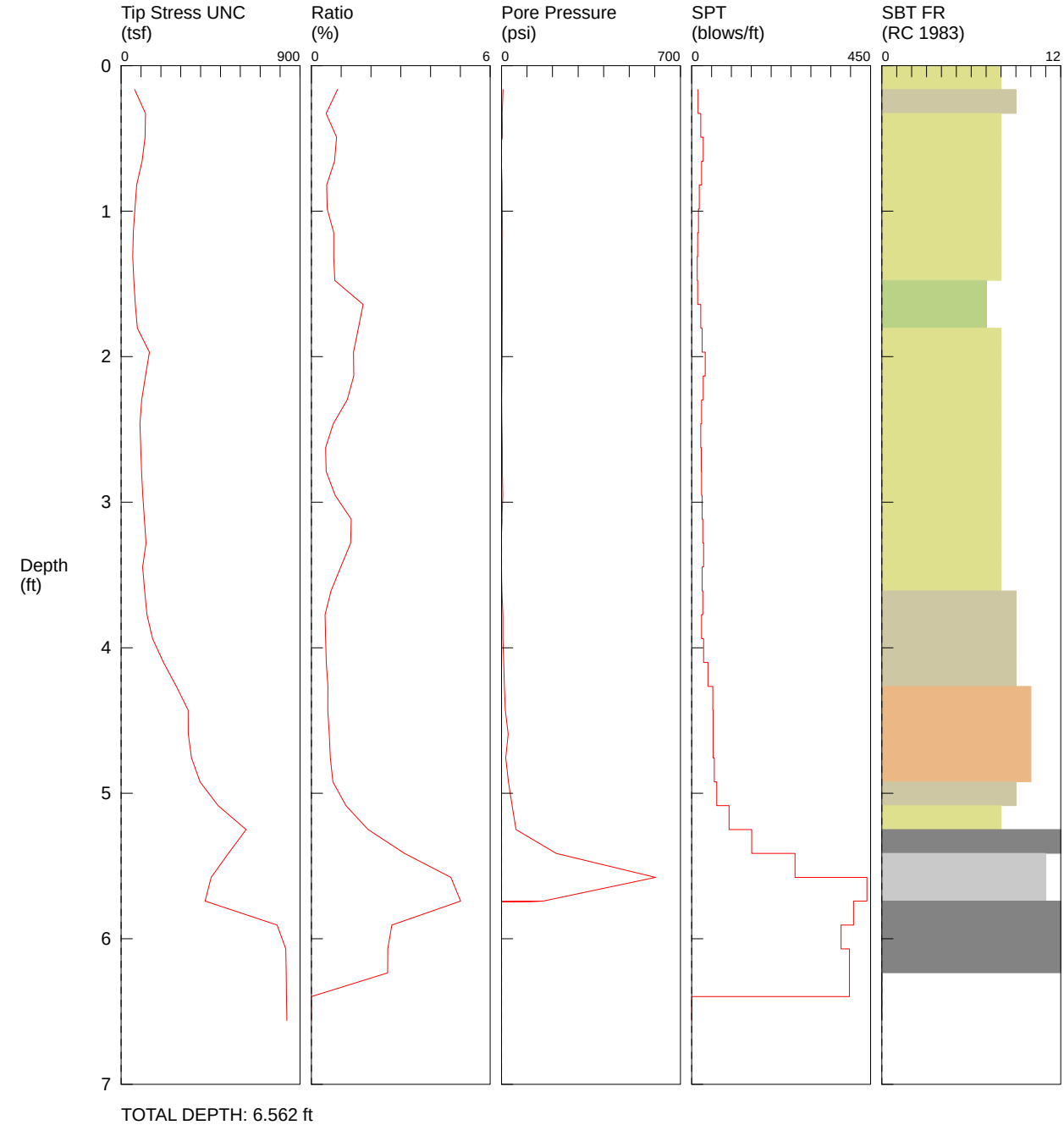
Project: ASUW Shell House
Project Location: Seattle, Washington
Project Number: 0183-139-00

Figure A-6
Sheet 1 of 1

CPT-01

CPT CONTRACTOR: : In Situ Engineering
CUSTOMER: GeoEngineers
LOCATION: Seattle
JOB NUMBER: 0183-139-00

OPERATOR: Forinash/Okbay
CONE ID: DDG1369
TEST DATE: 3/7/2024 2:05:24 PM
PREDRILL:: 0 ft
BACKFILL:: 20% Bentonite Slurry & Chips
SURFACE PATCH:: None



TOTAL DEPTH: 6.562 ft

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

Figure A-7

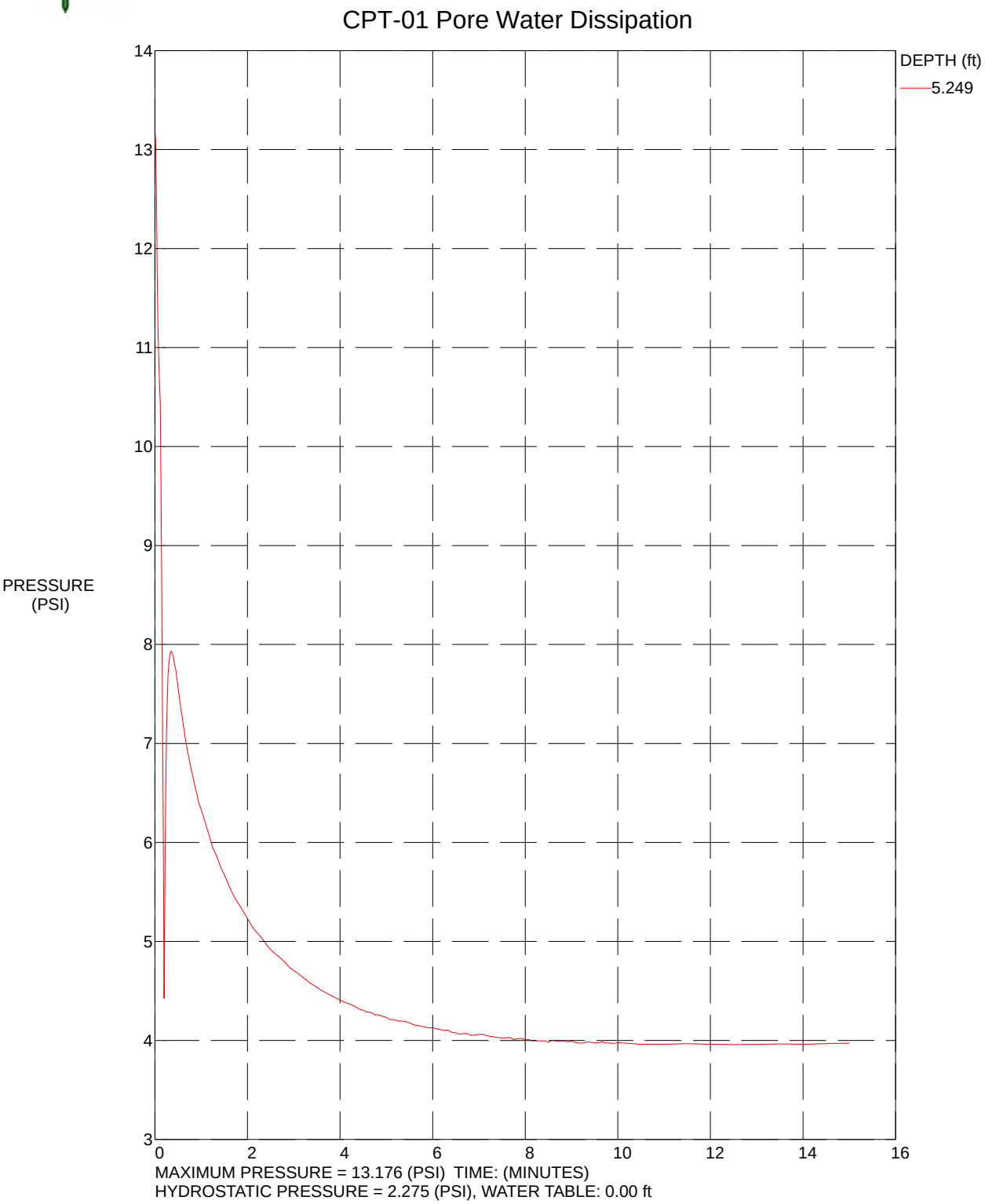
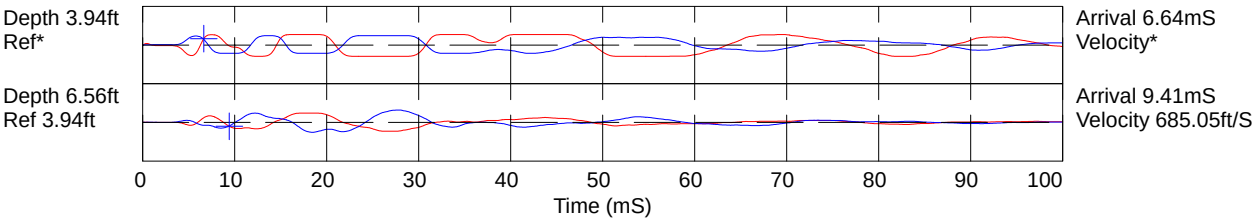


Figure A-7 cont'd

CPT-01

SEISMIC TEST



Hammer to Rod String Distance (ft): 4.92
* = Not Determined

COMMENT:

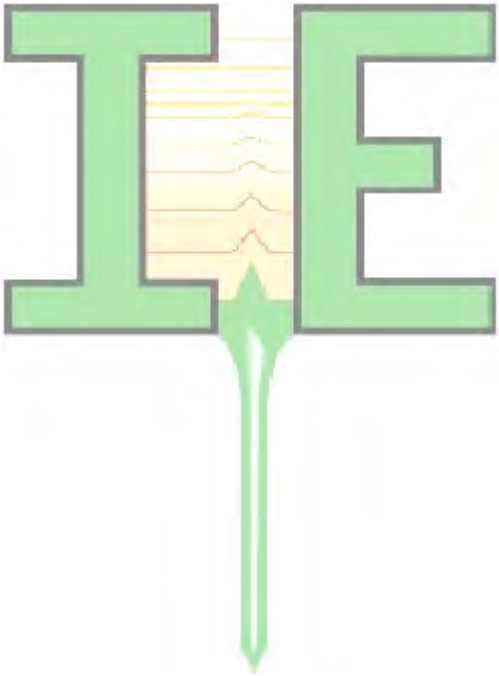
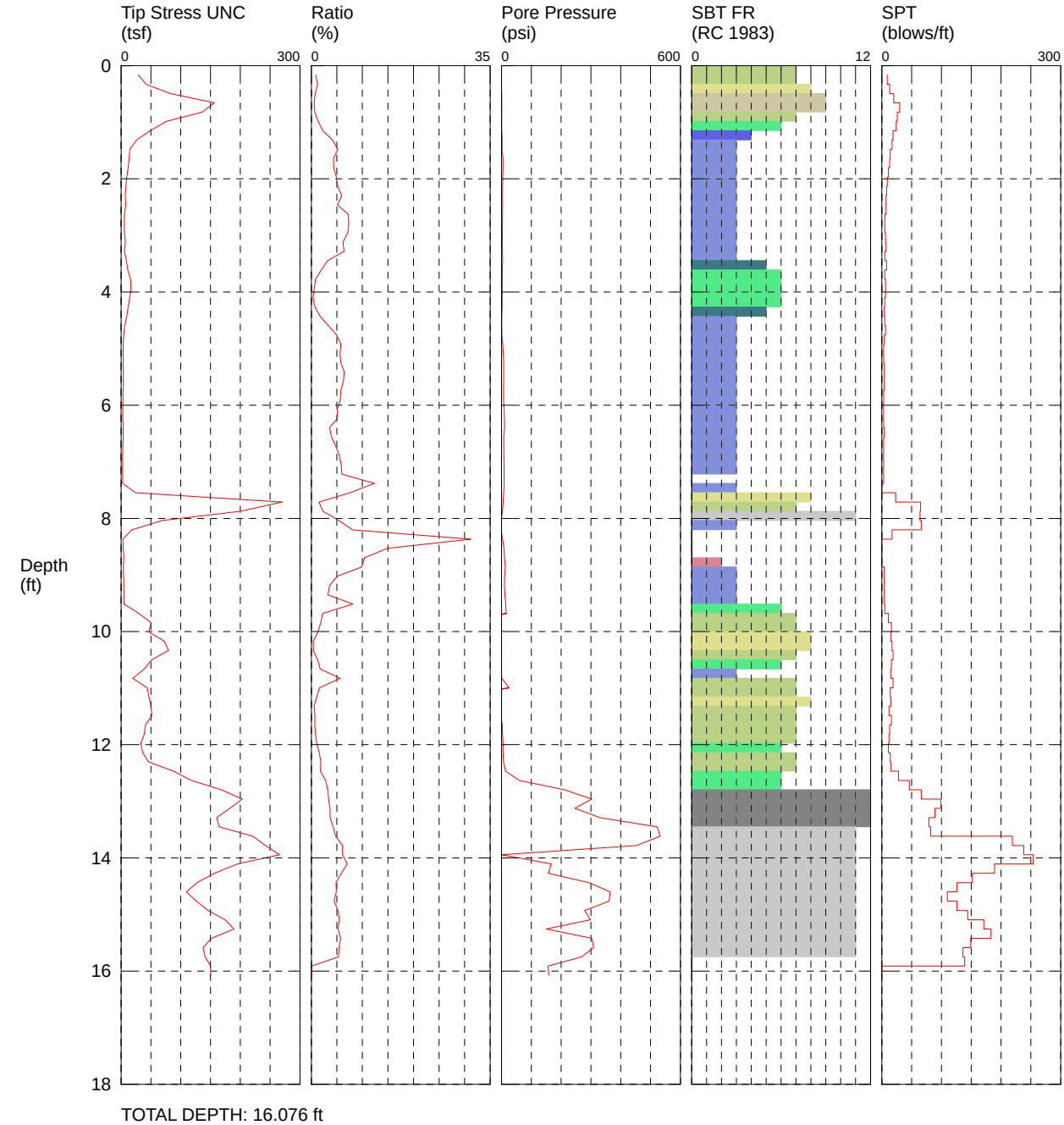


Figure A-7 cont'd

CPT-02

CPT CONTRACTOR: : In Situ Engineering
CUSTOMER: GeoEngineers
LOCATION: Seattle
JOB NUMBER: 0183-139-00

OPERATOR: Forinash/Okbay
CONE ID: DDG1369
TEST DATE: 3/7/2024 11:37:12 AM
PREDRILL:: 0 ft
BACKFILL:: 20% Bentonite Slurry & Chips
SURFACE PATCH:: None



TOTAL DEPTH: 16.076 ft

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

Figure A-8

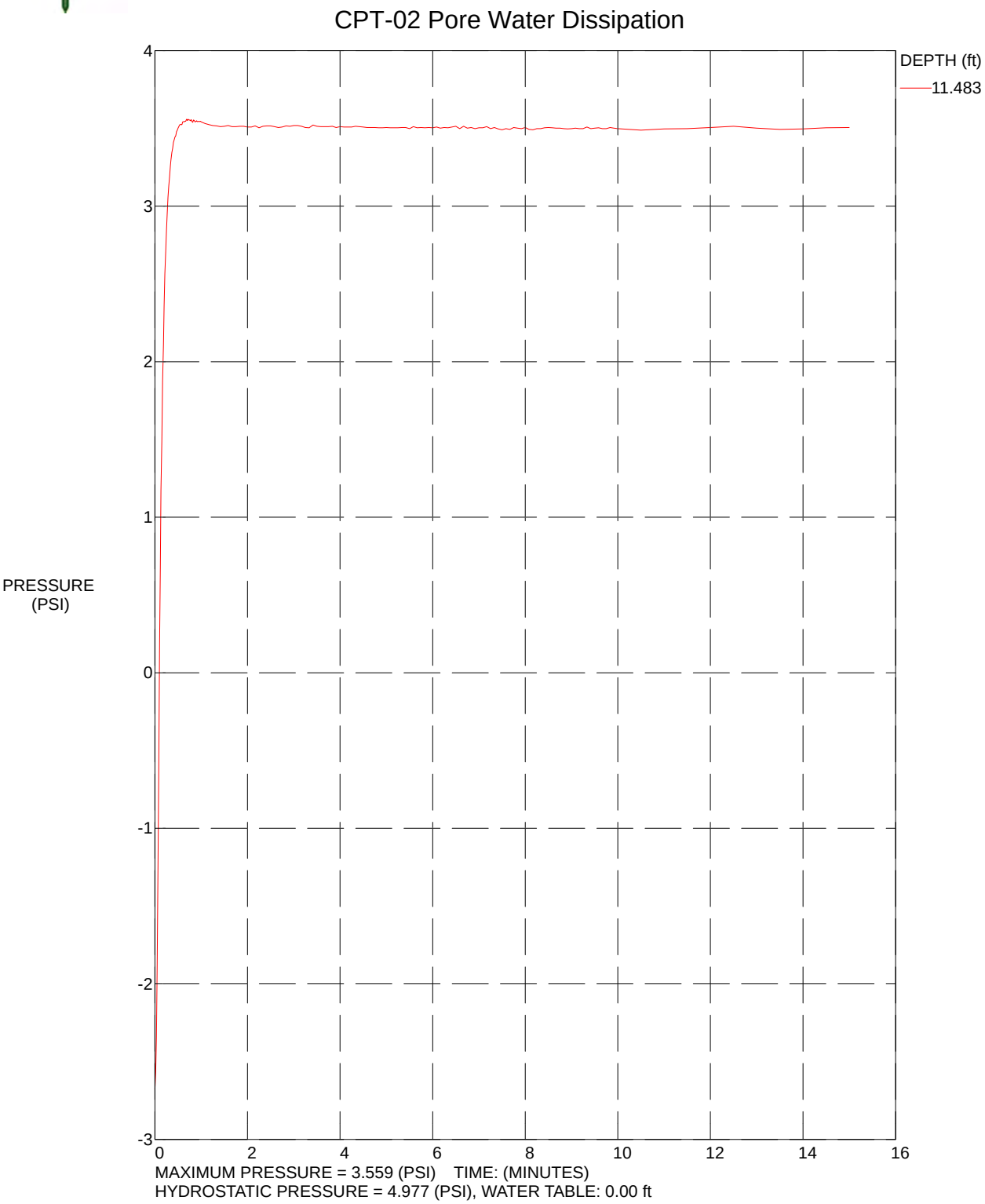
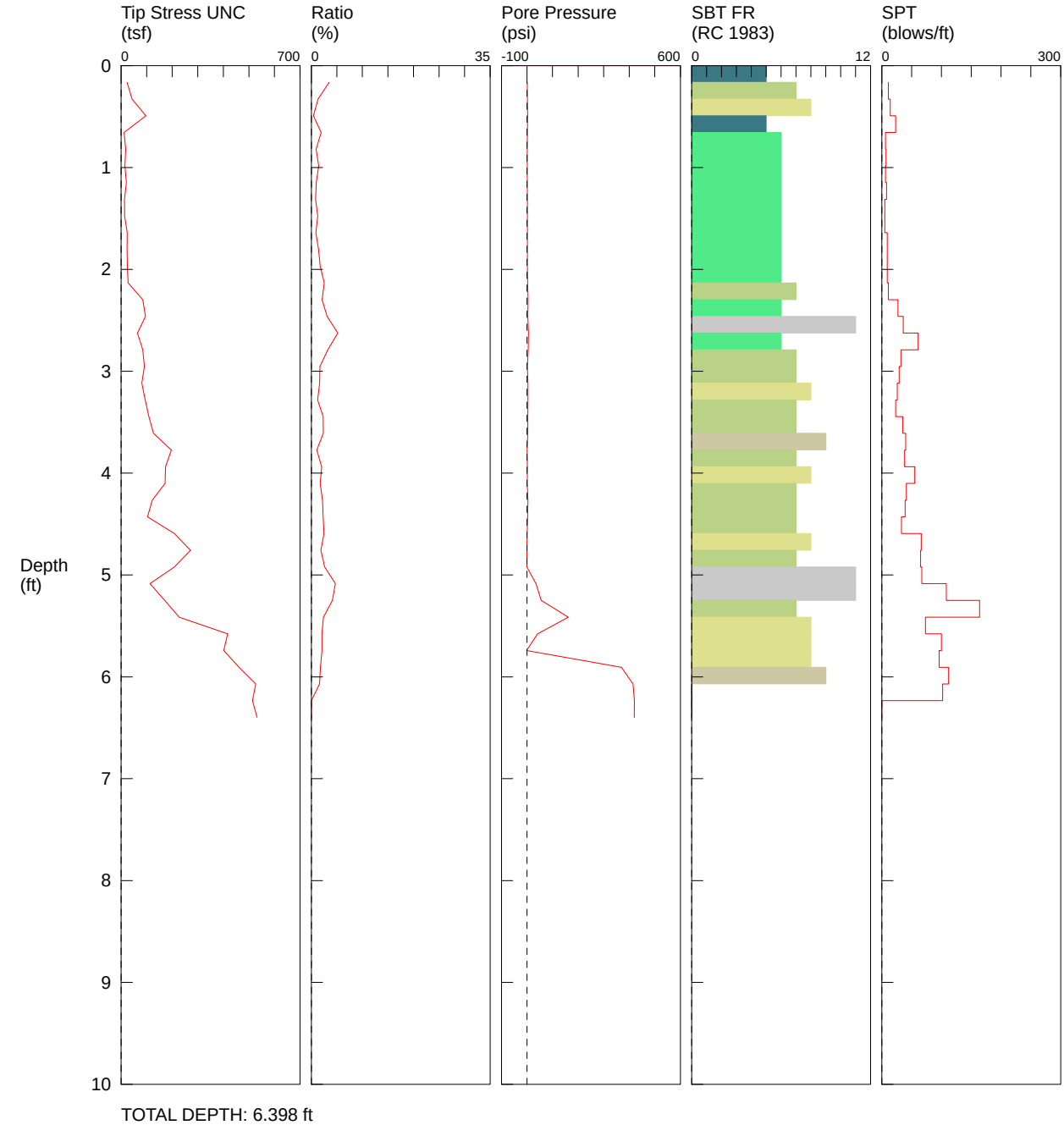


Figure A-8 cont'd

CPT-03

CPT CONTRACTOR: : In Situ Engineering
CUSTOMER: GeoEngineers
LOCATION: Seattle
JOB NUMBER: 0183-139-00

OPERATOR: Forinash/Okbay
CONE ID: DDG1369
TEST DATE: 3/7/2024 12:19:13 PM
PREDRILL:: 0 ft
BACKFILL:: 20% Bentonite Slurry & Chips
SURFACE PATCH:: None



TOTAL DEPTH: 6.398 ft

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

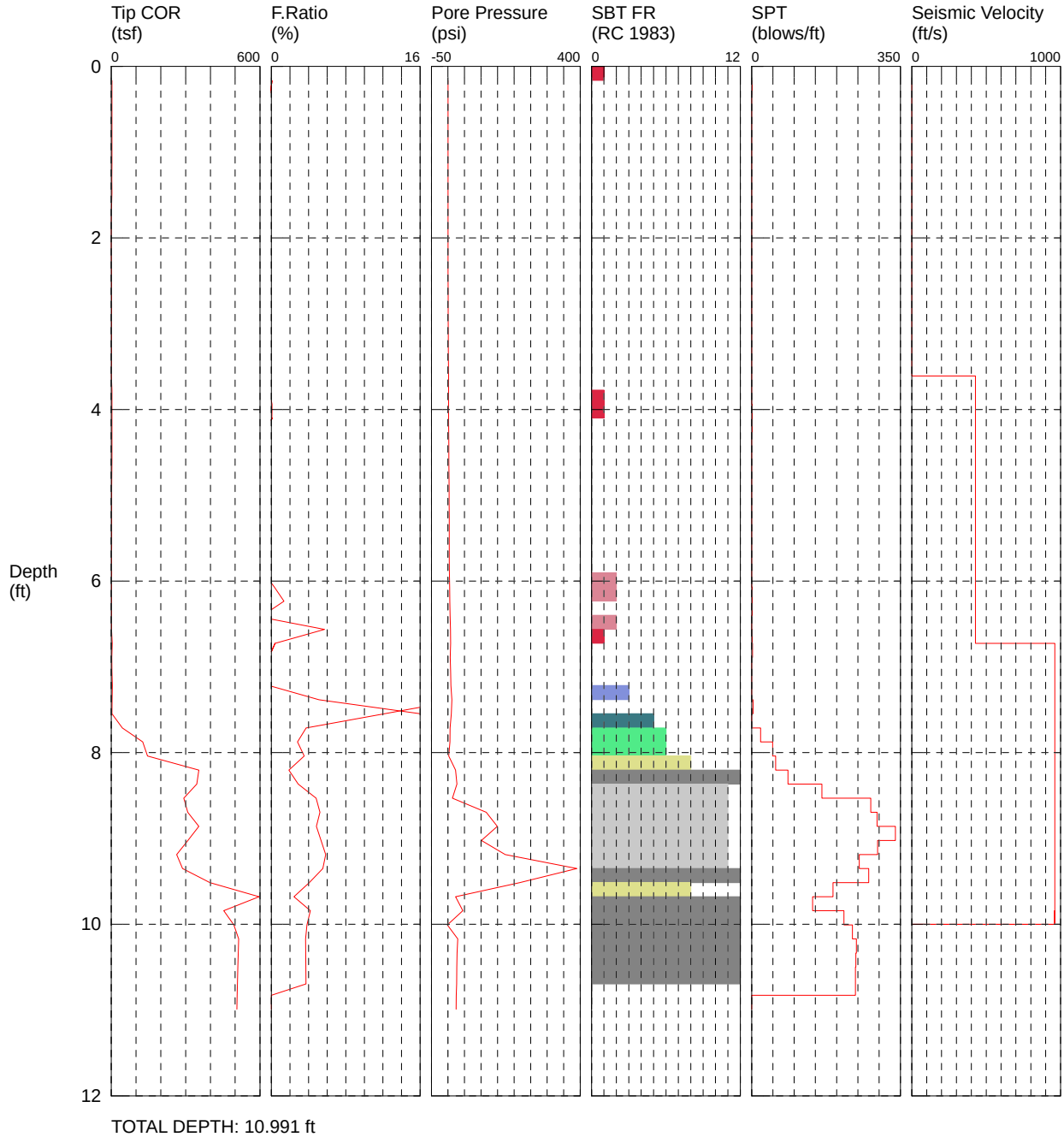
*SBT/SPT CORRELATION: UBC-1983

Figure A-9

CPT - 3A

CPT Contractor: In SItu Engineering
CUSTOMER: GeoEngineers
LOCATION: Seattle
JOB NUMBER: 0183-139-00

OPERATOR: Okbay
CONE ID: DDG1351
TEST DATE: 3/22/2024 10:01:44 AM
PREDRILL: 8 ft
BACKFILL: 20% Bentonite slurry & Chips
SURFACE PATCH: None



TOTAL DEPTH: 10.991 ft

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

Figure A-10

HOLE NUMBER: CPT - 3A Pore Water Dissipation

CPT Contractor: In SItu Engineering
PREPARED BY: GeoEngineers
LOCATION: Seattle
JOB NUMBER: 0183-139-00

OPERATOR: Okbay
CONE ID: DDG1351
TEST DATE: 3/22/2024 11:09:35 AM
PREDRILL: 8 ft
BACKFILL: 20% Bentonite slurry & Chips
SURFACE PATCH: None

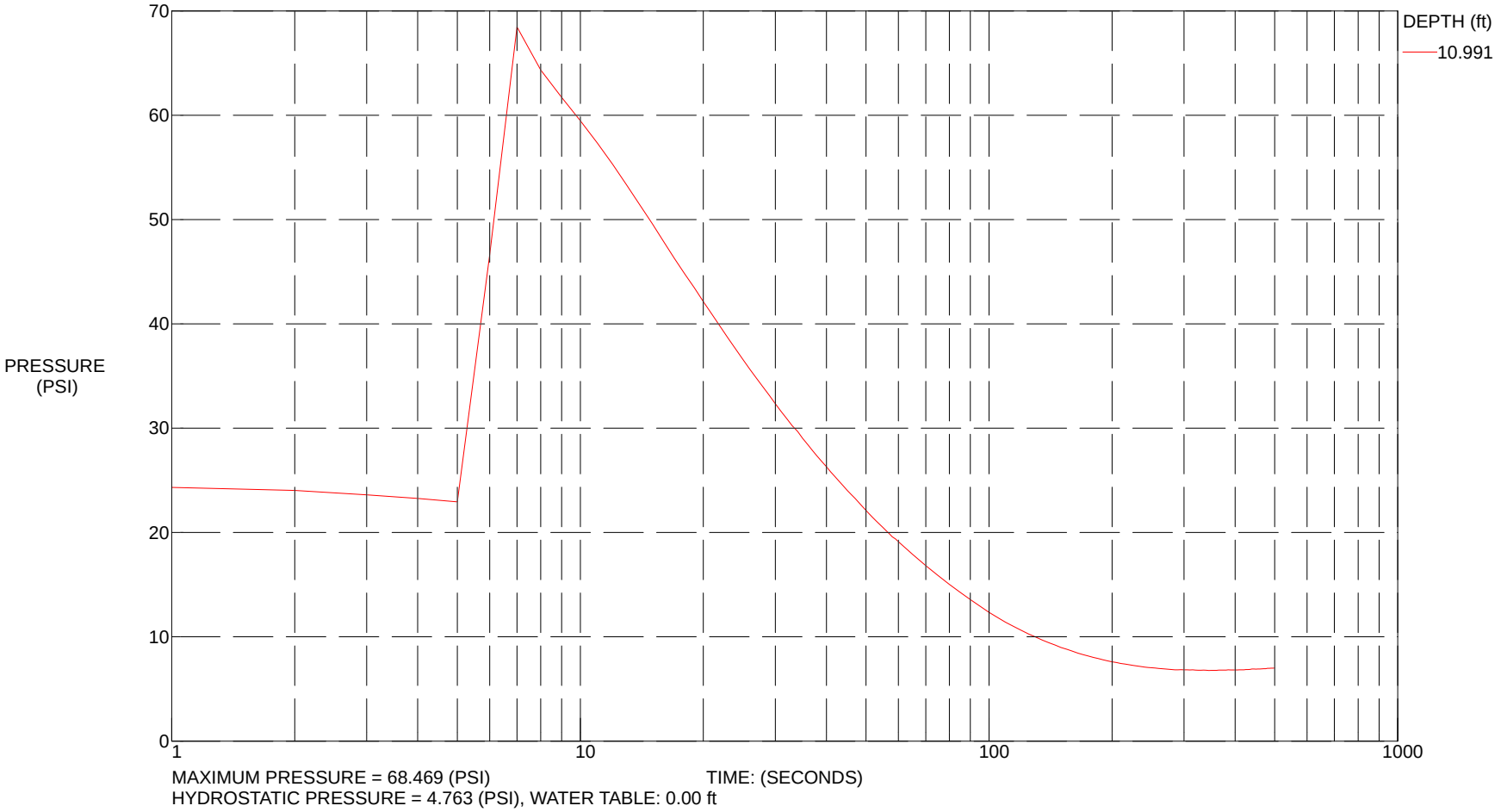
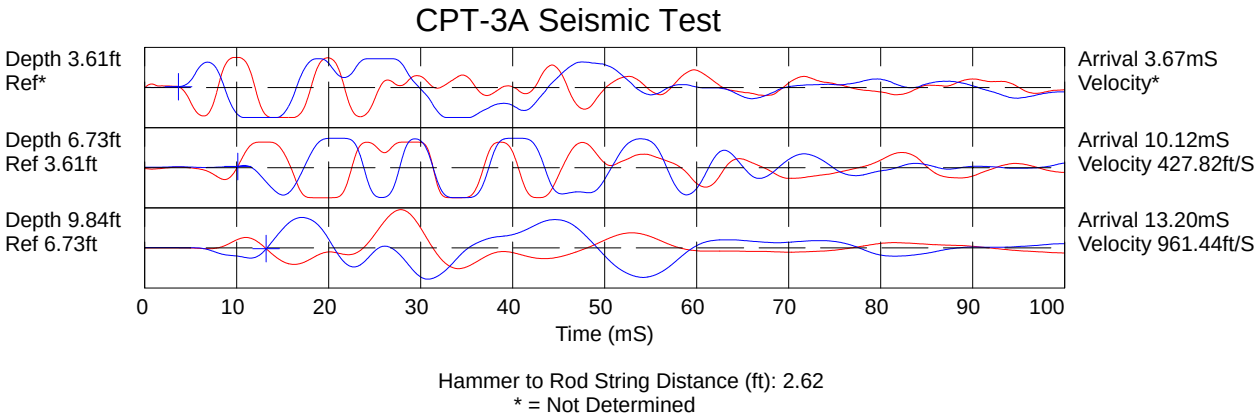


Figure A-10 cont'd



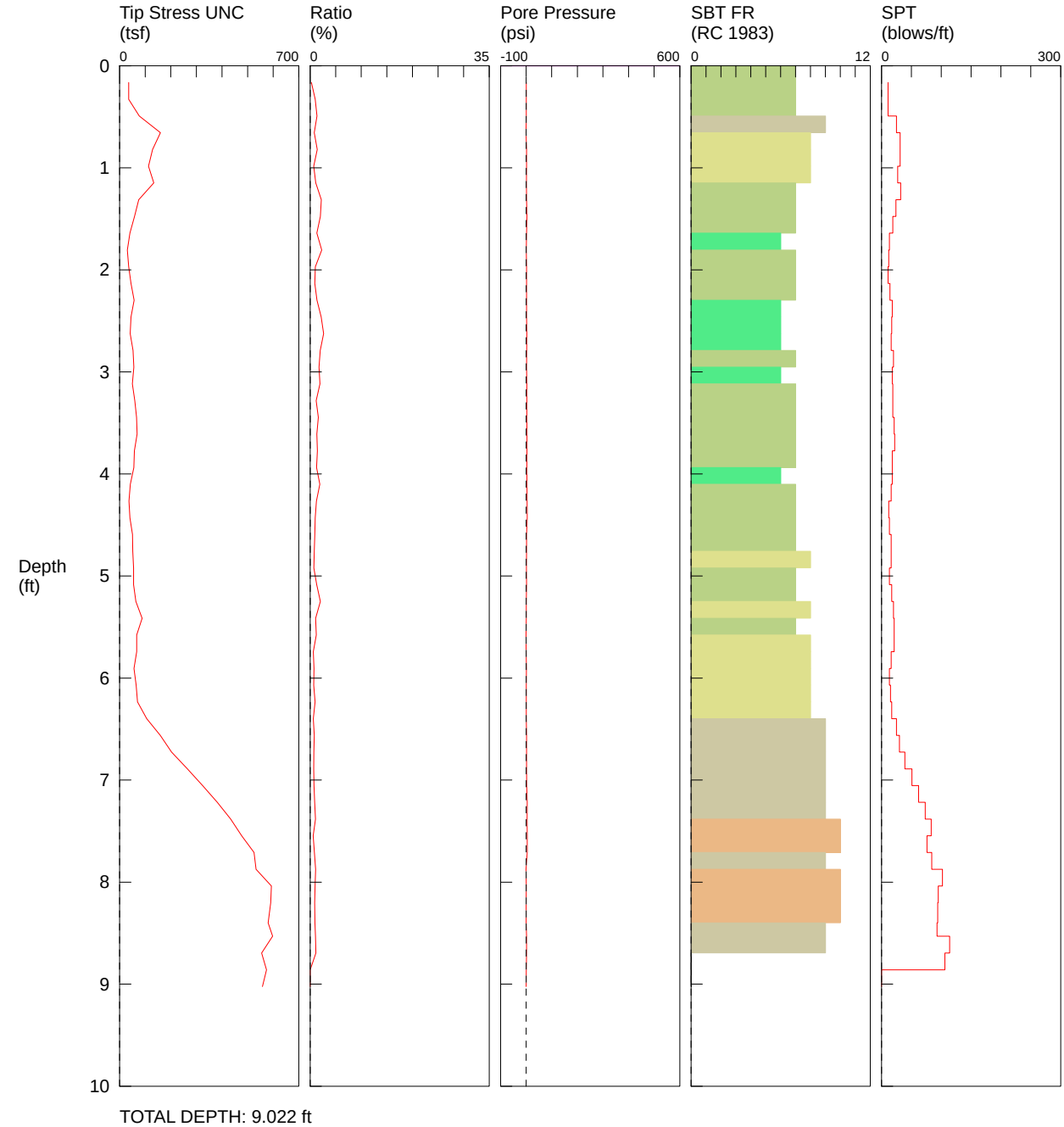
Hammer to Rod String Distance (ft): 2.62
* = Not Determined

Figure A-10 cont'd

CPT-04

CPT CONTRACTOR: : In Situ Engineering
CUSTOMER: GeoEngineers
LOCATION: Seattle
JOB NUMBER: 0183-139-00

OPERATOR: Forinash/Okbay
CONE ID: DDG1369
TEST DATE: 3/7/2024 12:43:02 PM
PREDRILL:: 0 ft
BACKFILL:: 20% Bentonite Slurry & Chips
SURFACE PATCH:: None



TOTAL DEPTH: 9.022 ft

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

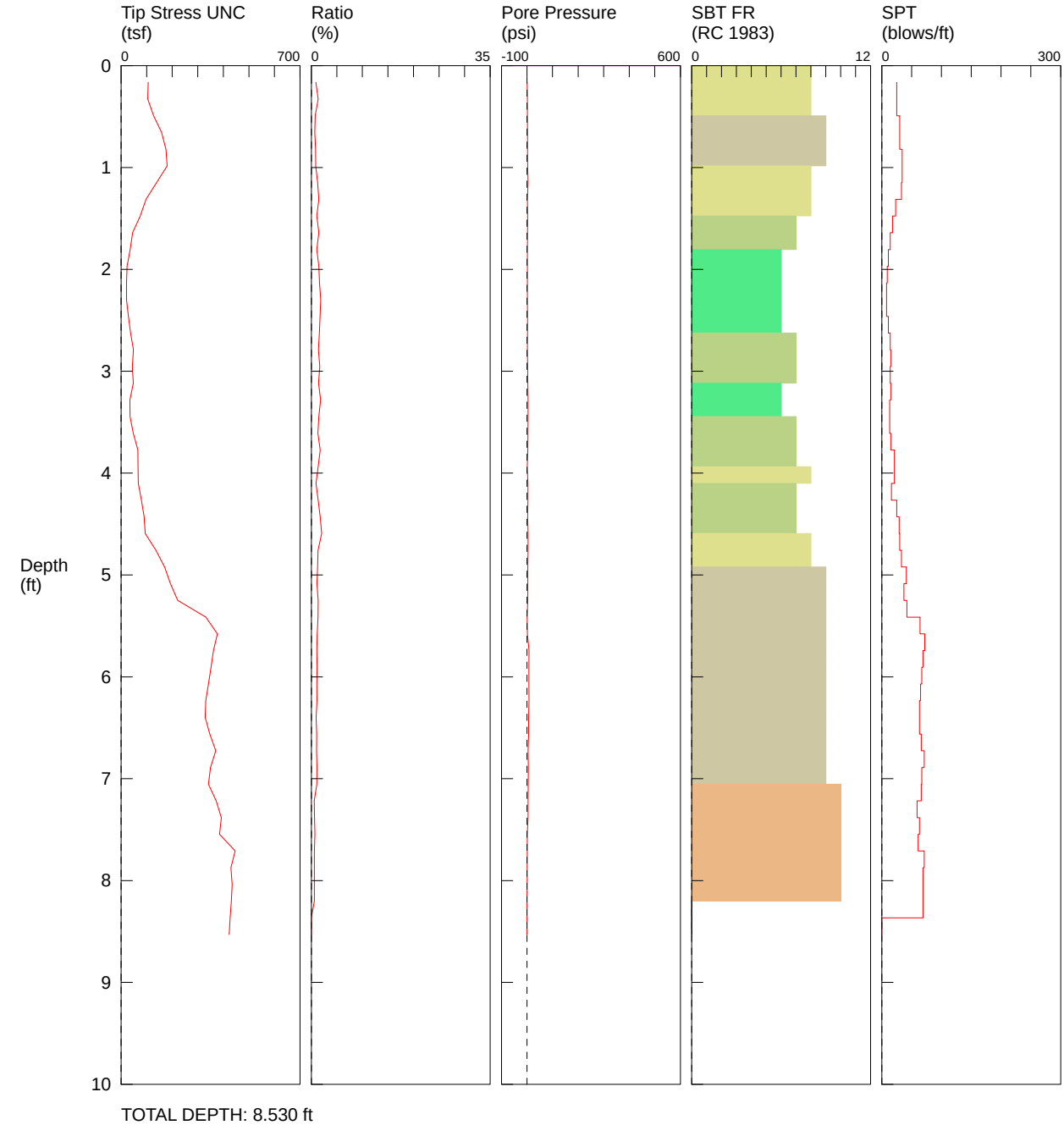
*SBT/SPT CORRELATION: UBC-1983

Figure A-11

CPT-04A

CPT CONTRACTOR: : In Situ Engineering
CUSTOMER: GeoEngineers
LOCATION: Seattle
JOB NUMBER: 0183-139-00

OPERATOR: Forinash/Okbay
CONE ID: DDG1369
TEST DATE: 3/7/2024 12:56:11 PM
PREDRILL:: 0 ft
BACKFILL:: 20% Bentonite Slurry & Chips
SURFACE PATCH:: None



TOTAL DEPTH: 8.530 ft

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

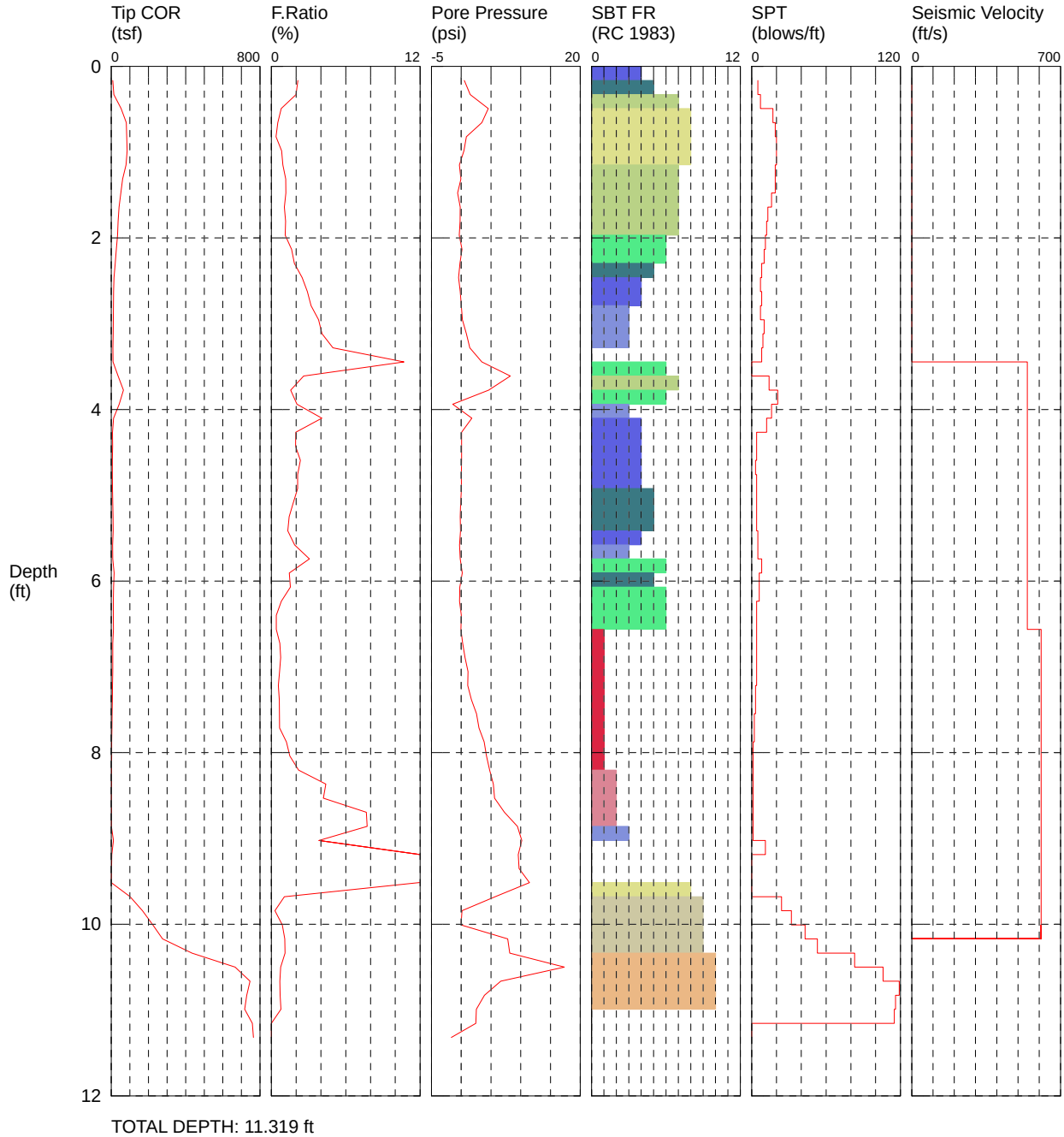
*SBT/SPT CORRELATION: UBC-1983

Figure A-12

CPT - 4B

CPT Contractor: In SItu Engineering
CUSTOMER: GeoEngineers
LOCATION: Seattle
JOB NUMBER: 0183-139-00

OPERATOR: Okbay
CONE ID: DDG1351
TEST DATE: 3/22/2024 11:09:35 AM
PREDRILL: 10 ft
BACKFILL: 20% Bentonite slurry & Chips
SURFACE PATCH: None



TOTAL DEPTH: 11.319 ft

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

Figure A-13

HOLE NUMBER: CPT - 4B Pore Water Dissipation

CPT Contractor: In SItu Engineering
PREPARED BY: In Situ Engineering
LOCATION: Seattle
JOB NUMBER: 0183-139-00

OPERATOR: Okbay
CONE ID: DDG1351
TEST DATE:
PREDRILL: 10 ft
BACKFILL: 20% Bentonite slurry & Chips
SURFACE PATCH: None

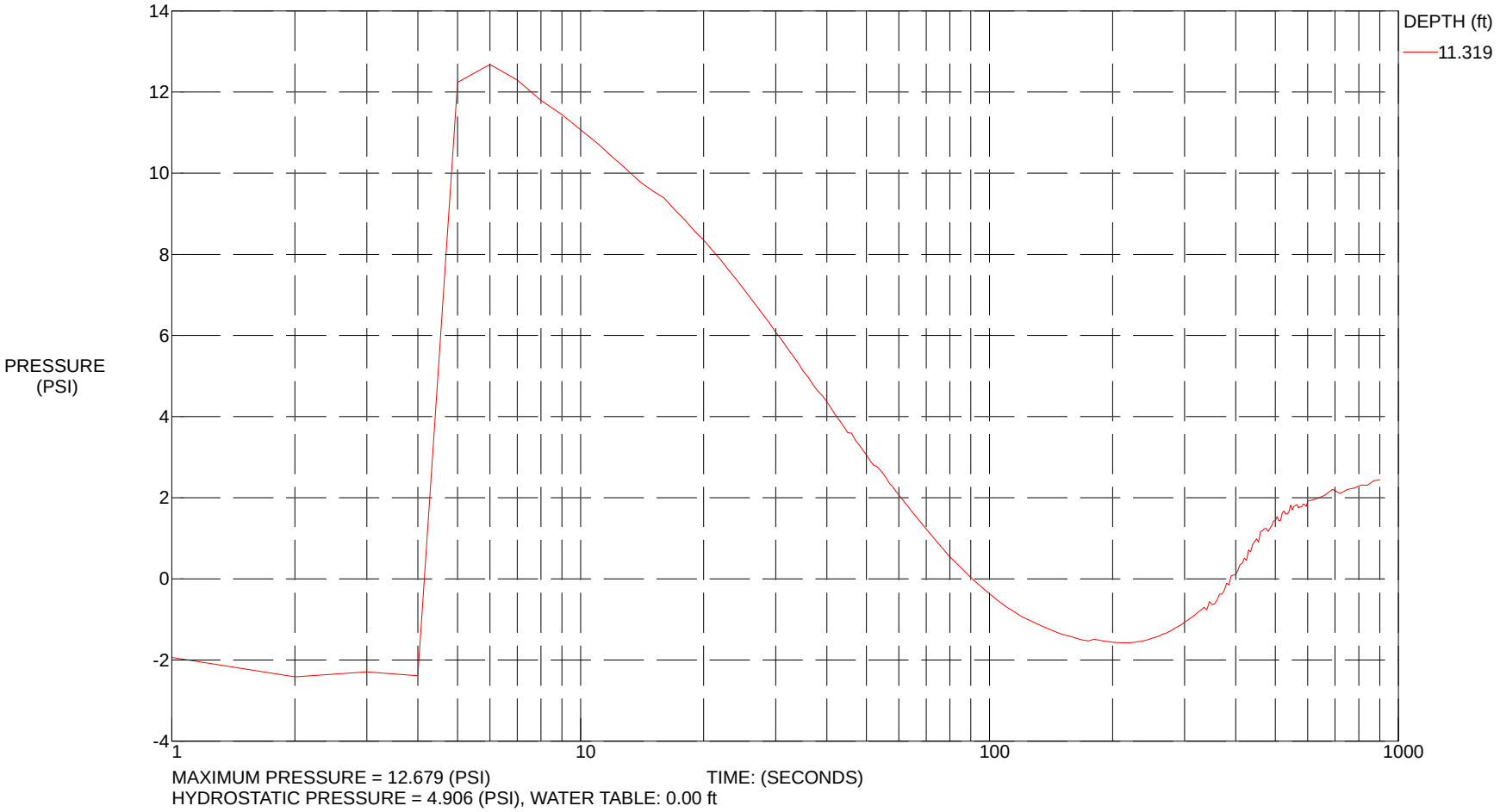
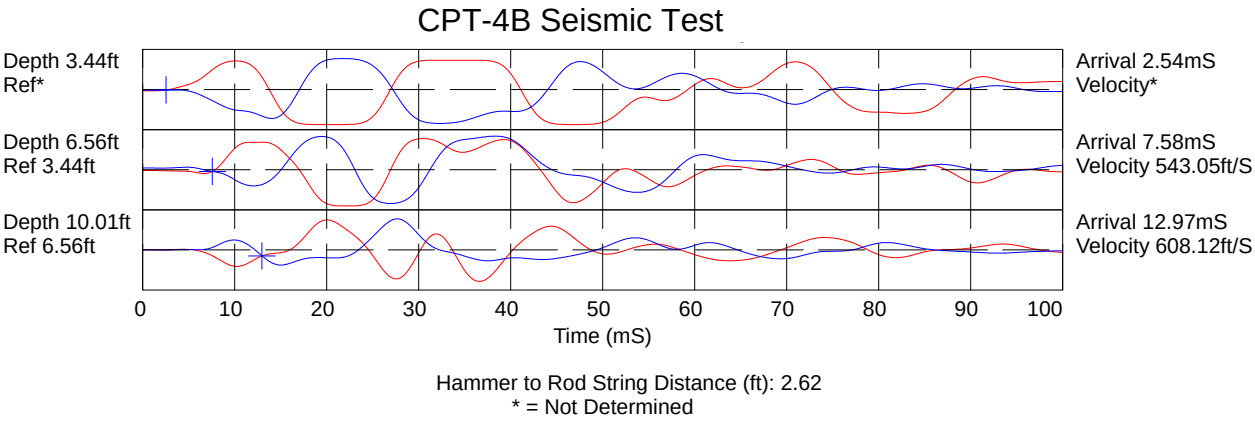


Figure A-13 cont'd



Hammer to Rod String Distance (ft): 2.62
* = Not Determined

Figure A-13 cont'd

CPT-05

CPT CONTRACTOR: : In Situ Engineering
CUSTOMER: GeoEngineers
LOCATION: Seattle
JOB NUMBER: 0183-139-00

OPERATOR: Forinash/Okbay
CONE ID: DDG1369
TEST DATE: 3/7/2024 1:17:33 PM
PREDRILL:: 0 ft
BACKFILL:: 20% Bentonite Slurry & Chips
SURFACE PATCH:: None

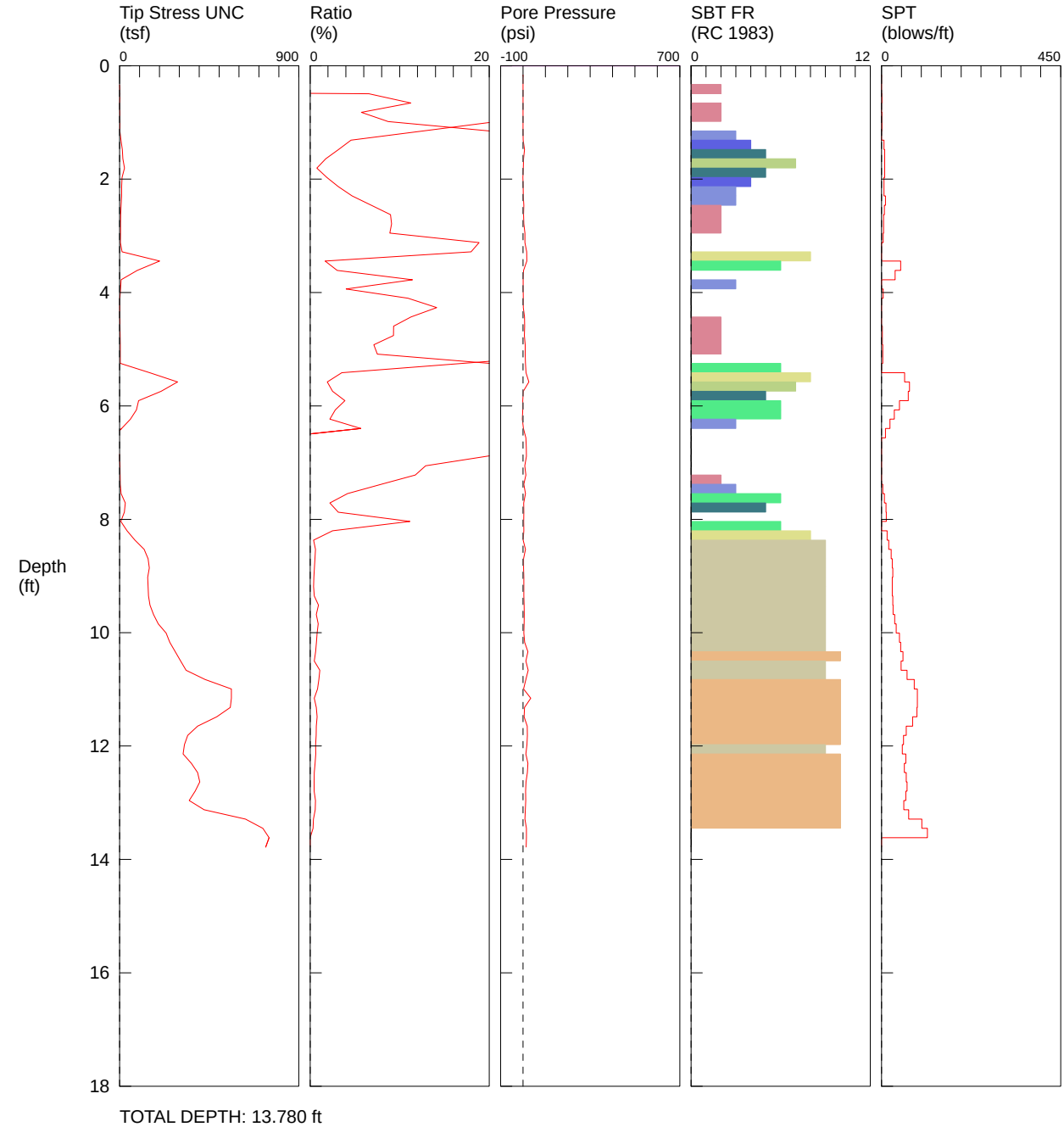


Figure A-14

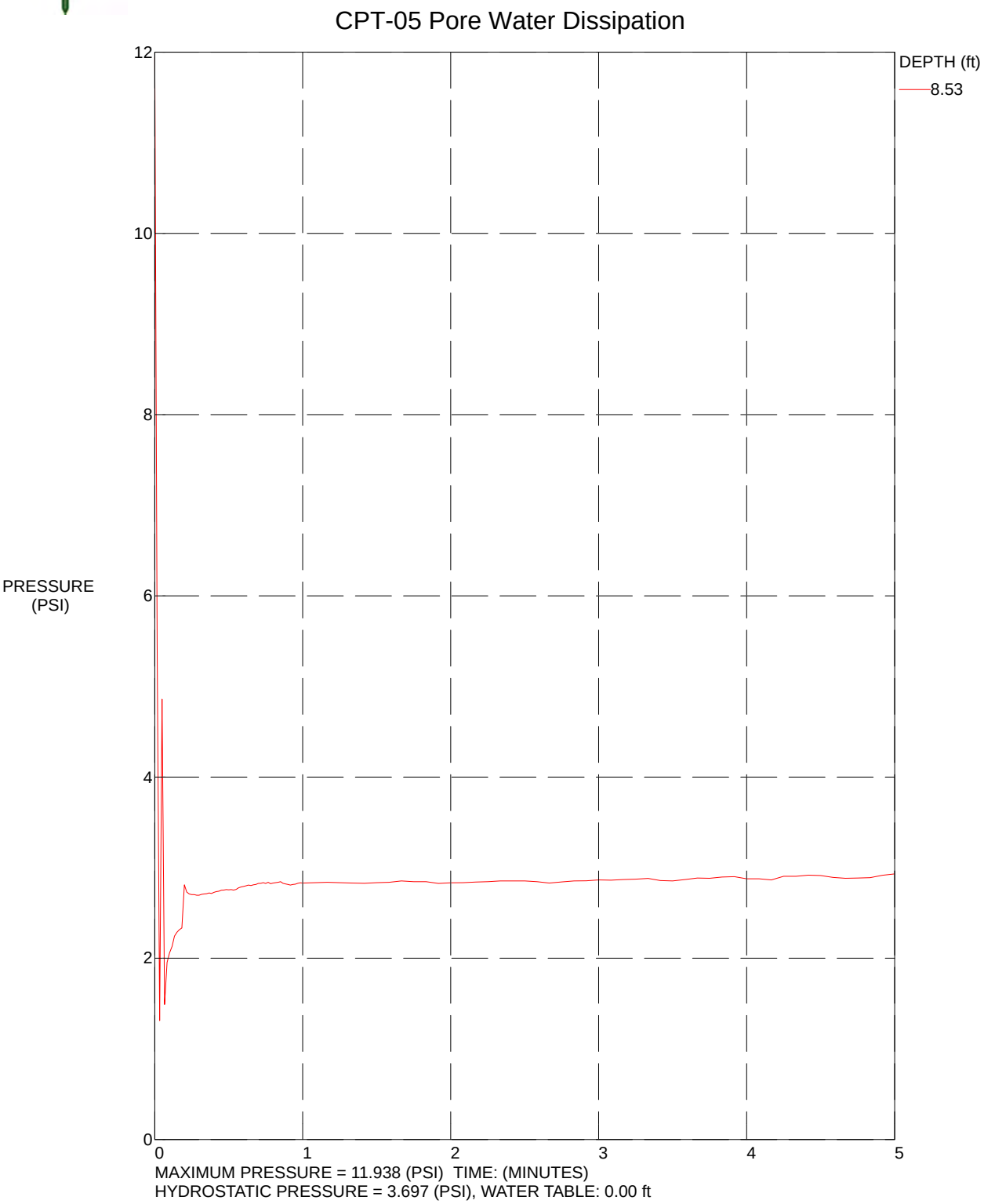


Figure A-14 cont'd

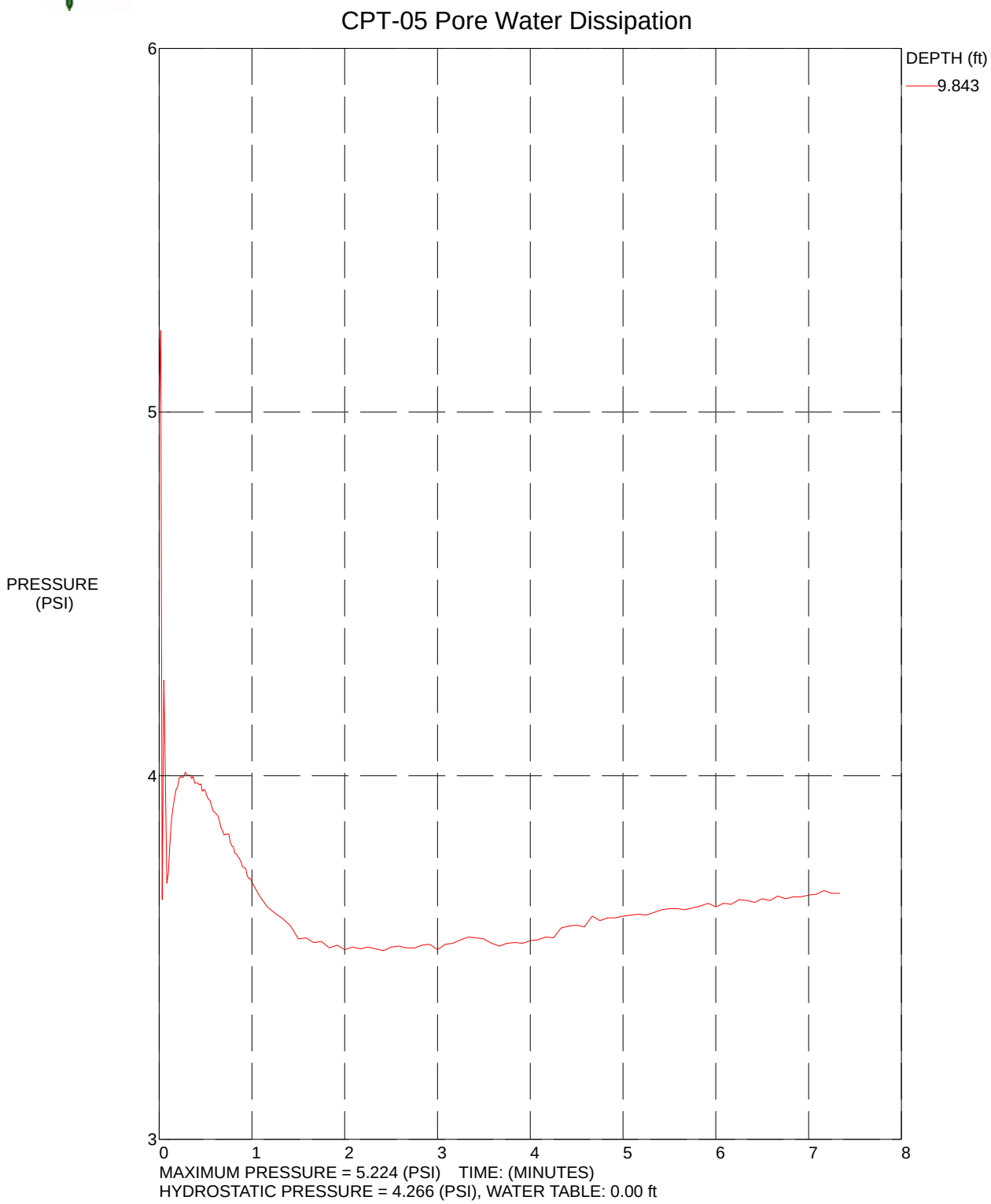
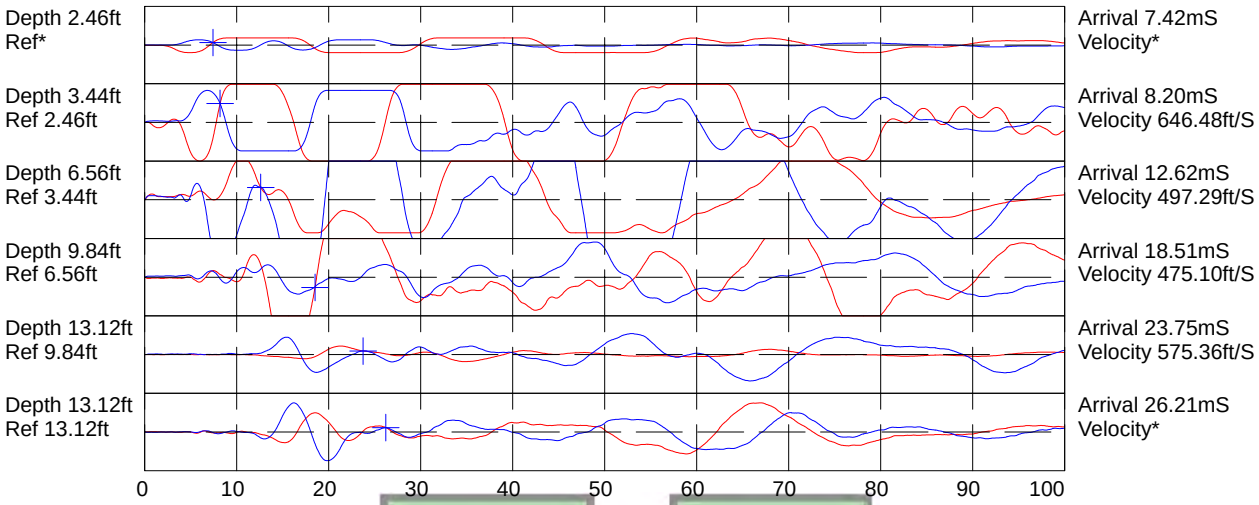


Figure A-14 cont'd

CPT-05

SEISMIC TEST



Hammer to Rod String Distance (ft): 4.92
* = Not Determined

COMMENT:

Figure A-14 cont'd

APPENDIX B
Laboratory Testing

APPENDIX B
LABORATORY TESTING

Soil samples obtained from the borings and test pits were transported to our laboratory and evaluated to confirm or modify field classifications, as well as to evaluate engineering properties of the soil. Representative samples were selected for laboratory testing that consisted of organic and moisture content determinations, percent fines, and sieve analyses. The tests were performed in general accordance with test methods of the ASTM International (ASTM) or other applicable procedures.

Soil Classifications

All soil samples obtained from the borings and test pits (and soils observed within the potholes) were visually classified in the field and/or in our laboratory using a system based on the Unified Soil Classification System (USCS) and ASTM classification methods. ASTM test method D 2488 was used to visually classify the soil samples, while ASTM D 2487 was used to classify the soils based on laboratory tests results. These classification procedures are incorporated in the exploration logs shown in Appendix A.

Organic Content Determinations

Organic content was determined in general accordance with ASTM D 2974 for numerous samples obtained from the explorations. The results of these tests are presented on the exploration logs at the respective sample depth in Appendix A and summarized in Table B-1 below for TP-2 and TP-3.

Moisture Content Determinations

Moisture contents were determined in general accordance with ASTM D 2216 for numerous samples obtained from the explorations. The results of these tests are presented on the exploration logs at the respective sample depth in Appendix A.

Percent Passing U.S. No. 200 Sieve (%F)

Selected samples were "washed" through the U.S. No. 200 mesh sieve to estimate the relative percentages of coarse- and fine-grained particles in the soil. The percent passing value represents the percentage by weight of the sample finer than the U.S. No. 200 sieve. These tests were conducted to verify field descriptions and to estimate the fines content for analysis purposes. The tests were conducted in accordance with ASTM D 1140, and the results are shown on the exploration logs in Appendix A at the respective sample depths.

Sieve Analysis

Sieve analyses were performed on several samples obtained from the explorations. The analyses were conducted in general accordance with ASTM C 136. The wet sieve analysis method was used to determine the percentage of soil greater than the U.S. No. 200 mesh sieve. The results of the sieve analyses were plotted, classified in general accordance with the USCS, and presented in Figure B-1.

Cation Exchange Capacity

Cation exchange capacity (CEC) testing was performed on samples from test pits TP-1 and TP-2 following the U.S. Environmental Protection Agency (EPA) 9081 test method. CEC testing was performed by Soiltest Farm Consultants, Inc. under subcontract to Anatek Labs, under subcontract to GeoEngineers. This test evaluates the total capacity of a soil to hold exchangeable cations. The results of the CEC tests are indicated on the test pit logs (Appendix A) at the respective sample depths and summarized in Table B-1.

TABLE B-1. RESULTS OF ORGANIC CONTENT AND CATION EXCHANGE CAPACITY TESTING

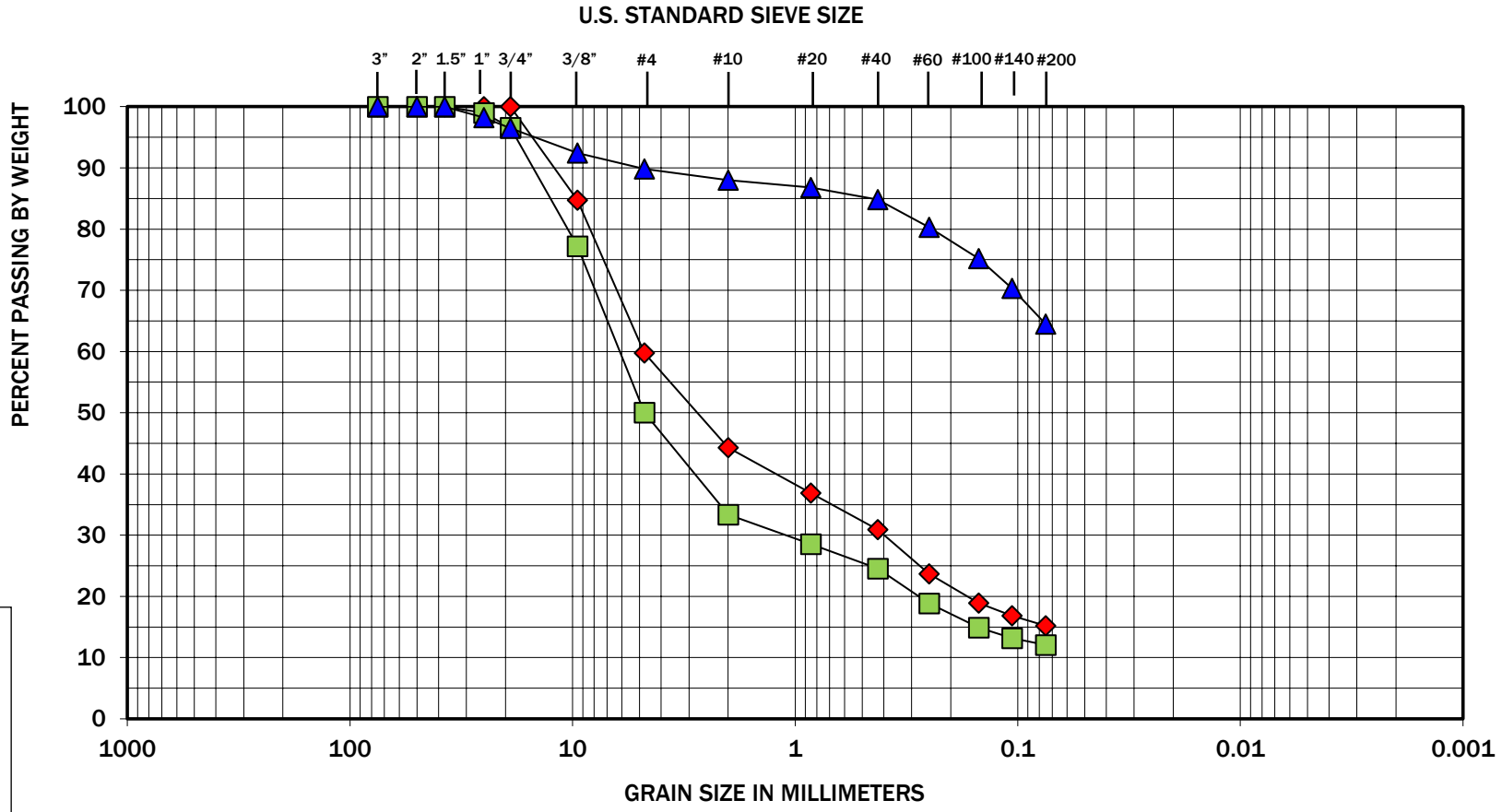
Location	Sample Depth (feet bgs)	Organic Content (%)	Cation Exchange Capacity, CEC (meq/100g)
TP-1	4	0.8	7.7
TP-2	2	8.6	8.6

Notes:

feet bgs = feet below ground surface

% = percent by weight of organic matter in the soil

meq/100g = milliequivalents per 100 grams of soil



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	GEI-1	2.5	13	Silty fine to coarse sand with gravel (SM)
■	TP-1	4	7	Silty fine gravel with sand (GM)
▲	TP-2	2	57	Sandy silt with organic matter (ML)

GeoEngineers

ASUW Shell House
Seattle, Washington

Sieve Analysis Results

Figure B-1

AASHTO ACCREDITED

The grain size analysis results were obtained in general accordance with ASTM D6913. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052

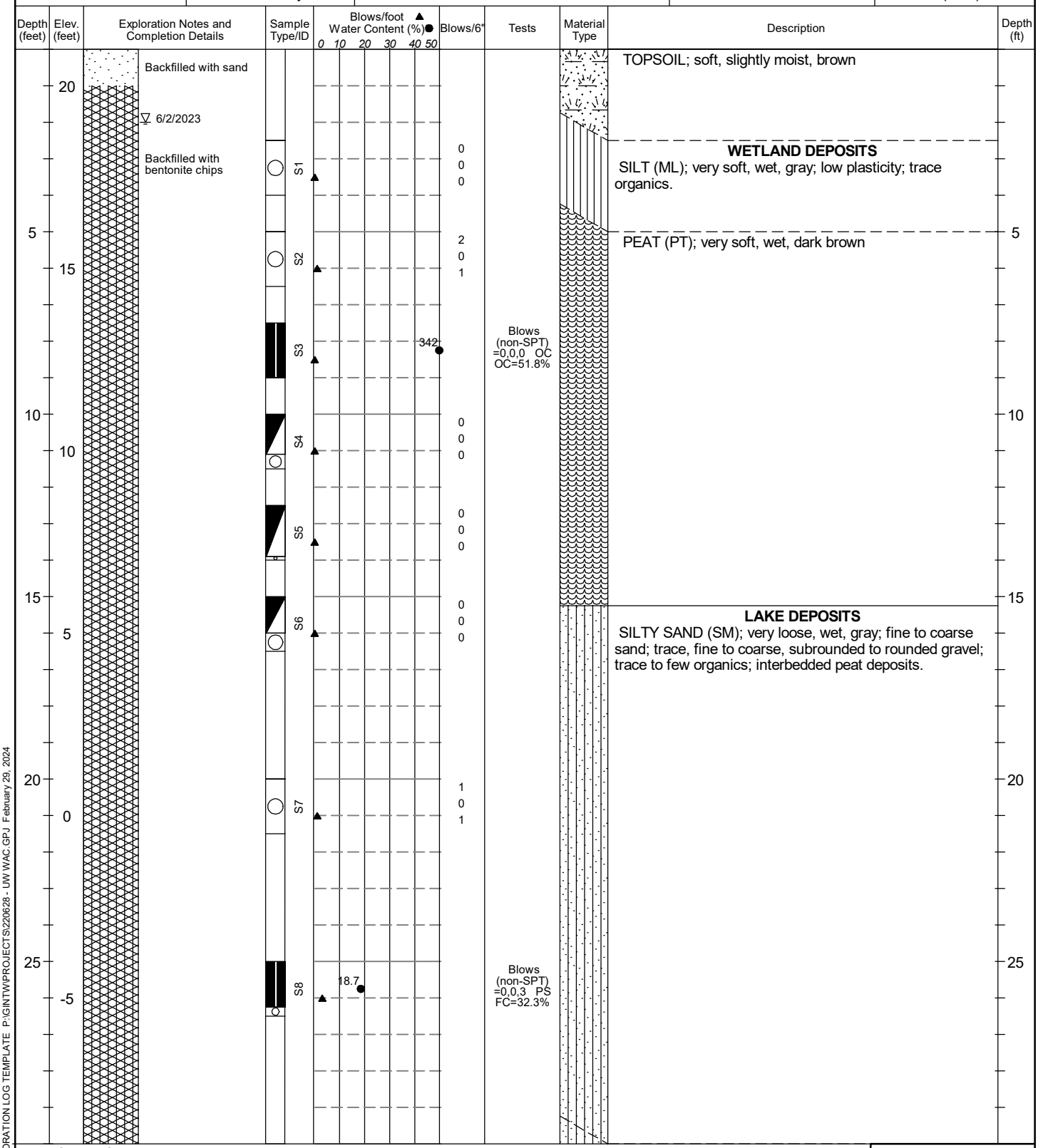
APPENDIX C
Exploration Logs from Previous Studies

APPENDIX C
EXPLORATION LOGS FROM PREVIOUS STUDIES

Appendix C includes logs from previous studies completed in the immediate vicinity of the project site.

- The logs of three borings (AB-01 through AB-03) and five CPTs (ACPT-01 through ACPT-05) completed by Aspect Consulting, LLC in 2023.

Aspect CONSULTING	UW Waterfront Athletics Center - 220628		Geotechnical Exploration Log	
	Project Address & Site Specific Location 3710 Montlake Blvd NE, Seattle, WA 98195, See Figure 2.		*Coordinates (Lat,Lon WGS84)* 47.6486, 122.2993 (est)	*Exploration Number* **AB-01**
Contractor Holocene, Inc	*Equipment* Diedrich D-50 Turbo	*Sampling Method* Autohammer; 140 lb hammer; 30" drop	*Ground Surface Elev. (NAVD88)* 21' (est)	
Operator Chris	*Exploration Method(s)* Mud rotary	*Work Start/Completion Dates* 6/2/2023	*Top of Casing Elev. (NAVD88)* NA	*Depth to Water (Below GS)* 2' (ATD)



Legend

Sample Type
- No Soil Sample Recovery
- Split Barrel 3" X 2.375"
- Split Barrel 2" X 1.375" (SPT)

Plastic Limit ⊢⊣ Liquid Limit

Water Level
- Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: STM
Approved by: MO 2/29/2024

Exploration Log AB-01
Sheet 1 of 2

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\220628 - UW WAC.GPJ February 29, 2024

Aspect CONSULTING	UW Waterfront Athletics Center - 220628		Geotechnical Exploration Log	
	Project Address & Site Specific Location 3710 Montlake Blvd NE, Seattle, WA 98195, See Figure 2.		*Coordinates (Lat,Lon WGS84)* 47.6486, 122.2993 (est)	*Exploration Number* **AB-01**
Contractor Holocene, Inc	*Equipment* Diedrich D-50 Turbo	*Sampling Method* Autohammer; 140 lb hammer; 30" drop	*Ground Surface Elev. (NAVD88)* 21' (est)	
Operator Chris	*Exploration Method(s)* Mud rotary	*Work Start/Completion Dates* 6/2/2023	*Top of Casing Elev. (NAVD88)* NA	*Depth to Water (Below GS)* 2' (ATD)

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot ▲ Water Content (%)● 0 10 20 30 40 50	Blows/6"	Tests	Material Type	Description	Depth (ft)
			S9		24 50/4.5"			**GLACIAL TILL** SILTY SAND (SM); very dense, moist, gray; fine to coarse sand; trace, fine to coarse, subrounded to rounded gravel.	
35	-15		S10		50/4.5"			SILTY SAND WITH GRAVEL (SM); very dense, slightly moist, gray; fine to coarse sand; fine to coarse, subrounded to rounded gravel.	35
40	-20		S11		30 50/5"			SILTY SAND (SM); very dense, wet, brown; fine to coarse sand; trace, subrounded to rounded gravel.	40
								Bottom of exploration at 41.5 ft. bgs.	
45	-25								45
50	-30								50
55	-35								55

Legend

Sample Type
- No Soil Sample Recovery
- Split Barrel 3" X 2.375"
- Split Barrel 2" X 1.375" (SPT)

Plastic Limit ⊢⊣ Liquid Limit

Water Level
- Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: STM
Approved by: MO 2/29/2024

Exploration Log AB-01
Sheet 2 of 2

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\220628 - UW WAC.GPJ February 29, 2024

Aspect CONSULTING	UW Waterfront Athletics Center - 220628		Geotechnical Exploration Log	
	Project Address & Site Specific Location 3710 Montlake Blvd NE, Seattle, WA 98195, See Figure 2.		*Coordinates (Lat,Lon WGS84)* 47.6480, 122.2998 (est)	*Exploration Number* **AB-02**
Contractor Holocene, Inc	*Equipment* Diedrich D-50 Turbo	*Sampling Method* Autohammer; 140 lb hammer; 30" drop	*Ground Surface Elev. (NAVD88)* 23' (est)	
Operator Chris	*Exploration Method(s)* Mud rotary	*Work Start/Completion Dates* 6/2/2023	*Top of Casing Elev. (NAVD88)* NA	*Depth to Water (Below GS)* No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot ▲ Water Content (%) ● 0 10 20 30 40 50	Blows/6"	Tests	Material Type	Description	Depth (ft)
0	20	Backfilled with sand						TOPSOIL; soft, slightly moist, brown	0
		Backfilled with bentonite chips	S1	10.7 ●	9 25 30	PS FC=45%		**GLACIAL TILL** SILTY SAND (SM); very dense, moist, gray-brown; fine to coarse sand; fine to coarse, subrounded to rounded gravel.	
5	15		S2	21.9 ●	21 30 36	AL LL=30% PL=22%		SANDY CLAY (CL); hard, moist, gray; low plasticity clay; trace, fine to coarse sand; trace, fine to coarse, subangular to rounded gravel.	5
			S3		30 50/6"				
10	10		S4	13.7 ●	26 42 50/4"	FC FC=70.4%			10
			S5		25 36 44				
15	5							Bottom of exploration at 14 ft. bgs.	15
20	0								20
25	-5								25

Legend

Sample Type
- ◯ No Soil Sample Recovery
- ◪ Split Barrel 2" X 1.375" (SPT)

Plastic Limit ⊢⊣ Liquid Limit

Water Level
- No Water Encountered

See Exploration Log Key for explanation of symbols

Logged by: STM
Approved by: MO 2/29/2024

Exploration Log AB-02
Sheet 1 of 1

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\220628 - UW WAC.GPJ February 29, 2024

Aspect CONSULTING	UW Waterfront Athletics Center - 220628		Geotechnical Exploration Log	
	Project Address & Site Specific Location 3710 Montlake Blvd NE, Seattle, WA 98195, See Figure 2.		*Coordinates (Lat,Lon WGS84)* 47.6478, 122.2997 (est)	*Exploration Number* **AB-03**
Contractor Holocene, Inc	*Equipment* Diedrich D-50 Turbo	*Sampling Method* Autohammer; 140 lb hammer; 30" drop	*Ground Surface Elev. (NAVD88)* 22' (est)	
Operator Chris	*Exploration Method(s)* Mud rotary	*Work Start/Completion Dates* 6/2/2023	*Top of Casing Elev. (NAVD88)* NA	*Depth to Water (Below GS)* 5' (ATD)

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot ▲ Water Content (%) ● (0 10 20 30 40 50)	Blows/6"	Tests	Material Type	Description	Depth (ft)
		Backfilled with sand						TOPSOIL; loose, slightly moist, brown	
								FILL SILTY SAND WITH GRAVEL (SM); loose, moist, brown; fine to coarse sand; fine to coarse, angular to subrounded gravel; trace to few organics.	
20		Backfilled with bentonite chips	S1	20.4	2 2 3	PS FC=44.5%		SILTY SAND (SM); loose, moist, gray; fine to coarse sand; trace to few, angular to subrounded gravel; trace to few organics; iron-oxide staining.	
5		▽ 6/2/2023	S2		0 0 0				5
								WETLAND DEPOSITS PEAT (PT); very soft, wet, dark brown.	
15			S3	566.3	0 0 0	OC OC=79.2%			
10			S4		0 0 0				10
10			S5		4 3 6			**LAKE DEPOSITS** SILTY SAND (SM); loose, moist, gray; trace, fine to coarse sand; trace, fine to coarse, subangular to rounded gravel; subtrace organics.	
15			S6	19.3	6 10 26	FC FC=40.1%		Blow counts may be overstated due to gravel.	15
5								**GLACIAL TILL** SILTY SAND (SM); very dense, gray-brown to gray, moist; fine to coarse sand; trace to few, fine to coarse, subrounded to rounded gravel.	
20			S7	12.7	23 50/5.5"	PS FC=36.8%			20
0									
25			S8		50/4.5"				25
-5									

Legend

Sample Type
- ◯ No Soil Sample Recovery
- ◪ Split Barrel 2" X 1.375" (SPT)

Plastic Limit ⊢⊣ Liquid Limit

Water Level
- ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: STM
Approved by: MO 2/29/2024

Exploration Log AB-03
Sheet 1 of 2

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\220628 - UW WAC.GPJ February 29, 2024

Aspect CONSULTING	UW Waterfront Athletics Center - 220628		Geotechnical Exploration Log	
	Project Address & Site Specific Location 3710 Montlake Blvd NE, Seattle, WA 98195, See Figure 2.		*Coordinates (Lat,Lon WGS84)* 47.6478, 122.2997 (est)	*Exploration Number* **AB-03**
Contractor Holocene, Inc	*Equipment* Diedrich D-50 Turbo	*Sampling Method* Autohammer; 140 lb hammer; 30" drop	*Ground Surface Elev. (NAVD88)* 22' (est)	
Operator Chris	*Exploration Method(s)* Mud rotary	*Work Start/Completion Dates* 6/2/2023	*Top of Casing Elev. (NAVD88)* NA	*Depth to Water (Below GS)* 5' (ATD)

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot ▲ Water Content (%)● 0 10 20 30 40 50	Blows/6"	Tests	Material Type	Description	Depth (ft)
			S9		50/3"			**GLACIAL TILL** SILTY SAND (SM); very dense, gray-brown to gray, moist; fine to coarse sand; trace to few, fine to coarse, subrounded to rounded gravel. (continued)	
35	-15		S10		50/2"				35
40	-20		S11		50/3"			Bottom of exploration at 40.25 ft. bgs.	40
45	-25								45
50	-30								50
55	-35								55

Legend

Sample Type
- ◯ No Soil Sample Recovery
- ◪ Split Barrel 2" X 1.375" (SPT)

Plastic Limit ⊢—⊣ Liquid Limit

Water Level
- ▽ Water Level ATD

See Exploration Log Key for explanation of symbols

Logged by: STM
Approved by: MO 2/29/2024

Exploration Log AB-03
Sheet 2 of 2

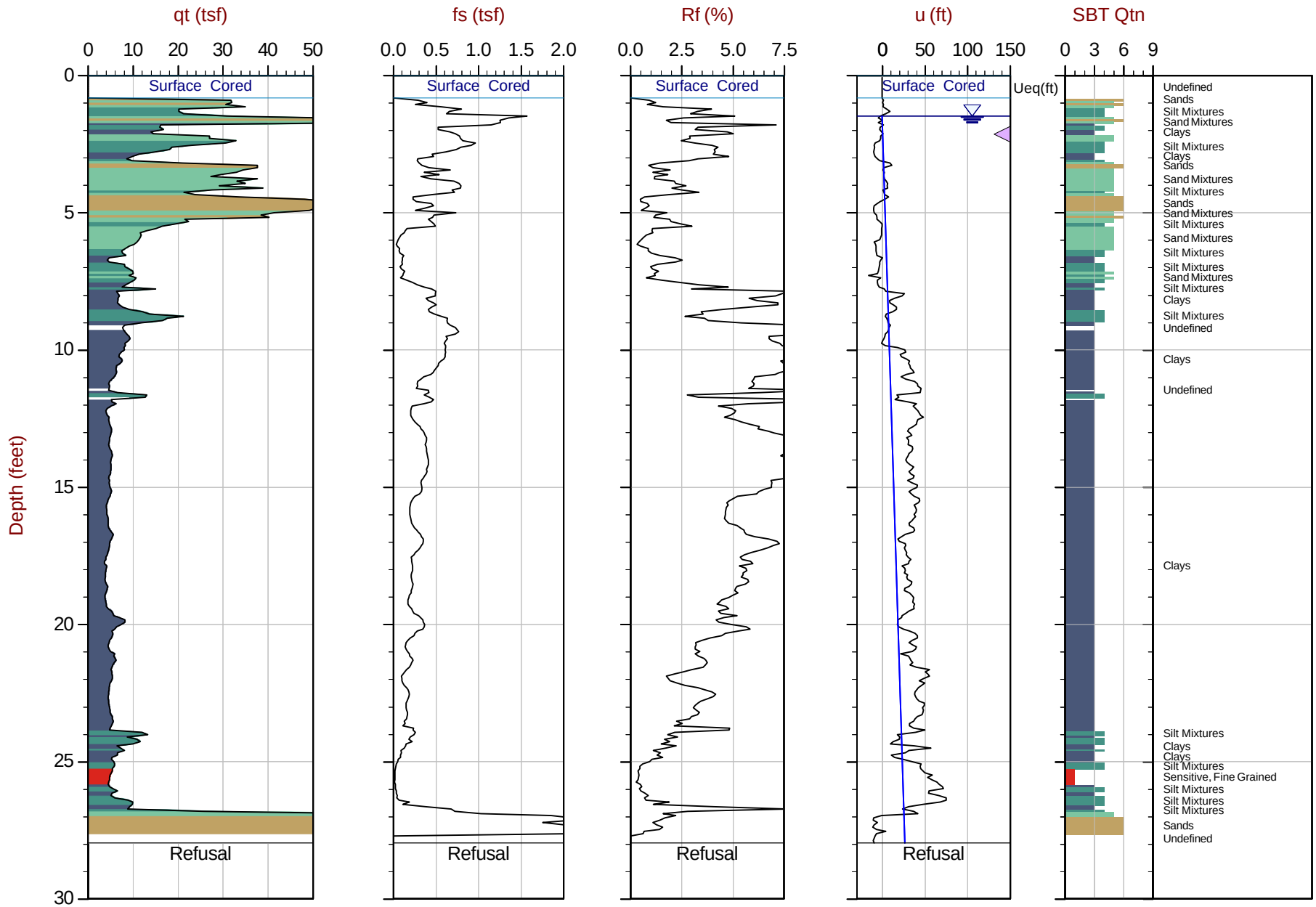
NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINTW\PROJECTS\220628 - UW WAC.GPJ February 29, 2024

CONETEC

Aspect

Job No: 23-59-25850
Date: 2023-05-18 13:15
Site: UW WAC Dock Renovation

Sounding: ACPT-01
Cone: 588:T1500F15U35



Max Depth: 8.525 m / 27.97 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 23-59-25850_CP01.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.64874 Long: -122.29927

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

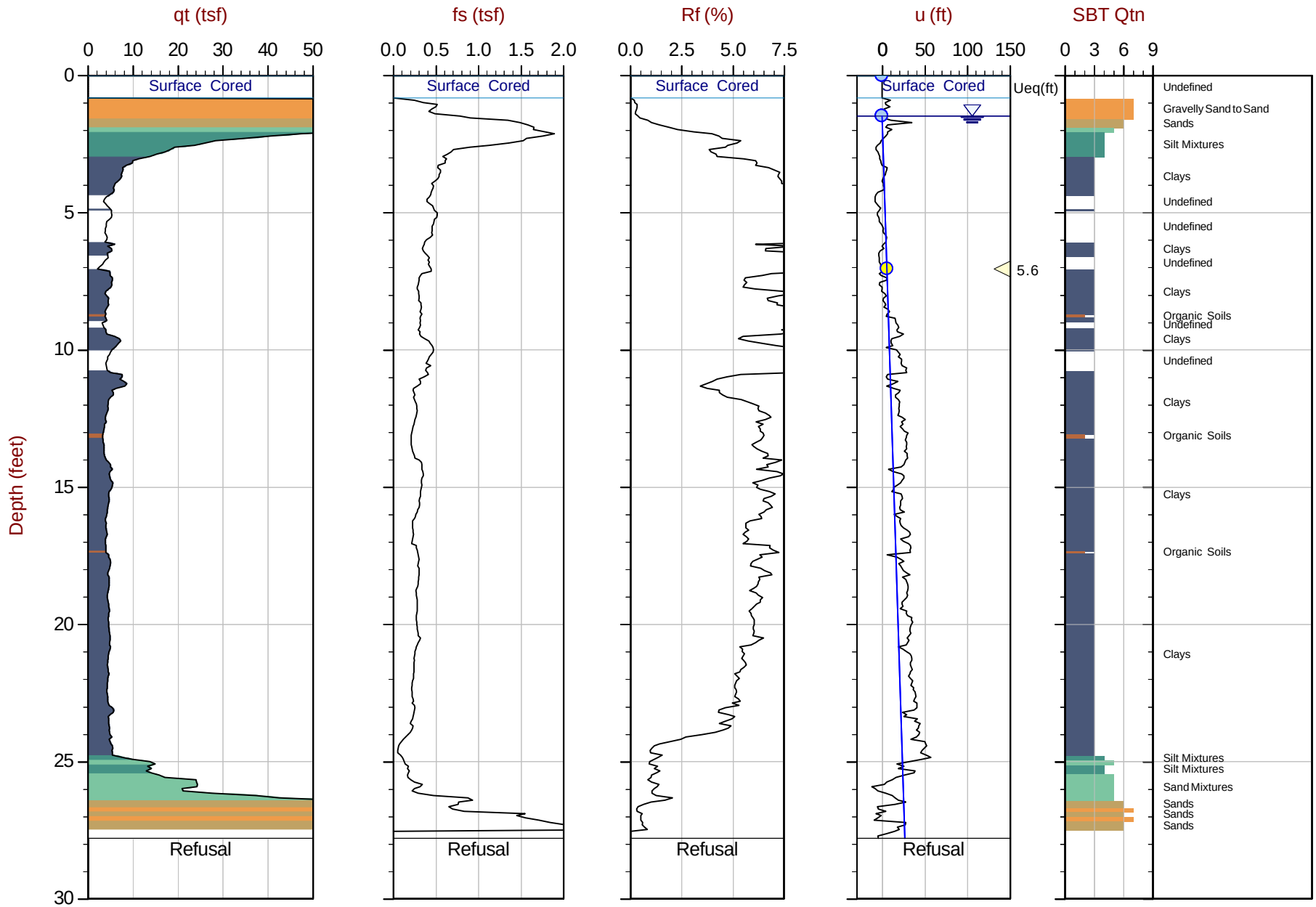
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Aspect

Job No: 23-59-25850
Date: 2023-05-18 11:17
Site: UW WAC Dock Renovation

Sounding: ACPT-02
Cone: 588:T1500F15U35



Max Depth: 8.475 m / 27.80 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 23-59-25850_SP02.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.64846 Long: -122.29951

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

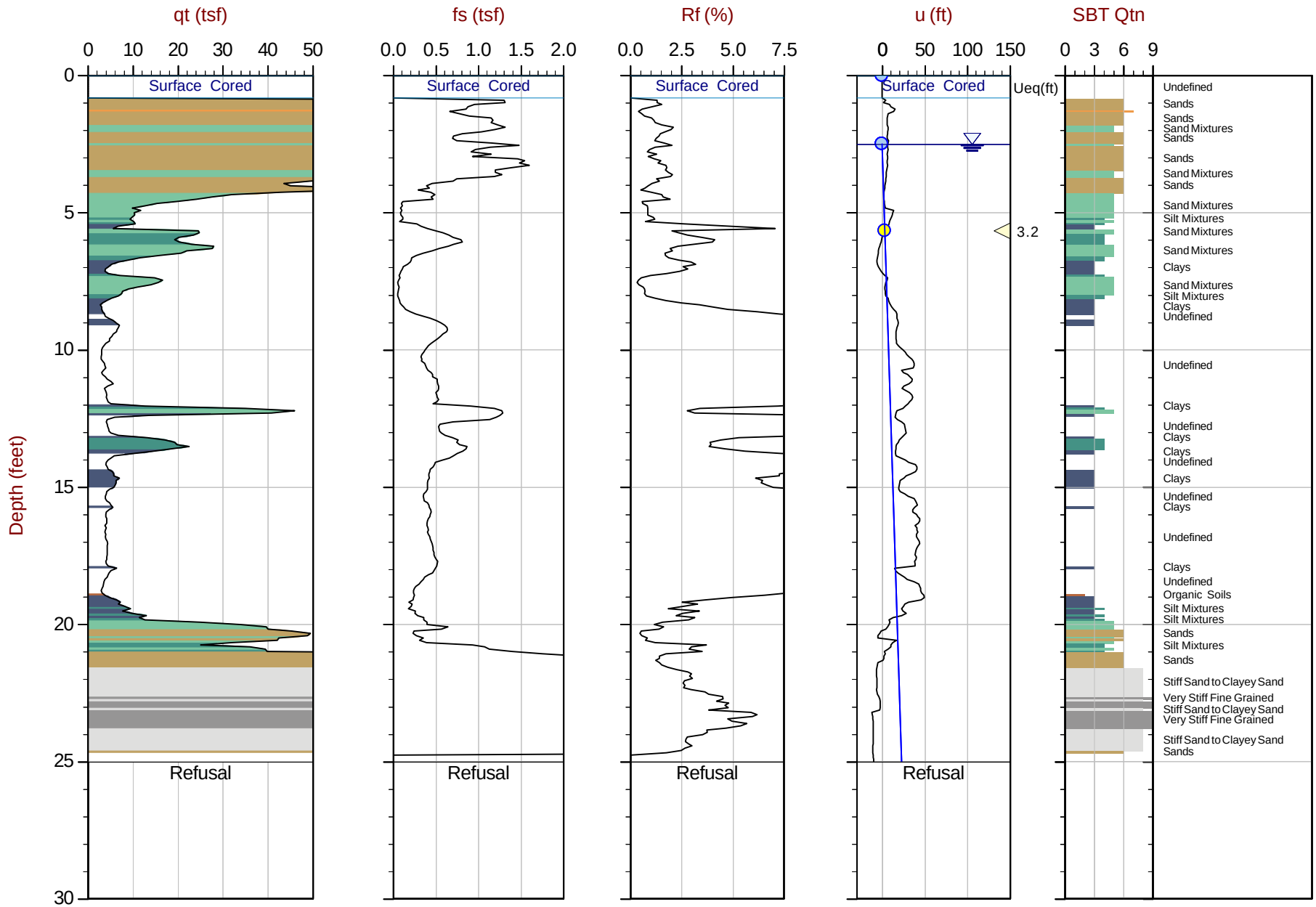
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Aspect

Job No: 23-59-25850
Date: 2023-05-18 10:04
Site: UW WAC Dock Renovation

Sounding: ACPT-03
Cone: 588:T1500F15U35



Max Depth: 7.625 m / 25.02 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 23-59-25850_CP03.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.64828 Long: -122.29973

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

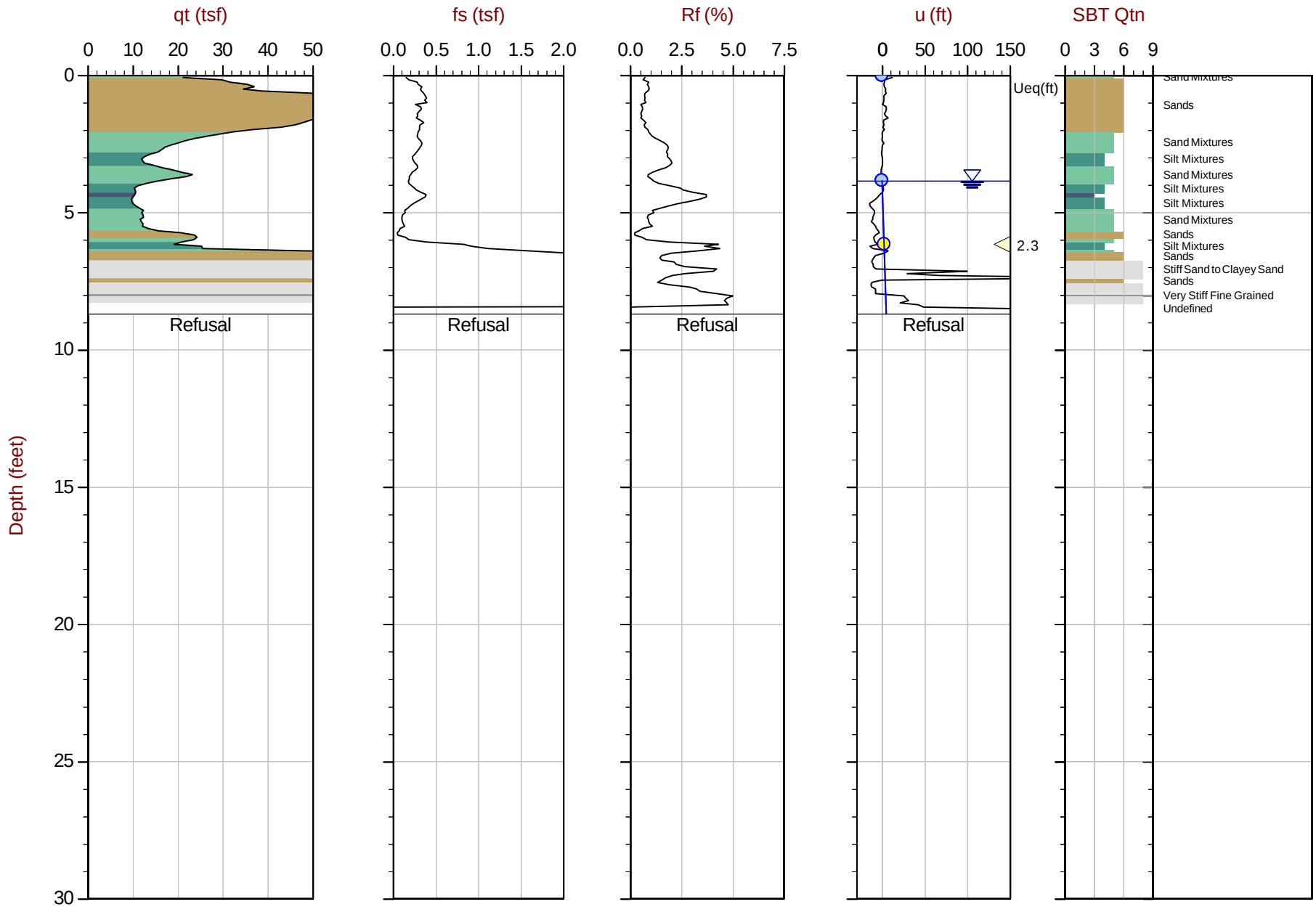
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Aspect

Job No: 23-59-25850
Date: 2023-05-18 08:58
Site: UW WAC Dock Renovation

Sounding: ACPT-04
Cone: 588:T1500F15U35



Max Depth: 2.650 m / 8.69 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 23-59-25850_CP04.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.64799 Long: -122.29980

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

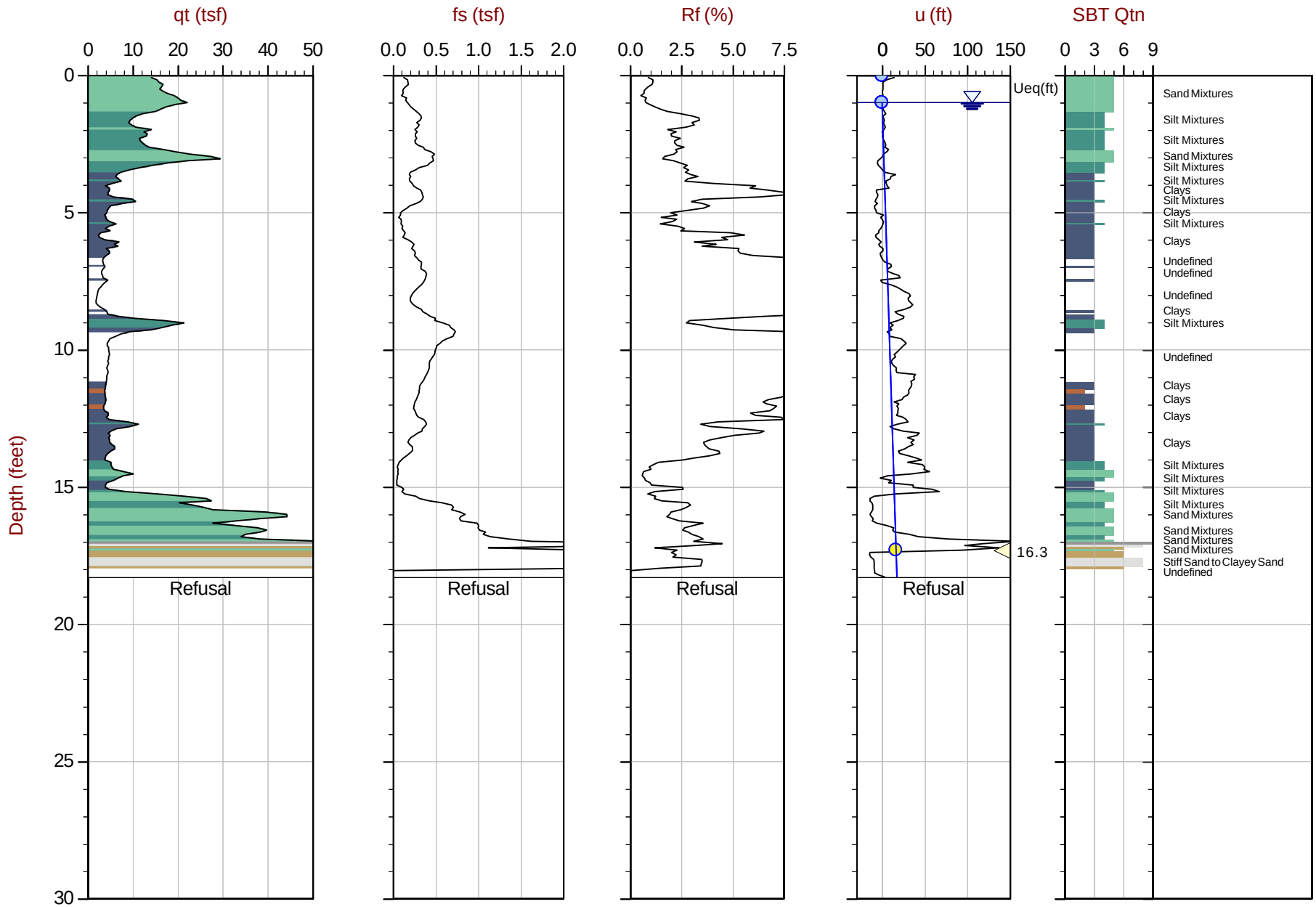
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Aspect

Job No: 23-59-25850
Date: 2023-05-18 07:45
Site: UW WAC Dock Renovation

Sounding: ACPT-05
Cone: 588:T1500F15U35



Max Depth: 5.575 m / 18.29 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 23-59-25850_SP05.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.64777 Long: -122.29960

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

APPENDIX D
Infiltration Testing

APPENDIX D
INFILTRATION TESTING

Three test pits (TP-1 through TP-3) were excavated around the perimeter of the Shell House at locations of potential infiltration facilities and/or permeable pavements. Detailed logs of the test pits are included in Appendix A. Infiltration testing was conducted in each of the three test pits completed at the site. The infiltration tests within TP-1 and TP-2 were conducted as small-scale pilot infiltration tests (PITs), while the infiltration test within TP-3 was conducted as a simple infiltration test (SIT).

Methodology

Small-Scale Pilot Infiltration Test

Small-scale PITs were conducted in test pits TP-1 and TP-2, which were initially excavated with a trackhoe to depths of approximately 4 and 2 feet, or approximately Elevation 23 and 22 feet, respectively. The test pits were excavated to the proposed subgrade elevations of the future infiltration facilities, as requested by Mayfly. For each PIT, a graduated yard stick was used as visual reference for monitoring water levels during testing. A piezoelectric pressure transducer was secured to the bottom of the yard stick to provide accurate water level records in 10-second intervals throughout the duration of the tests.

The first phase of a PIT is the "pre-soak" phase in which the test pit is filled with water and a water depth of at least 12 inches is maintained for at least six hours. The time and depth of water are recorded on an hourly basis. The pre-soak phase is intended to fully saturate the soil below the test pit. Water must be added more frequently to the PITs with higher infiltration rates.

The second phase of a PIT is the "steady state" phase in which water is added to the test pit at a rate that will maintain a depth of 12 inches above the bottom of the pit for a period of one hour. The time, depth of water, cumulative volume, flow rate and infiltration rate measurements are recorded every 15 minutes. Infiltration rates are dependent on the water depth in the pit because the hydraulic head of the water column 'pushes' water into the ground. For this reason, the testing phase requires a constant, or near-constant water depth. Per the 2021 CSSM, the infiltration rate is the lowest rate measured from the steady-state phase.

The third phase of a PIT is the "falling head" phase in which the PITs are left undisturbed for one hour or until the water infiltrates completely. The falling head period shows how infiltration changes over a continuous range of declining water depths. Completed City of Seattle Pilot Infiltration Test Checklists are attached.

Simple Infiltration Test

An SIT was conducted in TP-3, which was a hand-dug excavation approximately 2 feet in diameter and 2 feet deep, or approximately Elevation 21 feet. To complete the SIT, a graduated yard stick was used as visual reference for monitoring water levels during testing.

The first phase of the SIT is the "pre-soak" phase in which the test pit is filled with approximately 12 inches of water. The water depth is maintained for a minimum of 30 minutes. In order to determine the testing period for the simple infiltration test, water is then turned off and the test pit is allowed to drain for a period of one hour. The water level decline (in inches) is recorded. The test pit is then refilled with 12 inches of water and the process is repeated for an additional hour.

The testing period is determined based on the results of the pre-soak phase. During the "testing" phase of the test, the test pit is filled with approximately 12 inches of water and the time and depth of water in the hole is recorded at specified intervals (15-, 30-, or 60-minute intervals). The test is complete when six intervals have been completed. Per the 2021 CSSM, the infiltration rate is the lowest rate measured during the testing period. The completed City of Seattle Simple Infiltration Test Checklist for TP-3 is attached.

Testing Procedure

Small-Scale Pilot Infiltration Test

Test pits TP-1 and TP-2 were initially excavated with a compact excavator to approximately 4 feet wide by 3.5 feet long. TP-1 and TP-2 were initially excavated to depths of approximately 4 and 2 feet, or approximately Elevation 23 and 22 feet, respectively. The sidewalls in each test pit were kept as vertical as possible. Water for infiltration was provided by Kelly's Excavating using a 500-gallon water tank mounted on a trailer.

- TP-1 was conducted on April 4, 2024. The soil at the initial bottom (4 feet, test depth) of TP-1 generally consisted of silty fine gravel with sand (fill) (Appendix A). Groundwater was not observed during the initial excavation of TP-1. The test pit was initially filled with water to a depth of approximately 13 inches. The water was then turned off and the pit was allowed to drain over the pre-soak, steady-state, and falling head portions of the test. The test pit was not refilled during the testing period. After 6 hours of the pre-soak and 1 hour of testing, the water level had dropped approximately 1½ inches. After the test, the transducer was removed, the remaining water was bailed out of the test pit using the bucket of the excavator. The test pit was over excavated to a depth of 3 feet. Glacial till was observed below the test depth. Moderate groundwater seepage was observed at approximately 5¾ feet below the ground surface following the infiltration test, which was interpreted as being residual water from infiltration testing, suggesting that the water was mounding on top of the dense glacial till. The lowest infiltration rate measured during the steady-state phase, based on the complete transducer record, was used to determine the initial measured infiltration rate.
- TP-2 was conducted on April 4, 2024. The soil at the initial bottom (2 feet, test depth) of TP-2 generally consisted of peat (alluvium) (Appendix A). Groundwater seepage was not observed during the initial excavation of TP-2. The test pit was initially filled with water to a depth of approximately 13 inches. After the test, the transducer was removed, the remaining water was bailed out of the test pit using the bucket of the excavator, and the test pit was over excavated to a depth of 3½ feet. Slow groundwater seepage was observed at about 2¼ feet below the ground surface, which was interpreted as being residual water from infiltration testing. The lowest infiltration rate measured during the steady-state phase, based on the complete transducer record, was used to determine the initial measured infiltration rate.

Simple Infiltration Test

Test pit TP-3 was initially hand dug with a shovel to a depth of approximately 2 feet, or approximately Elevation 21 feet. The test pit was excavated to the proposed subgrade elevations of the future infiltration facilities, as requested by Mayfly. The bottom of the test pit was approximately 2 feet in diameter.

The soil at the initial bottom of TP-3 (2 feet, test depth) generally consisted of silty fine to medium sand with occasional gravel (fill) (Appendix A). Groundwater and groundwater seepage was not observed while excavating. The simple infiltration test was completed between April 4 and 5, 2024. The simple infiltration test consisted of a pre-soak period of 30 minutes and required the water level be maintained above 12 inches. After 30 minutes of pre-soak, two separate hour-long pre-soak tests were performed to evaluate the water level drop and determine the required testing period duration. Based on the results of the pre-soak test, the simple infiltration test required a 2-hour testing period where the depth of water and infiltration rate were measured every 30 minutes.

Because the test was performed between April through October, the pre-soaking period and testing period was repeated in the same hole 24 hours after the beginning of the first infiltration test. After the second test was completed 24 hours later, the test pit was drained and excavated an additional 3 feet below the infiltration testing depth. The test pit was overexcavated to observe and sample the soils below the level of the test. The same soil (fill) was observed below the test elevation in the test pit.

Design Infiltration Rates

The design infiltration rates for the simple and small-scale PITs are determined by applying correction factors (CFs) to the measured infiltration rates. The CF accounts for uncertainties in site variability and number of locations tested, the testing method, and the degree of influent control to prevent siltation and bio buildup. For simple, small- and large-scale PITs, the 2021 CSSM recommends that the correction factor be applied to the lowest measured infiltration rate. The correction factor was selected in accordance with CSSM based on professional judgment and assumptions regarding infiltration system design, operation and maintenance. The City of Seattle requires a CF of 0.5 unless a lower value is warranted by site conditions and shall not be less than 0.2. Based on the type and number of tests completed, as well as the size of the area to be infiltrated, a correction factor of 0.5 was used. The design infiltration rate is calculated by:

$$Design\ Infiltration\ Rate = Measured\ Infiltration\ Rate\ x\ CF$$

Measured and design infiltration rates from the PITs and SIT are summarized in Table D-1.

TABLE D-1. INFILTRATION RATES FROM PILOT INFILTRATION TESTING

Test Location	Test Type	Test Depth (feet bgs)	Measured Infiltration Rate (in/hr)	Design Infiltration Rate (in/hr)
TP-1	Small Pilot Infiltration Test	4	0	0
TP-2	Small Pilot Infiltration Test	2	2.6	1.3
TP-3	Simple Infiltration Test	2	0.5	0.25

Notes:

feet bgs = feet below ground surface; in/hr = inches per hour; CF = correction factor

Design infiltration rate = Measured infiltration rate x Correction factor (0.5)

GeoEngineers TP-1

City of Seattle
Department of Construction and Inspections
Applicant Services Center
700 Fifth Ave, Suite 2000, P.O. Box 34019
Seattle, WA 98124-4019
www.seattle.gov/sdci

Phone: 206-684-8850

City of Seattle
Pilot Infiltration Test (PIT) Checklist

Call before you dig – Utility Locates 811

Project Address: 3655 Walla walla Road Date: 04/04/2024

Permit Number: _____

Other Project Information: _____

This Infiltration Test was performed by:

Company Name: GeoEngineers Inc. Primary Contact Name: Rashi Modi

Phone Number: 4252847242 Email Address: rmodi@geoengineers.com

☑ Include site map or drainage control plan, with test locations clearly marked.

The intent of this checklist is to provide a summary of stormwater BMP infiltration testing requirements associated with the Pilot Infiltration Test (PIT). All projects and associated plans are also subject to the minimum requirements outlined in the City of Seattle Stormwater Manual and SMC Chapters 22.800 – 22.808, as well as the specific subsurface investigation and infiltration testing requirements outlined in Volume 3, Chapter 3 and Appendix D of the 2021 City of Seattle Stormwater Manual. See also Appendix C for site constraints that preclude infiltration facility feasibility (such as site slope > 8%).

This checklist does not preclude the use of professional judgment to evaluate and manage risk associated with design, construction, and operation of infiltration BMPs. Justification for testing procedures that deviate from the minimum investigation requirements specified in Appendix D shall be documented in a stamped and signed letter from a State of Washington licensed professional (licensed professional engineer, engineering geologist, geologist, or hydrogeologist) who has experience in infiltration and groundwater testing and infiltration facility design.

Before you start call Utility Locates 811 to request locates of utilities at your site.

SMALL PILOT INFILTRATION TEST (SMALL PIT) AND LARGE PILOT INFILTRATION TEST (LARGE PIT):
Note: The test methods outlined below may be modified due to site conditions if recommended by the licensed professional and the reasoning is documented in the testing report.

1. Indicate type of test:
   - ◉ Small PIT
   - ○ Large PIT
2. Date and time of tests: 04/04/2024 08:40 AM PST
3. Is the infiltration test within the footprint of the proposed infiltration facility? (Yes / No)
4. If "no," is testing being conducted within 50 feet of the proposed infiltration facility? (Yes / No)
   Explain why: Could not test on asphalt pavement

5. What is the total proposed impervious area (does not include permeable pavement surfaces) to be infiltrated on the site? TBD _____ ft^2

(Note: acceptance testing is required if testing was performed greater than 50 feet from the proposed infiltration facility, and greater than 5,000 ft^2 infiltrated on the site [see City of Seattle Stormwater Manual, Volume 3, Section 3.2].)

6. ☑ Dig an infiltration test pit
7. Test pit excavated to bottom elevation of the proposed infiltration facility (Yes / No)
   (See City of Seattle Stormwater Manual, Appendix D for additional details.)
8. Test pit surface dimensions (ft): Length: 4 _____ Width: 3.5 _____ Depth: 4 _____
9. Test pit bottom dimensions (ft): Length: 4 _____ Width: 3.5 _____
10. Test pit bottom area (ft^2): 14 _____
11. Small PIT only: Is the surface area of the test pit bottom at least 12 ft^2? (Yes / No)
12. Large PIT only: Is the surface area of the test pit bottom at least at least 32 ft^2? (Yes / No)
    a. If "no," indicate why: _____
13. Large PIT only: The test pit bottom area should be as close to the bottom area of the proposed infiltration facility as is feasible.
    a. Bottom area of proposed infiltration facility: _____ ft^2
    b. Bottom area of test pit: _____ ft^2
14. Identify device used to measure water level in test pit:
    ☑ Pressure transducer (recommended for areas with slow draining soils), or
    ☑ Vertical rod (min 5 ft long, ½-inch increments, placed in center of pit)
15. Identify method of delivering water to the bottom of the test pit (e.g., rigid pipe with a splash plate):
    water hose with perforated steel pipe attached at the end
    (The method of delivery must reduce erosion in the test pit that could cause clogging of the infiltration receptor)

16. **Testing Procedure:**
    a. **Pre-soak period**: Add water to maintain water level at least 12 inches above the bottom of the test pit for at least 6 hours. Record the time and depth of water hourly in the table below.

Time of Measurement (hh:mm)	Depth of Water (inches)
08:40	0
08:47	13
09:47	13.5
10:47	13.5
11:47	13.61
12:47	14.25
13:47	14.30
14:47	14.36

    b. **Steady-state period**: The steady-state data is used to establish the measured infiltration rate (see step 17)
       i. Add water to the test pit at a rate that will maintain a depth of 12 inches above the bottom of the test pit for 1 full hour. During this hour, record the time, depth of water, cumulative volume, and instantaneous flow rate every 15-minutes in the table below.
       ii. Calculate the infiltration rate for each 15-minute interval. First convert the flow rate to in^3/hr and the test pit bottom area (recorded in step 10) into in^2. Divide the flow rate by the bottom area and record the result in the table below.

Time of Measurement (hh:mm)	Depth of Water (inches)	Cumulative Volume (gallons)	Flow Rate (gpm)	Infiltration Rate (in/hr)
14:47	14.36	---	---	---
15:02	14.36	0	0	0
15:17	14.39	0	0	0
15:32	14.39	0	0	0
15:47	14.41	0	0	0

[1] gallon = 231 in^3, 1 ft^2 = 144 in^2

c. **Falling head period**: The falling head data is used to confirm the measured infiltration rate calculated from the steady- state data.
   i. At the end of the steady-state period, turn off the water and immediately record the time and depth of water in the table below. Record the time and depth of water every 15-minutes for a minimum of 1 hour, or until the pit is empty. (Note: in areas with slow draining soils, a pressure transducer is recommended to improve the accuracy of change in depth readings. In addition, users are encouraged to extend the testing period and use longer intervals to improve accuracy.)
   ii. Calculate the infiltration rate for each 15-minute interval (change in depth at each interval x 4) and record the results in the table below. Alternatively, users may also record the total time for fixed intervals of changes in depth, and use those values to compute the infiltration rates.

Time of Measurement (15-minute minimum intervals)	Depth of Water (inches)	Infiltration Rate (in/hr)
15:47	14.41	---
16:02	14.41	0
16:17	14.44	0
16:32	14.44	0
16:47	14.44	0

d. **Check for high groundwater / immediate groundwater mounding:**
   1. ☑ Within 24 hours after the falling head period, excavate the bottom of the pit *(Minimum excavation depths are provided in the City of Seattle Stormwater Manual, Appendix D, Section D-2.)*
   2. Is standing water or seepage visible in the excavation hole? (Yes / No)
   3. If "yes," record depth: 5.8 feet bgs

Note: Additional Groundwater Monitoring requirements may apply. See Table 3.1 and Table 3.2 in Volume 3, Section 3.2 of the City of Seattle Stormwater Manual.

17. Data Analysis/"Measured Infiltration Rate" Selection *(use the falling head data to confirm the measured*

infiltration rate calculated from the steady- state data):

a. Steady-state measured infiltration rate: Provide the lowest infiltration rate from steady-state table above: 0 in/hr
b. Selected "Measured Infiltration Rate" 0 in/hr
(Include an explanation if the selected rate deviates from the steady-state rate in step 16a.)
c. If the lowest measured infiltration rate is less than the minimum rate associated with an infiltration BMP, that BMP cannot be used.
d. If the measured infiltration rate is less than all minimum infiltration rates for infiltration BMPs (see Table 1 in the Reference Tables at the end of this document), no further investigation is required.

18. Calculate "Design Infiltration Rate": The design infiltration rate shall be calculated by applying the appropriate correction factor to the above measured infiltration rate (see the *City of Seattle Stormwater Manual, Appendix D, Section D-4).*

a. Select a correction factor.
b. Calculate the Design Infiltration Rate below.

☑ Design infiltration rate = 0 (Measured infiltration rate (in/hr)) x 0.5 (Correction Factor*) = 0 in/hr

*A Correction Factor of 0.5 must be used for all projects unless a lower value is warranted by site conditions, as recommended and documented by a licensed professional, and shall not be less than 0.2. See Appendix D, Section D-4.2.

19. Supporting Documents and Additional Analysis Required:

a. Include a report for the Small and Large PIT that includes documentation of the testing procedure (including this checklist and any supporting documentation), analysis, and results to assess infiltration feasibility, and an explanation of the correction factor used to determine the design infiltration rate. In addition, include the following information.
b. One or more of the following analysis/reports will be required. *See Table 3.1 and Table 3.2 in Volume 3, Section 3.2 of the City of Seattle Stormwater Manual.* Indicate which analysis/reports are required below and include them in the report.

- ☑ **Standard Subsurface Investigation Report** (*Appendix D, Section D-2.4)*
- ☐ **Comprehensive Subsurface Investigation Report** (*Appendix D, Section D-2.5)*
- ☐ **Groundwater Monitoring Report (***Appendix D, Section D-5)*
- ☐ **Characterization of Infiltration Receptor** (*Appendix D, Section D-6)*
- ☐ **Groundwater Mounding and Seepage Analysis** (*Appendix D, Section D-7)*

SIGNATURES ARE REQUIRED

The Small and Large PIT report shall be prepared by a licensed professional.

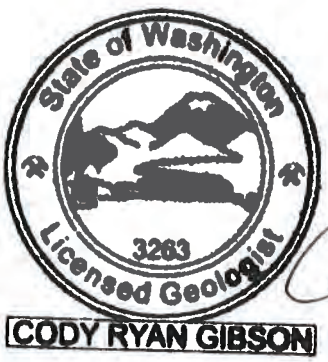
I certify that I have followed the procedures outlined in this document to determine the infiltration BMP infiltration rate.

Infiltration Test performed by:

Print Name Rashi Modi

Signature Rashi Modi Date 05/14/24

Professional Stamp:



5/14/24

REFERENCE TABLES

Table 1. Minimum Measured Infiltration Rates (Taken from the 2021 City of Seattle Stormwater Manual, Vol. 3, Section 3.2 – Table 3.3)

Infiltration BMP	Minimum Measured Infiltration Rate for On-site List Approach (in/hr)	Minimum Allowed Measured Infiltration Rate for Meeting Flow Control, Water Quality Treatment, and On-site Performance Standards (in/hr)
Infiltration Trenches	5	5
Drywells	5	5
Infiltrating Bioretention without underdrain	0.6	0.6
Infiltrating Bioretention with underdrain	0.3	No minimum
Rain Gardens	0.3	Not applicable (only for On-site List Approach)
Permeable Pavement Facility	0.3	0.3[b]
Permeable Pavement Surface	0.3[a]	No minimum
Sidewalk/Trail Compost-Amended Strip	0.3[a]	No minimum
Perforated Stub-out Connections	0.3	Not applicable (only for On-site List Approach)
Infiltration Basins	Not applicable	0.6
Infiltration Chambers/Vaults	Not applicable	0.6

[a] Infiltration testing not required, only necessary to prove infeasibility.

[b] No minimum infiltration rate if underdrain is installed.

GeoEngineers TP-2

City of Seattle
Department of Construction and Inspections
Applicant Services Center
700 Fifth Ave, Suite 2000, P.O. Box 34019
Seattle, WA 98124-4019
www.seattle.gov/sdci

Phone: 206-684-8850

City of Seattle
Pilot Infiltration Test (PIT) Checklist

Call before you dig – Utility Locates 811

Project Address: 3655 Walla Walla Road Date: 04/04/2024

Permit Number: _____

Other Project Information: _____

This Infiltration Test was performed by:

Company Name: GeoEngineers Inc. Primary Contact Name: Rashi Modi

Phone Number: 4252847242 Email Address: rmodi@geoengineers.com

☑ Include site map or drainage control plan, with test locations clearly marked.

The intent of this checklist is to provide a summary of stormwater BMP infiltration testing requirements associated with the Pilot Infiltration Test (PIT). All projects and associated plans are also subject to the minimum requirements outlined in the City of Seattle Stormwater Manual and SMC Chapters 22.800 – 22.808, as well as the specific subsurface investigation and infiltration testing requirements outlined in Volume 3, Chapter 3 and Appendix D of the 2021 City of Seattle Stormwater Manual. See also Appendix C for site constraints that preclude infiltration facility feasibility (such as site slope > 8%).

This checklist does not preclude the use of professional judgment to evaluate and manage risk associated with design, construction, and operation of infiltration BMPs. Justification for testing procedures that deviate from the minimum investigation requirements specified in Appendix D shall be documented in a stamped and signed letter from a State of Washington licensed professional (licensed professional engineer, engineering geologist, geologist, or hydrogeologist) who has experience in infiltration and groundwater testing and infiltration facility design.

Before you start call Utility Locates 811 to request locates of utilities at your site.

SMALL PILOT INFILTRATION TEST (SMALL PIT) AND LARGE PILOT INFILTRATION TEST (LARGE PIT):
Note: The test methods outlined below may be modified due to site conditions if recommended by the licensed professional and the reasoning is documented in the testing report.

1. Indicate type of test:
   - ◉ Small PIT
   - ○ Large PIT
2. Date and time of tests: 04/04/2024 08:31 AM PST
3. Is the infiltration test within the footprint of the proposed infiltration facility? (Yes / No)
4. If "no," is testing being conducted within 50 feet of the proposed infiltration facility? (Yes / No)
   Explain why: _____

5. What is the total proposed impervious area (does not include permeable pavement surfaces) to be infiltrated on the site? TBD _____ ft^2

(Note: acceptance testing is required if testing was performed greater than 50 feet from the proposed infiltration facility, and greater than 5,000 ft^2 infiltrated on the site [see City of Seattle Stormwater Manual, Volume 3, Section 3.2].)

6. ☑ Dig an infiltration test pit
7. Test pit excavated to bottom elevation of the proposed infiltration facility (Yes / No)

(See City of Seattle Stormwater Manual, Appendix D for additional details.)

8. Test pit surface dimensions (ft): Length: 4.3 _____ Width: 3.7 _____ Depth: 2 _____
9. Test pit bottom dimensions (ft): Length: 4.3 _____ Width: 3.7 _____
10. Test pit bottom area (ft^2): 15.91 _____
11. Small PIT only: Is the surface area of the test pit bottom at least 12 ft^2? (Yes / No)
12. Large PIT only: Is the surface area of the test pit bottom at least at least 32 ft^2? (Yes / No)
    a. If "no," indicate why: _____
13. Large PIT only: The test pit bottom area should be as close to the bottom area of the proposed infiltration facility as is feasible.
    a. Bottom area of proposed infiltration facility: _____ ft^2
    b. Bottom area of test pit: _____ ft^2
14. Identify device used to measure water level in test pit:
    ☑ Pressure transducer (recommended for areas with slow draining soils), or
    ☑ Vertical rod (min 5 ft long, ½-inch increments, placed in center of pit)
15. Identify method of delivering water to the bottom of the test pit (e.g., rigid pipe with a splash plate):
    water hose with perforate PVC pipe attached at the end

(The method of delivery must reduce erosion in the test pit that could cause clogging of the infiltration receptor)

16. **Testing Procedure:**
    a. **Pre-soak period**: Add water to maintain water level at least 12 inches above the bottom of the test pit for at least 6 hours. Record the time and depth of water hourly in the table below.

Time of Measurement (hh:mm)	Depth of Water (inches)
08:31	0
08:47	14.03
09:47	13.17
10:47	13.28
11:47	13.42
12:47	14.19
13:47	12.39
14:47	13.06

    b. **Steady-state period**: The steady-state data is used to establish the measured infiltration rate (see step 17)
        i. Add water to the test pit at a rate that will maintain a depth of 12 inches above the bottom of the test pit for 1 full hour. During this hour, record the time, depth of water, cumulative volume, and instantaneous flow rate every 15-minutes in the table below.
        ii. Calculate the infiltration rate for each 15-minute interval. First convert the flow rate to in^3/hr and the test pit bottom area (recorded in step 10) into in^2. Divide the flow rate by the bottom area and record the result in the table below.

Time of Measurement (hh:mm)	Depth of Water (inches)	Cumulative Volume (gallons)	Flow Rate (gpm)	Infiltration Rate (in/hr)
14:47	13.06	---	---	---
15:02	14.58	10	0.53	3.1
15:17	13.58	18.7	0.71	4.3
15:32	12.61	27.7	0.60	4.0
15:47	11.72	36.5	0.58	3.2

[1] 1 gallon = 231 in^3, 1 ft^2 = 144 in^2

c. **Falling head period**: The falling head data is used to confirm the measured infiltration rate calculated from the steady- state data.

i. At the end of the steady-state period, turn off the water and immediately record the time and depth of water in the table below. Record the time and depth of water every 15-minutes for a minimum of 1 hour, or until the pit is empty. (Note: in areas with slow draining soils, a pressure transducer is recommended to improve the accuracy of change in depth readings. In addition, users are encouraged to extend the testing period and use longer intervals to improve accuracy.)

ii. Calculate the infiltration rate for each 15-minute interval (change in depth at each interval x 4) and record the results in the table below. Alternatively, users may also record the total time for fixed intervals of changes in depth, and use those values to compute the infiltration rates.

Time of Measurement (15-minute minimum intervals)	Depth of Water (inches)	Infiltration Rate (in/hr)
15:47	11.72	---
16:02	10.84	3.5
16:17	10.06	3.1
16:32	9.31	3
16:47	8.56	3
17:02	7.9	2.6

d. **Check for high groundwater / immediate groundwater mounding:**

1. ☑ Within 24 hours after the falling head period, excavate the bottom of the pit *(Minimum excavation depths are provided in the City of Seattle Stormwater Manual, Appendix D, Section D-2.)*
2. Is standing water or seepage visible in the excavation hole? (Yes / No)
3. If "yes," record depth: 2.3 feet bgs

Note: Additional Groundwater Monitoring requirements may apply. See Table 3.1 and Table 3.2 in Volume 3, Section 3.2 of the City of Seattle Stormwater Manual.

17. Data Analysis/"Measured Infiltration Rate" Selection *(use the falling head data to confirm the measured*

infiltration rate calculated from the steady- state data):

a. Steady-state measured infiltration rate: Provide the lowest infiltration rate from steady-state table above: 3.1 in/hr
b. Selected "Measured Infiltration Rate" 2.6 in/hr
(Include an explanation if the selected rate deviates from the steady-state rate in step 16a.)
Most conservative infiltration rate
c. If the lowest measured infiltration rate is less than the minimum rate associated with an infiltration BMP, that BMP cannot be used.
d. If the measured infiltration rate is less than all minimum infiltration rates for infiltration BMPs (see Table 1 in the Reference Tables at the end of this document), no further investigation is required.

18. Calculate "Design Infiltration Rate": The design infiltration rate shall be calculated by applying the appropriate correction factor to the above measured infiltration rate (see the *City of Seattle Stormwater Manual, Appendix D, Section D-4).*

a. Select a correction factor.
b. Calculate the Design Infiltration Rate below.

☑ Design infiltration rate = 2.6 (Measured infiltration rate (in/hr)) x 0.5 (Correction Factor*) = 1.3 in/hr

*A Correction Factor of 0.5 must be used for all projects unless a lower value is warranted by site conditions, as recommended and documented by a licensed professional, and shall not be less than 0.2. See Appendix D, Section D-4.2.

19. Supporting Documents and Additional Analysis Required:

a. Include a report for the Small and Large PIT that includes documentation of the testing procedure (including this checklist and any supporting documentation), analysis, and results to assess infiltration feasibility, and an explanation of the correction factor used to determine the design infiltration rate. In addition, include the following information.
b. One or more of the following analysis/reports will be required. *See Table 3.1 and Table 3.2 in Volume 3, Section 3.2 of the City of Seattle Stormwater Manual.* Indicate which analysis/reports are required below and include them in the report.

- ☑ **Standard Subsurface Investigation Report** (*Appendix D, Section D-2.4)*
- ☐ **Comprehensive Subsurface Investigation Report** (*Appendix D, Section D-2.5)*
- ☐ **Groundwater Monitoring Report (***Appendix D, Section D-5)*
- ☐ **Characterization of Infiltration Receptor** (*Appendix D, Section D-6)*
- ☐ **Groundwater Mounding and Seepage Analysis** (*Appendix D, Section D-7)*

SIGNATURES ARE REQUIRED

The Small and Large PIT report shall be prepared by a licensed professional.

I certify that I have followed the procedures outlined in this document to determine the infiltration BMP infiltration rate.

Infiltration Test performed by:

Print Name Rashi Modi

Signature Rashi Modi Date 05/14/24

Professional Stamp:

Cody Gibson 5/14/24

REFERENCE TABLES

Table 1. Minimum Measured Infiltration Rates (Taken from the 2021 City of Seattle Stormwater Manual, Vol. 3, Section 3.2 – Table 3.3)

Infiltration BMP	Minimum Measured Infiltration Rate for On-site List Approach (in/hr)	Minimum Allowed Measured Infiltration Rate for Meeting Flow Control, Water Quality Treatment, and On-site Performance Standards (in/hr)
Infiltration Trenches	5	5
Drywells	5	5
Infiltrating Bioretention without underdrain	0.6	0.6
Infiltrating Bioretention with underdrain	0.3	No minimum
Rain Gardens	0.3	Not applicable (only for On-site List Approach)
Permeable Pavement Facility	0.3	0.3[b]
Permeable Pavement Surface	0.3[a]	No minimum
Sidewalk/Trail Compost-Amended Strip	0.3[a]	No minimum
Perforated Stub-out Connections	0.3	Not applicable (only for On-site List Approach)
Infiltration Basins	Not applicable	0.6
Infiltration Chambers/Vaults	Not applicable	0.6

[a] Infiltration testing not required, only necessary to prove infeasibility.

[b] No minimum infiltration rate if underdrain is installed.

GeoEngineers TP-3

City of Seattle
Department of Construction and Inspections
Applicant Services Center
700 Fifth Ave, Suite 2000, P.O. Box 34019
Seattle, WA 98124-4019
www.seattle.gov/sdci

Phone: 206-684-8850

City of Seattle
Simple Infiltration Test Checklist
Call before you dig – Utility Locates 811

Project Address: 3655 Walla Walla Road Date: 4/8/24

Permit Number: _____

This Infiltration Test was performed by:

Company Name: GeoEngineers Contact Name: Cody Gibson

Phone Number: 4258616000 Email Address: cgibson@geoengineers.com

☑ Include site map or drainage control plan, with test locations clearly marked.

The intent of this checklist is to provide a summary of stormwater BMP subsurface investigation and infiltration testing requirements associated with the Simple Subsurface Investigation. All projects and associated plans are also subject to the minimum requirements outlined in the City of Seattle Stormwater Manual and SMC Chapters 22.800 – 22.808, as well as the specific subsurface investigation and infiltration testing requirements outlined in Volume 3, Chapter 3 and Appendix D of the 2021 City of Seattle Stormwater Manual.

This checklist does not preclude the use of professional judgment to evaluate and manage risk associated with design, construction, and operation of infiltration BMPs.

See Appendix C for site constraints that may preclude infiltration facility feasibility for some BMPs. The Simple Infiltration Test is not allowed for projects with no off-site point of discharge (Section 4.3.2.1). These projects shall use a Small Pilot Infiltration Test (PIT).

Before you start call Utility Locates 811 to request locates of utilities at your site.

The Simple Subsurface Investigation involves an Infiltration Testing element and a Subsurface Investigation element. Although the Infiltration Testing is listed first below, the Infiltration Testing and Subsurface Investigation can be done in any order.

INFILTRATION TESTING:

1. Is the infiltration test within the footprint of the proposed infiltration facility? ☑ Yes ☐ No

2. If "no," is the test within 50 feet of the proposed infiltration facility? ☐ Yes ☐ No

Explain why: _____

3. What is the total proposed new plus replaced impervious area (not including permeable pavement surfaces) infiltrated on the site? TBD ft^2

4. Date and time of test(s): 4/4/24 at 11:14am and 4/5/24 at 7:47am

- *If performed November through March, one test is required.*
- *If performed April through October, two tests are required.*
  - *Tests must be in the same hole within 2-days.*
  - *The beginning of each test must be spaced 24-hours apart.*

5. ☑ Dig an infiltration test hole at least 2-feet deep, measured from the proposed finished grade, and 2-feet across. It is recommended that the test hole depth be at the bottom of the facility to provide the best design information. (Note: this hole is separate from the hole in Step 11below)

6. Diameter of test hole (2-foot minimum): 2 feet

7. Depth of test hole (2-foot minimum): 2 feet

8. Describe soil type and texture (e.g., sand, clay, gravel.): silty sand wtih gravel (sm)

9. Pre-soak period

☑ **a)** Add water to the 12-inch mark. (Measure depth using a ruler, scale, or tape measure).

☑ **b)** Stabilize water depth for a minimum of 30-minutes by adding water until the depth is maintained at a minimum of 12 inches, then move on to step c.

c) Stop adding water, then record the number of inches the water has fallen in 1 hour: 2 inches

d) Record the number of inches the water has fallen from hour 1 to hour 2: 2 inches

e) What is the smaller of the two numbers in row 9c and 9d above? (check only one box below)

- ○ > 3-inches (Use Table 1 below – 15-minute intervals.)
- ◉ Between 1-inch and 3-inches (Use Table 2 below – 30-minute intervals.)
- ○ < 1-inch (Use Table 3 below – 60-minute intervals.)

This is your "testing period".

10. Testing period

Based on the answer to 9e above, use either Table 1, 2 or 3 on the Results and Certification page to record your data and:

☑ **a)** Refill the hole to the 12-inch mark.

☑ **b)** Immediately record the time and depth of water in the appropriate table below.

☑ **c)** Based on your time interval (answer to 9e above):

- ✓ Record the time and depth of water in the hole at the specified intervals.
- ✓ Complete the table by recording six measurements (in addition to the starting depth).
- ✓ If the hole empties prior to the six measurements, refill to the 12-inch mark and continue recording until you have completed the table.

☑ **d)** Using the depth of water recorded at each interval, calculate the infiltration rate and record the results:

- Table 1: Infiltration Rate = Change in depth between each interval x 4
- Table 2: Infiltration Rate = Change in depth between each interval x 2
- Table 3: Infiltration Rate = Change in depth between each interval x 1

☑ **e)** If performed April through October, repeat steps 9 and 10 in the same hole 24 hours after the beginning of the first infiltration test and record the results in the Infiltration Test #2 Result tables.

SUBSURFACE INVESTIGATION:

11. ☑ Dig a hole to the depth required per Table 5 below (2-feet below proposed facility in the wet season and 3-feet below the proposed facility in the dry season) and approximately 5-feet from the proposed infiltration facility. (See the footnote at the end of Table 5 – depth is measured from the bottom of the proposed infiltration facility.)

12. Record total depth of hole from surrounding ground surface: 5 feet

13. While digging the hole, did you:

a) Hit hard pan? (i.e. hardened soil that is like concrete) ☐ Yes ☑ No

b) Encounter standing water or seepage in the hole? ☐ Yes ☑ No

14. If you answered "yes" to either (13a) or (13b), infiltration is not feasible for this site. Test is finished.

INFILTRATION TEST RESULTS AND CERTIFICATION

Infiltration Test #1 Results

Table 1 (15-min)

Time (15-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Table 2 (30-min)

Time (30-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
11:14	12	---
11:44	11	2
12:14	10	2
12:44	9.25	1.5
13:14	8.5	1.5
13:44	8	1
14:14	7.5	1

Table 3 (60-min)

Time (60-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Infiltration Test #2 Results (Required if performed April through October – see step 4 above)

Table 1 (15-min)

Time (15-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

Table 2 (30-min)

Time (30-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
7:47	12	---
8:17	11.25	1.5
8:47	10.75	1
9:17	10 25	1
9:47	9.875	.75
10:17	9.5	.75
10:47	9.25	.5

Table 3 (60-min)

Time (60-min)	Depth of Water (inches)	Infiltration Rate (in/hr)
	12	---

☑ The lowest infiltration rate from the tables above = 0.5 in/hr (Measured infiltration rate)

- *If the lowest measured infiltration rate is less than the minimum rate associated with an infiltration BMP (see Table 4 below), that BMP cannot be used.*
- *If the measured infiltration rate is less than all minimum infiltration rates for infiltration BMPs, no further investigation is required.*

☑ Design infiltration rate = Measured infiltration rate x 0.5 = 0.25 in/hr

SIGNATURES ARE REQUIRED

I certify that I have followed the procedures outlined in this document to determine the infiltration BMP feasibility and infiltration rate.

Infiltration Test performed by:

Print Name Cody R Gibson

Signature _____ Date 4/8/24

Subsurface Investigation performed by:

Print Name Cody Gibson

Signature _____ Date 4/8/24

REFERENCE TABLES

Table 4. Minimum Measured Infiltration Rates (Taken from the 2021 City of Seattle Stormwater Manual, Vol. 3, Section 3.2 – Table 3.3)

Infiltration BMP	Minimum Measured Infiltration Rate for On-site List Approach (in/hr)	Minimum Allowed Measured Infiltration Rate for Meeting Flow Control, Water Quality Treatment, and On-site Performance Standards (in/hr)
Infiltration Trenches	5	5
Drywells	5	5
Infiltrating Bioretention without underdrain	0.6	0.6
Infiltrating Bioretention with underdrain	0.3	No minimum
Rain Gardens	0.3	Not applicable (only for On-site List Approach)
Permeable Pavement Facility	0.3	0.3[b]
Permeable Pavement Surface	0.3[a]	No minimum
Sidewalk/Trail Compost-Amended Strip	0.3[a]	No minimum
Perforated Stub-out Connections	0.3	Not applicable (only for On-site List Approach)
Infiltration Basins	Not applicable	0.6
Infiltration Chambers/Vaults	Not applicable	0.6

[a] Infiltration testing not required, only necessary to prove infeasibility.

[b] No minimum infiltration rate if underdrain is installed.

Table 5. Minimum Investigation Depth and Vertical Separation Requirements (Taken from the 2021 City of Seattle Stormwater Manual, Appendix D, Section D-2.3)

Simple Subsurface Investigation Elements

Minimum Investigation Depth and Vertical Separation Requirements

All BMPs			
		Minimum Vertical Separation, ft[a]	
Season	Minimum Investigation Depth (ft)[a]	Groundwater	Hydraulically-Restrictive Layer
Wet Season (November – March)	2	1	1
Dry Season (April – October)	3	2	1

Soil Characteristics

Type and texture of soil

[a] The bottom of the BMP is defined as the deepest portion of proposed BMP where infiltrating water is expected to move into the underlying soil.

APPENDIX E
Report Limitations and Guidelines for Use

APPENDIX E
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Read These Provisions Closely

It is important to recognize that the geoscience practices (geotechnical engineering, geology, and environmental science) rely on professional judgment and opinion to a greater extent than other engineering and natural science disciplines, where more precise and/or readily observable data may exist. To help clients better understand how this difference pertains to our services, GeoEngineers includes the following explanatory "limitations" provisions in its reports. Please confer with GeoEngineers if you need to know more how these "Report Limitations and Guidelines for Use" apply to your project or site.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

This report has been prepared for use by the University of Washington and members of the design team for use in the design of this project. This report may be made available to prospective contractors for bidding or estimating purposes; but our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GeoEngineers structures its services to meet the specific needs of its clients. No party other than the party to whom this report is addressed may rely on the product of our services unless we agree to such reliance in advance and in writing. Within the limitations of the agreed scope of services for the Project, and its schedule and budget, our services have been executed in accordance with our Agreement with the University of Washington dated March 26, 2019 and generally accepted geotechnical practices in this area at the time this report was prepared. We do not authorize, and will not be responsible for, the use of this report for any purposes or projects other than those identified in the report.

- Not prepared for you,
- Not prepared for your project,
- Not prepared for the specific site explored, or
- Completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

- The function of the proposed structure;
- Elevation, configuration, location, orientation or weight of the proposed structure;
- Composition of the design team; or
- Project ownership.

[1] Developed based on material provided by GBA, GeoProfessional Business Association; www.geoprofessional.org.

If important changes are made after the date of this report, GeoEngineers should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the site, new information or technology that becomes available subsequent to the report date, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. If more than a few months have passed since issuance of our report or work product, or if any of the described events may have occurred, please contact GeoEngineers before applying this report for its intended purpose so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Geotechnical and Geologic Findings are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies the specific subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied its professional judgment to render an informed opinion about subsurface conditions at other locations. Actual subsurface conditions may differ, sometimes significantly, from the opinions presented in this report. Our report, conclusions and interpretations are not a warranty of the actual subsurface conditions.

Geotechnical Engineering Report Recommendations are Not Final

We have developed the following recommendations based on data gathered from subsurface investigation(s). These investigations sample just a small percentage of a site to create a snapshot of the subsurface conditions elsewhere on the site. Such sampling on its own cannot provide a complete and accurate view of subsurface conditions for the entire site. Therefore, the recommendations included in this report are preliminary and should not be considered final. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for the recommendations in this report if we do not perform construction observation.

We recommend that you allow sufficient monitoring, testing and consultation during construction by GeoEngineers to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes if the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective means of managing the risks associated with unanticipated conditions. If another party performs field observation and confirms our expectations, the other party must take full responsibility for both the observations and recommendations. Please note, however, that another party would lack our project-specific knowledge and resources.

A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by members of the design team or by contractors can result in costly problems. GeoEngineers can help reduce the risks of misinterpretation by conferring with appropriate members of the design team after submitting the report, reviewing pertinent elements of the design team's plans and specifications, participating in pre-bid and preconstruction conferences, and providing construction observation.

Do not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. The logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Photographic or electronic reproduction is acceptable, but separating logs from the report can create a risk of misinterpretation.

Give Contractors a Complete Report and Guidance

To help reduce the risk of problems associated with unanticipated subsurface conditions, GeoEngineers recommends giving contractors the complete geotechnical engineering or geologic report, including these "Report Limitations and Guidelines for Use." When providing the report, you should preface it with a clearly written letter of transmittal that:

- Advises contractors that the report was not prepared for purposes of bid development and that its accuracy is limited; and
- Encourages contractors to conduct additional study to obtain the specific types of information they need or prefer.

Contractors Are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule, or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and adjacent properties.

Geotechnical, Geologic and Environmental Reports Should Not Be Interchanged

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention, or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings, or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants, and no conclusions or inferences should be drawn regarding Biological Pollutants as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria and viruses, and/or any of their byproducts.

GeoEngineers

Attachment B
Critical Areas Report

UNIVERSITY OF WASHINGTON
ASUW SHELL HOUSE RESTORATION PROJECT

Critical Areas Report

Prepared for
University of Washington

January 2024

ESA

UNIVERSITY OF WASHINGTON
ASUW SHELL HOUSE RESTORATION PROJECT

Critical Areas Report

Prepared for
University of Washington
Seattle, WA 98195

January 2024

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Critical Areas Report for ASUW Shell House Restoration Project

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ASUW SHELL HOUSE RESTORATION PROJECT

Critical Areas Report

1.0 Authorization and Scope of Work

The University of Washington (UW) has requested that Environmental Science Associates (ESA) document critical areas within the vicinity of the ASUW Shell House, located within the City of Seattle (City), King County, Washington. The University of Washington (UW) is proposing to restore the ASUW Shell House (Shell House), and the restoration will convert the building from a storage facility into a mixed-use assembly space. UW is embarking on the design phase for the building's restoration. This Critical Areas Report will help to inform the design approach and direction. Per the scope of work, ESA reviewed areas with ground disturbance, performed a field investigation, identified and delineated critical areas, and prepared this report.

This Critical Areas Report adheres to the City requirements described in the SMC 25.09.330 – *Environmentally Critical Area Exception Application Submittal Requirements*. Critical areas regulated by the City through its critical areas ordinance (SMC 25.09) that potentially occur on-site and within the study area include waters of the United States (U.S.) such as lakes and wetlands, and fish and wildlife habitat conservation areas (FWHCAs). The Lake Washington shoreline environment extends 200 feet into the study area. Lake Washington is a designated Shoreline of the State, which places it within shoreline jurisdiction under the City's Shoreline Master Program (SMC 23.60A). This report describes critical areas mapped by existing resources, presents the results of a field investigation (focusing on wetlands and fish and wildlife habitat), and describes potential regulatory implications associated with identified critical areas relevant to the project. Geological critical areas such as seismic and erosion hazards, critical aquifer recharge areas, and channel migration hazard areas are not addressed in this report.

2.0 Site Location and Study Area

The ASUW Shell House is located within the Lake Washington/Cedar/Sammamish River watershed, Water Resource Inventory Area (WRIA) 8. The study area and existing Shell House building consist of two parcels (King County parcel numbers 1625049001 and 162504HYDR) in the southeast quarter of Section 16, Township 25 North, Range 4 East within the City of Seattle (**Figure 1**; figures are included in **Appendix A**). The study area is in the shoreline district of Lake Washington immediately north of the entrance to the Lake Washington Ship Canal (Ship Canal) at the Montlake Cut, approximately 500 feet southeast of the UW Husky Stadium. The study area is within the City's Conservancy Management (CM) Shoreline Environment as governed by SMC 23.60A – Seattle Shoreline Master Program Regulations.

The elevation of Lake Washington has been managed by the U.S. Army Corps of Engineers (Corps) since 1916 when the Cedar River was rerouted to drain into the lake and the lake's outlet rerouted from the Black River to the Lake Washington Ship Canal (Ship Canal). The Ship Canal runs from the Montlake Cut near the University of Washington to its confluence with Puget Sound at Shilshole Bay. Rerouting the Cedar River through the newly constructed Ship Canal caused the lake to drop in elevation by 9 feet.

Built in 1918 on land used by Indigenous Coast Salish peoples to carry canoes between Lake Washington and Portage Bay, the 13,000 square foot Shell House has served many uses, including a seaplane hangar for the U.S. Navy, UW Rowing shell house, boat building workshop for George Pocock's legendary racing shells, and most recently, a storage facility for waterfront recreation vessels. The study area of the Shell House is well developed with unpaved public trails, paved access roads, and parking lots associated with Husky Stadium. Docks for small watercraft extend into the Union Bay, east of the Shell House. Vegetation consists of manicured lawn and forested, shrub, and herbaceous vegetation communities. The upland slopes north of the Shell House and the shore of the Lake Washington Ship Canal are vegetated with a mix of native tree and shrub species including bigleaf maple (*Acer macrophyllum*), Douglas-fir (*Pseudostuga menziesii*), western redcedar (*Thuja plicata*), Pacific and Sitka willow (*Salix lasiandra* and *S. sitchensis*), black cottonwood (*Populus balsamifera*), snowberry (*Symphoricarpos albus*), and Nootka rose (*Rosa nutkana*). Emergent wetland vegetation along the shoreline east of the Shell House consists of slough sedge (*Carex obnupta*), panicled bulrush (*Scirpus microcarpus*), hardstem bulrush (*Schoenoplectus acutus*), and soft rush (*Juncus effusus*).

3.0 Methods

3.1 Review of Existing Documentation

Prior to conducting the field investigation, ESA biologists reviewed readily available documentation to get a preliminary indication of study area conditions and assess the potential for regulated critical areas to be present on-site. Copies of existing information are provided in **Appendix B.** The following documents and sources were reviewed:

- King County iMap (King County 2023).
- The City of Seattle Department of Construction and Inspection (SDCI) geographic information system (GIS) (City of Seattle 2023a).
- The City of Seattle GeoData Environmentally Critical Area (ECA) Wildlife Habitat mapping tool (City of Seattle 2023b).
- U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) Mapper (USFWS 2023a).
- USFWS Information for Planning and Consultation (IPaC) species and habitat database (USFWS 2023b).
- Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture (USDA) Web Soil Survey (NRCS 2023a).

- NRCS National Water and Climate Center Wetlands Climate Tables WETS Climate Data Resources (NRCS 2023b).
- Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species (PHS) on the Web (WDFW 2023).
- Statewide Washington Integrated Fish Distribution (SWIFD) online mapping (NWIFC 2023).
- National Marine Fisheries Service (NMFS) Endangered Species Act Critical Habitat Mapper (NMFS 2023a).
- NMFS Essential Fish Habitat Mapper (NMFS 2023b).
- Washington State Department of Ecology (Ecology) Water Quality Atlas for 303(d) listed waters and total maximum daily load (TMDL) water quality improvement projects (Ecology 2023).

Online mapping resources indicate the potential presence of critical areas in the vicinity of the study area. However, these resources are not definitive and may not reflect the current site conditions. As a result, ESA combined review of the above technical resources with an on-site assessment to verify the presence and extent of critical areas.

3.2 Wetland Identification, Delineation, and Classification

ESA biologists delineated wetlands according to local, state, and federal guidelines within the study area boundary. Wetlands were delineated using the Routine Determination Method in the U.S. Army Corps of Engineers *Wetland Delineation Manual* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region – Version 2.0* (Corps 2010).

Wetland delineation consisted of: (1) assessing vegetation, soil, and hydrologic characteristics to identify areas meeting the wetland criteria; and (2) marking wetland boundaries. In places that appeared to have wetland characteristics, the dominant plant species, soil conditions in test pits, and evidence of hydrologic conditions were recorded on routine data forms. Upland areas adjacent to potential wetland areas were also evaluated. Based on the field data, a wetland/non-wetland determination was made for each examined area. Following confirmation of all three wetland parameters in an area, the wetland boundary was marked by placing sequentially numbered, fluorescent pink flagging along the wetland perimeter. Data plots were marked with plain pink flagging. The flag and data plot locations were recorded using ArcGIS Collector application on an Apple iPad paired with an EOS Arrow 100 Global Navigation Satellite System (GNSS) device.

Several tools were used to identify and classify plants and soils examined within the study area. The wetland indicator status and scientific names of plants were identified using the National Wetland Plant List Version 3.5 (Corps 2020). Hydric soil conditions were assessed using *Field Indicators of Hydric Soils in the United States* Version 8.2 (NRCS 2018).

The wetlands delineated within the study area were classified according to federal, state, and local systems. The USFWS system (Cowardin et al. 1979) is a descriptive classification, based on physical attributes (i.e., vegetation, soils, and water regime). The hydrogeomorphic (HGM)

classification is based on three fundamental factors that influence how wetlands function: position in the landscape (geomorphic setting), water source (hydrology), and the flow and fluctuation of the water once in the wetland (hydrodynamics) (Brinson 1993).

3.3 Wetland Functional Assessment

Wetlands perform a variety of biological, physical (hydrologic), and chemical (water quality) functions. How and to what level these functions are provided depend primarily on the wetland's HGM classification. Functions for wetlands delineated within the study area were classified using the Washington State Wetland Rating System for Western Washington (Ecology Wetland Rating System) (Hruby 2023). The rating system first classifies a wetland's HGM class and then assigns multiple aspects related to each function type (water quality, hydrology, and habitat) a high, medium, or low level of function based on the wetland's attributes. The system classifies wetlands into four hierarchical categories based on rarity, sensitivity to disturbance, and water quality, hydrologic, and habitat functions. Classifications range from Category I wetlands, which exhibit outstanding features (rare wetland type, relatively undisturbed or high sensitivity to disturbance, and high level of functions) to Category IV wetlands, which have the lowest levels of function and are often heavily disturbed.

The City has codified use of the Ecology Wetland Rating System (SMC 25.09.160.A), and assigns wetland buffer widths based on wetland category, existing buffer conditions, size, proximity to waters of the UW, and habitat score. Wetland buffers in the City of Seattle range from 50 feet to 200 feet (SMC 25.09.160 Table A).

4.0 Existing Documentation

4.1 Climate and Precipitation

The climate of Washington west of the Cascade Mountain range, where the study area is located, generally includes summers with moderate temperatures that can be partly cloudy, and winters with cooler temperatures that can be overcast and wet. Over the course of the year, temperatures typically vary from 38 degrees Fahrenheit (°F) to 69° F and are rarely below 29° F or above 77° F (NRCS 2023b). Precipitation is frequent, and the average growing season period is from April 8 to November 11 (217 days) each year (NRCS 2023b). A comparison between WETS average precipitation data and recorded precipitation leading up to the field investigation is shown in **Table 1** below. For the purposes of this analysis, data from the Seattle Tacoma Airport WETS Station were used. Complete climate data are included in **Appendix B**.

TABLE 1
AVERAGE VS. MEASURED PRECIPITATION (IN INCHES) FOR THE WATER YEAR AND THE 3 MONTHS PRIOR TO THE FIELD INVESTIGATION

Time Interval	Recorded Precipitation	WETS			Within Normal Range?
		Average	30% Chance Less	30% Chance More	
Prior Water Year (October 2022 - November 2023)	39.34	37.07	33.52	40.09	**Yes**
3 Months Prior to Survey					
August 2023	0.27	1.02	0.38	1.24	**No**
September 2023	3.44	1.63	0.69	1.90	**No**
October 2023	2.89	3.19	1.96	3.86	**Yes**

Precipitation was within the normal range for the prior water year. However, two of the months preceding the field investigation were outside of the normal range; August 2023 had low precipitation levels, while September 2023 had high precipitation levels. Although precipitation of these months was outside the normal levels, hydrology was within a "normal" range for the purposes of the field investigation, and the "normal circumstances" methodology (Environmental Laboratory 1987) was used for wetland delineation.

4.2 Wetlands and Soils

The NWI maps Lake Washington as an approximately 22,863-acre lacustrine unconsolidated bottom and aquatic bed wetland and deep water system that is permanently flooded (**Figure 2, Appendix A**) (USFWS 2023a). PHS also maps the lake as a lacustrine wetland system providing aquatic habitat (WDFW 2023). Across the Montlake Cut within the southwest edge of the study area, NWI, PHS, and SDCI map freshwater palustrine forested and scrub-shrub wetlands that are seasonally flooded (USFWS 2023a, WDFW 2023, City of Seattle 2023a).

According to the NRCS Web Soil Survey (NRCS 2023a), soils within the study area are classified as Urban Land. This soil type is typical of urban development and does not indicate the presence of wetlands.

4.3 Shorelines of the State

The study area is within the shoreline environment of Lake Washington, which is a designated as a Shoreline of the State. The state water typing system, Washington Administrative Code (WAC) 222-16-030, classifies waters as S, F, Np, or Ns, depending on their Shoreline of the State status, presence of fish habitat, annual flow rate (seasonal or perennial), and connections to other waters.

The City, whose shoreline jurisdiction extends 200 feet landward of the Ordinary High Water Mark (OHWM) and its associated wetlands, regulates Shorelines of the State, or Type S waters, under SMC Chapter 23.60A - *Seattle Shoreline Master Program Regulations*. The code classifies shorelines within the City of Seattle into eleven shoreline environment designations which

include Conservancy and Urban classification, based on basin and shoreline condition, location relative to the county Urban Growth Area, and specific drainage basin.

4.4 Fish and Wildlife Habitat

Fish and wildlife habitat conservation areas (as defined in SMC 25.09.012.D) include areas defined and/or mapped by WDFW as biodiversity areas and corridors; priority habitats except wetlands (which are defined in subsection SMC 25.09.012.C); corridors of land or water connecting priority habitats or habitat areas for species of local importance; areas that provide habitat for species of local importance; riparian corridors; priority habitat areas as regulated by SMC 23.60A.156 and 23.60A.160 (Shoreline Districts); and areas that state or federally designated endangered, threatened, and sensitive species have a primary association with. FWHCAs, including critical habitat designated by NMFS for salmonids, are mapped within the study area (**Figure 2, Appendix A**) (NMFS 2023a, NMFS 2023b).

Both the USFWS and the NMFS provide listings of threatened and endangered species protected under the Endangered Species Act that are under their jurisdiction **(Table 2).** The current listings indicate the potential presence of three federally listed salmonid species that use the Lake Washington Ship Canal adjacent to the study area: Puget Sound Evolutionarily Significant Unit (ESU) Chinook salmon (*Oncorhynchus tshawytscha*), Puget Sound Distinct Population Segment (DPS) steelhead (*O. mykiss*), and Coastal-Puget Sound DPS bull trout (*Salvelinus confluentus*) (NMFS 1999, 2007; USFWS 1999). Along with the above-listed salmonids, SWIFD also lists pink (*O. gorbuscha*), coho (*O. kisutch*), and sockeye (*O. nerka*) salmon occurring in the Lake Washington Ship Canal during their life cycle (NWIFC 2023).

Critical habitat exists within the study area for Coastal-Puget Sound DPS bull trout (USFWS 2023b) and Puget Sound ESU Chinook salmon (NMFS 2023a). Essential Fish Habitat is also mapped for Chinook within the study area (NMFS 2023b).

In addition to these fish species, five additional species protected by or proposed to be protected by the Endangered Species Act potentially occur in the study area and vicinity: North American wolverine (*Gulo gulo luscus*), marbled murrelet (*Brachyramphus marmoratus*), yellow-billed cuckoo (*Coccyzus americanus*), northwestern pond turtle (*Actinemys marmorata*), and monarch butterfly (*Danaus plexippus*) **(Table 2).**

Along with these listed species, several bird species protected under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) potentially occur in the study area. These species include, but are not limited to, bald eagle **(***Haliaeetus leucocephalus*), evening grosbeak (*Coccothraustes vespertinus*), olive-sided flycatcher (*Contopus cooperi*), and rufous hummingbird (*Selasphorus rufus*) (USFWS 2023b).

TABLE 2
FEDERALLY LISTED FISH AND WILDLIFE SPECIES POTENTIALLY PRESENT IN THE STUDY AREA

Common Name (Scientific Name)	ESA Status	Jurisdiction	Critical Habitat in Study Area?
Coastal-Puget Sound DPS Bull Trout (*Salvelinus confluentus*)	Threatened	USFWS	Yes
Puget Sound Chinook Salmon ESU (*Oncorhynchus tshawytscha*)	Threatened	NMFS	Yes
Puget Sound Steelhead DPS (*Oncorhynchus mykiss*)	Threatened	NMFS	No
Northwestern Pond Turtle (*Actinemys marmorata*)	Proposed Threatened	USFWS	No
North American Wolverine[1] (*Gulo gulo luscus*)	Proposed Threatened	USFWS	No
Marbled Murrelet[1] (*Brachyramphus marmoratus*)	Threatened	USFWS	No
Yellow-billed Cuckoo[1] (*Coccyzus americanus*)	Threatened	USFWS	No
Monarch Butterfly[1] (*Danaus plexippus*)	Candidate	USFWS	No

SOURCE: NMFS 1999, 2007, 2023a; USFWS 1999, 2023b

1 The study area does not contain suitable habitat, such as mature coniferous forest or undeveloped corridors, to support these species; therefore, these species do not occur within the study area.

Species of Local Importance

Species of Local Importance are defined in SMC 25.09.200.C and include local populations of native species that are vulnerable; in danger of extinction; have recreational, commercial, or tribal value; or are not adequately protected by existing agencies outside of the City.

Areas immediately north and south of the study area are mapped by PHS as biodiversity corridor with stands of mixed conifer and deciduous trees intermixed with snags, downed logs, and wetlands, providing habitat for nesting bald eagles and great blue heron (*Ardea herodias*), waterfowl, and northwestern pond and painted turtles (*Chrysemys picta*) (WDFW 2023).

The Seattle ECA Wildlife Habitat mapping tool indicates that Lake Washington has important habitat for a diversity of wintering waterfowl, particularly diving birds including bufflehead (*Bucephala albeola*) and mergansers (*Mergus* spp.) (City of Seattle 2023b). A great blue heron management area is mapped approximately 0.3 mile northeast of the study area, and a bald eagle management area is also mapped 0.5 mile southeast of the study area (City of Seattle 2023b). Per SMC 25.09.200.C.5, great blue herons are designated species of local importance.

5.0 Results of Field Investigation

Two ESA biologists conducted a field investigation within the Shell House study area on November 7, 2023 to investigate potential critical areas. Representative photographs of the study area are included in **Appendix C**.

5.1 Wetlands

The NWI mapped a small portion of freshwater palustrine forested and scrub-shrub wetlands within the southwest portion of the study area within 295 feet of the Shell House. However, this

area was not assessed due to it being highly unlikely to be impacted by the proposed project because it is located on the opposite side of the Montlake Cut from the Shell House. Additionally, the assigned buffer of this wetland complex, which at maximum would be 200 feet (SMC 25.09.160 Table A), does not extend into potential work areas of the project.

5.2 Fish and Wildlife Habitat Areas

The study area is mapped as having essential and critical habitat for salmonids (NMFS 2023a, NMFS 2023b), both of which are considered by the City to be FWHCAs (SMC 25.09.012.D). During the time of the field investigation, some nearshore salmonid habitat such as vegetation, woody debris, and a natural shoreline substrate was observed within the study area. However, the study area is located within a well-developed area, and the majority of the Ship Canal has armored banks and limited riparian vegetation canopy. In general, the area provides limited habitat opportunity. Although open water, wetlands, and other accessible habitat exist near the study area, its proximity to Husky Stadium introduces regular noise and traffic disturbances that limit habitat opportunity for terrestrial species.

During the field investigation, ESA biologists observed several bird species, including Anna's hummingbird (*Calypte anna*), pine siskin (*Spinus pinus*), wood duck (*Aix sponsa*), and cormorant (*Phalacrocorax* sp.). No habitat for protected species such as old-growth forest, large snags, or priority habitat logs (logs over 4 inches in diameter and more than 6 feet long) were observed within the study area during the field investigation. Additionally, no protected species or species of local importance were observed during the field investigation.

6.0 Regulatory Context

As of December 2023, the design options for the restoration of the Shell House have been created to avoid impacts on FWHCAs, and their associated buffers. The current design options do not include filling or shading wetlands, work within or below the OHWM of Lake Washington, or significant vegetation disturbance such as the removal of trees. If the design options change and include any of these types of impacts, several federal, state, and local permits may be required. These may include Clean Water Act Section 404 and 401 permits verified by the Corps and Ecology, respectively; Hydraulic Project Approval (HPA) issued by WDFW; and a Shoreline Permit issued by the City. This section summarizes the regulatory requirements associated with the site.

6.1 Federal

The discharge of fill or dredge materials to waters of the U.S. (e.g., wetland and streams) would require the project proponent to apply for a Section 404 permit from the Corps. If in-water or overwater work were to occur, an Individual Corps permit may need to be pursued.

The Corps would initiate Endangered Species Act Section 7 consultation with the USFWS and NMFS to ensure the project does not jeopardize the continued existence of any threatened, endangered, or proposed species, or result in the destruction or adverse modification of critical habitat.

The Section 404 permit would require issuance of a Section 401 Water Quality Certification, a federal permit administered in Washington State by Ecology. The certification indicates that Ecology has reasonable assurance that the project will comply with state water quality standards and other aquatic resource protection requirements under Ecology's authority.

6.2 State

Ecology provides oversight to local governments in regulating activities near Shorelines of the State, including Lake Washington. The City's shoreline jurisdiction extends 200 feet from the OHWM of the lake shoreline, putting the study area within shoreline jurisdiction. Development activities within the shoreline jurisdiction would require either a Shoreline Exemption, a Substantial Shoreline Development Approval, or a Shoreline Variance. More information regarding Shoreline Exemptions is provided in the City's regulatory overview.

If a design option where in-water work is proposed were pursued for the project, WDFW would require a HPA. Only projects that use, divert, obstruct, or change the natural bed or flow of state waters require a HPA from WDFW. The HPA permit is authorized through Chapter 77.55 Revised Code of Washington (RCW) and administered through rules in the WAC.

6.3 City of Seattle

The City regulates critical areas under SMC 25.09, *Regulations for Environmentally Critical Areas*. Within the study area, multiple areas are designated critical areas, including wetlands and FWHCAs.

Fish and Wildlife Habitat Conservation Areas (FWHCAs)

Review of proposed development impacts on a FWHCA is required under SMC 25.09.200. Development without consultation with WDFW is prohibited within FWHCAs, and the project will need to comply with any requirements of that agency and the follow standards per SMC 25.09.200.B.3 to protect them, as follows:

a. Minimize development;

b. Locate development in areas that maximize the retention of trees and vegetation;

c. Establish a buffer zone to protect habitat and treed and vegetated areas;

d. Preserve important tree and vegetation and other habitat features;

e. Limit access to habitat areas;

f. Impose seasonal restriction of construction activities, and non-disturbance areas as appropriate to protect fish or wildlife species present on the site;

Current proposed design options would not result in notable impacts to FWHCAs because the Shell House exists within a developed area that is already subjected to frequent shoreline use. Project construction would comply with any seasonal fish and avian breeding windows for sensitive species and would not significantly disturb or remove existing vegetation. In addition,

construction best management practices (BMPs) will be followed to reduce disturbance to wildlife and associated habitat within the study area.

Shoreline Approvals

The project will be required to comply with the state Shoreline Management Act (SMA), as the entire study area is located within the shoreline jurisdiction. As administrator of the state SMA, Ecology has developed laws relative to the executive of the SMA within the Washington Administrative Code (WAC 173-27). The WAC requires local municipalities with waterbodies that meet the definition of a shoreline or shoreline of statewide significance in RCW 90.58.030 to develop a local Shoreline Master Program (SMP). The City has adopted the SMA and regulates it through SMC 23.60A. The project would be required to obtain a Shoreline Approval prior to any work occurring within the shoreline jurisdiction and may be eligible for an exemption from a Shoreline Substantial Development Permit (SSDP) (as described below).

A SSDP is required for development that meets the definition of substantial development according to RCW 90.58.030(3)(e):

> *"…any development of which the total cost or fair market value exceeds five thousand dollars, or any development which materially interferes with the normal public use of the water or shorelines of the state. The dollar threshold established in this subsection (3)(e) must be adjusted for inflation by the office of financial management every five years, beginning July 1, 2007, based upon changes in the consumer price index during that time period."*

Effective July 1, 2022, the dollar threshold for substantial development and uses had a fair market value of $8,504 (Ecology 2023). The cost of the proposed project would far exceed the fair market value for non-exempt development in the City's shoreline district. However, current design options being explored for the project are confined to the existing footprint of the Shell House building, ground disturbance for utility connections, and accessibility improvements. Given this limitation, the proposed project may be considered as "Normal Maintenance," under both the City's SMP (SMC 23.60A.020.C) and WAC (WAC 173-27- 040(2)(b)), and would then qualify for a shoreline exemption.

> **SMC 23.60a.020.C.1:**
>
> *C. Exemptions. The following substantial developments are exempt from obtaining a shoreline substantial development permit from the Director:*
>
> *1. "Normal maintenance" or repair of existing structures or developments, including damage by accident, fire or elements.*
>
> *a. "Normal maintenance" means those usual acts to prevent a decline, lapse or cessation from a lawfully established state comparable to its original condition, including but not limited to its size, shape, configuration, location, and external appearance, within a reasonable period after decay or partial destruction, except where repair causes substantial adverse effects to shoreline resources or environment.*

> b. *Replacement of a structure or development is repair if such replacement is the common method of repair for the type of structure or development and the replacement structure or development is comparable to the original structure or development including but not limited to its size, shape, configuration, location and external appearance, and the replacement does not cause substantial adverse effects to shoreline resources or environment.*
>
> **WAC 173.27-040(2)(b):**
>
> *Normal maintenance or repair of existing structures or developments, including damage by accident, fire or elements. "Normal maintenance" includes those usual acts to prevent a decline, lapse, or cessation from a lawfully established condition. "Normal repair" means to restore a development to a state comparable to its original condition, including but not limited to its size, shape, configuration, location and external appearance, within a reasonable period after decay or partial destruction, except where repair causes substantial adverse effects to shoreline resource or environment. Replacement of a structure or development may be authorized as repair where such replacement is the common method of repair for the type of structure or development and the replacement structure or development is comparable to the original structure or development including but not limited to its size, shape, configuration, location and external appearance and the replacement does not cause substantial adverse effects to shoreline resources or environment.*

The restoration of the Shell House would have limited and temporary impacts on critical areas within the study area, including noise and ground disturbance that would be mitigated by following construction best management practices. If the final selected design of the project results in additional impacts on critical areas, the project will follow appropriate mitigation sequencing and procedures, as described in SMC 25.09.065. Additionally, the project will increase public access to the shoreline environment and meet the overall goals of the City's SMP, which is to encourage shoreline-dependent use of the area.

7.0 Limitations

Within the limitations of schedule, budget, scope-of-work, and seasonal constraints, we warrant that this investigation was conducted in accordance with generally accepted environmental science practices, including the technical guidelines and criteria in effect at the time this investigation was performed. The results and conclusions of this report represent the authors' best professional judgment, based on information provided by the project proponent in addition to that obtained during the course of this study. No other warranty, expressed or implied, is made.

8.0 References

Brinson, M.M. 1993. *A Hydrogeomorphic Classification for Wetlands.* URL: https://erdc-library.erdc.dren.mil/jspui/bitstream/11681/6483/1/TR-WRP-DE-4.pdf. Accessed: November 2023.

City of Seattle. 2023a. *The City of Seattle Department of Construction and Inspection (SDCI) GIS*. URL: https://seattlecitygis.maps.arcgis.com/apps/webappviewer/index.html?id=f822b2c6498c4163b0cf908e2241e9c2. Accessed November 2023.

City of Seattle. 2023b. *The City of Seattle GeoData Environmentally Critical Area (ECA) Wildlife Habitat mapping tool.* URL: https://data-seattlecitygis.opendata.arcgis.com/maps/SeattleCityGIS::eca-wildlife-habitat. Accessed: November 2023.

Corps (U.S. Army Corps of Engineers). 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (Version 2.0), ERDC/EL TR-10-3. U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Corps (U.S. Army Corps of Engineers). 2020. *National Wetland Plant List,* Version 3.5. Updated 2018. URL: http://wetland-plants.usace.army.mil/nwpl_static/v34/home/home.html. Accessed: June 2022.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States, publication #FWS/OBS-79/31*. United States Department of the Interior, Fish and Wildlife Service, Office of Biological Services, Washington, D.C.

Ecology (Washington State Department of Ecology). 2023. *Water Quality Atlas*. URL: https://apps.ecology.wa.gov/waterqualityatlas/wqa/map. Accessed: November 2023.

Environmental Laboratory. 1987. *Corps of Engineers Wetlands Delineation Manual.* Technical Report Y-87-1. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Hruby, T., and A. Yahnke. 2023. Washington State Wetland Rating System for Western Washington Version 2.0: 2014 Update. Publication #32-06-009. Washington Department of Ecology, Olympia, WA.

King County. 2023. King County Interactive Mapping (iMap) Tool. URL: https://kingcounty.gov/services/gis/Maps/imap.aspx. Accessed November 2023.

NMFS (National Marine Fisheries Service). 1999. *Endangered and threatened species; threatened status for three Chinook salmon evolutionarily significant units (ESUs) in Washington and Oregon, and endangered status for one Chinook salmon ESU in Washington*. Final Rule. March 24, 1999. Federal Register 64(56):14308-14328.

NMFS. 2007. *Endangered and Threatened Species: Final Listing Determination for Puget Sound Steelhead*. May 11, 2007. Federal Register 72(91): 26722–26735.

NMFS. 2023a. *Critical Habitat Mapper.* URL: https://www.fisheries.noaa.gov/resource/map/national-esa-critical-habitat-mapper. Accessed: November 2023.NMFS. 2023b. *Essential Fish Habitat Mapper.* URL: https://www.fisheries.noaa.gov/resource/map/essential-fish-habitat-mapper. Accessed: November 2023.

NRCS (Natural Resources Conservation Service). 2018. *Field Indicators of Hydric Soils in the United States: A Guide for Identifying and Delineating Hydric Soils*, Version 8.2. URL: https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053171.pdf. Accessed: November 2023.

NRCS (Natural Resources Conservation Service). 2023a. *Web Soil Survey*. URL: https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx. Accessed: November 2023.

NRCS. 2023b. *National Water and Climate Center Wetlands Climate Tables WETS Climate Data Resources.* URL: https://www.nrcs.usda.gov/wps/portal/wcc/home/climateSupport/wetlandsClimateTables/. Accessed November 2023.

NWIFC (Northwest Indian Fisheries Commission). 2023. *Statewide Washington Integrated Fish Distribution (SWIFD).* URL: https://geo.nwifc.org/swifd/. Accessed: November 2023.

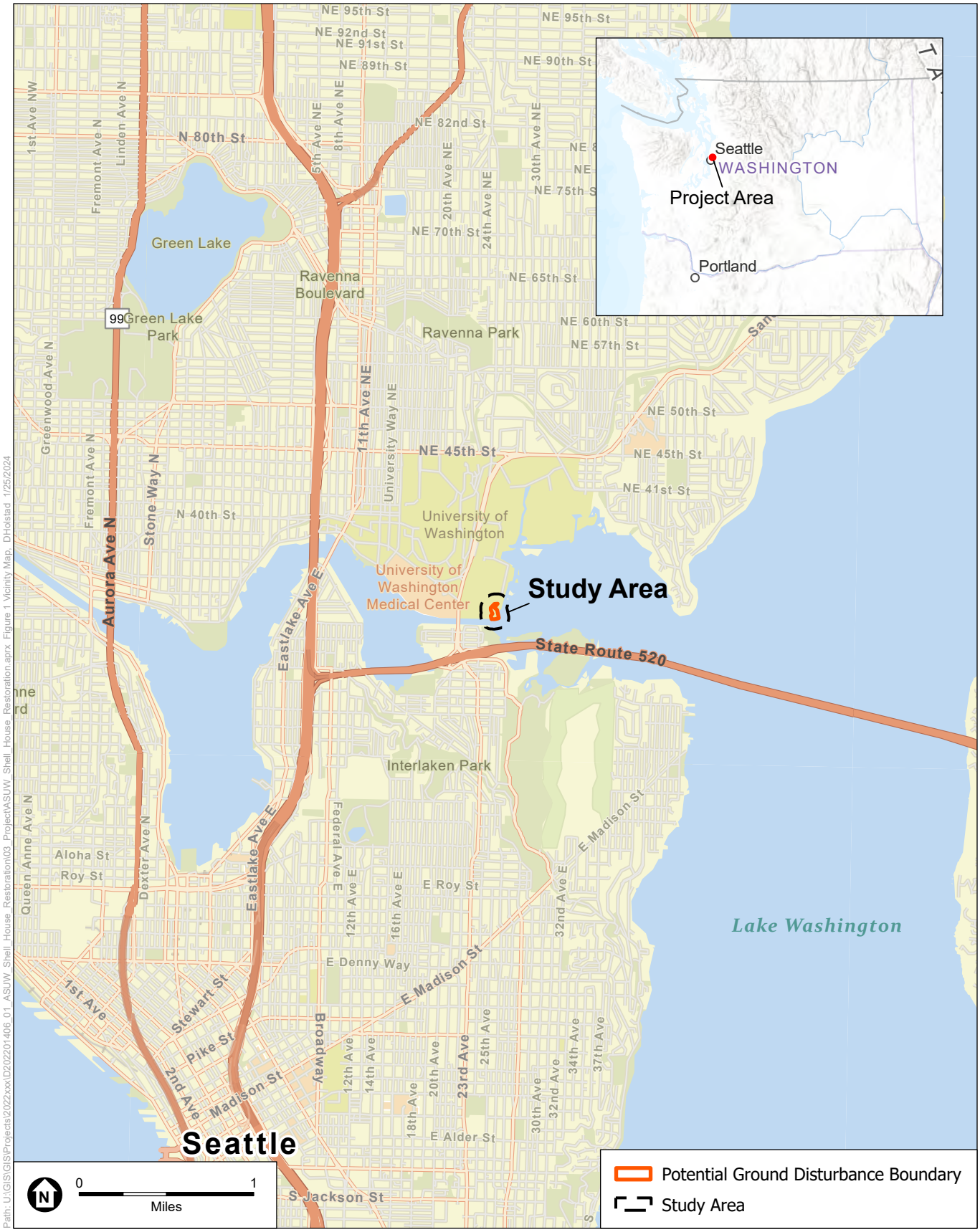
USFWS (U.S. Fish and Wildlife Service). 1999. *Endangered and threatened wildlife and plants; determination of threatened status for bull trout in the coterminous United States*. Final rule November 1, 1999. Federal Register 64(210):58910-58933.

USFWS (U.S. Fish and Wildlife Service). 2023a. *National Wetlands Inventory Wetlands Mapper.* URL: https://www.fws.gov/program/national-wetlands-inventory/wetlands-mapper. Accessed November 2023.

USFWS. 2023b. *Information for Planning and Consultation (IPaC) Tool*. URL: https://ipac.ecosphere.fws.gov/. Accessed November 2023.

WDFW (Washington Department of Fish and Wildlife). 2023. *Priority Habitats and Species (PHS): Maps.* URL: https://wdfw.wa.gov/species-habitats/at-risk/phs/maps. Accessed November 2023.

Appendix A
Figures

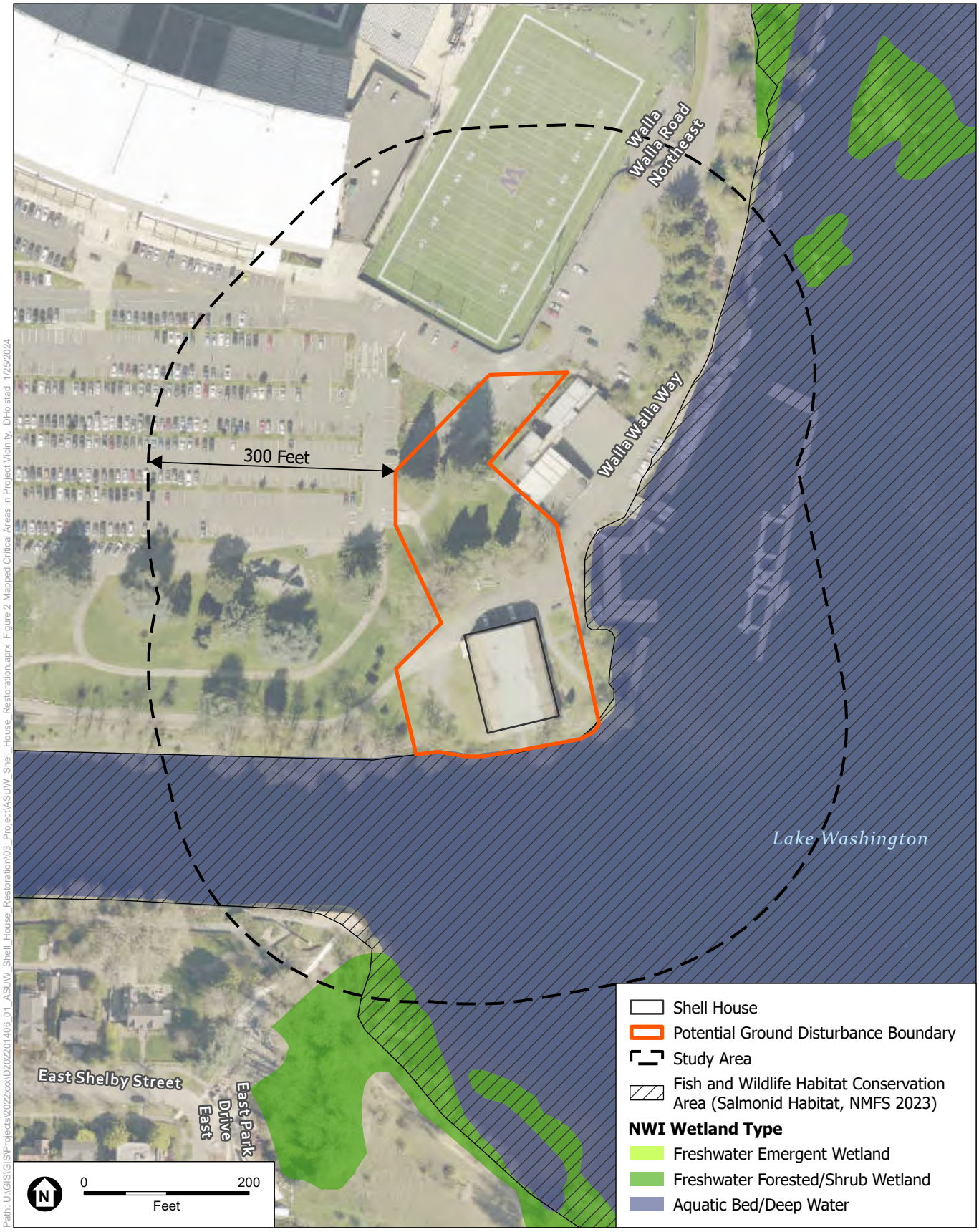


SOURCE: Basemap: ESRI, 2023

ASUW Shell House Restoration

Figure 1
Vicinity Map

ESA



SOURCE: Imagery: King County, 2021; Wetlands: USFWS, 2023; Building: BRH Engineering, 2023

ASUW Shell House Restoration

Figure 2
Mapped Critical Areas in Project Vicinity

ESA

Appendix B
Existing Information

U.S. Fish and Wildlife Service
National Wetlands Inventory

ASUW Shell House Restoration Project

November 15, 2023

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

ASUW Shell House Restoration Project

11/15/2023, 2:15:56 PM

Wetland - ECA4

1:2,000

0 90 180 360 ft

0 25 50 100 m

City of Seattle

Custom Soil Resource Report
Soil Map (ASUW Shell House Restoration Project)

Map Scale: 1:1,920 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: City of Seattle, Washington
Survey Area Data: Version 7, Aug 29, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 31, 2022—Aug 8, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (ASUW Shell House Restoration Project)

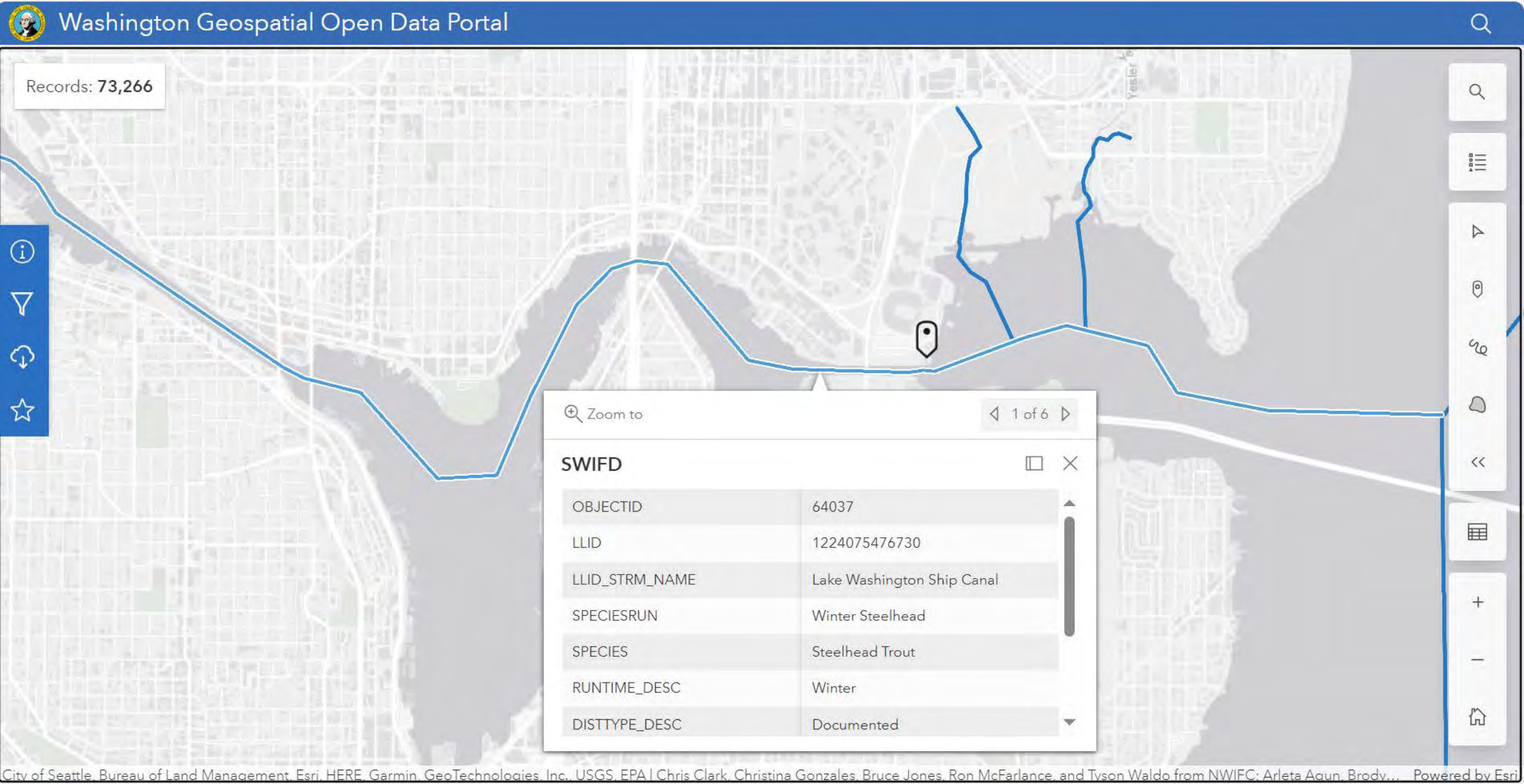
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
989	Urban land, 5 to 20 percent slopes	7.8	45.8%
1326	Mukilteo-Water complex, 0 to 2 percent slopes	0.3	1.9%
3055	Urban land-Alderwood complex, 0 to 5 percent slopes	0.9	5.1%
3058	Alderwood-Everett-Urban land complex, 0 to 12 percent slopes	0.1	0.4%
Totals for Area of Interest		**17.0**	**100.0%**

Map Unit Descriptions (ASUW Shell House Restoration Project)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not


Washington Geospatial Open Data Portal
Records: 73,266
Zoom to
1 of 6
SWIFD
OBJECTID 64037
LLID 1224075476730
LLID_STRM_NAME Lake Washington Ship Canal
SPECIESRUN Winter Steelhead
SPECIES Steelhead Trout
RUNTIME_DESC Winter
DISTTYPE_DESC Documented
City of Seattle, Bureau of Land Management, Esri, HERE, Garmin, GeoTechnologies, Inc., USGS, EPA | Chris Clark, Christina Gonzales, Bruce Jones, Ron McFarlance, and Tyson Waldo from NWIFC; Arleta Agun, Brody...
Powered by Esri

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

King County, Washington

Local office

Washington Fish And Wildlife Office

(360) 753-9440
(360) 753-9405

510 Desmond Drive Se, Suite 102
Lacey, WA 98503-1263

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

---

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).

2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
North American Wolverine Gulo gulo luscus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/5123	Threatened

Birds

NAME	STATUS
Marbled Murrelet Brachyramphus marmoratus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/4467	Threatened
Yellow-billed Cuckoo Coccyzus americanus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/3911	Threatened

Reptiles

NAME	STATUS
Northwestern Pond Turtle Actinemys marmorata Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/1111	Proposed Threatened

Fishes

NAME	STATUS
Bull Trout Salvelinus confluentus There is **final** critical habitat for this species. Your location overlaps the critical habitat. https://ecos.fws.gov/ecp/species/8212	Threatened

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus* Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

This location overlaps the critical habitat for the following species:

NAME	TYPE
Bull Trout *Salvelinus confluentus* https://ecos.fws.gov/ecp/species/8212#crithab	Final

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Sep 30

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

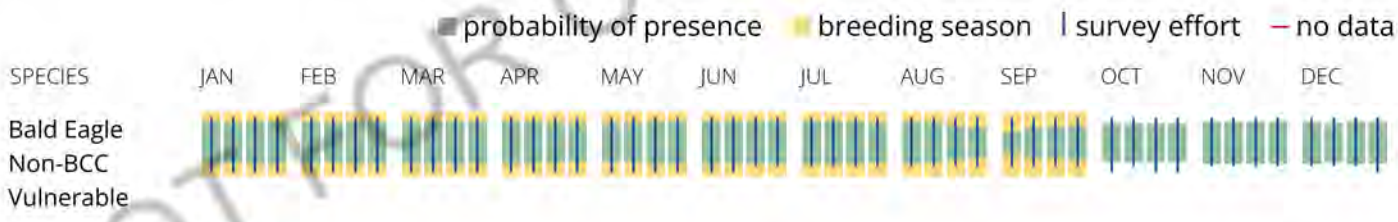
Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this

location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Jan 1 to Sep 30
Black Swift *Cypseloides niger* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8878	Breeds Jun 15 to Sep 10
Black Turnstone *Arenaria melanocephala* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds elsewhere
California Gull *Larus californicus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
Clark's Grebe *Aechmophorus clarkii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Evening Grosbeak *Coccothraustes vespertinus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 15 to Aug 10

Lesser Yellowlegs Tringa flavipes This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Olive-sided Flycatcher Contopus cooperi This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3914	Breeds May 20 to Aug 31
Rufous Hummingbird selasphorus rufus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8002	Breeds Apr 15 to Jul 15
Short-billed Dowitcher Limnodromus griseus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9480	Breeds Jun 1 to Aug 10
Western Grebe aechmophorus occidentalis This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/6743	Breeds Jun 1 to Aug 31

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

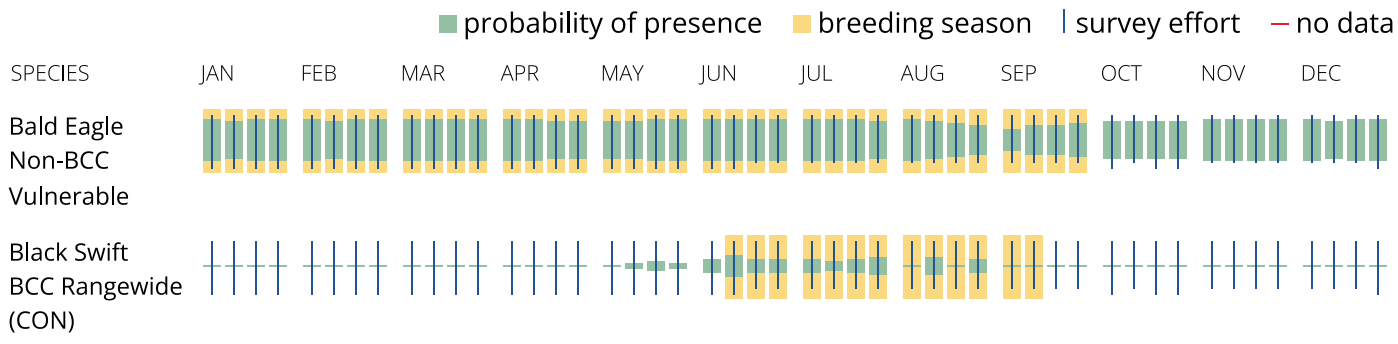
Breeding Season ( )
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

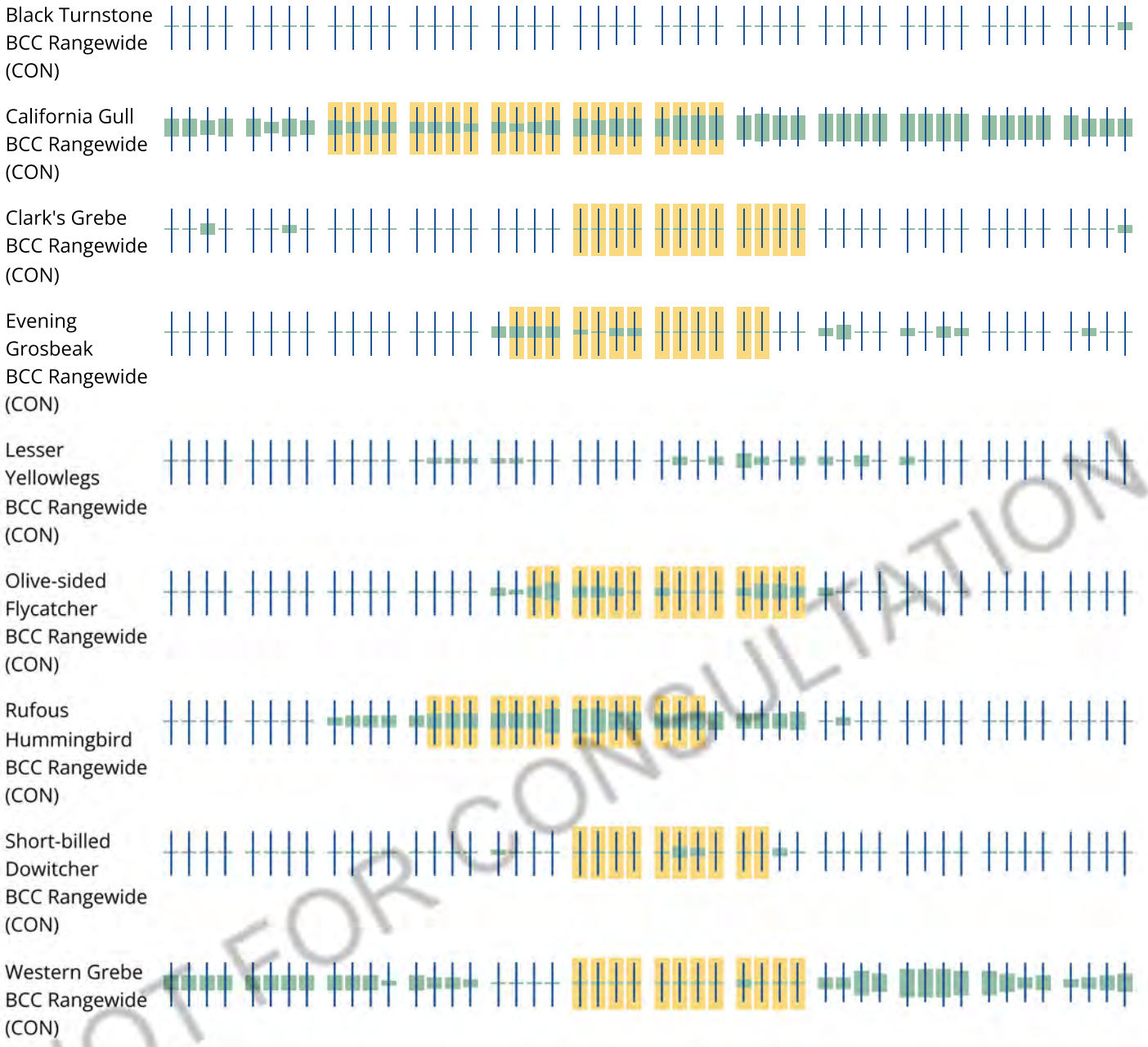
Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.





Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

LAKE

L1UBHh

L2ABHh

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Essential Fish Habitat Mapper

Pacific

?

View Content

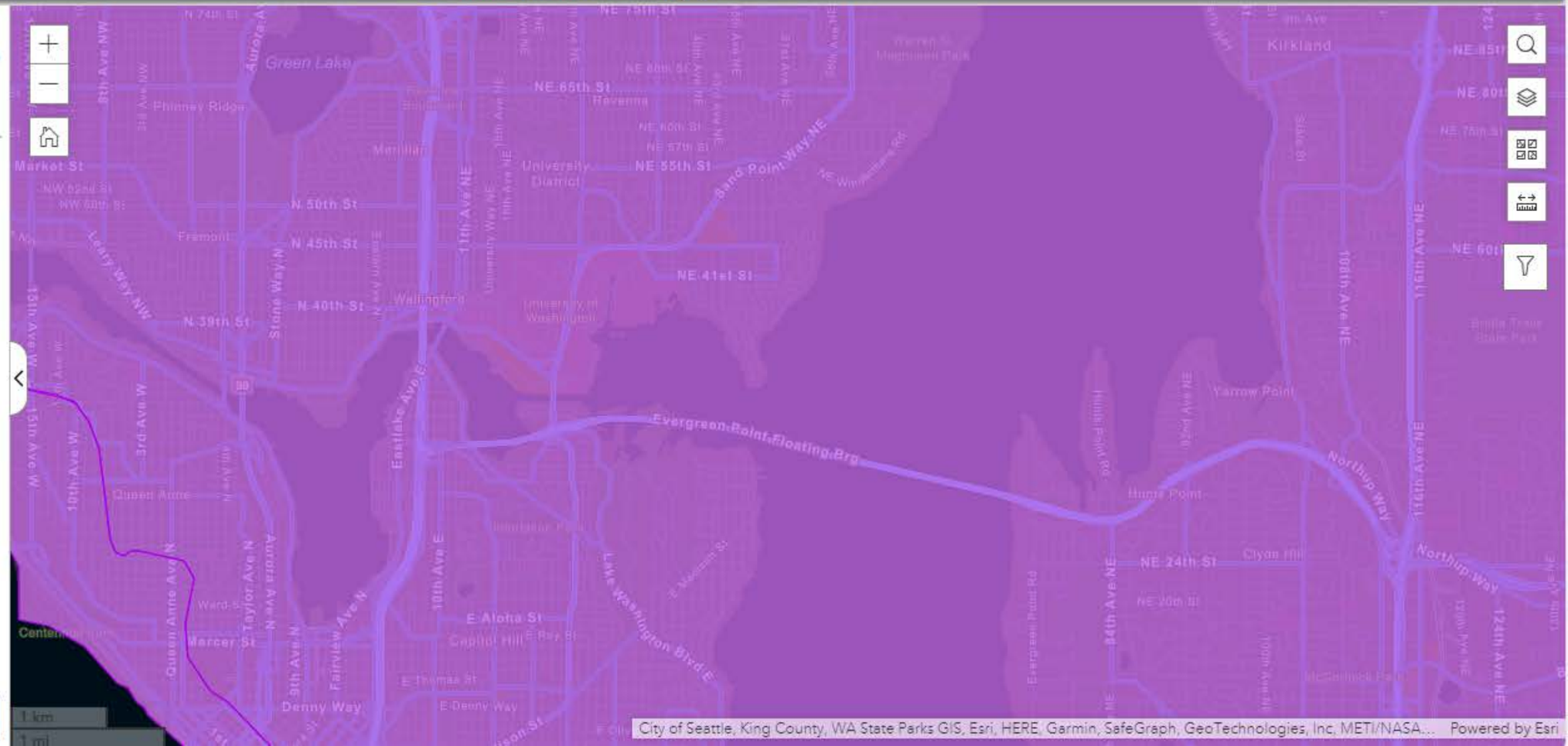
Essential Fish Habitat

Chinook salmon EFH

Coho salmon EFH

Choose Another Council

Generate Report



EFH Mapper Report

EFH Data Notice

Essential Fish Habitat (EFH) is defined by textual descriptions contained in the fishery management plans developed by the regional fishery management councils. In most cases mapping data can not fully represent the complexity of the habitats that make up EFH. This report should be used for general interest queries only and should not be interpreted as a definitive evaluation of EFH at this location. A location-specific evaluation of EFH for any official purposes must be performed by a regional expert. Please refer to the following links for the appropriate regional resources.

West Coast Regional Office

Query Results

Degrees, Minutes, Seconds: Latitude = 47º 38' 51" N, Longitude = 123º 42' 2" W
Decimal Degrees: Latitude = 47.648, Longitude = -122.300

The query location intersects with spatial data representing EFH and/or HAPCs for the following species/management units.

EFH

Link	Data Caveats	Species/Management Unit	Lifestage(s) Found at Location	Management Council	FMP
		Groundfish	ALL	Pacific	Groundfish

Pacific Salmon EFH

Link	HUC Name	Species/Management Unit	Lifestage(s) Found at Location	Management Council	FMP
	Lake Washington	Chinook Salmon, Coho Salmon	All	Pacific	Pacific Coast Salmon Plan

Atlantic Salmon

No Atlantic Salmon were identified at the report location.

HAPCs

No Habitat Areas of Particular Concern (HAPC) were identified at the report location.

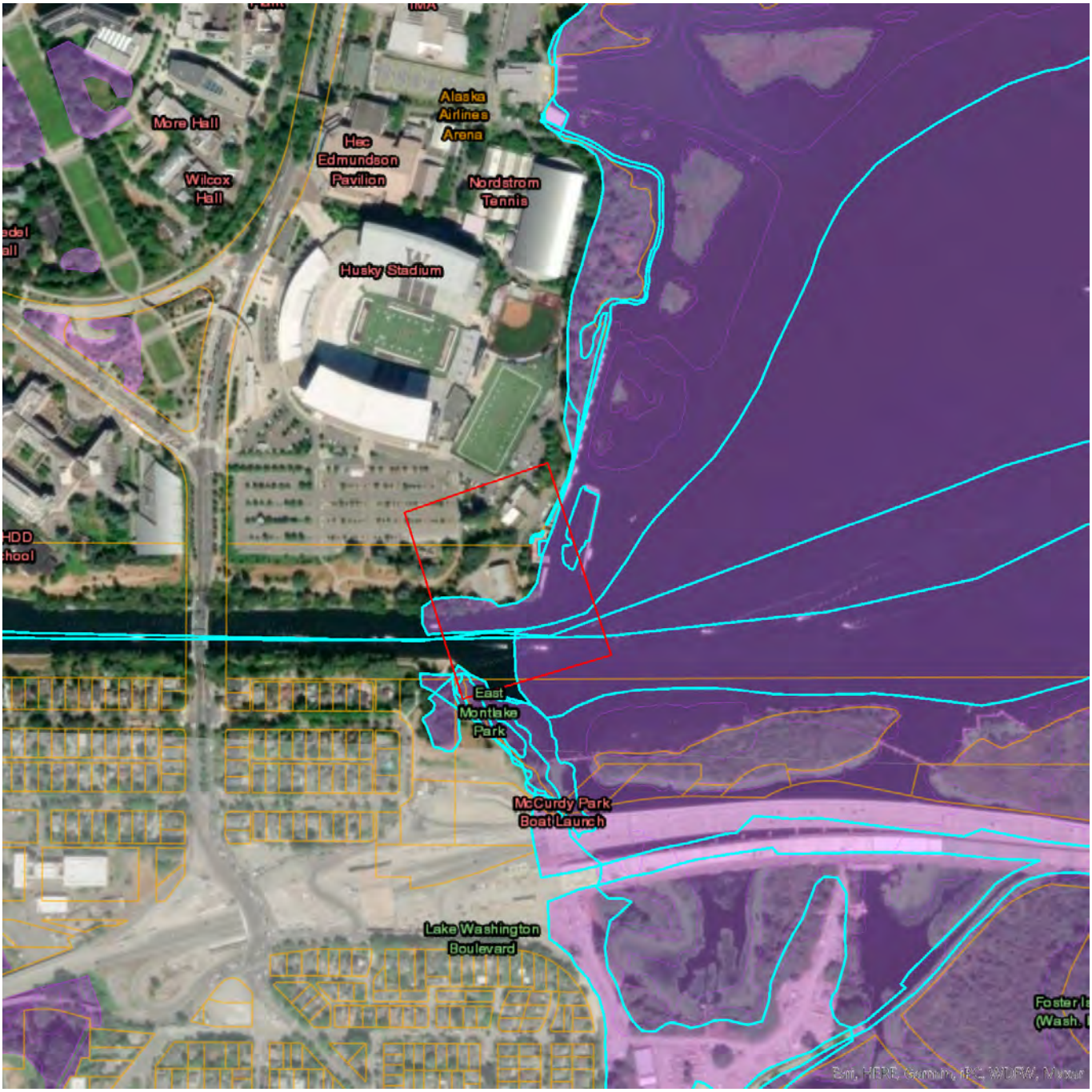
EFH Areas Protected from Fishing

No EFH Areas Protected from Fishing (EFHA) were identified at the report location.

Spatial data does not currently exist for all the managed species in this area. The following is a list of species or management units for which there is no spatial data. ****For links to all EFH text descriptions see the complete data inventory: open data inventory -->**
Pacific Coastal Pelagic Species, Jack Mackerel, Pacific (Chub) Mackerel, Pacific Sardine, Northern Anchovy - Central Subpopulation, Northern Anchovy - Northern Subpopulation,

Spatial data does not currently exist for all the managed species in this area. The following is a list of species or management units for which there is no spatial data. ****For links to all EFH text descriptions see the complete data inventory: open data inventory -->**
Pacific Highly Migratory Species, Bigeye Thresher Shark - North Pacific, Bluefin Tuna - Pacific, Dolphinfish (Dorado or Mahimahi) - Pacific, Pelagic Thresher Shark - North Pacific, Swordfish - North Pacific

Priority Habitats and Species on the Web



Report Date: 11/15/2023

PHS Species/Habitats Overview:

Occurence Name	Federal Status	State Status	Sensitive Location
Sockeye	Not Warranted	N/A	No
Coho	N/A	N/A	No
Chinook	Threatened	N/A	No
Steelhead	Threatened	N/A	No
Sockeye	N/A	N/A	No
Coho	Candidate	N/A	No
Dolly Varden/ Bull Trout	N/A	N/A	No
Winter Steelhead	N/A	N/A	No
Resident Coastal Cutthroat	N/A	N/A	No
Fall Chinook	N/A	N/A	No
Waterfowl Concentrations	N/A	N/A	No
Wetlands	N/A	N/A	No
Biodiversity Areas And Corridor	N/A	N/A	No
Lake	N/A	N/A	No
Freshwater Forested/Shrub Wetland	N/A	N/A	No

PHS Species/Habitats Details:

Sockeye	
Scientific Name	*Oncorhynchus nerka*
Priority Area	Occurrence
Accuracy	NA
Notes	LLID: 1224075476730, Stock Name: Lake Washington/Sammamish Tribs Sockeye, Run: Unspecified, Status: Healthy
Source Record	5200
Source Dataset	SASI
Source Name	Not Given
Source Entity	WDFW Fish Program
Federal Status	Not Warranted
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
More Info	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm
Geometry Type	Lines

Coho	
Scientific Name	*Oncorhynchus kisutch*
Priority Area	Occurrence/Migration
Site Name	Lake Washington Ship Canal
Accuracy	NA
Notes	LLID: 1224075476730, Fish Name: Coho Salmon, Run Time: Unknown or not Applicable, Life History: Anadromous
Source Record	44381
Source Dataset	SWIFD
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
More Info	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm
Geometry Type	Lines

Chinook	
Scientific Name	*Oncorhynchus tshawytscha*
Priority Area	Occurrence
Accuracy	NA
Notes	LLID: 1224075476730, Stock Name: Cedar Chinook, Run: Sum/Fall, Status: Depressed
Source Record	1144
Source Dataset	SASI
Source Name	Not Given
Source Entity	WDFW Fish Program
Federal Status	Threatened
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
More Info	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm
Geometry Type	Lines

Steelhead	
Scientific Name	*Oncorhynchus mykiss*
Priority Area	Occurrence
Accuracy	NA
Notes	LLID: 1224075476730, Stock Name: Lake Washington Winter Steelhead, Run: Winter, Status: Critical
Source Record	6154

Source Dataset	SASI
Source Name	Not Given
Source Entity	WDFW Fish Program
Federal Status	Threatened
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
More Info	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm
Geometry Type	Lines

Sockeye	
Scientific Name	*Oncorhynchus nerka*
Priority Area	Occurrence/Migration
Site Name	Lake Washington Ship Canal
Accuracy	NA
Notes	LLID: 1224075476730, Fish Name: Sockeye Salmon, Run Time: Unknown or not Applicable, Life History: Anadromous
Source Record	44385
Source Dataset	SWIFD
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
More Info	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm
Geometry Type	Lines

Coho	
Scientific Name	*Oncorhynchus kisutch*
Priority Area	Occurrence
Accuracy	NA
Notes	LLID: 1224075476730, Stock Name: Lake Washington/Sammamish Tribs Coho, Run: Unspecified, Status: Depressed
Source Record	3120
Source Dataset	SASI
Source Name	Not Given
Source Entity	WDFW Fish Program
Federal Status	Candidate
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
More Info	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm
Geometry Type	Lines

Sockeye	
Scientific Name	*Oncorhynchus nerka*
Priority Area	Occurrence
Accuracy	NA
Notes	LLID: 1224075476730, Stock Name: Lake Washington Beach Spawning Sockeye, Run: Unspecified, Status: Depressed
Source Record	5300
Source Dataset	SASI
Source Name	Not Given
Source Entity	WDFW Fish Program
Federal Status	Not Warranted
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
More Info	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm
Geometry Type	Lines

Dolly Varden/ Bull Trout	
Scientific Name	*Salvelinus malma/S. confluentus*
Priority Area	Occurrence/Migration
Site Name	Lake Washington Ship Canal
Accuracy	NA
Notes	LLID: 1224075476730, Fish Name: Bull Trout, Run Time: Unknown or not Applicable, Life History: Unknown
Source Record	44383
Source Dataset	SWIFD
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
More Info	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm
Geometry Type	Lines

Chinook	
Scientific Name	*Oncorhynchus tshawytscha*
Priority Area	Occurrence
Accuracy	NA
Notes	LLID: 1224075476730, Stock Name: Sammamish Chinook, Run: Sum/Fall, Status: Healthy
Source Record	1128
Source Dataset	SASI
Source Name	Not Given
Source Entity	WDFW Fish Program
Federal Status	Threatened
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
More Info	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm
Geometry Type	Lines

Winter Steelhead	
Scientific Name	*Oncorhynchus mykiss*
Priority Area	Occurrence/Migration
Site Name	Lake Washington Ship Canal
Accuracy	NA
Notes	LLID: 1224075476730, Fish Name: Steelhead Trout, Run Time: Winter, Life History: Anadromous

Source Record	44386
Source Dataset	SWIFD
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
More Info	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm
Geometry Type	Lines

Coho	
Scientific Name	*Oncorhynchus kisutch*
Priority Area	Occurrence
Accuracy	NA
Notes	LLID: 1224075476730, Stock Name: Cedar Coho, Run: Unspecified, Status: Depressed
Source Record	3130
Source Dataset	SASI
Source Name	Not Given
Source Entity	WDFW Fish Program
Federal Status	Candidate
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
More Info	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm
Geometry Type	Lines

Resident Coastal Cutthroat	
Scientific Name	*Oncorhynchus clarki*
Priority Area	Occurrence/Migration
Site Name	Lake Washington Ship Canal
Accuracy	NA
Notes	LLID: 1224075476730, Fish Name: Cutthroat Trout, Run Time: Unknown or not Applicable, Life History: Unknown
Source Record	44379
Source Dataset	SWIFD
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
More Info	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm
Geometry Type	Lines

Fall Chinook	
Scientific Name	*Oncorhynchus tshawytscha*
Priority Area	Occurrence/Migration
Site Name	Lake Washington Ship Canal
Accuracy	NA
Notes	LLID: 1224075476730, Fish Name: Chinook Salmon, Run Time: Fall, Life History: Anadromous
Source Record	44380
Source Dataset	SWIFD
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
More Info	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm
Geometry Type	Lines

Sockeye	
Scientific Name	*Oncorhynchus nerka*
Priority Area	Occurrence
Accuracy	NA
Notes	LLID: 1224075476730, Stock Name: Cedar Sockeye, Run: Unspecified, Status: Depressed
Source Record	5400
Source Dataset	SASI

Source Name	Not Given
Source Entity	WDFW Fish Program
Federal Status	Not Warranted
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
More Info	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm
Geometry Type	Lines

Dolly Varden/ Bull Trout	
Scientific Name	*Salvelinus malma/S. confluentus*
Priority Area	Breeding Area
Site Name	Lake Washington Ship Canal
Accuracy	NA
Notes	LLID: 1224075476730, Fish Name: Bull Trout, Run Time: Unknown or not Applicable, Life History: Unknown
Source Record	44384
Source Dataset	SWIFD
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
More Info	http://wdfw.wa.gov/wlm/diversty/soc/soc.htm
Geometry Type	Lines

Waterfowl Concentrations	
Priority Area	Breeding Area
Site Name	UNION BAY - LAKE WASHINGTON
Accuracy	1/4 mile (Quarter Section)
Notes	THE WETLANDS AT THE MOUTH OF UNIVERSITY SLOUGH, ALONG THE UNION BAY NATURAL AREA, MARSH AND FOSTER ISLANDS AND ASSOCIATED UW ARBORETUM SHORELINE PROVIDE NESTING AND LOAFING OPPORTUNITIES FOR URBAN DABBLER SPECIES, INCLUDING WOOD DUCKS.
Source Record	918012
Source Dataset	PHSREGION
Source Name	ANDERSON, CHRIS WDFW
Source Entity	WA Dept. of Fish and Wildlife
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS LISTED OCCURRENCE
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
ManagementRecommendations	http://wdfw.wa.gov/publications/pub.php?id=00026
Geometry Type	Polygons

Waterfowl Concentrations	
Priority Area	Regular Concentration
Site Name	UNION BAY - LAKE WASHINGTON
Accuracy	1/4 mile (Quarter Section)
Notes	UNION BAY IS THE AREA OF LAKE WASHINGTON HAVING THE MOST DIVERSE AND NUMEROUS WINTERING WATERFOWL, PARTICULARLY DIVERS SUCH AS BUFFLEHEADS AND MERGANSERS. UP TO 1900 WATERFOWL WINTER IN UNION BAY.
Source Record	918013
Source Dataset	PHSREGION
Source Name	ANDERSON, CHRIS WDFW
Source Entity	WA Dept. of Fish and Wildlife
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS LISTED OCCURRENCE
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
ManagementRecommendations	http://wdfw.wa.gov/publications/pub.php?id=00026
Geometry Type	Polygons

Wetlands	
Priority Area	Aquatic Habitat

Site Name	ARBORETUM, FOSTER ISLAND, AND, UNIVERSITY OF WASH
Accuracy	1/4 mile (Quarter Section)
Notes	UNION BAY WETLANDS. THESE WETLANDS ARE REPORTED TO HOST A DIVERSE WILDLIFE POPULATION (145 SPECIES) ARBORETUM/LAKESIDE TRAIL DEIS. 1990.
Source Record	902029
Source Dataset	PHSREGION
Source Name	MULLER, TED
Source Entity	WA Dept. of Fish and Wildlife
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
ManagementRecommendations	http://www.ecy.wa.gov/programs/sea/wetlands/bas/index.html
Geometry Type	Polygons

Biodiversity Areas And Corridor	
Priority Area	Terrestrial Habitat
Site Name	WASHINGTON ARBORETUM AND ENVIRONS - SEATTLE
Accuracy	1/4 mile (Quarter Section)
Notes	STANDS OF CINIFER, DECIDUOUS, AND MIXED CONIFER-DECIDUOUS TREES INTERMIXED WITH LANDSCAPED GRASSLANDS AND FOREST. SNAGS, DOWNED LOGS, AND WETLANDS ARE PRESENT. NESTING BALD EAGLES, AND GREAT BLUE HERON. WESTERN POND AND PAINTED TURTLES.
Source Record	915021
Source Dataset	PHSREGION
Source Name	JOHNSON, TERRY WDFW
Source Entity	WA Dept. of Fish and Wildlife
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
ManagementRecommendations	http://wdfw.wa.gov/publications/pub.php?id=00023
Geometry Type	Polygons

Lake	
Priority Area	Aquatic Habitat
Site Name	N/A
Accuracy	NA
Notes	Wetland System: Lake - NWI Code: L1ABHh
Source Dataset	NWIWetlands
Source Name	Not Given
Source Entity	US Fish and Wildlife Service
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
ManagementRecommendations	http://www.ecy.wa.gov/programs/sea/wetlands/bas/index.html
Geometry Type	Polygons

Lake	
Priority Area	Aquatic Habitat
Site Name	N/A
Accuracy	NA
Notes	Wetland System: Lake - NWI Code: L1ABHh
Source Dataset	NWIWetlands
Source Name	Not Given
Source Entity	US Fish and Wildlife Service
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
ManagementRecommendations	http://www.ecy.wa.gov/programs/sea/wetlands/bas/index.html
Geometry Type	Polygons

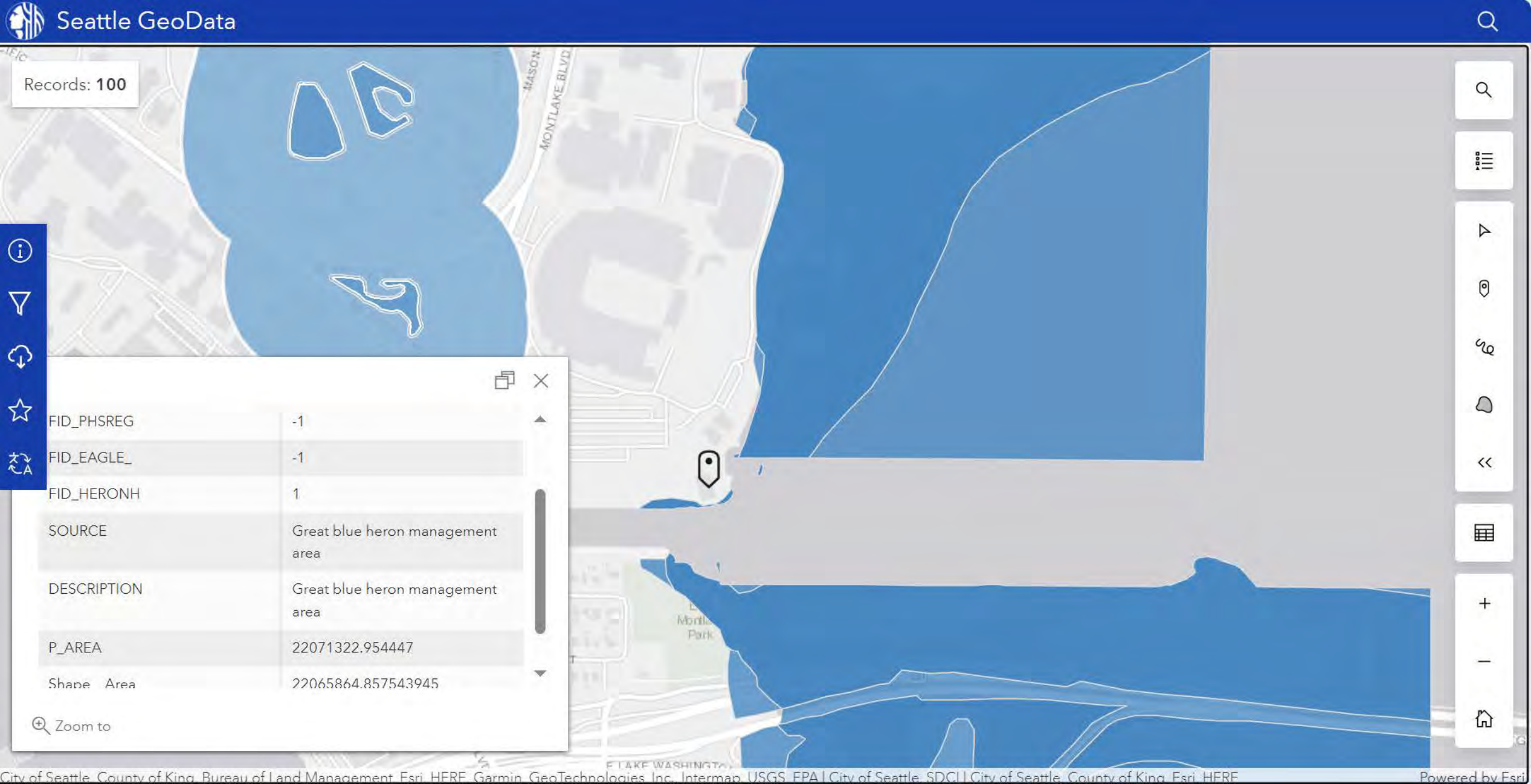
Lake	
Priority Area	Aquatic Habitat
Site Name	N/A
Accuracy	NA
Notes	Wetland System: Lake - NWI Code: L2ABHh
Source Dataset	NWIWetlands
Source Name	Not Given
Source Entity	US Fish and Wildlife Service
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
ManagementRecommendations	http://www.ecy.wa.gov/programs/sea/wetlands/bas/index.html
Geometry Type	Polygons

Lake	
Priority Area	Aquatic Habitat
Site Name	N/A
Accuracy	NA
Notes	Wetland System: Lake - NWI Code: L2ABHh
Source Dataset	NWIWetlands
Source Name	Not Given
Source Entity	US Fish and Wildlife Service
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
ManagementRecommendations	http://www.ecy.wa.gov/programs/sea/wetlands/bas/index.html
Geometry Type	Polygons

Freshwater Forested/Shrub Wetland	
Priority Area	Aquatic Habitat
Site Name	N/A
Accuracy	NA
Notes	Wetland System: Freshwater Forested/Shrub Wetland - NWI Code: PFO/SSAh
Source Dataset	NWIWetlands
Source Name	Not Given
Source Entity	US Fish and Wildlife Service

Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
ManagementRecommendations	http://www.ecy.wa.gov/programs/sea/wetlands/bas/index.html
Geometry Type	Polygons

Freshwater Forested/Shrub Wetland	
Priority Area	Aquatic Habitat
Site Name	N/A
Accuracy	NA
Notes	Wetland System: Freshwater Forested/Shrub Wetland - NWI Code: PFO/SSCh
Source Dataset	NWIWetlands
Source Name	Not Given
Source Entity	US Fish and Wildlife Service
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
ManagementRecommendations	http://www.ecy.wa.gov/programs/sea/wetlands/bas/index.html
Geometry Type	Polygons


Seattle GeoData
Records: 100
MONTLAKE BLVD
FID_PHSREG -1
FID_EAGLE_ -1
FID_HERONH 1
SOURCE Great blue heron management area
DESCRIPTION Great blue heron management area
P_AREA 22071322.954447
Shape_Area 22065864.857543945
Zoom to
City of Seattle, County of King, Bureau of Land Management, Esri, HERE, Garmin, GeoTechnologies, Inc., Intermap, USGS, EPA | City of Seattle, SDCI | City of Seattle, County of King, Esri, HERE
Powered by Esri

Appendix C
Photographs

ESA

Photo by ESA 2023 ASUW Shell House Restoration Project

Photograph 1
Docks on Union Bay east of the Shell House, looking south

Photo by ESA 2023

ASUW Shell House Restoration Project

Photograph 2
Upland area adjacent to Shell House, looking southwest.

Photo by ESA 2023

ASUW Shell House Restoration Project

Photograph 3
Emergent vegetation along the shore of Union Bay looking south

Photo by ESA 2023

ASUW Shell House Restoration Project

Photograph 4
Emergent vegetation along shoreline, looking northwest

Photo by ESA 2023

ASUW Shell House Restoration Project

Photograph 5
Shoreline of Lake Washington Ship Canal south of Shell House

Photo by ESA 2023

ASUW Shell House Restoration Project

Photograph 6
Forested area along north shore of Lake Washington looking east

Photo by ESA 2023

ASUW Shell House Restoration Project

Photograph 7
Husky Stadium north of Shell House, looking northwest

Attachment C
Arborist Report

Tree Solutions Inc
Consulting Arborists

Project No. TS - 9412

Arborist Report

To:	ESA
Site:	ASUW Shell House University of Washington Seattle Campus
Re:	Tree Inventory
Date:	July 13, 2024 Updated August 19, 2024
Project Arborist:	Holly Iosso, ASCA Registered Consulting Arborist # 567 ISA Certified Arborist PN-6298A ISA Qualified Tree Risk Assessor
Attached:	Table of Trees Arborist Site Map and Grove Study (Aerial as Base Map) Arborist Site Map (Survey as Base Map)

Summary

ASUW Shell House

The ASUW Shell House is a historically significant structure, located on the shores of Union Bay on the southeast corner of the University of Washington (UW) Seattle Campus. As part of an architectural restoration project, Tree Solutions was asked to assess trees near the structure, and subsequently uphill from the structure.

I inventoried and assessed 38 trees[1] within the Project Area on the north, east and south sides of the Shell House. Of these, thirteen (13) met the criteria of Tier 2 per Seattle Director's Rule 07-20234.

There is one tree grove[2] within the project area.

There were no construction plans to review as part of this tree assessment.

[1] Trees with diameter at standard height (DSH) ≥6 inches.

[2] Tree grove is eight or more trees each with a DSH of ≥12 inches with continuously overlapping canopies (SMC 25.11.130), excluding certain species and trees growing entirely in "the public place" or right-of-way.

Assignment and Scope of Work

This report documents the tree inventory and assessment by Holly Iosso of Tree Solutions Inc., who visited the site on June 26, 2024, and again on August 13, 2024. Tree Solutions Inc (TSI) was asked to complete a tree inventory and arborist report for a defined area surrounding the ASUW Shell House structure. This was requested by Stacy Bumback of ESA to assist the design team during the SEPA analysis and permitting phase of this project.

Observations

Site

This report only includes trees within the Project Area on the University of Washington (UW) Seattle campus, as referenced in the key map (**Figure 1**) and defined by the shaded areas in **Figure 2**.

The ASUW Shell House is part of the UW campus and is within the Major Institution Zone[3].

According to the Seattle Department of Construction and Inspections GIS map there is one relevant environmentally critical areas (ECA) within the Project Area: Steep Slope (ECA 1) (see **Figure 3**).

Planting, disturbing, or removing vegetation in some ECAs and their buffers (landslide-prone critical areas, steep slope erosion hazard areas, wetlands, and wildlife habitat conservation areas) are restricted (SMC 25.09.070). Steep slopes buffers include areas within 15-feet of the top and toe of a slope.

All trees assessed are within 200 feet of Union Bay.

Tree Groves

One tree grove is within the Project Area, see Grove Study in **Figure 4**.

Trees

All data for individual trees are listed in the attached **Table of Trees** and include species, tree diameter at standard height (DSH), average dripline measurements, health and structural condition, tier and grove status, and observations. The Table of Trees includes trees growing in the Project Area as well trees with overhanging canopy or with root systems that may grow into the Project Area. Some trees listed in the Table of Trees are not located within the Project Area.

Tree locations are shown on the two attached Arborist Site Maps. One map shows tree locations with GPS locations (with 2021 Aerial image as the background), the other corresponds to surveyed tree locations.

[3] Per the on-line City GIS map (https://seattlecitygis.maps.arcgis.com) accessed on July 10, 2024.

Tree Regulations

Seattle Department of Construction and Inspections (SDCI) regulates all trees on private property. It also regulates all trees on property such as UW; although it does not regulate trees in the public right of way (ROW) where trees are managed and regulated by Seattle's Department of Transportation (SDOT).

Private Property & Publicly Owned Property (SDCI)
Seattle Municipal Code (SMC) classifies trees in these areas under a four-tiered system, based on tree size and species.

Table 1. Tree Classifications (SMC 25.11.050)

Tree category	Definitions	During development – Related to SDCI permit	Not part of a SDCI permit application
Tier 1	Includes • heritage trees	May not be removed unless deemed hazardous or in need of emergency action*.	May not be removed unless deemed hazardous or in need of emergency action*.
Tier 2	Includes • trees ≥ 24 in DSH • trees in groves • trees < 24" for tree species listed in Director's Rule 07-2023	May be approved for removal as part of overall development permit.	May not be removed unless deemed hazardous or in need of emergency action.
Tier 3	Includes • all other trees ≥ 12" DSH not considered Tier 2 trees	May be approved for removal as part of overall development permit.	May not be removed unless deemed hazardous or in need of emergency action.**
Tier 4	Includes • all other trees ≥ 6" DSH	May be approved for removal as part of overall development permit.	May not be removed unless deemed hazardous or in need of emergency action, Exception: up to two Tier 4 trees may be removed over a 3-yr period.**

*Documentation is required for all hazardous and emergency removals.
** When no development is proposed, no more than two Tier 4 trees may be removed in any three-year period on developed lots in Neighborhood Residential, Lowrise, Midrise, commercial, and Seattle Mixed zones, and no more than three Tier 3 and Tier 4 trees may be removed on developed lots in any one-year period in all other zones.

Trees approved for removal may only be removed by an SDCI Registered Tree Service Provider.

Additionally, pruning these trees must be conducted by an SDCI Registered Service Provider (SMC 25.11.130) and all commercial tree work must be reported prior to pruning.

Reportable work includes:

- Removal of any Tier 1, Tier 2, Tier 3, or Tier 4 tree,
- Removal of live branches 4 inches in diameter or greater,
- Pruning, or the removal of live roots 2 inches in diameter or greater, and
- Removal of live branches constituting 25 percent or more of a tree's foliage-bearing area (excluding trees cultivated for fruit production or trees managed as hedges).

The registered tree service provider must create a public notice that is posted to the SDCI website at least three full business days before any reportable work is done or six full business days prior to any tree removal work. Notice must be posted on-site while the work is occurring.

Public ROW (SDOT)
Planting and removing trees in the ROW, regardless of tree size, requires prior approval from SDOT. All pruning must be performed by a Registered SDOT Tree Service Provider.

Tree Protection

Private Property & Publicly Owned Property (SDCI)
A tree protection area (TPA) is required for all Tier 1, Tier 2, and Tier 3 trees that are proposed for retention during a construction project. This is a protection zone surrounding a tree where excavation, access and material storage cannot occur (SMC 25.11.060). Tree protection areas are also required for trees (Tier 1, Tier 2, and Tier 3) growing adjacent to the project with canopies and/or roots extending into the project area.

A basic tree protection area (BTPA) is calculated using a radius that is equal to one foot for every inch DSH of a tree (SMC 25.11.060). It is intended to guide the design process initially and is typically revised over the course of the design process (Matheny et al, 2023). A revised tree protection area (TPA) can be reduced by up to 35-percent, but not closer than one half of the BTPA radius. Additional reductions in the size of the TPA may be permitted if alternative construction methods are employed.

Tree protection areas are listed in the attached **Table of Trees**.

Tree protection measures should be implemented during construction and are intended to help maintain soil integrity (reduce soil compaction), limit root loss, protect overhead canopy, and maintain tree health. These measures can include (but are not limited to) mulching, temporary irrigation, soil protection, construction monitoring by the project arborist and tree protection fencing. The location of tree protection fencing should be along the edges of the TPA. Once in place, the fence should not be moved unless the project arborist is present. Example of tree protection specifications is in Appendix G.

Discussion – Construction Impacts

Proposed Plans

This report is preliminary; we have not reviewed design or construction plans that may impact trees within the Project Area.

Respectfully submitted,

Holly Iosso
Consulting Arborist

Appendix A **Glossary**

ANSI A300: Standards for Tree Care. American National Standards Institute (ANSI).

Diameter at Standard height (DSH): diameter of the tree trunk measured 54 inches (4.5 feet) above grade. (SMC 25.11.130)

Dripline: an area encircling the base of a tree, the minimum extent of which is delineated by a vertical line extending from the outer limit of a tree's branch tips down to the ground. The dripline may be irregular in shape to reflect the variation in branch outer limits. (SMC 25.11.130)

ISA: International Society of Arboriculture

Public Place: public right-of-way and the space above or beneath its surface, whether or not opened or improved, including streets, avenues, ways, boulevards, drives, places, alleys, sidewalks, planting strips, squares, triangles, and plazas that are not privately owned. (SMC 15.02.046)

Regulated Tree: A tree required by municipal code to be identified in an arborist report (SMC 25.11.130).

Reportable Work: removal of live branches 4 inches in diameter or greater; pruning or removal of live roots 2 inches in diameter or greater; or removal of live branches constituting 25 percent or more of a tree's foliage-bearing area. Pruning of trees cultivated for fruit production and maintenance of hedges is not reportable work. (SMC 25.11.130)

Tier 1 tree: A heritage tree. A heritage tree is a tree or group of trees as defined in Title 15 (SMC 25.11.130)

Tier 2 tree: Any tree that is 24 inches in diameter at standard height or greater, tree groves, each tree comprising a tree grove, and specific tree species below 24 inches in diameter at standard height as provided by Director's Rule 7-2023 "Designation of Tier 2 Trees". (SMC 25.11.130)

Tier 3 tree: Any tree that is 12 inches in diameter at standard height or greater but less than 24 inches in diameter at standard height and is not defined as a Tier 1 or Tier 2 tree. (SMC 25.11.130)

Tier 4 tree: Any tree that is 6 inches or greater in diameter at standard height but less than 12 inches in diameter at standard height and is not defined as a Tier 1 or Tier 2 tree. (SMC 25.11.130)

Tree Protection Area (TPA): the area surrounding a tree defined by a specified distance, in which excavation and other construction-related activities must be avoided unless approved by the (SDCI) Director. The TPA is variable depending on species, age and health of the tree, soil conditions, and proposed construction. (SMC 25.11.130)

Tree Protection Area, Basic (BTPA): the area surrounding a tree defined by a specified distance, in which excavation and other construction-related activities must be avoided unless approved by the (SDCI) Director. This area is delineated using a radius that is equal to one foot for every inch DSH of the tree. (SMC 25.11.130)

Tree Service Provider: means any person or entity engaged in commercial tree work. (SMC 25.11.130)

Visual Tree Assessment (VTA): method of evaluating structural defects and stability in trees by noting the pattern of growth. Developed by Claus Mattheck (Harris, *et al* 1999)

Appendix B **References**

Accredited Standards Committee A300 (ASC 300). ANSI A300 (Part 1) Tree, Shrub, and Other Woody Plant Management – Standard Practices (Pruning). Londonderry: Tree Care Industry Association, 2017.

Council of Tree and Landscape Appraisers, Guide for Plant Appraisal, 10th Edition, Second Printing. Atlanta, GA: The International Society of Arboriculture (ISA), 2019.

Harrell, B. "Executive Order 2023-03: One Seattle Tree Plan: Growing and Fostering an Equitable tree Canopy on Public Land". City of Seattle, 2023.

Matheny, Smiley, Gilpin, Hauer. "Best Management Practices – Managing Trees During Construction, Third Edition". International Society of Arboriculture (ISA), 2023.

Mattheck, Claus and Helge Breloer, The Body Language of Trees.: A Handbook for Failure Analysis. London: HMSO, 1994.

Seattle Department of Transportation. "Street Tree Manual". City of Seattle, 2014.

Seattle Municipal Code: TREE PROTECTION
25.11.010 - Purpose and intent
25.11.020 - Exemptions
25.11.030 - Emergency actions
25.11.040 - Hazardous tree removal
25.11.050 - General provisions for regulated tree categories
25.11.060 - Requirements for trees when development is proposed
25.11.070 - Tree protection on sites undergoing development in Neighborhood Residential, Lowrise, Midrise, commercial, and Seattle Mixed zones
25.11.080 - Tree protection on sites in Major Institution Overlay Districts
25.11.090 - Tree replacement, maintenance, and site restoration
25.11.100 - Tree service provider registration
25.11.110 - Off-site planting and voluntary payment in lieu
25.11.115 - Modification of tree removal, replacement, and voluntary in-lieu payment requirements
25.11.120 - Enforcement and penalties
25.11.130 - Definitions

Seattle Municipal Code: REGULATIONS FOR ENVIRONMENTALLY CRITICAL AREAS
25.09.070 - Standards for tree and vegetation and impervious surface management

Standard Plans for Municipal Construction. Plan sheets 132a, 132b, 133. City of Seattle, 2023.

Standard Specifications for Roads, Bridges, and Municipal Construction. Section 8-01.3(2)B. City of Seattle, 2023.

Torgelson, N. "Director's Rule 7-2023". Seattle, WA, 2023 – Designation of Tier-2 Trees

Torgelson, N. "Director's Rule 8-2023". Seattle, WA, 2023 – Payment in Lieu of Tree Replacement Pursuant to the Tree Protection Code.

Torgelson, N. "Director's Rule 10-2023". Seattle, WA, 2023 – Administration of the SDCI Tree Service Provider Registry.

Torgelson, N. "Director's Rule 11-2023 DRAFT". Seattle, WA, 2023 – Tree Measurements

Torgelson, N. "Director's Rule 12-2023". Seattle, WA, 2023 – Tree Replacement Requirements

Appendix C **Site Map**

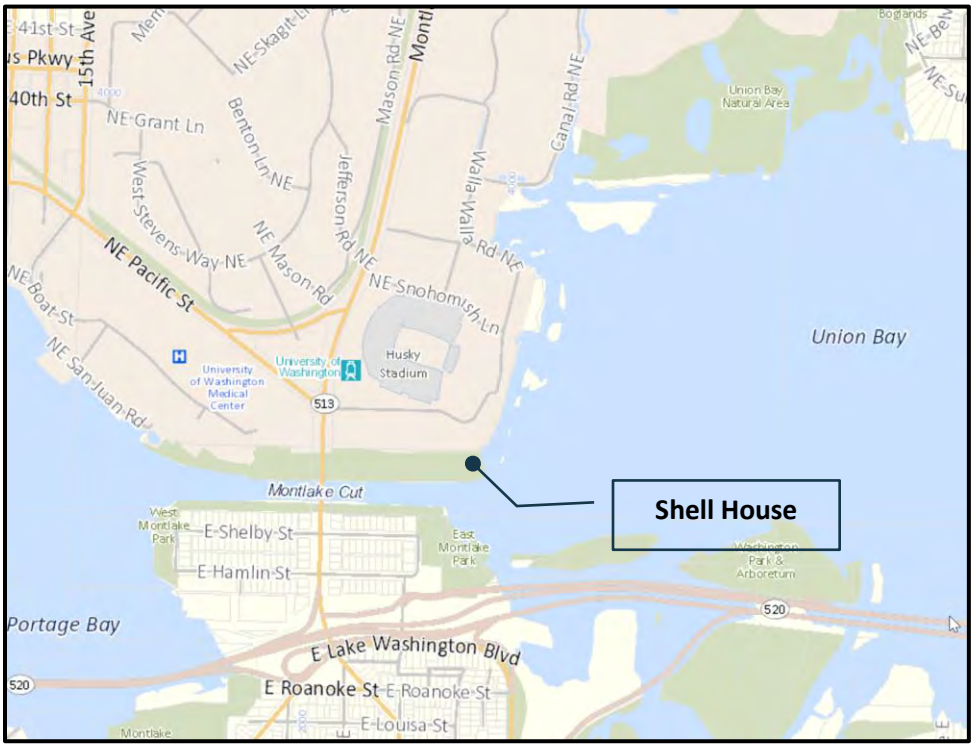


Figure 1. Key Map

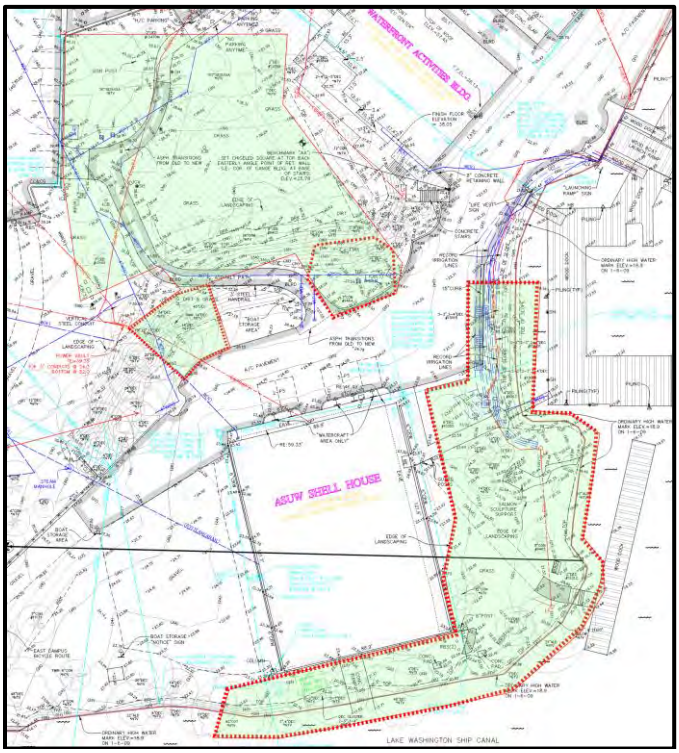


Figure 2. Limits of Project Area as defined by red outline/shaded areas (updated with additional scope of work)

Figure 3. Environmental Critical Areas
Purple = steep slope / ECA1

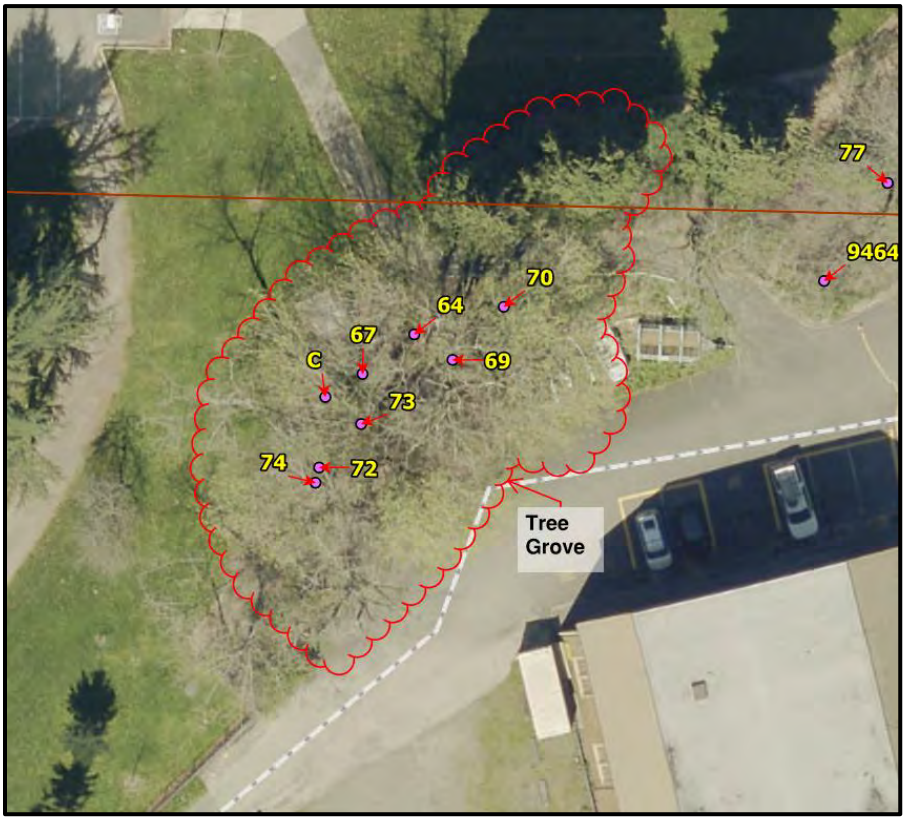


Figure 4. Tree Grove Study

Appendix D **Photographs**

Photo 1. View looking west towards trees ‘A’ and ‘B’.

Photo 2. Access was limited for trees ‘A’ and ‘B’.

Photo 3. View from ASUW Shell House looking southeast. Large cottonwood tree (present in aerial photos and on survey) has been removed.

Photo 4. View along waterfront looking east. Trunk cages are installed on all trees along the waterfront to deter beavers damage.

Photo 5. View looking east towards Union Bay.

Photo 6. View along waterfront looking north.

Photo 7. View looking north from ASUW Shell House.

Photo 8. View looking northwest from ASUW Shell House. Trees in image comprise a tree grove and are Tier 2 trees.

Photo 9. Tree 101: Tip dieback present on lower crown on all sides of tree.

Photo 10. Tree 101: Insect webbing can indicate a spider mite infestation.

Photo 11. Tree 101: Basal damage and beaver fencing.

Photo 12. View looking southwest at trees 60, 9413, 61, and 62

Photo 13. View looking west at tree 10166 (left) and tree 11811 (right)

Photo 14. View looking north at tree 59 and 58.

Photo 15. View looking south at tree 59 and 58.

Photo 16. View looking north at tree 59 and 58.

Appendix E **Assumptions & Limiting Conditions**

1 Consultant assumes that the site and its use do not violate, and is in compliance with, all applicable codes, ordinances, statutes or regulations.

2 The consultant may provide a report or recommendation based on published municipal regulations. The consultant assumes that the municipal regulations published on the date of the report are current municipal regulations and assumes no obligation related to unpublished city regulation information.

3 Any report by the consultant and any values expressed therein represent the opinion of the consultant, and the consultant's fee is in no way contingent upon the reporting of a specific value, a stipulated result, the occurrence of a subsequent event, or upon any finding to be reported.

4 All photographs included in this report were taken by Tree Solutions, Inc. during the documented site visit, unless otherwise noted. Sketches, drawings and photographs (included in, and attached to, this report) are intended as visual aids and are not necessarily to scale. They should not be construed as engineering drawings, architectural reports or surveys. The reproduction of any information generated by architects, engineers or other consultants and any sketches, drawings or photographs is for the express purpose of coordination and ease of reference only. Inclusion of such information on any drawings or other documents does not constitute a representation by the consultant as to the sufficiency or accuracy of the information.

5 Unless otherwise agreed, (1) information contained in any report by consultant covers only the items examined and reflects the condition of those items at the time of inspection; and (2) the inspection is limited to visual examination of accessible items without dissection, excavation, probing, climbing, or coring.

6 These findings are based on the observations and opinions of the authoring arborist, and do not provide guarantees regarding the future performance, health, vigor, structural stability or safety of the plants described and assessed.

7 Measurements are subject to typical margins of error, considering the oval or asymmetrical cross-section of most trunks and canopies.

8 Tree Solutions did not review any reports or perform any tests related to the soil located on the subject property unless outlined in the scope of services. Tree Solutions staff are not and do not claim to be soils experts. An independent inventory and evaluation of the site's soil should be obtained by a qualified professional if an additional understanding of the site's characteristics is needed to make an informed decision.

9 Our assessments are made in conformity with acceptable evaluation/diagnostic reporting techniques and procedures, as recommended by the International Society of Arboriculture.

Appendix F **Methods**

Measuring

Tree diameter at standard height (DSH) is measured at 54 inches (4.5 feet) above grade. If a tree had multiple stems, each stem was measured individually and a single stem equivalent was calculated as the root of the sum of each diameter squared (example with 3 stems: DSH = square root [$(stem)^2 + (stem)^2 + (stem)^2$]. A multi-stem tree is regulated based on this single-stem equivalent diameter value. Because this value is calculated in the office following field work, some trees in our data set may have diameters smaller than 6 inches. These trees are included in the tree table for informational purposes only and not factored into tree totals discussed in this report.

Tagging

Most trees had tree tags from a previous inventory. We did not attach additional tags if they were missing. We used the tree identification number from the online campus tree map [4]. Trees identified with letters are placeholders until the university assigns those trees numbers.

Evaluating

Tree health and structure was assessed utilizing visual tree assessment (VTA) methods. The basis behind VTA is the identification of symptoms, which the tree produces in reaction to a weak spot or area of mechanical stress. A tree reacts to mechanical and physiological stresses by growing more vigorously to re-enforce weak areas, while depriving less stressed parts. An understanding of the uniform stress allows the arborist to make informed judgments about the condition of a tree.

Rating

Tree health ratings take into consideration crown indicators such as foliar density, size, color, stem and shoot extensions. Tree structure ratings take into consideration form, as well as structural defects (including past damage and decay). Tree Solutions has adapted our ratings based on the Purdue University Extension formula values for health condition (*Purdue University Extension bulletin FNR-473-W - Tree Appraisal*). These values are a general representation used to assist arborists in assigning ratings.

Health

Excellent - Perfect specimen with excellent form and vigor, well-balanced crown. Normal to exceeding shoot length on new growth. Leaf size and color normal. Trunk is sound and solid. Root zone undisturbed. No apparent pest problems. Long safe useful life expectancy for the species.

Good - Imperfect canopy density in few parts of the tree, up to 10% of the canopy. Normal to less than ¾ typical growth rate of shoots and minor deficiency in typical leaf development. Few pest issues or damage, and if they exist they are controllable or tree is reacting appropriately. Normal branch and stem development with healthy growth. Safe useful life expectancy typical for the species.

Fair - Crown decline and dieback up to 30% of the canopy. Leaf color is somewhat chlorotic/necrotic with smaller leaves and “off” coloration. Shoot extensions indicate some stunting and stressed growing conditions. Stress cone crop clearly visible. Obvious signs of pest problems contributing to lesser condition, control might be possible. Some decay areas found in main stem and branches. Below average safe useful life expectancy

[4] https://depts.washington.edu/ceogis/Public/Trees

Poor - Lacking full crown, more than 50% decline and dieback, especially affecting larger branches. Stunting of shoots is obvious with little evidence of growth on smaller stems. Leaf size and color reveals overall stress in the plant. Insect or disease infestation may be severe and uncontrollable. Extensive decay or hollows in branches and trunk. Short safe useful life expectancy.

Structure

Excellent - Root plate undisturbed and clear of any obstructions. Trunk flare has normal development. No visible trunk defects or cavities. Branch spacing/structure and attachments are free of any defects.

Good - Root plate appears normal, with only minor damage. Possible signs of root dysfunction around trunk flare. Minor trunk defects from previous injury, with good closure and less than 25% of bark section missing. Good branch habit; minor dieback with some signs of previous pruning. Codominant stem formation may be present, requiring minor corrections.

Fair - Root plate reveals previous damage or disturbance. Dysfunctional roots may be visible around the main stem. Evidence of trunk damage or cavities, with decay or defects present and less than 30% of bark sections missing on trunk. Co-dominant stems are present. Branching habit and attachments indicate poor pruning or damage, which requires moderate corrections.

Poor - Root plate disturbance and defects indicate major damage, with girdling roots around the trunk flare. Trunk reveals more than 50% of bark section missing. Branch structure has poor attachments, with several structurally important branches dead or broken. Canopy reveals signs of damage or previous topping or lion-tailing, with major corrective action required.

Appendix G **Tree Protection Specifications**

The following is a list of protection measures which can be incorporated into construction documents. Tree protection should be employed before, during, and after construction to ensure the long-term viability of retained trees.

1. **Project Arborist:** The project arborists shall at minimum have an International Society of Arboriculture (ISA) Certification and ISA Tree Risk Assessment Qualification.
2. **Tree Protection Area (TPA):** TPA is the area surrounding a tree defined by a specified distance, in which excavation and other construction-related activities must be avoided unless approved by the Director (SMC 25.11.130).
3. **Tree Protection Fencing:** Tree protection fencing shall consist of 6-foot-tall chain-link fencing installed at the edge of the TPA as approved by the project arborist. Fence posts shall be anchored into the ground or bolted to existing hardscape surfaces.
    a. Where trees are being retained as a group the fencing shall encompass the entire area including all landscape beds or lawn areas associated with the group.
    b. Per arborist approval, TPA fencing may be placed at the edge of existing hardscape within the TPA to allow for staging and traffic.
    c. Where work is planned within the TPA, install fencing at edge of TPA and move to limits of disturbance at the time that the work within the TPA is planned to occur. This ensures that work within the TPA is completed to specification.
    d. Where trees are protected at the edge of the project boundary, construction limits fencing shall be incorporated as the boundary of tree protection fencing.
4. **Access Beyond Tree Protection Fencing:** The project manager or project arborist shall be present when tree protection areas are accessed.
5. **Tree Protection Signage:** Tree protection signage shall be affixed to fencing every 20 feet. Signage shall be fluorescent, at least 2’ x 2’ in size. Signage must include all information in the PDF located here: http://www.seattle.gov/Documents/Departments/SDCI/Codes/TreeProtectionAreaSign.pdf in addition to the contact information for the project manager and instructions for gaining access to the area.
6. **Filter / Silt Fencing:** Filter / silt fencing within or at the edge of the TPA of retained trees shall be installed in a manner that does not sever roots. Install so that filter / silt fencing sits on the ground and is weighed in place by sandbags or gravel. Do not trench to insert filter / silt fencing into the ground.
7. **Monitoring:** The project arborist shall monitor all ground disturbance at the edge of or within the TPA.
8. **Soil Protection:** Retain existing paved surfaces within or at the edge of the TPA for as long as possible. No parking, foot traffic, materials storage, or dumping (including excavated soils) are allowed within the TPA. Heavy machinery shall remain outside of the TPA. Access to the tree protection area will be granted under the supervision of the project arborist. If the project arborist allows, heavy machinery can enter the area if soil is protected from the load. Acceptable methods of soil protection include placing 3/4-inch plywood over 6 inches of wood chip mulch, or use of AlturnaMats® (or equivalent product approved by the project arborist). Compaction of soils within the TPA must not occur.
9. **Soil Remediation:** Soil compacted within the TPA of retained trees shall be remediated using pneumatic air excavation according to a specification produced by the project arborist.
10. **Canopy Protection**: Where fencing is installed at the limits of disturbance within the TPA, canopy management (pruning or tying back) shall be conducted to ensure that vehicular traffic does not

damage canopy parts. Exhaust from machinery shall be located 5 feet outside the dripline of retained trees. No exhaust shall come in contact with foliage for prolonged periods of time.

11. **Duff/Mulch:** Apply 6 inches of arborist wood chip mulch or hog fuel over bare soil within the TPA to prevent compaction and evaporation. TPA shall be free of invasive weeds to facilitate mulch application. Keep mulch 1 foot away from the base of trees and 6 inches from retained understory vegetation. Retain and protect as much of the existing duff and understory vegetation as possible.
12. **Excavation:** Excavation done within the TPA shall use alternative methods such as pneumatic air excavation or hand digging. If heavy machinery is used, use flat front buckets with the project arborist spotting for roots. When roots are encountered, stop excavation and cleanly sever roots. The project arborist shall monitor all excavation done within the TPA.
13. **Fill:** Limit fill to 1 foot of uncompacted well-draining soil, within the TPA of retained trees. In areas where additional fill is required, consult with the project arborist. Fill must be kept at least 1 foot from the trunks of trees.
14. **Root Pruning:** Limit root pruning to the extent possible. All roots shall be pruned with a sharp saw making clean cuts. Do not fracture or break roots with excavation equipment.
15. **Root Moisture:** Root cuts and exposed roots shall be immediately covered with soil, mulch, or clear polyethylene sheeting and kept moist. Water to maintain moist condition until the area is back filled. Do not allow exposed roots to dry out before replacing permanent back fill.
16. **Hardscape Removal:** Retain hardscape surfaces for as long as practical. Remove hardscape in a manner that does not require machinery to traverse newly exposed soil within the TPA. Where equipment must traverse the newly exposed soil, apply soil protection as described in section 8. Replace fencing at edge of TPA if soil exposed by hardscape removal will remain for any period of time.
17. **Tree Removal:** All trees to be removed that are located within the TPA of retained trees shall not be ripped, pulled, or pushed over. The tree should be cut to the base and the stump either left in place or ground out. A flat front bucket can also be used to sever roots around all sides of the stump, or the roots can be exposed using hydro or air excavation and then cut before removing the stump.
18. **Irrigation:** Retained trees with soil disturbance within the TPA will require supplemental water from June through September. Acceptable methods of irrigation include drip, sprinkler, or watering truck. Trees shall be watered three times per month during this time.
19. **Pruning:** Pruning required for construction and safety clearance shall be done with a pruning specification provided by the project arborist in accordance with American National Standards Institute ANSI-A300 2017 Standard Practices for Pruning. Pruning shall be conducted or monitored by an arborist with an ISA Certification.
20. **Plan Updates:** All plan updates or field modifications that result in impacts within the TPA or change the retained status of trees shall be reviewed by the senior project manager and project arborist prior to conducting the work.
21. **Materials:** Contractor shall have the following materials on-site and available for use during work in the TPA:
    - **Sharp and clean bypass hand pruners**
    - **Sharp and clean bypass loppers**
    - **Sharp hand-held root saw**
    - **Reciprocating saw with new blades**
    - **Shovels**
    - **Trowels**
    - **Clear polyethylene sheeting**
    - **Burlap**
    - **Water**

Tree Solutions Inc
Consulting Arborists

Table of Trees
ASUW Shell House
Seattle, WA

Arborist: HI
Date of Inventory: June 28, 2024
Table Prepared: Updated August 19, 2024

DSH (Diameter at Standard Height) is measured 4.5 feet above grade, or as specified in the Guide for Plant Appraisal, 10th Edition , published by the Council of Tree and Landscape Appraisers.
DSH for multi-stem trees are noted as a single stem equivalent, calculated as the square root of the sum of the DSH for each individual stem squared.
Tier is based on SMC 25.11 and Director's Rule 7-2023.
Tree Protection Area is calculated as 10 times DSH or greater depending on tree species, health, and age.
Tree ID has been pre-assigned by UW. Most trees do not have tags in this area. Letters identify trees that are not listed in the UW GIS Tree Database.
Dripline is measured from the center of the tree to the outermost extent of the canopy and is an average of all four directions.
Trees in bold were added with this TOT revision

Tree ID	Scientific Name	Common Name	DSH Single Stem Equivalent (inches)	DSH Single Stem	DSH Multistem	Health Condition	Structural Condition	Dripline Radius avg	Tier 2 Threshold	Grove	Tier Level	Basic Tree Protection Area (feet)	Tree Protection Area (feet)	Notes
58	**Sequoia sempervirens**	**Coast redwood**	**103.5**	**103.5**		**Good**	**Good**	**35**	**24.0**		**2**	**104**	**86**	**Four main stems grow from base. Structure good.**
59	**Sequoiadendron giganteum**	**Giant sequoia**	**76.3**	**76.3**		**Good**	**Good**	**27**	**24.0**		**2**	**76**	**64**	
60	**Chamaecyparis lawsoniana**	**Lawson cypress**	**28.8**	**28.8**		**Good**	**Good**	**18**	**24.0**		**2**	**29**	**24**	
61	**Chamaecyparis lawsoniana**	**Lawson cypress**	**27.1**	**27.1**		**Good**	**Good**	**18**	**24.0**	Grove	**2**	**27**	**23**	
62	**Chamaecyparis lawsoniana**	**Lawson cypress**	**32.1**	**32.1**		**Good**	**Good**	**12**	**24.0**	Grove	**2**	**32**	**27**	
64	*Acer macrophyllum*	Bigleaf maple	36.0	36.0		Fair	Fair	20	*24.0*	Grove	2	36	30	
67	*Acer macrophyllum*	Bigleaf maple	22.6		12,14,13	Good	Fair	25	*24.0*	Grove	2	23	19	
69	*Acer macrophyllum*	Bigleaf maple	23.4		14.5,13,13	Fair	Fair	25	*24.0*	Grove	2	23	20	Dieback, broken branches.
70	*Acer macrophyllum*	Bigleaf maple	33.1		24,14,18	Fair	Fair	30	*24.0*	Grove	2	33	28	
72	*Acer macrophyllum*	Bigleaf maple	27.0	27.0		Good	Good	35	*24.0*	Grove	2	27	23	
73	*Acer macrophyllum*	Bigleaf maple	22.7	22.7		Good	Good	20	*24.0*	Grove	2	23	19	All trees in this area qualify as a grove.
74	*Acer macrophyllum*	Bigleaf maple	23.0	23.0		Good	Good	30	*24.0*	Grove	2	23	19	
77	*Fraxinus latifolia*	Oregon ash	13.8	13.8		Fair	Fair	20	*24.0*		3	14	12	
78	*Fraxinus latifolia*	Oregon ash	13.0	13.0		Fair	Fair	20	*24.0*		3	13	11	
79	*Fraxinus latifolia*	Oregon ash	11.0	11.0		Fair	Fair	16	*24.0*		4	11	9	
80	*Acer macrophyllum*	Bigleaf maple	40.0	40.0		Good	Good	30	*24.0*		2	40	33	Estimated DBH / restricted access.

Table of Trees
ASUW Shell House
Seattle, WA

Arborist: HI
Date of Inventory: June 28, 2024
Table Prepared: Updated August 19, 2024

Tree ID	Scientific Name	Common Name	DSH Single Stem Equivalent (inches)	DSH Single Stem	DSH Multistem	Health Condition	Structural Condition	Dripline Radius avg	Tier 2 Threshold	Grove	Tier Level	Basic Tree Protection Area (feet)	Tree Protection Area (feet)	Notes
82	*Fraxinus latifolia*	Oregon ash	14.0	14.0		Fair	Fair	20	*24.0*		3	14	12	All OR ash in area have dieback and broken branches in this area.
83	*Fraxinus latifolia*	Oregon ash	16.0	16.0		Fair	Fair	20	*24.0*		3	16	13	
85	*Populus alba c. nivea*	White poplar	12.2	12.2		Good	Good	8	*24.0*		3	12	10	
86	*Populus alba c. nivea*	White poplar	7.5	7.5		Good	Good	6	*24.0*		4	8	6	
87	*Populus alba c. nivea*	White poplar	11.2	11.2		Good	Good	8	*24.0*		4	11	9	
88	*Populus alba c. nivea*	White poplar	12.4	12.4		Good	Good	8	*24.0*		3	12	10	
89	*Populus alba c. nivea*	White poplar	10.7	10.7		Good	Good	8	*24.0*		4	11	9	
94	*Salix babylonica 'Pendula'*	Weeping willow	19.2		15,12	Fair	Fair	20	*24.0*		3	19	16	Dieback, beaver fencing in place, multi-stem at base. Estimated DBH / restricted access.
96	*Alnus rubra*	Red alder	18.0	18.0		Fair	Fair	15	-		3	18	15	Estimated DBH / restricted access. Beaver fencing in place, grows out of embankment
97	*Fraxinus latifolia*	Oregon ash	10.2	10.2		Good	Good	15	*24.0*		4	10	8	Recent pruning on west side, beaver fencing in place
98	*Populus alba c. nivea*	White poplar	10.2	10.2		Good	Good	8	*24.0*		4	10	8	
99	*Populus alba c. nivea*	White poplar	15.0	15.0		Good	Good	8	*24.0*		3	15	13	
101	*Abies pinsapo*	Spanish fir	14.0	14.0		Fair	Fair	10	*24.0*		3	14	12	New shoot dieback due to insect damage. Potential spider mites? Beaver damage / beaver fencing in place at base.
9063	*Acer macrophyllum*	Bigleaf maple	14.4	14.4		Good	Good	20	*24.0*		3	14	12	
9413	***Sequoia sempervirens***	**Coast redwood**	**8.8**	**8.8**		**Good**	**Good**	**10**	***24.0***		**4**	**9**	**7**	
9413	***Sequoia sempervirens***	**Coast redwood**	**8.8**	**8.8**		**Good**	**Good**	**10**	***24.0***		**4**	**9**	**7**	
9464	*Pinus ponderosa*	Ponderosa pine	8.0	8.0		Good	Good	10	*24.0*		4	8	7	

Tree Solutions Inc
Consulting Arborists

Table of Trees
ASUW Shell House
Seattle, WA

Arborist: HI
Date of Inventory: June 28, 2024
Table Prepared: Updated August 19, 2024

Tree ID	Scientific Name	Common Name	DSH Single Stem Equivalent (inches)	DSH Single Stem	DSH Multistem	Health Condition	Structural Condition	Dripline Radius avg	Tier 2 Threshold	Grove	Tier Level	Basic Tree Protection Area (feet)	Tree Protection Area (feet)	Notes
9465	*Pinus ponderosa*	Ponderosa pine	8.5	8.5		Good	Good	5	*24.0*		4	9	7	Beaver fencing at base.
10166	***Metasequoia glyptostroboides***	**Dawn redwood**	**7.7**	**7.7**		**Good**	**Good**	**8**	***24.0***		**4**	**8**	**6**	
10355	*Tilia cordata*	Littleleaf linden	5.9	5.9		Good	Good	9	*24.0*		-	6	5	
11811	***Quercus coccinea***	**Scarlet oak**	**8.5**	**8.5**		**Good**	**Good**	**12**	***24.0***		**4**	**9**	**7**	
12251	***Quillaja saponaria***	**Soap Bark**	**7.5**	**7.5**		**Good**	**Good**	**12**	***24.0***		**4**	**8**	**6**	
13618	*Acer circinatum*	Vine maple	6.6		3, 3, 3, 2.5, 2.5, 2	Good	Good	8	*8.0*		4	7	5	
13619	*Alnus rubra*	Red alder	12.5	12.5		Good	Good	15	-		3	13	10	
13620	*Acer circinatum*	Vine maple	5.9		3, 3, 3, 2, 2,	Good	Good	8	*8.0*		-	6	5	
13623	*Acer circinatum*	Vine maple	6.2		3,3,4,2	Good	Good	10	*8.0*		4	6	5	
A	*Rhus typhina*	Staghorn sumac	12.0	12.0		Good	Fair	15	*24.0*		3	12	10	Grows horizontally out of bank
B	*Alnus rubra*	Red alder	10.1		7,7.25	Good	Fair	16	-		4	10	8	Multi-stem at base, grows out of embankment
C	*Prunus cerasifera*	Cherry plum	6.0	6.0		Good	Fair	8	*21.0*		4	6	5	
K	***Corylus cornuta***	**Beaked hazelnut**	**5.6**		**3,2,2,2,2,2, 1,1,1,**	**Good**	**Good**	**15**	***24.0***		**-**	**6**	**5**	

Parcel boundaries and trees are located approximately.

Tree Solutions Inc
Consulting Arborists
2940 Westlake Ave N #200
Seattle, WA 98109
206-528-4670

University of Washington Shell House
3655 Walla Walla Rd
Seattle, WA 98195
Parcels: 1625204HYDR, 1625049001

Legend

- Assessed Trees
- King County Parcels

Feet
0 12.5 25 50

N

Site Map

Date: August 19, 2024

Arborist:
Holly Iosso RCA 567
ISA PN-6298A
ISA TRAQ

S.E. 1/4, SEC. 16, TWP. 25 N., RGE. 04 E., W.M.

STATEMENT OF TOPOGRAPHIC MAP ELEMENTS (WAC 332-130-145)

2(b) PURPOSE: FEASIBILITY AND DESIGN

2(c) CONTOUR SOURCE: CONTOURS DERIVED FROM DIRECT FIELD OBSERVATIONS

2(f) CONTOUR ACCURACY: COMPLIES WITH UNITED STATES NATIONAL MAP ACCURACY STANDARDS (90% OR GREATER OF ALL SURVEY POINTS CHECKED ARE CORRECT WITHIN HALF OF ONE CONTOUR INTERVAL).

2(g) LIMITATIONS: THE PURPOSE OF THIS TOPOGRAPHIC SURVEY IS TO SUPPORT DESIGN & ENGINEERING WORK, AND TO ILLUSTRATE BOUNDARY AND TITLE INVESTIGATIONS.

2(h) BOUNDARY SOURCE: FIELD SURVEY OF CONTROLLING MONUMENTS, AND CONSIDERATION OF EXISTING RECORDS OF SURVEYS & RECORD PLATS FOR DETERMINING ON THE GROUND POSITIONS OF DEEDED PROPERTY AND EASEMENT LINES.

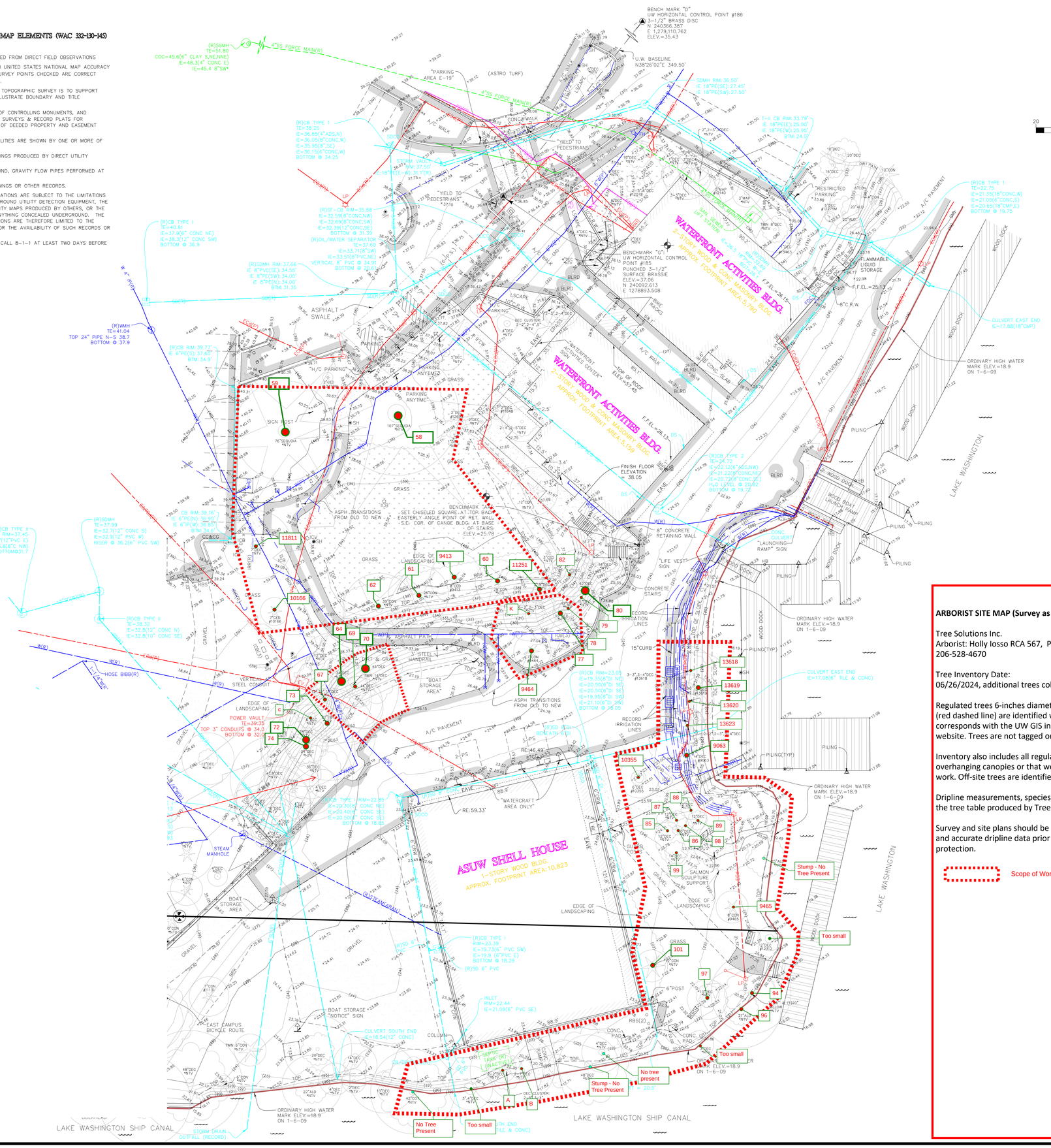
3(a) & 3(b) UTILITIES: UNDERGROUND UTILITIES ARE SHOWN BY ONE OR MORE OF THE FOLLOWING METHODS:

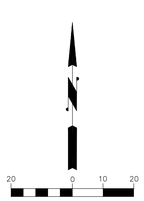
1. SURVEY FIELD OBSERVATION OF MARKINGS PRODUCED BY DIRECT UTILITY DETECTION WORK.
2. DIRECT OBSERVATIONS OF UNDERGROUND, GRAVITY FLOW PIPES PERFORMED AT VISIBLE CONTROLLING STRUCTURES.
3. SCALING OF AS-BUILTS, DESIGN DRAWINGS OR OTHER RECORDS.

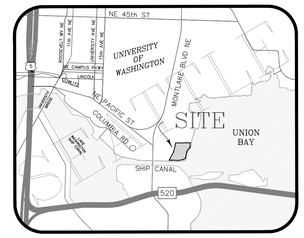
3(c) SCOPE STATEMENT: UTILITY INVESTIGATIONS ARE SUBJECT TO THE LIMITATIONS OF ACCURACY OF CONVENTIONAL UNDERGROUND UTILITY DETECTION EQUIPMENT, THE EXISTENCE / ACCURACY OF RECORD UTILITY MAPS PRODUCED BY OTHERS, OR THE AWARENESS OR LOCAL KNOWLEDGE OF ANYTHING CONCEALED UNDERGROUND. THE COMPREHENSIVENESS OF SAID INVESTIGATIONS ARE THEREFORE LIMITED TO THE CAPACITY OF SAID TECHNOLOGIES AND /OR THE AVAILABILITY OF SUCH RECORDS OR KNOWLEDGE.

PURSUANT TO R.C.W. 19.22.030, ALWAYS CALL 8–1–1 AT LEAST TWO DAYS BEFORE YOU DIG.

WASHINGTON811.COM







VICINITY MAP

NO SCALE

LEGEND

⊕	AREA DRAIN
ABAN/RET	ABANDONED/RETIRED
	ASPHALT (ASPH)
BE	BUILDING ENTRANCE
o	BOLLARD (BLRD)
	BRICK SURFACE
	BUILDING LINE
BC	BUILDING CORNER
BR	BIKE RACK
BTM	BOTTOM OF STRUCTURE
BVA	BUILDING VEHICLE ACCESS
	CANOPY
	CATCH BASIN (CB)
	CONCRETE SURFACE
CC/XC/&G	CONCRETE/EXTRUDED CURB/& GUTTER
CD	CONDUIT DROP
CW/BW/AW	CONCRETE/BRICK/ASPHALT WALK
CRW/BRW/WRW	CONCRETE/BLOCK/WOOD RETAINING WALL
-x-x-	CHAIN LINK FENCE (CLF)
CTV	CABLE TV
COL	COLUMN
℄/M	CENTERLINE/MONUMENT LINE
CS/MS/WS	CONCRETE/METAL/WOOD STAIRS
♿	H/C PARKING SPACE
CON	CONIFEROUS TREE
DEC	DECIDUOUS TREE
COC	CENTER OF CHANNEL
DS/RD	DOWN SPOUT/ROOF DRAIN
DWY	DRIVEWAY
ECD	ELECTRICAL CONDUIT
ED	ELECTRICAL DUCT
EHH/EJB	ELECTRICAL HANDHOLE/JUNCTION BOX
EMH	ELECTRICAL MANHOLE
EM	ELECTRICAL METER
EV/ET	ELECTRICAL VAULT/TRANSFORMER
----/SBC	FEATURE BELOW OBJECT (DASHED TEXT)
	FOUND SURVEY MONUMENT (AS NOTED)
	FIRE HYDRANT
FDC	FIRE DEPT. CONNECTION (FDC)
FO	FIBER OPTICS
FOMH	FIBER OPTIC MANHOLE
FOV	FIBER OPTIC VAULT
FFE	FINISH FLOOR ELEVATION
G	GAS MAIN
GM	GAS METER
GV	GAS VALVE
GB	GRADE BREAK
	GRAVEL SURFACE
GR	GROUNDING ROD
	GUY ANCHOR
GP /UP /PP	GUY/POWER/UTILITY POLE
	HANDRAIL
SP	STRAIN POLE
IR	IRRIGATION LINE (RECORD)
ICB	IRRIGATION CONTROL BOX
IV	IRRIGATION VALVE
IL	INDUCTION LOOP (TRAFFIC)
I	INLET (TYPE 250A)
I	INLET (TYPE 250B)
in	INSERTED PIPE
IE	INVERT ELEVATION
	LIGHT POLE (METAL)
	LIGHT POLE (WOOD)
	LIGHT POLE (DECORATIVE)
LSCAPE/PA	LANDSCAPE/PLANTER
	MANHOLE
MB	MAILBOX (FEDERAL/PRIVATE)
MW	MONITOR WELL
*NTV	NO TAG VISIBLE
OHP/OHC/OHT	OVERHEAD POWER/CABLE/TELEPHONE
OHG/OHB	OVERHEAD GUYWIRE/BUS (TROLLEY)
P.S.	PARKING SPACE(S)
	PILING
PL	PROPERTY LINE (PL)
(P)	PAINTED UTILITY LOCATION
	PIPE FLOW DIRECTION
CP/DI/CMP/VC	CONCRETE/IRON/METAL/CLAY (PIPE TYPES)
PE/PVC	POLYETHYLENE PIPE (POLYMER PIPE TYPES)
PPS	PARKING PAY STATION
	POST INDICATOR VALVE
PS/PSS	COMBINED/SANITARY SEWER
X PS	X NUMBER PARKING STALLS
PSD	STORM DRAIN
	PRIVATE CATCH BASIN
RBS	REMOVABLE BOLLARD SLEEVE
RE/PPT	ROOF/PARAPET ELEVATION
(R)	RECORD DATA
RHD	RHODODENDRON
	ROCKERY
RE	ROOF ELEVATION
SF-CB	STORM FILTER CB BY CONTECH (PIPES NOT VISIBLE OR MEASURED)
SD	SERVICE DRAIN (STORM)
SDCO/SSCO	STORM DRAIN/SANITARY SEWER
SH	SPRINKLER HEAD
SP	SPRINKLER
STM/V	STEAM LINE/VAULT
SSS	SANITARY SIDE SEWER (RECORD)
	SIGN/STREET NAME SIGN
TC/SL	TRAFFIC CONTROL/STREET LIGHT HANDHOLE
	TRAFFIC CONTROL CABINET (TRSCC)
TCHD	TRENCH DRAIN
	TEMPORARY BENCHMARK (TBM)
TCD	TELEPHONE CONDUIT (BURIED)
TD	TELEPHONE DUCT
TV	TELEPHONE VAULT
TMH	TELEPHONE MANHOLE
TS	TELEPHONE SENTRY
	TRAFFIC FLOW DIRECTION
TOE	TOE OF SLOPE
TOP	TOP OF BANK
ULBL	UPPER LEVEL BUILDING LINE
WV	WATER VAULT
W	WATER MAIN
WM	WATER METER
	WATER VALVE
	WATER BLOWOFF VALVE
	WATER GATE VALVE/CHAMBER
VO/CO	VACATION/CONDEMNATION ORDINANCE
WE	WIRE ELEVATION
	WOOD FENCE (WF)
	WOOD SURFACE
	IRON FENCE (WF)
	YARD LIGHT
ALD	ALDER TREE
CED	CEDAR TREE
COT	COTTONWOOD TREE
PINE	PINE TREE
SEQ	SEQUOIA TREE
	BRASS DISC

ARBORIST SITE MAP (Survey as Base Map)

Tree Solutions Inc.
Arborist: Holly Iosso RCA 567, PN 6298A
206-528-4670

Tree Inventory Date:
06/26/2024, additional trees collected 8/13/2024

Regulated trees 6-inches diameter or greater within the project area (red dashed line) are identified with a number. This number corresponds with the UW GIS inventory accessed on the UW website. Trees are not tagged on site.

Inventory also includes all regulated off-site trees that had overhanging canopies or that were likely to be impacted by site work. Off-site trees are identified by a letter unless otherwise noted.

Dripline measurements, species, and other tree specifics are listed in the tree table produced by Tree Solutions Inc.

Survey and site plans should be updated to include tree identifiers and accurate dripline data prior to any design related to tree protection.

Scope of Work Area

10/23/2023
JAMES MARSHALL HARPER
REGISTERED PROFESSIONAL LAND SURVEYOR
STATE OF WASHINGTON

BUSH & HITCHINGS, INC. CORPORATE SEAL 1969 BUSH, ROED & HITCHINGS, INC.

BUSH, ROED & HITCHINGS, INC.
LAND SURVEYORS & CIVIL ENGINEERS
15400 SE 30TH PL, STE 100
BELLEVUE, Washington
98007-6546
(206) 323-4144
1-800-935-0508
WWW.BRHINC.COM

TOPOGRAGHIC SURVEY
ASUW SHELL HOUSE
UNIVERSITY OF WASHINGTON
CITY OF SEATTLE
KING COUNTY
WASHINGTON

drawn by	checked by
ABW/MAJ	JMH
scale	date
1" = 20'	10/23/23
job no.	
2023118.00	
sheet 1 of 1	

DATE
REVISION
NO.

30"-42" 10/23/2023 U:\C3D\2023\2023118\SURVEY\CIVIL\VS-SUR-00.DWG

Attachment D
Avian Survey Letter

SHANNON & WILSON

June 25, 2024

Ms. Sydney Thiel
Project Delivery Group
UW Facilities Building Box 352205
3988 Jefferson Road NE
Seattle, WA 98195

RE: AVIAN SURVEY LETTER, WAC & HUSKY HARBOR DOCK IMPROVEMENTS AND ASSOCIATED STUDENTS OF THE UNIVERSITY OF WASHINGTON SHELL HOUSE RESTORATION PROJECTS, UNIVERSITY OF WASHINGTON, SEATTLE, WASHINGTON

Dear Ms. Thiel:

This letter addresses potential impacts to avian species on the University of Washington (UW) campus, as it pertains to work being proposed on two projects: the WAC & Husky Harbor Dock Improvements Project, which is located 3710 Montlake Boulevard NE, Seattle, Washington; and the Associated Students of the University of Washington (ASUW) Shell House Restoration Project, which is located at 3655 Walla Walla Road, Seattle, Washington (see Figure 1). Together, both projects will hereby be referred to as the "Project." Our scope of services includes one avian survey focusing on great blue heron (*Ardea herodias*) and bald eagle (*Haliaeetus leucocephalus*) nesting activity throughout the survey area, and all bird species covered under the Migratory Bird Treaty Act (MBTA) within the Project footprint. The survey area boundaries will encompass a minimum 800-foot buffer to include both potential great blue heron and bald eagle management zones. The great blue heron is a designated species of local importance within the City of Seattle's (City's) environmentally critical areas regulations (Seattle Municipal Code [SMC] 25.09.200.C.5). The bald eagle was removed from the federal Endangered Species Act list in 2007 and from the Washington State list of special status species in 2017, and therefore no longer has explicit protection under the City's regulations. However, the species is still protected under the federal Bald and Golden Eagle Protection Act and the MBTA.

This letter will summarize background information on the Project and applicable species, survey methods and results, as well as discuss applicable regulations and potential regulatory requirements.

BACKGROUND

The UW Recreation offers kayak and canoe rentals from spring through fall, providing students and the community with opportunities to enjoy water-based activities. The Waterfront Activity Center serves as a hub for students, staff, and visitors to utilize the adjacent shoreline and recreate in the vicinity. Additionally, the docks provide moorage space for boaters and tour boats, such as Argosy Cruises, to utilize on UW football game days.

In their current state, many of the existing docks have deteriorated over time and are approaching the end of their useful life. The Project aims to replace several aging docks, remove the outdated boat ramp, introduce a canoe launch beach to improve access for non-motorized watercraft, and reorient the dock to optimize space utilization and improve navigation.

In addition to the dock improvements, a separate project seeks to restore the ASUW Shell House facility. These improvements will address code-required upgrades, including seismic, infrastructure upgrades, and accessibility improvements. The use will remain Academic land use, but the building code use of the building will change from a storage facility to assembly occupancy to support student events and community gatherings. The Shell House is a registered structure on the National Historic Register (1975) and a Seattle Landmark (2018)..

Project Description

The Project involves the removal of up to six existing docks and the boat ramp, as well as the addition of two extension docks at the outer dock. Two of the removed docks will be replaced with a sand/gravel canoe launching beach to improve non-motorized boat access. The Project also includes a bid alternate to replace and reorient one dock to provide Americans with Disabilities Act (ADA) accessibility.

The site work adjacent to the ASUW Shell House includes improvements to the existing network of gravel and packed earth paths on the east side, connecting to the docks and the south area. These walkways will be removed, replaced, and potentially realigned via excavation and grading. The new walkways are likely to be poured-in-place concrete and/or grass-crete material. A new portion of vehicular paving will be installed to accommodate emergency vehicle access and may include alcoves with seating and interpretive elements related to the site's notable history. Efforts will be made to preserve trees in this area, with an arborist assessment planned to identify tree-retention strategies.

To the north of the ASUW Shell House, an arrival plaza is planned, which will also form part of the emergency vehicle turning area. The existing asphalt paving will be resurfaced with a combination of asphalt and poured-in-place concrete. Benches, a planter, and a small enclosure for utilities and waste receptacles may also be included in the scope. An ADA parking space will be included within the paved area.

The gravel lot to the west of the ASUW Shell House, currently used for marine craft storage and occasional parking, will receive surface repairs. Additional work that may be included in the scope includes demolishing the existing failing retaining wall to the northwest to construct an accessible sloped walkway connecting the E19 parking lot to the north entrance. If funded, this may require the removal of approximately six small trees, subject to the arborist's assessment. A potential new pathway connecting Walla Walla Road to the south elevation of the ASUW Shell House is also being considered, along with the possibility of re-grading the west gravel lot and installing retaining/seat walls, interpretive elements, and new plantings.

Along the south elevation of the ASUW Shell House, a new deck or plaza is proposed, extending along the entire elevation without encroaching on the Ordinary High Water Mark. Tree removal in this area is unlikely, but planting restoration is likely.

ASUW Shell House construction will include building renovation including replacement of specific windows, removal and replacement of the roof and siding shingles (for adding insulation), and structural upgrades to the foundation and interior framework to improve seismic performance.

Dock construction techniques have been selected to minimize disturbance to the surrounding environment. Piling installation will be carried out from a barge, utilizing a vibratory hammer whenever possible to reduce noise and vibration impacts. An impact hammer will only be used if necessitated by hard driving conditions. The construction of the canoe launching beach near the docks will involve the removal and proper disposal of soft sediment at an approved upland location. The beach will be built using a layered system, consisting of a geotextile fabric base, followed by a crushed rock/ballast layer, another geotextile fabric layer, and finally a sand/gravel surface. All beach construction activities are expected to be completed using upland-based equipment, minimizing in-water work. New floats will be fabricated off-site to reduce on-site construction time and associated impacts.

The WAC & Husky Harbor Dock Improvements project is scheduled to commence and conclude in early 2025. In-water work will occur during the regulatory work window[1] that protects fish habitat. Inclusion of the Montlake Dock work is subject to acceptance of an Additive Bid Item.

The ASUW Shell House Restoration project is scheduled to commence in Spring 2025 and conclude in Summer 2026.

Species of Consideration

In western Washington, the breeding season for the great blue heron spans a six-month period starting in early February, with courtship behavior culminating around August when successful offspring have fledged and dispersed. Nesting colonies can range from five to 500 nests and are typically located in areas with large mature stands of mixed coniferous and deciduous trees in close proximity to large bodies of water. On the UW campus, there is one great blue heron management area designated by the City's Department of Planning and Community Development in conjunction with the Washington Department of Fish and Wildlife (WDFW). The management area includes two documented nesting sites and their associated year-round buffers. The Project is not located within the management areas or year-round buffers.

Bald eagles create large nests in large trees, which they reuse year after year. In western Washington, they begin laying eggs from late February to early March. Eggs are then incubated for approximately 35 days until they hatch. Chicks will stay in the nest for 10 to 12 weeks, after which they will fledge. Bald eagle management areas are documented on both the north and south sides of Union Bay. According to the Seattle Department of Construction and Inspections GIS online mapping tool, the closest documented management areas are approximately half a mile southeast of the Project site; however, habitat in the forested areas north and south of the Project site could support nesting activity, and undocumented nests may be observed.

The general nesting season for all bird species in Washington State occurs from late January to mid-August. The length of time from nest building to fledging and the number of clutches per year varies from species to species. Many bird species create new nests each year, so it is possible to observe new nests during any given nesting season; therefore, areas where tree removal could occur should be surveyed.

[1] The allowable in-water work window is July 16 – March 15, as published by UW Army Corps of Engineers' Approved Work Window for Rivers and Lakes.

FIELD METHODS

The UW anticipates construction to begin in early 2025, prior to the start of the 2025 nesting season. To comply with the City's critical area code, a Shannon & Wilson biologist conducted an avian survey on March 28th during the 2024 nesting season. During the survey, areas with mature trees within approximately 800 feet of the Project area (excluding private property and developed areas) were visually observed using both the naked eye and binoculars (see Figure 1 for survey area). Nests of appropriate size for eagle or heron were observed for signs of activity for approximately 20 minutes. Observations included listening for sounds of adults and chicks, visual observations of the nest for any sign of movement, watching for adult ingress and egress from any nests, and studying areas below any nest for any sign of use (droppings, feathers, etc.). The locations of observed nests were collected using a hand-held global positioning system unit and documented in Figure 1.

RESULTS

During the survey, one active bald eagle nest was identified in a mature deciduous tree located approximately 350 feet southwest of the ASUW Shell House on the south side of the Montlake Cut (Figure 1). The nest, measuring roughly 4 to 5 feet in diameter, was constructed of large sticks, which is characteristic of bald eagle nests.

Throughout the observation period, a single bald eagle was seen perched in the nest, exhibiting nesting behavior. The eagle remained on the nest for the entire duration of the 20-minute observation, suggesting that it may be incubating eggs. No additional bald eagles were observed entering or leaving the nest during this time.

Several great blue herons were observed wading and hunting along the shoreline, however, no great blue heron nests were observed within the survey area. Additionally, no active nests of any bird covered under the MBTA were observed within the Project footprint during the survey.

APPLICABLE REGULATIONS FOR AVIAN SPECIES

The City regulates fish and wildlife habitat conservation areas under SMC 25.09.200. Under City code, "Development on parcels containing fish and wildlife habitat conservation areas shall comply with any species habitat management plan set out in a Director's Rule. The Director may establish by rule a habitat management plan to protect any species listed as endangered or threatened under the federal Endangered Species Act, any priority habitat or species identified by WDFW or any species of local importance"(SMC 25.09.200.B.2). Species of local importance currently include the great blue heron. Other species, including

the bald eagle, have been covered under critical areas ordinances in the past and could be included again if they become relisted under state law as threatened or endangered.

The U.S. Fish and Wildlife Service (USFWS) is responsible for implementing and enforcing the MBTA, which makes it illegal "to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid Federal permit" (USFWS, 1918[2]). "Take" can include the knowing destruction of a nest or activities that would cause a nest to fail. Great blue herons and bald eagles are both migratory birds, as are all species of bird native to the United States.

The USFWS is also responsible for implementing the Bald and Golden Eagle Protection Act of 1940. This act is enforceable regardless of the species listing status and "provides for the protection of the bald eagle and the golden eagle (as amended in 1962) by prohibiting the take, possession, sale, purchase, barter, offer to sell, purchase or barter, transport, export or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit" (USFWS, 1940[3]).

DISCUSSION

The results of the 2024 avian survey are being used to inform the potential need for additional requirements necessary to comply with the applicable regulations stated above. Timing restrictions, including the allowable window for in-water work (July 16 – March 15) and construction durations proposed to last over a year, may inform the avian-related permitting requirements needed for the Project.

Based on the presence of a potentially active bald eagle nest within 660 feet of the Project footprint, the following recommendations may be required to be in compliance with the Bald and Golden Eagle Protection Act:

- Establishment of a 660-foot buffer around the active bald eagle nest during the nesting season (January 1 through August 15) to minimize disturbance to the nesting pair and their offspring.
- Avoidance of construction activities that generate loud noises or significant visual disturbances within the 660-foot buffer during the nesting season.

[2] U.S. Fish and Wildlife Service (USFWS), 1918, The Migratory Bird Treaty Act (MBTA; 16 U.S.C. 703 et seq.), 50 CFR 10.13.
[3] U.S. Fish and Wildlife Service (USFWS), 1940, Bald and Golden Eagle Protection Act (16 USC. 668-668c), 50 CFR 22.6.

- If construction activities cannot be avoided within the 660-foot buffer during the nesting season, consultation with the USFWS and the City to determine appropriate permitting requirements and mitigation measures.
- Conducting a follow-up survey prior to the start of construction in early 2025 to confirm the status of the bald eagle nest and to identify any new nests that may have been established in the vicinity of the Project area.

No great blue heron nests were observed within the survey area; however, if great blue heron activity is observed anywhere else within the survey area during construction, the Project may have to comply with timing restrictions and mitigation sequencing outlined in SMC 25.09.065, which will require the development of a mitigation plan and maintenance and monitoring plan. Similar provisions may be required for other avian species if they become listed under state law and are included as species of local importance prior to the completion of the construction related to the Project.

To comply with the MBTA, no trees with active nests (those with eggs or young) should be removed until those nests have been deemed inactive. However, inactive nests (unused or abandoned nests or nests currently being built but that do not have eggs or young in them) can legally be removed under the MBTA (note, this does not include the removal of eagle nests, which may require an Eagle Nest Take Permit under the Bald and Golden Eagle Protection Act). Removing inactive nests that may become active would aid in minimizing the potential for "take" under the MBTA. If tree removal is proposed during nesting season (late January to mid-August), we recommend that those trees be surveyed for nests (active or inactive) no more than five days prior to removal.

CLOSURE

The findings and conclusions documented in this letter have been prepared for specific application to this Project, and have been developed in a manner consistent with that level of care and skill normally exercised by members of the environmental science profession currently practicing under similar conditions in the area, and in accordance with the terms and conditions set forth in our agreement. The conclusions presented in this letter are professional opinions based on interpretation of information currently available to us and are made within the operational scope, budget, and schedule constraints of this Project. No warranty, express or implied, is made.

If you have any questions, please contact me at merci.clinton@shanwil.com or 206-695-6715.

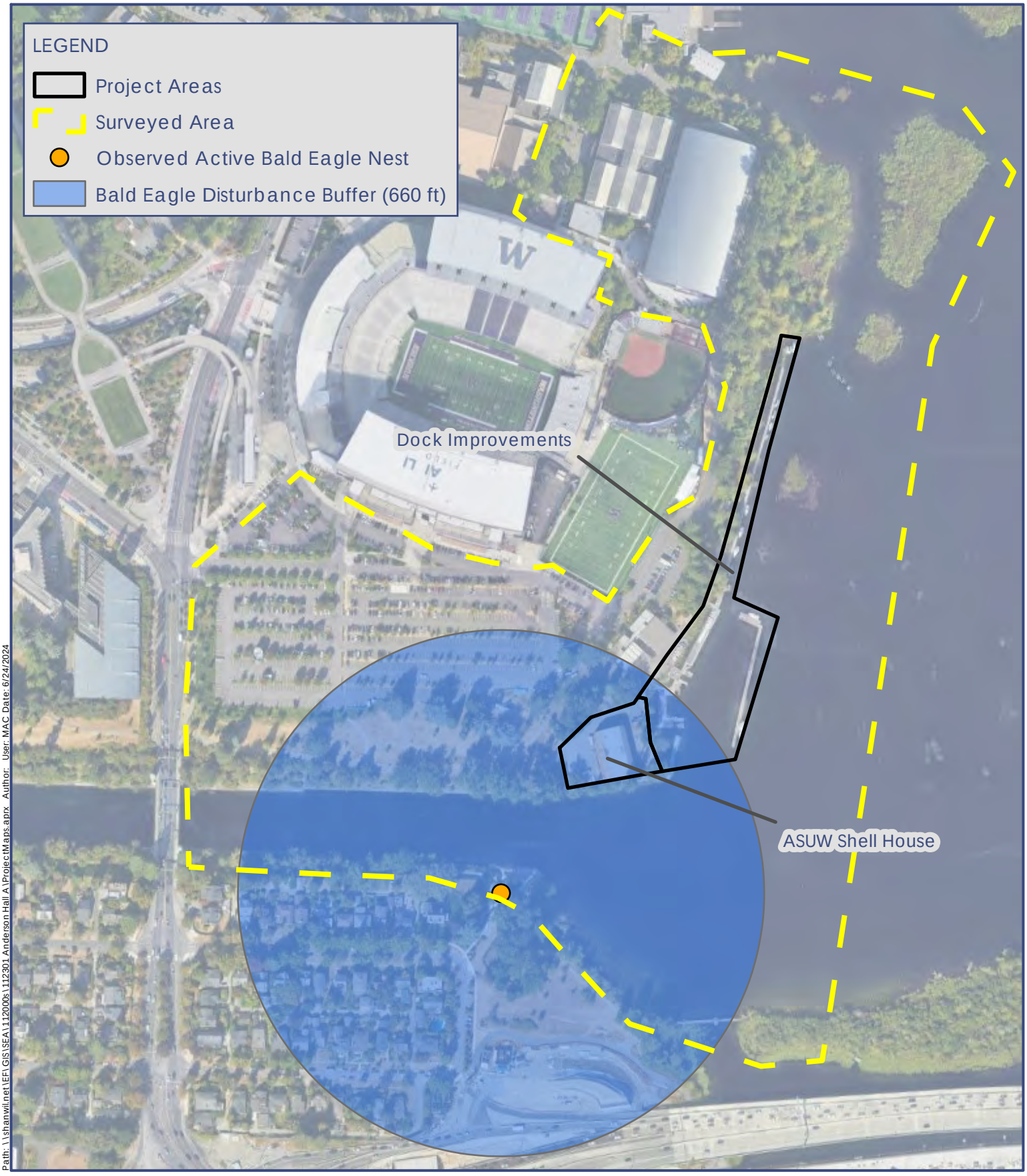
Sincerely,

SHANNON & WILSON

Merci Clinton, MSEM, PWS
Senior Biologist

MAC:KLW/mac

Enc. Figure 1 – 2024 Survey Map



0 400 Feet

Notes:
Active bald eagle nest was documented during the March 28, 2024 survey.

N

June 2024

2024 SURVEY MAP

112808

Figure 1

Attachment E

Selected Pages from 30% Design Plans

ASUW SHELL HOUSE RENOVATION

UNIVERSITY OF WASHINGTON
3655 WALLA WALLA RD
SEATTLE, WA 98195

30% DESIGN
06/28/2024

MITHUN

SEATTLE / Pier 56, 1201 Alaskan Way, #200
Seattle, WA 98101 / 206.623.3344

SAN FRANCISCO / 585 Howard Street, #300
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UNIVERSITY of WASHINGTON

UNIVERSITY OF WASHINGTON
ASUW SHELL HOUSE RENOVATION

UW PROJECT NO. 206756

SHEET INDEX

Sheet No.	Sheet Name
GENERAL	
G0.00	COVER
G1.01	PROJECT INFO AND INDEX
G1.02	ABBREVIATIONS, SYMBOLS AND LEGENDS
G3.05	OCCUPANT LOAD DIAGRAMS
CIVIL	
C100	COVER
C200	DEMOLITION AND TESC PLAN
C300	SITE PLAN
C301	SITE DETAILS
C400	GRADING PLAN
C401	GRADING PLAN SOUTH
C402	GRADING ENLARGEMENTS
C500	UTILITY PLAN
C501	UTILITY PLAN SOUTH
C502	UTILITY DETAILS
LANDSCAPE ARCHITECTURAL	
L0.01	TREE RETENTION PLAN
L1.00	FIRE ACCESS DIAGRAM
L1.01	OVERALL SITE PLAN - BASE
L1.02	OVERALL SITE PLAN - VALUE ADD
L4.00	SITE SECTIONS
L4.10	SITE DETAILS
L4.11	SITE DETAILS
L4.12	SITE DETAILS
L5.00	OVERALL PLANTING PLAN
L5.01	PLANTING DETAILS
ARCHITECTURAL DEMO	
AD2.01	DEMO FLOOR PLANS
AD2.09	DEMO ROOF PLAN
AD3.01	DEMO ELEVATIONS
AD7.01	DEMO RCP
ARCHITECTURAL	
A2.01	FLOOR PLANS
A2.02	FLOOR PLANS - VALUE ADDS
A2.09	ROOF PLAN
A3.01	EXTERIOR ELEVATION
A3.11	BUILDING SECTION
A4.01	WALL SECTIONS
A7.01	REFLECTED CEILING PLAN
A8.06	FINISH PLAN
A9.01	PARTITION TYPES
A10.01	SCHEDULES
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S2.01	FOUNDATION AND MEZZANINE FRAMING PLANS
S2.02	LOFT/TRUSS BOTTOM CHORD AND ROOF FRAMING PLANS
S3.01	TYPICAL CONCRETE DETAILS
S3.02	FOOTING DETAILS
S3.06	CONCRETE DETAILS
S5.01	TYPICAL DETAILS
S6.01	EX TRUSS DETAILS
S6.06	NEW MEZZANINE DETAILS
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S6.12	TRUSS ELEVATIONS
S6.13	TRUSS ELEVATIONS
MECHANICAL	
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M0.02	MECHANICAL NOTES
M2.21	MECHANICAL PLANS - LEVEL 01
M2.22	MECHANICAL PLANS - MEZZANINE
M3.11	MECHANICAL ISOMETRICS
M3.12	MECHANICAL ISOMETRICS
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P0.02	PLUMBING NOTES AND CODE INFO
P2.20	PLUMBING PLANS - FOUNDATION
P2.21	PLUMBING PLANS - LEVEL 01
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P6.01	PLUMBING SCHEDULES
P7.01	PLUMBING DIAGRAMS
FIRE PROTECTION	
FP1.01	FIRE SPRINKLER PLANS
ELECTRICAL	
E0.01	COVER SHEET AND GENERAL INFORMATION
E0.02	GENERAL ELECTRICAL NOTES
E1.01	ELECTRICAL SITE PLAN
E2.01	LIGHTING PLANS
E3.01	POWER PLANS
E5.01	ONE-LINE DIAGRAM
LIGHTING DEMO	
ELD1.01	LIGHTING DEMOLITION PLANS
LIGHTING	
EL0.00	LIGHTING LEGEND AND ABBREVIATIONS
EL0.01	LIGHTING SITE PLAN
EL0.02	LIGHTING SITE PLAN - VALUE ADD
EL1.01	LIGHTING PLANS - BASE DESIGN
EL2.01	LIGHTING PLANS - VALUE ADD
EL3.00	LIGHTING SECTION VIEWS
EL4.00	LIGHTING DETAILS
EL6.00	LIGHTING SHEDULES
AUDIO/VISUAL	
AV0.01	AV PLANS

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SEATTLE, WA 98144

CONTACT: DENIS BLOUNT
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646.578.1566

8 G1 Vicinity Map
1/4" = 1'-0"

13 G1 Location Map
NTS

GENERAL NOTES

1. DO NOT SCALE DRAWINGS. WRITTEN DIMENSIONS TAKE PRECEDENCE.
2. DRAWINGS HAVE BEEN PREPARED ON AN ORIGINAL SHEET SIZE OF 30" x 42".
3. HORIZONTAL DIMENSIONS SHOWN INDICATE FACE OF (F.O.) CONCRETE, F.O. FINISH OR CENTERLINE OF COLUMN GRIDLINE, UNLESS OTHERWISE NOTED. VERTICAL DIMENSIONS INDICATE TOP OF (T.O.) SLAB, T.O. SUBFLOOR, UNLESS OTHERWISE NOTED.
4. CRITICAL CLEARANCES ARE DESIGNATED "CLEAR", "CLR" AND ARE TO FINISH FACE OF PARTITION.
5. WHERE PARTITIONS AND WALLS OF DIFFERING WIDTHS ARE CONTINUOUS AND WHERE THE PLANS DO NOT INDICATE WHICH SURFACE TAKES PRECEDENCE FOR ALIGNMENT, CONTACT ARCHITECT FOR CLARIFICATION PRIOR TO LAYOUT.
6. INFORMATION REGARDING EXISTING CONDITIONS USED TO PREPARE THESE DRAWINGS HAS BEEN PROVIDED BY OTHERS.
7. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS, DATUM, LEVELS AND CONDITIONS PERTAINING TO THE WORK PRIOR TO COMMENCING CONSTRUCTION. PROVIDE WRITTEN NOTIFICATION TO THE ARCHITECT OF ANY DISCREPANCIES WITH THE DOCUMENTS. THE ARCHITECT WILL ISSUE A WRITTEN DIRECTIVE IF FURTHER CLARIFICATION IS REQUIRED.
8. THESE DRAWINGS ARE THE EXCLUSIVE PROPERTY OF MITHUN, INC. AND HAVE BEEN PREPARED FOR USE IN THE EXECUTION OF THE ENCLOSED PROJECT. USE OR REPRODUCTION FOR ANY OTHER PURPOSE WITHOUT THE WRITTEN PERMISSION OF MITHUN, INC. IS PROHIBITED.

DEMO NOTES

1. SECURE ALL OTHER PERMITS AS NEEDED BY ANY OTHER GOVERNING AUTHORITIES.
2. ALL HAZARDOUS WASTE SHALL BE REMOVED AND DISPOSED OF BY A STATE LICENSED HAZARDOUS MATERIAL REMOVAL CONTRACTOR.
3. SALVAGE ALL RECYCLABLE MATERIAL AND DELIVER TO THE APPROPRIATE RECYCLING VENUES.
4. DEMOLISH EXISTING PER PLAN AND PROPERLY DISPOSE OF ALL DEBRIS.
5. TERMINATE AND CAP ALL ABANDONED EXISTING UTILITIES, REROUTE EXISTING UTILITIES AFFECTED BY DEMO. UTILITES TO INCLUDE BUT NOT LIMITED TO: ELECTRICITY, DOMESTIC WATER, GAS, SEWER, STORM DRAIN, TELEPHONE.
6. WHERE STRUCTURES ARE TO BE REMOVED, PROTECT ALL ADJACENT EXISTING STRUCTURE AND FINISHES.
7. REPAIR, PATCH AND REFINISH ADJACENT STRUCTURE AFFECTED BY DEMOLITION.
8. PROTECT CITY SIDEWALK AND REPAIR ANY DAMAGES CAUSED BY THE DEMOLITION.
9. SALVAGE ALL AREAS OF NON-HAZARDOUS MATERIAL CONTAINING ORIGINAL 1X8 LAP SIDING FOR REUSE AS NOTED BELOW.

PROJECT SUMMARY

RENOVATION OF AN EXISTING 1918 HANAGER PREVIOUSLY USED BY UW AS A SHELL HOUSE FOR ITS STORIED ROWING PROGRAM. REVISIONS INCLUDE HAZARDOUS MATERIAL ABATEMENT, SEISMIC UPGRADES, STRATEGIC INTERIOR SPACE PLANNING AND FINISH UPGRADES, UPGRADES TO TEH M/E/P/T, LIGHTING AND FIRE ALARM SYSTEMS, ADDITION OF A FIRE SPRINKLER SYSTEM AND EXTERIOR ENVELOPE UPGRADES.

PROJECT ADDRESS

3655 WALLA WALLA ROAD
SEATTLE, WA 98195

COUNTY: KING

UPDATE

PARCEL INFORMATION

TAX PARCEL NUMBER

LEGAL DESCRIPTION

SEE SURVEY DRAWING FOR DETAILS
OR
TYPE IN LEGAL DESCRIPTION

PERMIT INFORMATION

PERMITTING AGENCY:
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P.O. BOX 34019
SEATTLE, WA 98124
206.684.8850

RELATED PERMIT NUMBERS:
SDCI PROJECT NO.: 6716621-CN
LANDUSE PERMIT NO./MASTER USE PERMIT (MUP) NO.: 3034000-LU
SHORELINE SUBSTANTIAL DEVELOPMENT PERMIT NO.: ##########
USACE PERMIT NO.: #######
LANDMARKS STATUS NO.: #######

ZONING:	LAND USE CODE OF THE CITY OF SEATTLE
BUILDING:	2021 SEATTLE EXISTING BUILDING CODE (SEBC)
	2021 SEATTLE BUILDING CODE (SBC)
FIRE:	2021 SEATTLE FIRE CODE
MECHANICAL:	2021 SEATTLE MECHANICAL CODE
ELECTRICAL:	2020 NATIONAL ELECTRICAL CODE W/ SEATTLE AMENDMENTS
PLUMBING:	2021 SEATTLE PLUMBING CODE
ENERGY:	2021 SEATTLE ENERGY CODE

CODE AS AMENDED AND ADOPTED BY THE STATE BUILDING CODE COUNCIL AND THE CITY OF SEATTLE

ZONE CLASSIFICATION:
MIO-37-LR1 (M)

ZONE DISTRICT:
****

OCCUPANCY GROUPS:
A-3

TYPE OF CONTRUCTION:
TYPE: VB

FIRE PROTECTION:
SPRINKLERED PER NFPA 13

DETERMINATIONS AND EXEMPTIONS

UPDATE

UPDATE

DEFERRED SUBMITTAL LIST

1. FIRE ALARM / PROTECTION
2. SIDE SEWER PERMIT FOR TEMPORARY DEWATERING
3. ELECTRICAL PERMIT
4. LOW VOLTAGE AND COMMUNICATION PERMIT
5. PLUMBING PERMIT
6. FIRE SPRINKLER DESIGN
7. GAS PIPING DESIGN
8. IRRIGATION
9. ELEVATOR PERMIT

UPDATE

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Seattle, WA 98101 / 206.623.3344

SAN FRANCISCO / 585 Howard Street, #300
California, CA 94105 / 415.956.0688

LOS ANGELES / 5837 Adams Blvd
Culver City, CA 90232 / 323.937.2150

mithun.com

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PROJECT
ASUW SHELL HOUSE RENOVATION

LOCATION
3655 WALLA WALLA RD SEATTLE, WA 98195

PREPARED FOR
UNIVERSITY OF WASHINGTON

UNIVERSITY of WASHINGTON

NO.	DATE	REVISION

PARTNER IN CHARGE
RF
PROJECT MANAGER
EB
PROJECT ARCHITECT
DJ
PROJECT DESIGNER
RF
PROJECT TEAM MEMBERS
ME
CHECK

TITLE
PROJECT INFO AND INDEX

PROJECT NO.
2327300 / UW 206756
DATE
6/28/24

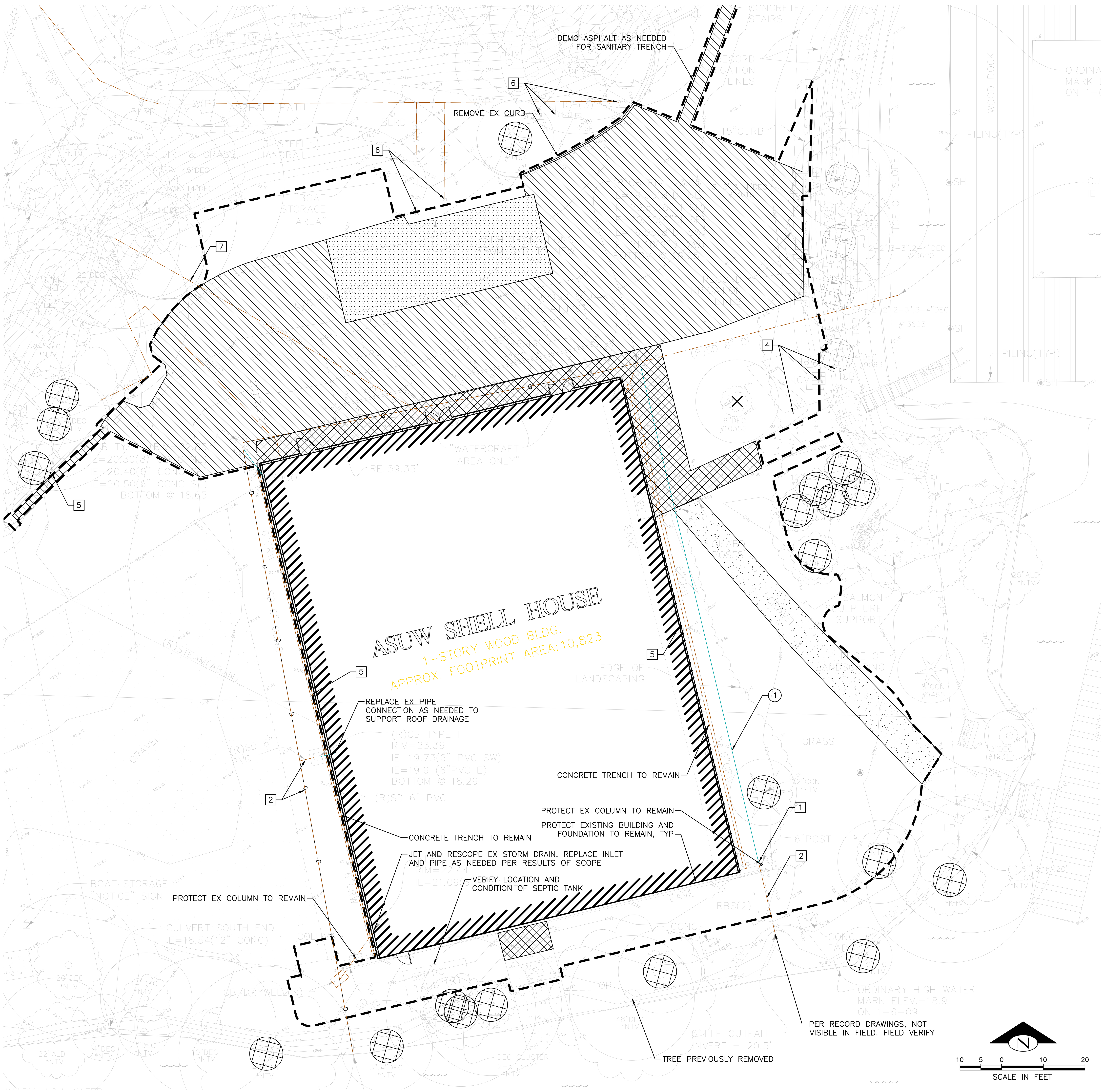
ORIGINAL SHEET SIZE 30" x 42"

SHEET NUMBER

30% DESIGN

NOT FOR CONSTRUCTION

6/4/2024 5:36:43 PM



LEGEND

- CIVIL LIMITS OF WORK (LOW)
- CONSTRUCTION FENCE
- DEMOLISH ASPHALT PAVEMENT
- DEMOLISH CONCRETE PAVEMENT
- 2" GRIND AND OVERLAY
- DEMOLISH GRAVEL
- DEMOLISH EXISTING
- PROTECT EXISTING
- ABANDON EXISTING
- DEMOLISH TREE
- TREE PROTECTION

NOTES

1. SEE XXX FOR DEMOLITION GENERAL NOTES
2. ALL EXISTING SITE ELEMENTS INCLUDING UTILITIES WITHIN THE LIMITS OF WORK ARE TO BE PROTECTED AND PRESERVED WITH THE EXCEPTION OF TREES MARKED FOR DEMOLITION AND ITEMS NOTED FOR DEMOLITION.
3. CONTRACTOR RESPONSIBLE FOR ANY AND ALL DAMAGES TO EXISTING ELEMENTS TO REMAIN.

KEYNOTES

ITEMS TO BE REMOVED OR SALVAGED

(1) REMOVE EXIST STORM DRAIN PIPING, MANHOLES, CATCH BASINS, INLETS, VAULTS, TRENCH DRAINS, CLEAN OUTS AND OTHER APPURTENANCES.

KEYNOTES

ITEMS TO REMAIN OR ABANDON

[1] CUT AND CAP EXISTING UTILITY WHERE INDICATED.

[2] EXIST STORM DRAIN PIPING, MANHOLES, CATCH BASINS, INLETS, VAULTS, TRENCH DRAINS, CLEAN OUTS AND ASSOCIATED APPURTENANCES TO REMAIN.

[3] EXIST SANITARY SEWER PIPING, MANHOLES, CLEAN OUTS, AND ASSOCIATED APPURTENANCES TO REMAIN.

[4] VERIFY EXTENT OF IRRIGATION TO REMAIN PRIOR TO CONSTRUCTION.

[5] EXIST BUILDING, STAIRS OR WALL AND FOUNDATION TO REMAIN.

[6] EXIST WATER LINES, VAULTS, METERS AND ASSOCIATED APPURTENANCES TO REMAIN.

[7] EXIST ELECTRICAL LINES, VAULTS AND ASSOCIATED APPURTENANCES TO REMAIN.

[8] EXIST STEAM LINES, VAULTS, AND ASSOCIATED APPURTENANCES TO REMAIN.

[9] EXISTING GAS LINE, VALVES AND ASSOCIATED APPURTENANCES TO REMAIN.

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PROJECT
ASUW SHELL HOUSE RENOVATION

LOCATION
**3655 WALLA WALLA RD
SEATTLE, WA 98195**

PREPARED FOR
UNIVERSITY OF WASHINGTON

UNIVERSITY of WASHINGTON

MAYFLY
ENGINEERING + DESIGN, PLLC
www.mayflyeng.com | v 206.935.5356

NO.	DATE	REVISION

PARTNER IN CHARGE

PROJECT MANAGER

PROJECT LANDSCAPE ARCHITECT

PROJECT TEAM MEMBERS

CHECK

TITLE
DEMOLITION AND TESC PLAN

PROJECT NO.
2327300 / UW 206756

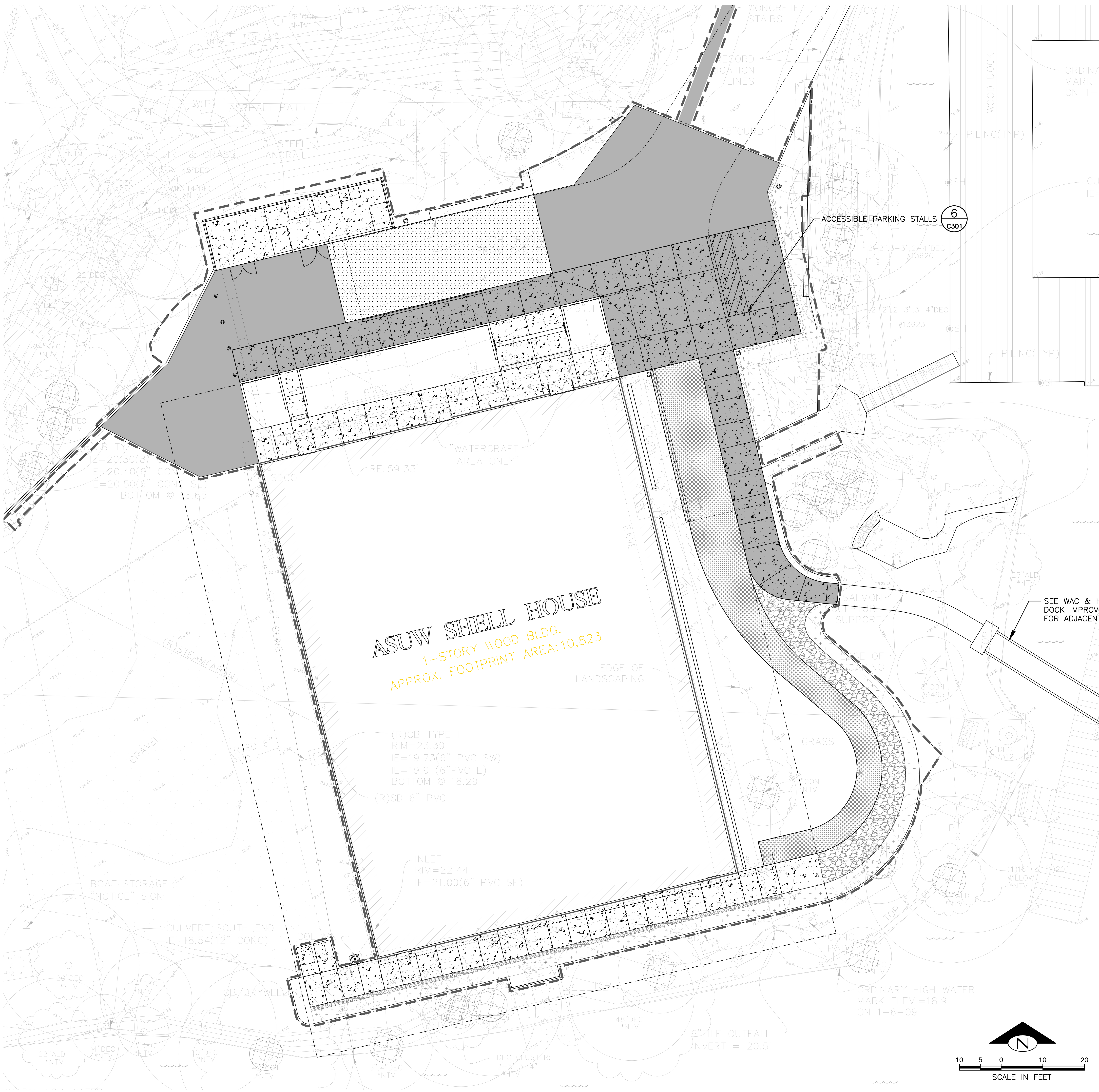
DATE
06/28/24

ORIGINAL SHEET SIZE 30" x 42"

SHEET NUMBER
C200

30% DESIGN

NOT FOR CONSTRUCTION



LEGEND

	ONSITE CIVIL LIMITS OF WORK (LOW)	
	LIGHT DUTY CONCRETE PAVING	1/C301
	HEAVY DUTY CONCRETE PAVING	1/C301
	GRASSPAVE SURFACING PER SHEET L4.10	
	ASPHALT PAVEMENT	4/C301
	2" GRIND AND OVERLAY	5/C301
	COMPOST AMENDED VEGETATED FILTER STRIP (CAVFS)	3/C502
	GRAVEL SURFACE	3/C301
	TREE PROTECTION	

SITE NOTES

1. SEE SHEET C100 FOR ABBREVIATIONS AND GENERAL NOTES.
2. THE LIMITS OF WORK SHOWN ON THIS PLAN SHALL BE CLEARLY FLAGGED IN THE FIELD PRIOR TO CONSTRUCTION. DURING THE CONSTRUCTION PERIOD, NO DISTURBANCE BEYOND THE FLAGGED LIMITS OF WORK SHALL BE PERMITTED. THE FLAGGING SHALL BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
3. REFERENCE TREE PROTECTION PLAN FOR ALL WORK WITHIN TREE PROTECTION ZONE.
4. ALL DIMENSIONS, STATIONS, OFFSETS, NORTHINGS AND EASTINGS ARE TAKEN TO THE BOTTOM FACE OF CURB, BOTTOM FACE OF WALL, OR EDGE OF PAVEMENT, UNLESS NOTED OTHERWISE.
5. SEE LANDSCAPE DRAWINGS XXX, FOR ALL PAVEMENT FINISHES AND SCORING.

MITHŪN

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PROJECT
ASUW SHELL HOUSE RENOVATION

LOCATION
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PREPARED FOR
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NO DATE REVISION

PARTNER IN CHARGE
PROJECT MANAGER
PROJECT LANDSCAPE ARCHITECT
PROJECT TEAM MEMBERS
CHECK

TITLE
SITE PLAN

PROJECT NO.
2327300 / UW 206756
DATE
06/28/24

SHEET NUMBER
C300
30% DESIGN

ORIGINAL SHEET SIZE 30" x 42"

6/4/2024 5:36:43 PM

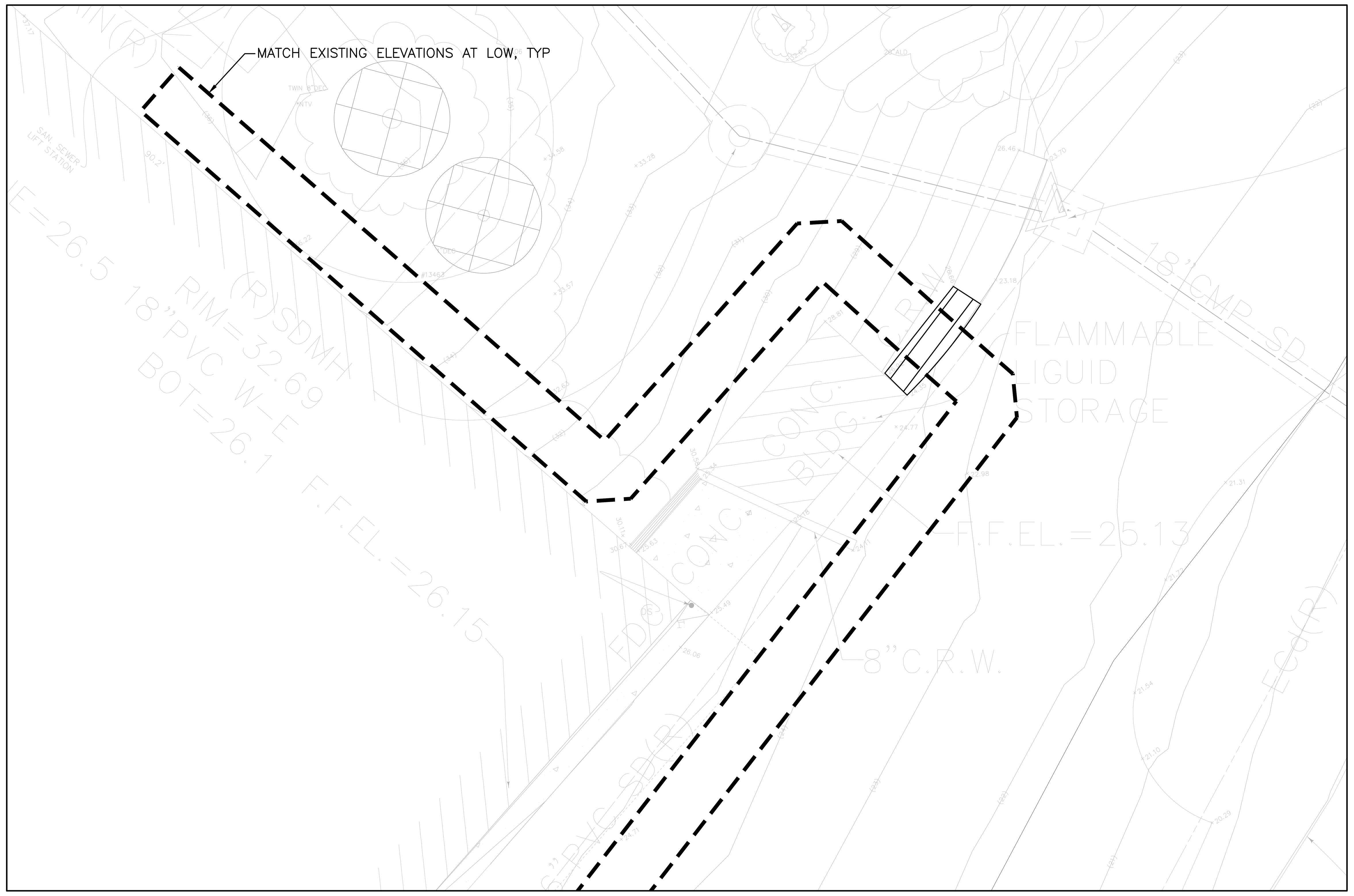
NOT FOR CONSTRUCTION

LEGEND

(dashed line)	ONSITE CIVIL LIMITS OF WORK (LOW)
XXX	MAJOR CONTOUR
XXX	MINOR CONTOUR
(dashed line)	GRADE BREAK
(arrow)	SLOPE ARROW
XXX.XX	SPOT GRADE
ME XXX.XX	MATCH EXISTING GRADE
TC	TOP OF CURB
BC	BOTTOM OF CURB
(symbol)	TREE PROTECTION

GRADING NOTES

1. SEE SHEET C100 FOR ABBREVIATIONS AND GENERAL NOTES.
2. THE LIMITS OF WORK SHOWN ON THIS PLAN SHALL BE CLEARLY FLAGGED IN THE FIELD PRIOR TO CONSTRUCTION. DURING THE CONSTRUCTION PERIOD, NO DISTURBANCE BEYOND THE FLAGGED LIMITS OF WORK SHALL BE PERMITTED. THE FLAGGING SHALL BE MAINTAINED FOR THE DURATION OF CONSTRUCTION.
3. REFERENCE TREE PROTECTION AND REMOVAL PLAN FOR ALL WORK WITHIN TREE PROTECTION ZONE.
4. ALL EXISTING ELEVATIONS ARE BASED ON THE SURVEY PROVIDED AND PERMITTED AND CONSTRUCTED DEMOLITION PLAN AND FIELD VERIFY ALL EXISTING ELEVATIONS PRIOR TO CONSTRUCTION.
5. GRADING SHALL BE STABILIZED BY OCTOBER 31ST, AND NO EXCAVATION OR FILL PLACEMENT MAY BE PERFORMED BETWEEN OCTOBER 31ST AND APRIL 1ST.
6. ALL PEDESTRIAN AND VEHICULAR PAVING SIDESLOPES TO BE 1.5% OR LESS.
7. MAX DESIGN SLOPE AT ALL LANDINGS 1.5%



SEWER FORCE MAIN UTILITY CONNECTION
SCALE 1"=5'

1

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PROJECT
ASUW SHELL HOUSE RENOVATION

LOCATION
3655 WALLA WALLA RD SEATTLE, WA 98195

PREPARED FOR
UNIVERSITY OF WASHINGTON

UNIVERSITY of WASHINGTON

MAYFLY
ENGINEERING + DESIGN, PLLC
www.mayflyeng.com | v 206.935.5356

NO	DATE	REVISION

PARTNER IN CHARGE
PROJECT MANAGER
PROJECT LANDSCAPE ARCHITECT
PROJECT TEAM MEMBERS
CHECK

TITLE
GRADING PLAN

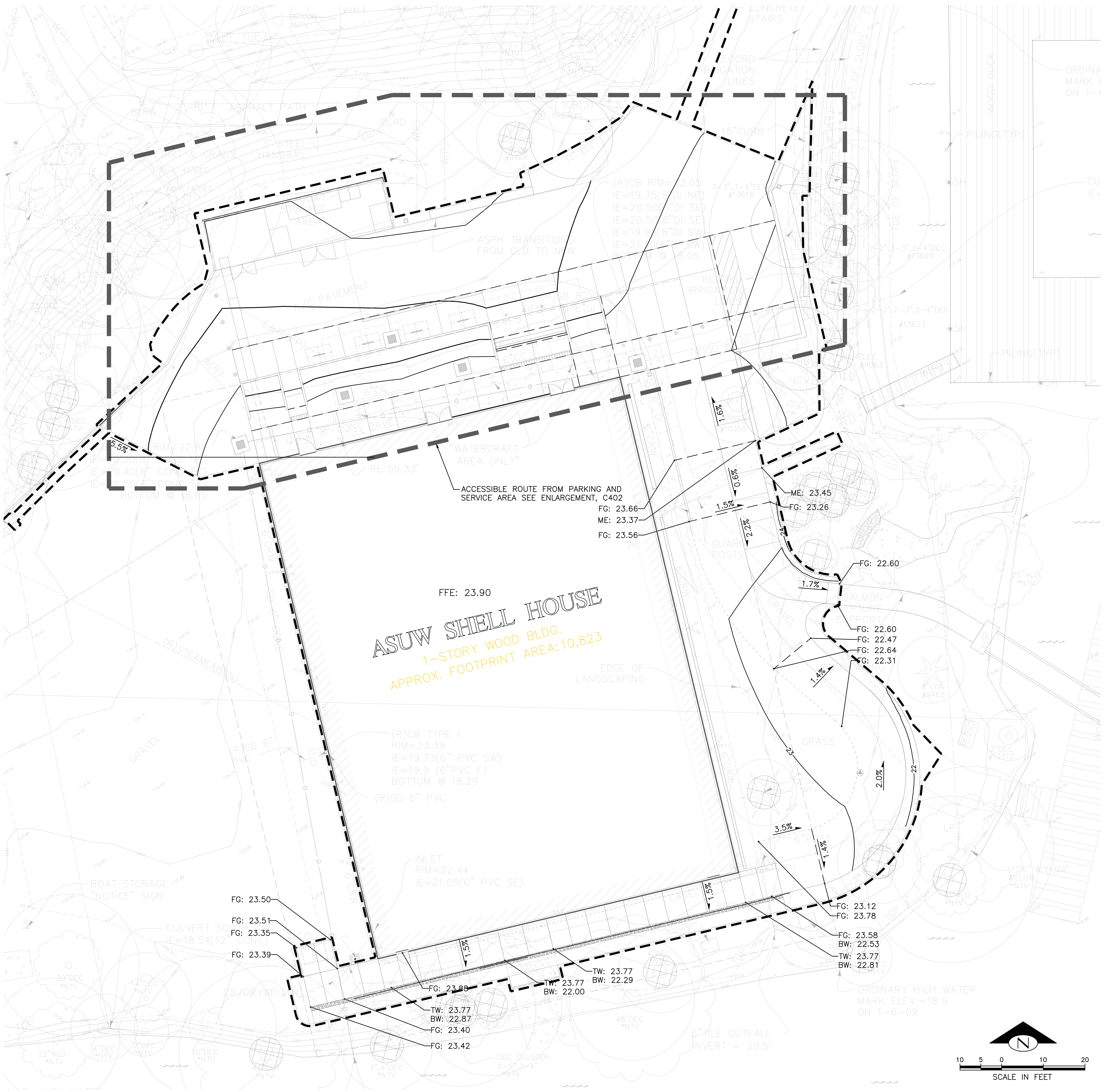
PROJECT NO.
2327300 / UW 206756
DATE
06/28/24

SHEET NUMBER
C400
30% DESIGN

6/4/2024 5:36:43 PM

NOT FOR CONSTRUCTION

6/4/2024 5:36:43 PM



LEGEND

(heavy dashed line)	ONSITE CIVIL LIMITS OF WORK (LOW)
—XXX—	MAJOR CONTOUR
—XXX—	MINOR CONTOUR
— — —	GRADE BREAK
←	SLOPE ARROW
XXX.XX	SPOT GRADE
ME XXX.XX	MATCH EXISTING GRADE
TC	TOP OF CURB
BC	BOTTOM OF CURB
(circle)	TREE PROTECTION

GRADING NOTES

1. SEE SHEET C100 FOR ABBREVIATIONS AND GENERAL NOTES.
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7. MAX DESIGN SLOPE AT ALL LANDINGS 1.5%

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NO.	DATE	REVISION

PARTNER IN CHARGE

PROJECT MANAGER

PROJECT LANDSCAPE ARCHITECT

PROJECT TEAM MEMBERS

CHECK

TITLE
GRADING PLAN SOUTH

PROJECT NO.
2327300 / UW 206756

DATE
06/28/24

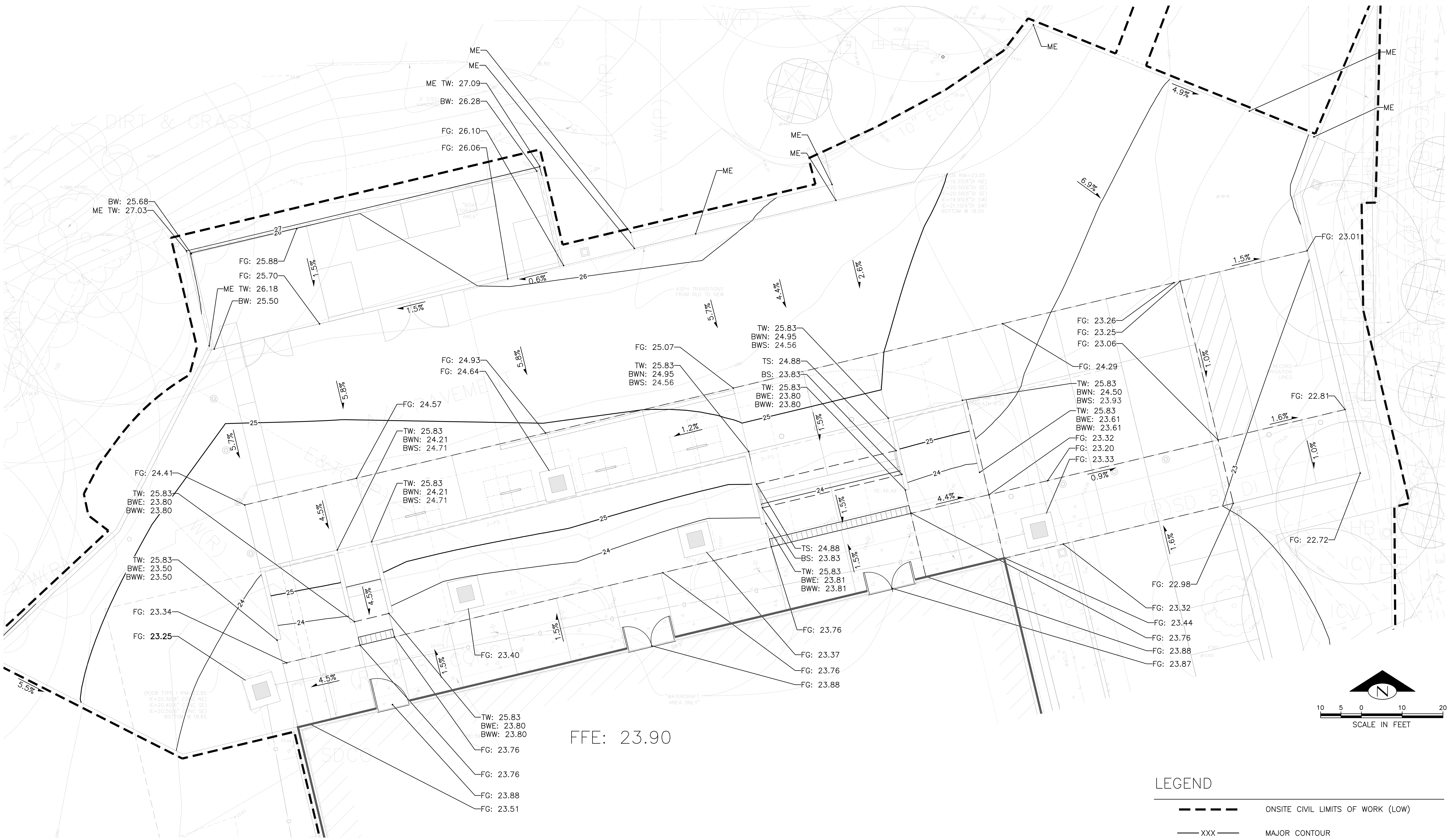
ORIGINAL SHEET SIZE 30" x 42"

SHEET NUMBER
C401

30% DESIGN

NOT FOR CONSTRUCTION

6/4/2024 5:36:43 PM



GRADING DETAIL 1

LEGEND

— — —	ONSITE CIVIL LIMITS OF WORK (LOW)
——XXX——	MAJOR CONTOUR
——XXX——	MINOR CONTOUR
— — — —	GRADE BREAK
←	SLOPE ARROW
XXX.XX	SPOT GRADE
ME XXX.XX	MATCH EXISTING GRADE
TC	TOP OF CURB
BC	BOTTOM OF CURB
	TREE PROTECTION

GRADING NOTES

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7. MAX DESIGN SLOPE AT ALL LANDINGS 1.5%

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PARTNER IN CHARGE
PROJECT MANAGER
PROJECT LANDSCAPE ARCHITECT
PROJECT TEAM MEMBERS
CHECK

TITLE
GRADING ENLARGEMENTS

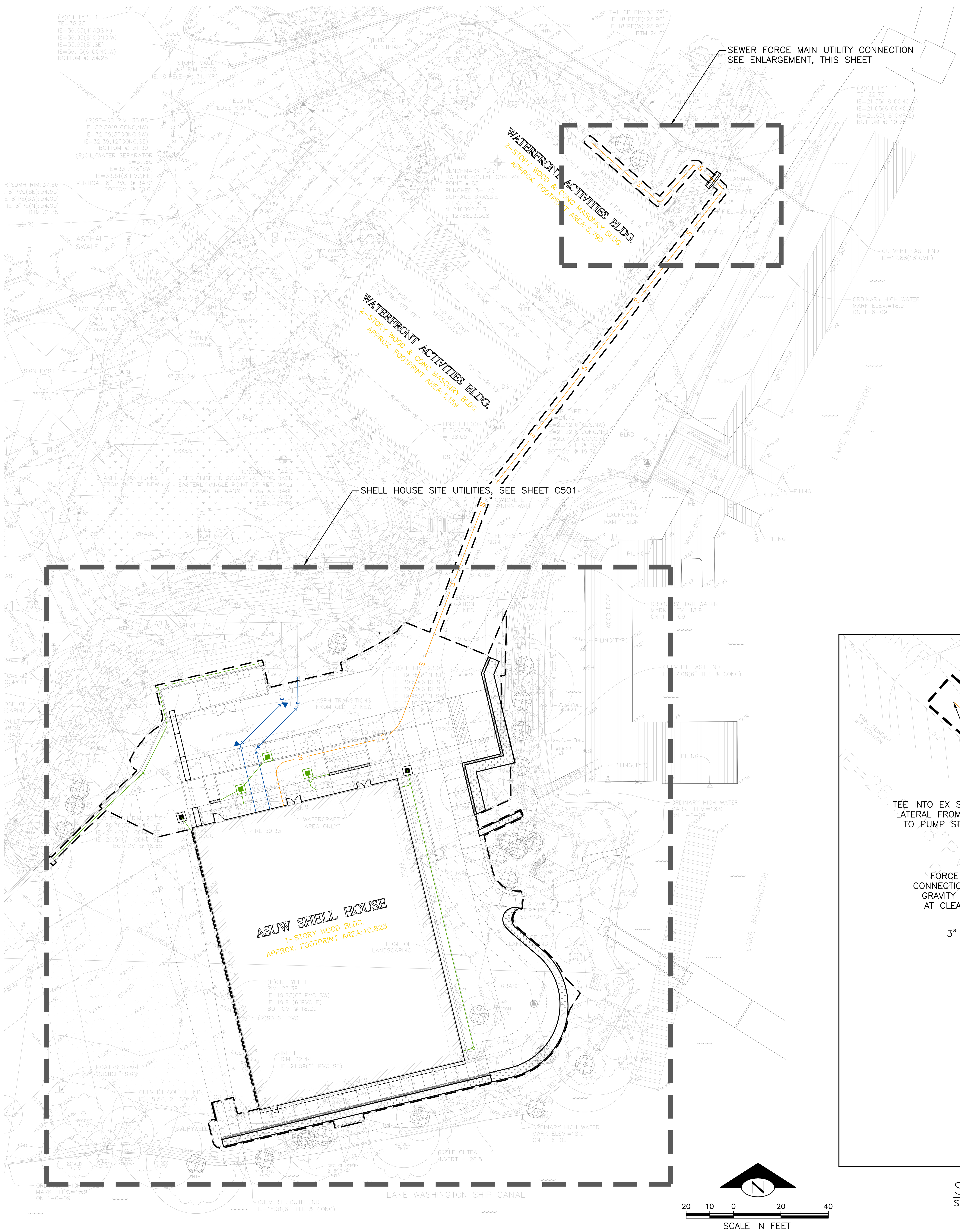
PROJECT NO.
2327300 / UW 206756
DATE
06/28/24

ORIGINAL SHEET SIZE 30" x 42"

SHEET NUMBER
C402
30% DESIGN

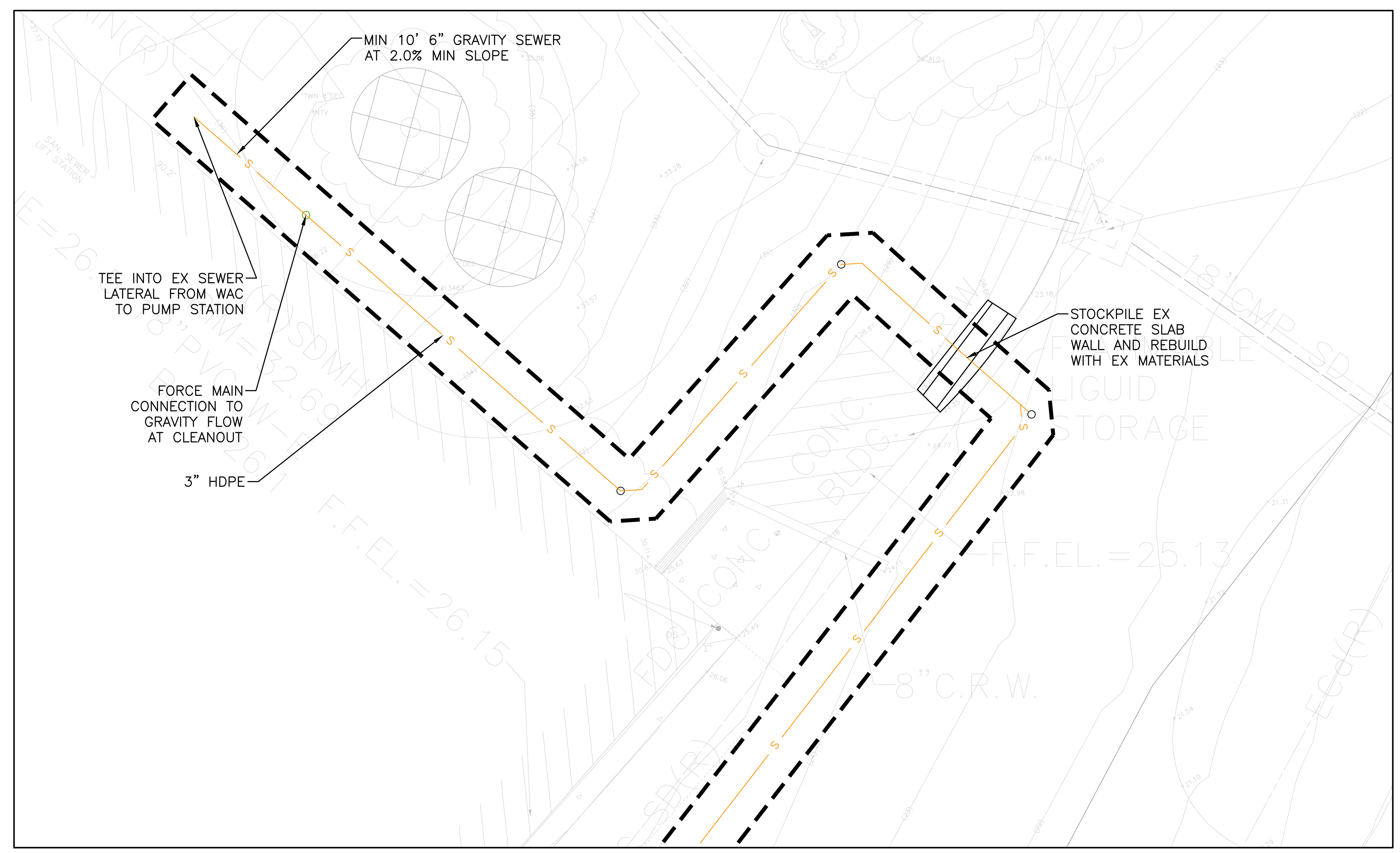
NOT FOR CONSTRUCTION

6/4/2024 5:36:43 PM



LEGEND

Symbol	Description	Detail
	CIVIL LIMITS OF WORK (LOW)	
	EXISTING SEWER PIPE TO REMAIN	
	EXISTING WATER PIPE TO REMAIN	
	WATER PIPE	4/C502
	WATER VALVE	
	WATER FITTINGS	
	CONCRETE THRUST BLOCK	
	PERFORATED UNDERDRAIN PIPE	
	FRENCH DRAIN	5/C502
	EXISTING STORM PIPE TO REMAIN	
	STORM PIPE	4/C502
	TRENCH DRAIN	
	STORM CATCH BASIN	2/C502
	STORM CLEANOUT	1/C502
	COMPOST AMENDED VEGETATED FILTER STRIP W/ LEVEL SPREADER, WHERE INDICATED	3/C502
	TREE PROTECTION	



SEWER FORCE MAIN UTILITY CONNECTION (1)
SCALE 1"=5'

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PROJECT MANAGER
PROJECT LANDSCAPE ARCHITECT
PROJECT TEAM MEMBERS
CHECK

TITLE
UTILITY PLAN

PROJECT NO.
2327300 / UW 206756

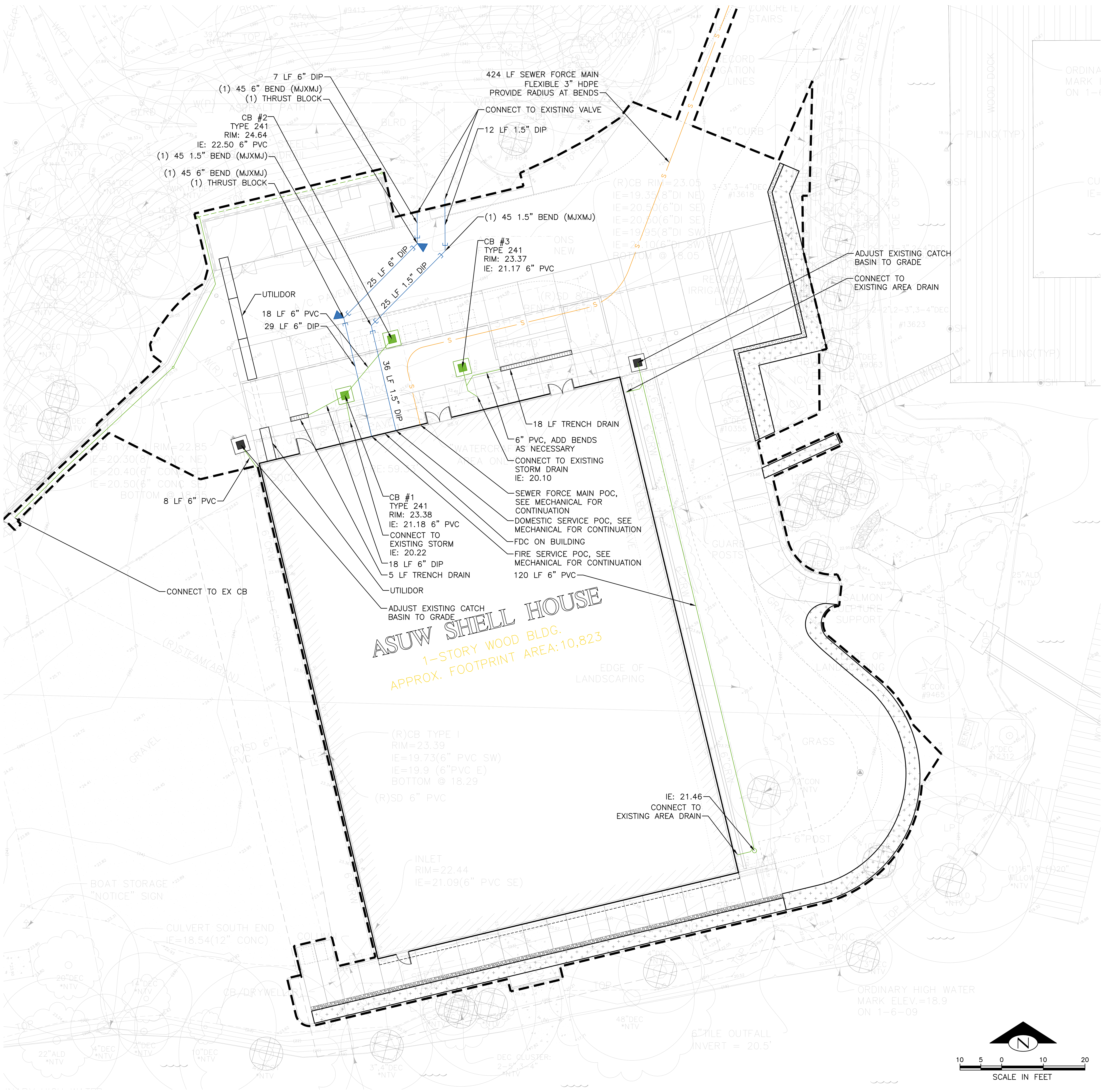
DATE
06/28/24

ORIGINAL SHEET SIZE 30" x 42"

SHEET NUMBER
C500

30% DESIGN

NOT FOR CONSTRUCTION



LEGEND

- CIVIL LIMITS OF WORK (LOW)
- EXISTING SEWER PIPE TO REMAIN
- EXISTING WATER PIPE TO REMAIN
- WATER PIPE — 4/C502
- WATER VALVE
- WATER FITTINGS
- CONCRETE THRUST BLOCK
- PERFORATED UNDERDRAIN PIPE
- FRENCH DRAIN — 5/C502
- EXISTING STORM PIPE TO REMAIN
- STORM PIPE — 4/C502
- TRENCH DRAIN
- STORM CATCH BASIN — 2/C502
- STORM CLEANOUT — 1/C502
- COMPOST AMENDED VEGETATED FILTER STRIP W/ LEVEL SPREADER, WHERE INDICATED — 3/C502
- TREE PROTECTION

STORM DRAINAGE NOTES

1. SEE SHEET C100 FOR EXISTING LEGEND, GENERAL NOTES, AND ABBREVIATIONS.
2. SIDE SEWERS AND DRAINAGE FACILITIES SHALL BE CONSTRUCTED PER THE "REQUIREMENTS FOR DESIGN OF SIDE SEWERS (DRAINAGE & WASTEWATER)" DIRECTORS' RULE DPD 4-2011/2011-004 AND PER THE "2021 SEATTLE STORMWATER MANUAL" DIRECTORS' RULE SDCI 10-2021/SPU DWW-200.
3. A SEPARATE DRAINAGE AND SIDE SEWER PERMIT IS REQUIRED FOR ALL ONSITE DRAINAGE ELEMENTS AND SIDE SEWERS/SERVICE DRAINS. APPROVAL OF THIS PLAN IS REQUIRED PRIOR TO OBTAINING A DRAINAGE AND SIDE SEWER PERMIT.
4. DEVIATIONS FROM THE APPROVED DRAINAGE AND WASTEWATER CONTROL PLAN REQUIRE A FORMAL POST-SUBMITTAL REVISION FOR PLAN REVIEW AND APPROVAL. POST-SUBMITTAL REVISIONS MUST BE SUBMITTED ELECTRONICALLY THROUGH THE SDCI PROJECT PORTAL.
5. THE FOLLOWING BMPS ARE REQUIRED TO MEET CODE FOR ONSITE STORMWATER MANAGEMENT:
   5.1. COMPOST AMENDED VEGETATED FILTER STRIP (CAVFS)
   5.2. COMPOST AMENDED SOILS FOR ALL PLANTING AREAS
6. CONNECT TO EX STORM DRAIN SYSTEM. FIELD VERIFY EX CONDITIONS PRIOR TO CONSTRUCTION. ADJUST CONNECTION LOCATION AS NEEDED. VERIFY ALL ADJUSTMENTS WITH PROJECT ENGINEER.
7. MAINTAIN EXISTING CONNECTION TO DOWNSPOUTS. FIELD VERIFY EXISTING LOCATIONS.

GENERAL UTILITY NOTES

1. SEE SHEET XXX FOR EXISTING LEGEND, GENERAL NOTES, AND ABBREVIATIONS.
2. THESE PLANS INCLUDE DESIGN FOR WATER AND SANITARY SEWER ONLY.
3. SEE GRADING AND DRAINAGE PLANS FOR STORM DRAINAGE DESIGN.
4. COORDINATE WITH UW, UTILITY PURVEYORS (COS & SPU) AND FRANCHISE UTILITY WORK WITH SCL, PSE, COMCAST, AND CENTURYLINK PRIOR TO CONSTRUCTION AND CONFIRM SCHEDULING OF WORK, ROUTING AND SIZES OF UTILITIES.
5. FIELD VERIFY ALL ELEVATIONS AND NOTIFY ENGINEER OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION.
6. SEE DEMO PLAN FOR ALL DEMOLITION.
7. PROVIDE A 3' MINIMUM COVER OVER WATER LINES.

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PREPARED FOR
UNIVERSITY OF WASHINGTON

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NO DATE REVISION

PARTNER IN CHARGE
PROJECT MANAGER
PROJECT LANDSCAPE ARCHITECT
PROJECT TEAM MEMBERS
CHECK

TITLE
UTILITY PLAN SOUTH

PROJECT NO.
2327300 / UW 206756

DATE
06/28/24

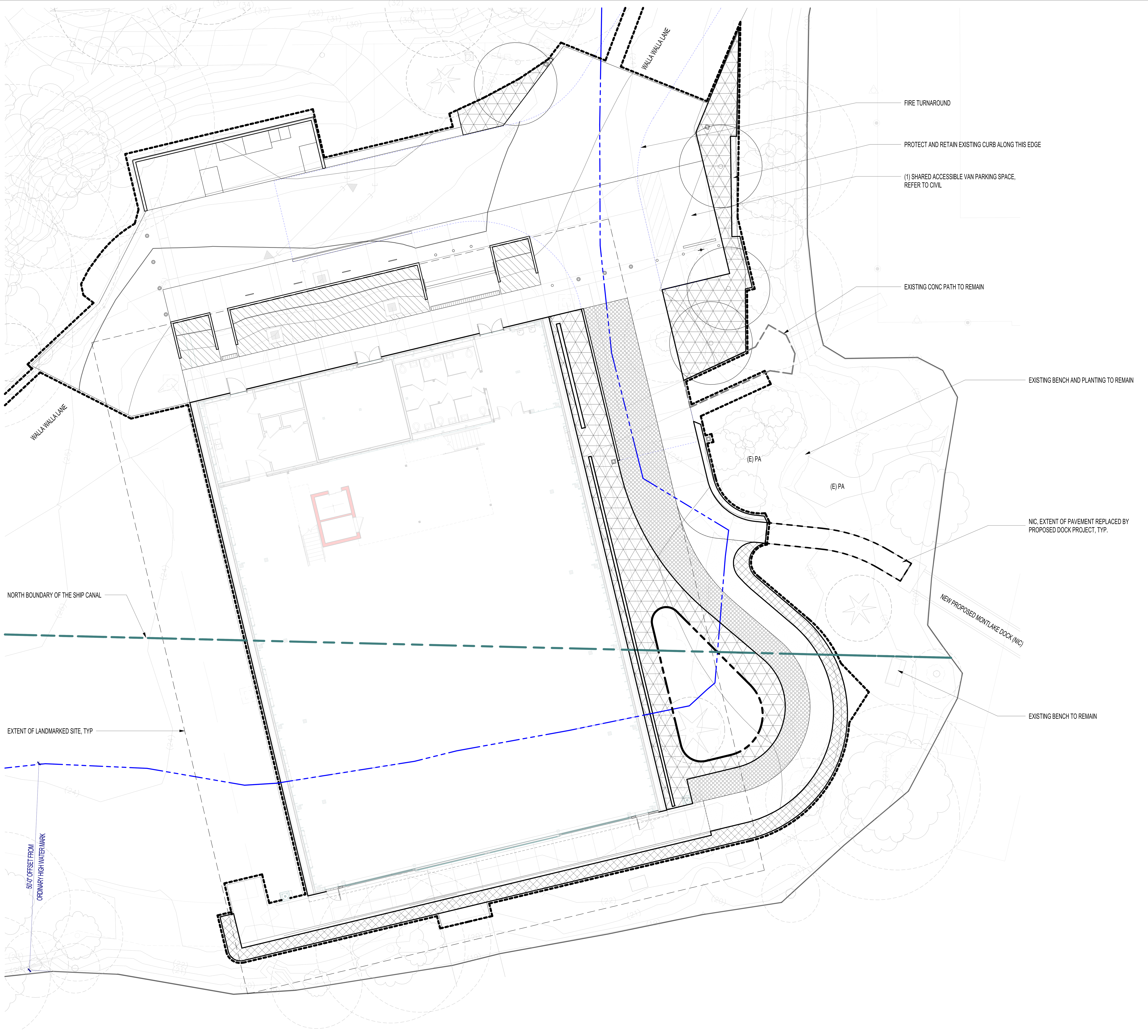
SHEET NUMBER
C501
30% DESIGN

ORIGINAL SHEET SIZE 30" x 42"

6/4/2024 5:36:43 PM

NOT FOR CONSTRUCTION

6/28/2024 5:56:18 PM



16 OVERALL PLANTING PLAN - BASE

1" = 10'-0" | 11/L1.00

0 5' 10' 20' 30'
1" = 10'

SITE MATERIALS LEGEND

- LIMIT OF WORK
- LIMIT OF WORK
- (E) PA — EXISTING PLANTING AREA
- EXISTING TREE TO RETAIN & PROTECT, REFER TO L0.01 — DRIPLINE, TYP
- PLANTING MIX - A
- PLANTING MIX - B
- PLANTING MIX - C
- PLANTING MIX - D
- PA TO REMAIN WITH POCKET PLANTING ENHANCEMENTS
- PROPOSED TREE — 7 / L5.01

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PROJECT
ASUW SHELL HOUSE RENOVATION

LOCATION
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PREPARED FOR
UNIVERSITY OF WASHINGTON

UNIVERSITY of WASHINGTON

NO	DATE	REVISION

PARTNER IN CHARGE: RF
PROJECT MANAGER: EB
PROJECT LANDSCAPE ARCHITECT: DK
PROJECT TEAM MEMBERS: CSR
CHECK

TITLE
OVERALL PLANTING PLAN

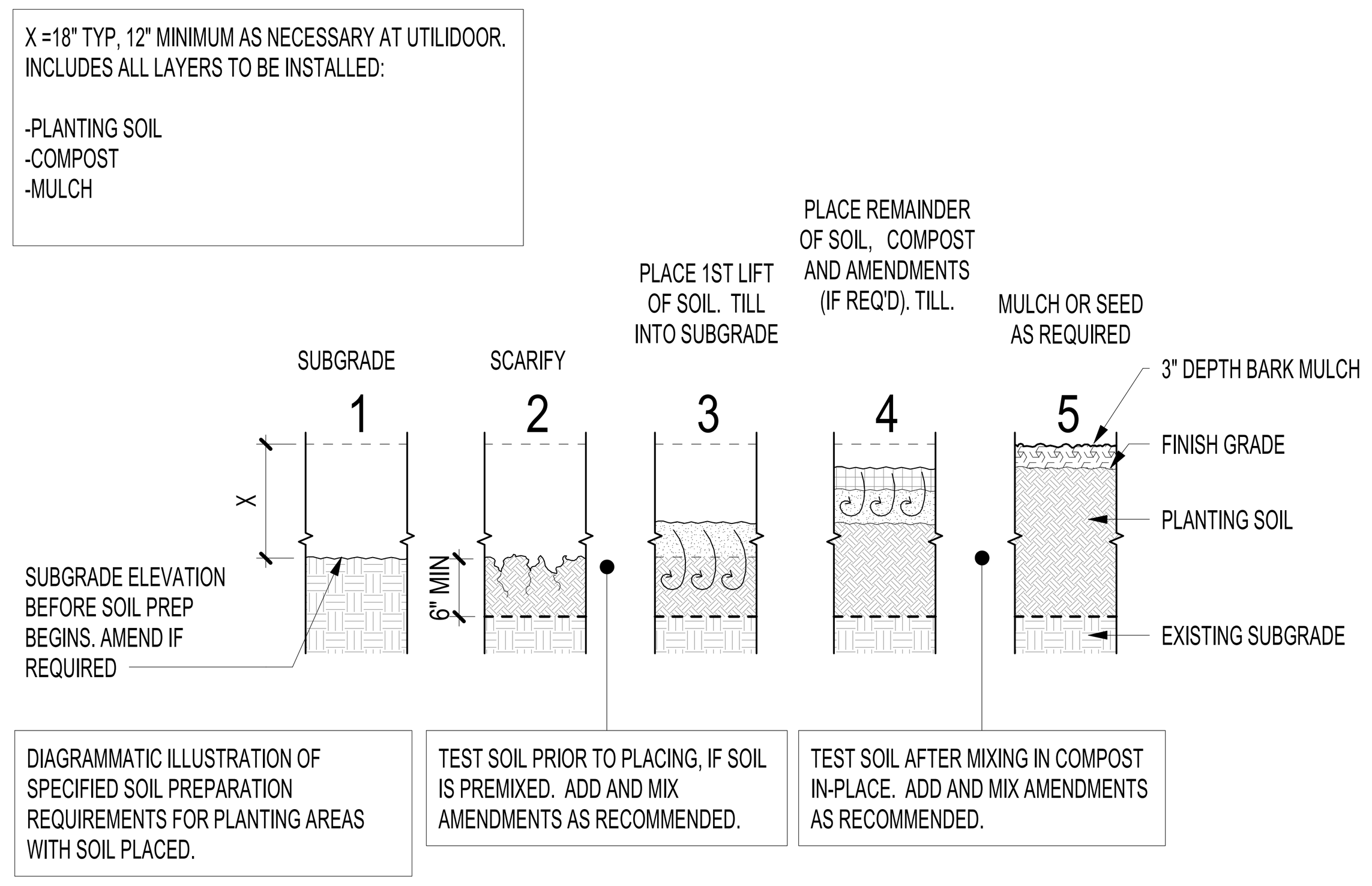
PROJECT NO.
2327300 / UW 206756

DATE
06/28/2024

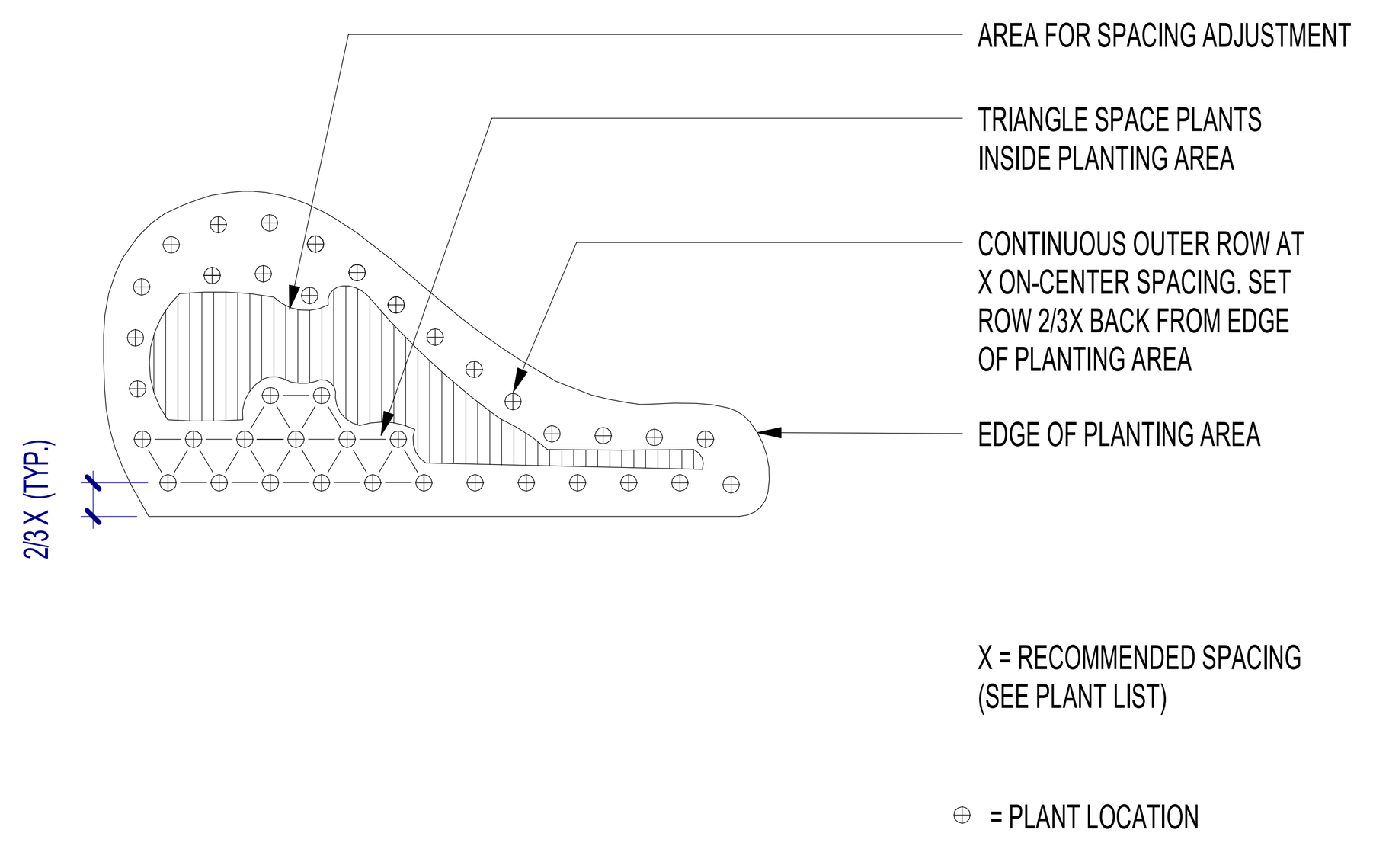
ORIGINAL SHEET SIZE 30" x 42"

SHEET NUMBER
L5.00
30% DESIGN

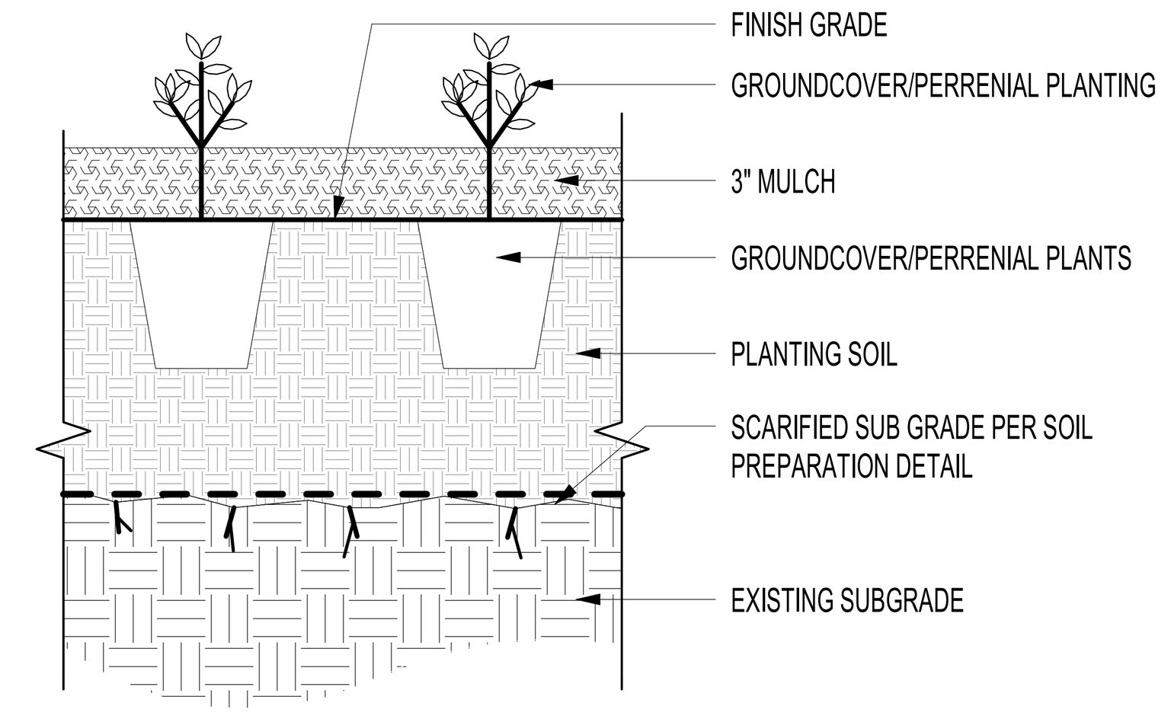
NOT FOR CONSTRUCTION


X =18" TYP, 12" MINIMUM AS NECESSARY AT UTILIDOOR. INCLUDES ALL LAYERS TO BE INSTALLED:
-PLANTING SOIL
-COMPOST
-MULCH
SUBGRADE
SCARIFY
PLACE 1ST LIFT OF SOIL. TILL INTO SUBGRADE
PLACE REMAINDER OF SOIL, COMPOST AND AMENDMENTS (IF REQ'D). TILL.
MULCH OR SEED AS REQUIRED
1
2
3
4
5
3" DEPTH BARK MULCH
FINISH GRADE
PLANTING SOIL
EXISTING SUBGRADE
X
6" MIN
SUBGRADE ELEVATION BEFORE SOIL PREP BEGINS. AMEND IF REQUIRED
DIAGRAMMATIC ILLUSTRATION OF SPECIFIED SOIL PREPARATION REQUIREMENTS FOR PLANTING AREAS WITH SOIL PLACED.
TEST SOIL PRIOR TO PLACING, IF SOIL IS PREMIXED. ADD AND MIX AMENDMENTS AS RECOMMENDED.
TEST SOIL AFTER MIXING IN COMPOST IN-PLACE. ADD AND MIX AMENDMENTS AS RECOMMENDED.

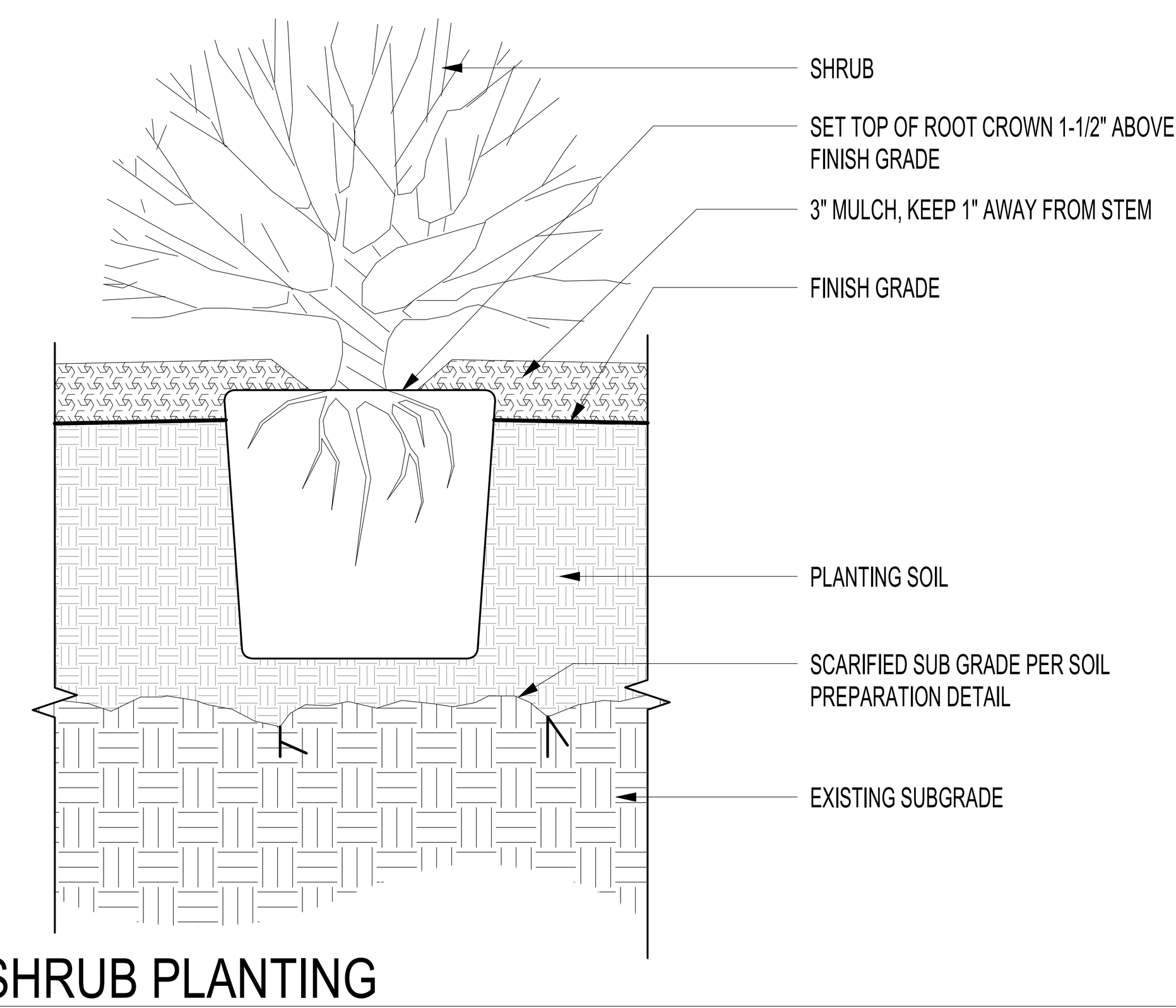
1 SOIL PREPARATION
6" = 1'-0"


AREA FOR SPACING ADJUSTMENT
TRIANGLE SPACE PLANTS INSIDE PLANTING AREA
CONTINUOUS OUTER ROW AT X ON-CENTER SPACING. SET ROW 2/3X BACK FROM EDGE OF PLANTING AREA
EDGE OF PLANTING AREA
2/3X (TYP.)
X = RECOMMENDED SPACING (SEE PLANT LIST)
= PLANT LOCATION

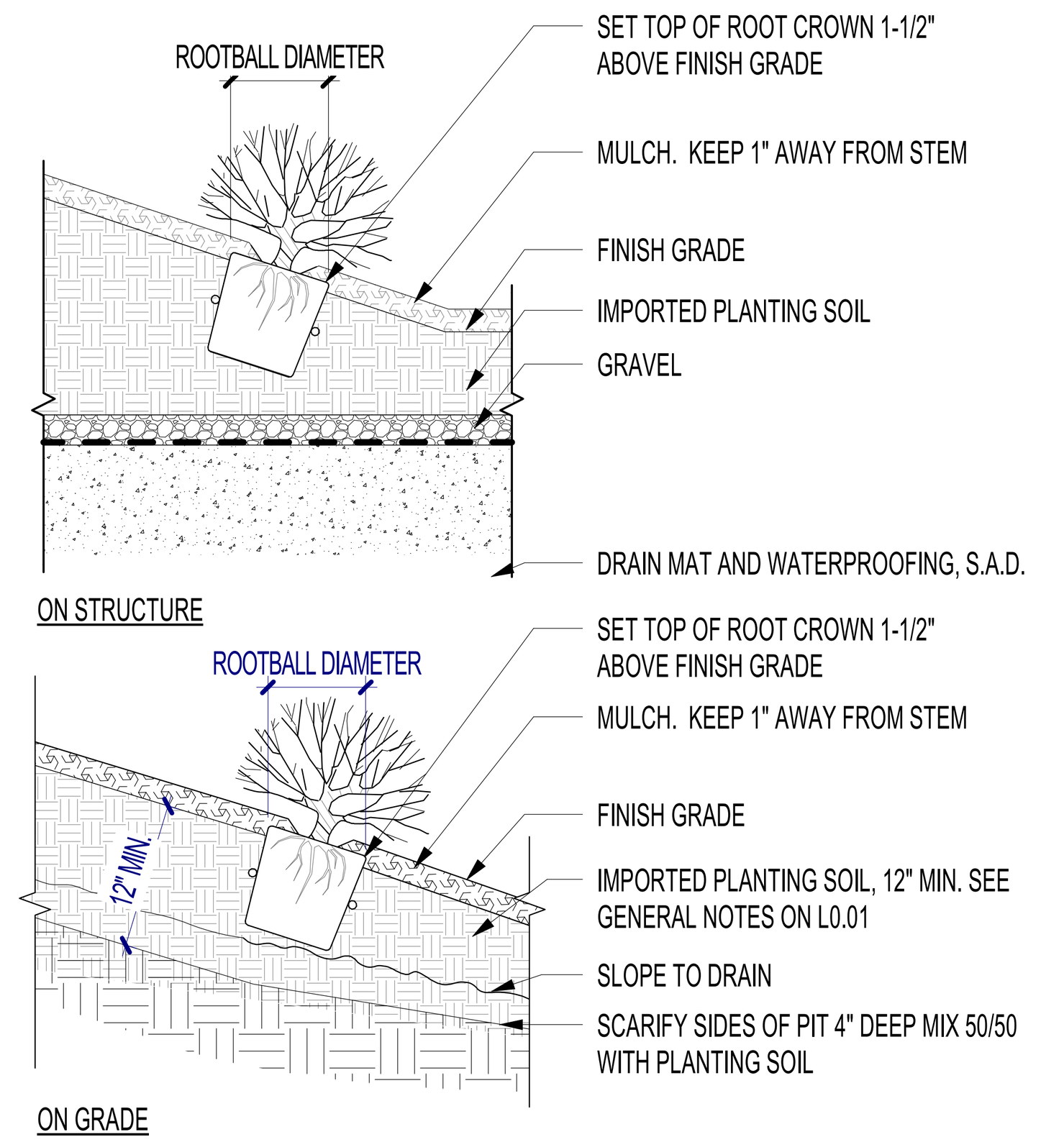
2 PLANT SPACING
1/2" = 1'-0"



3 GROUNDCOVER PLANTING
NTS

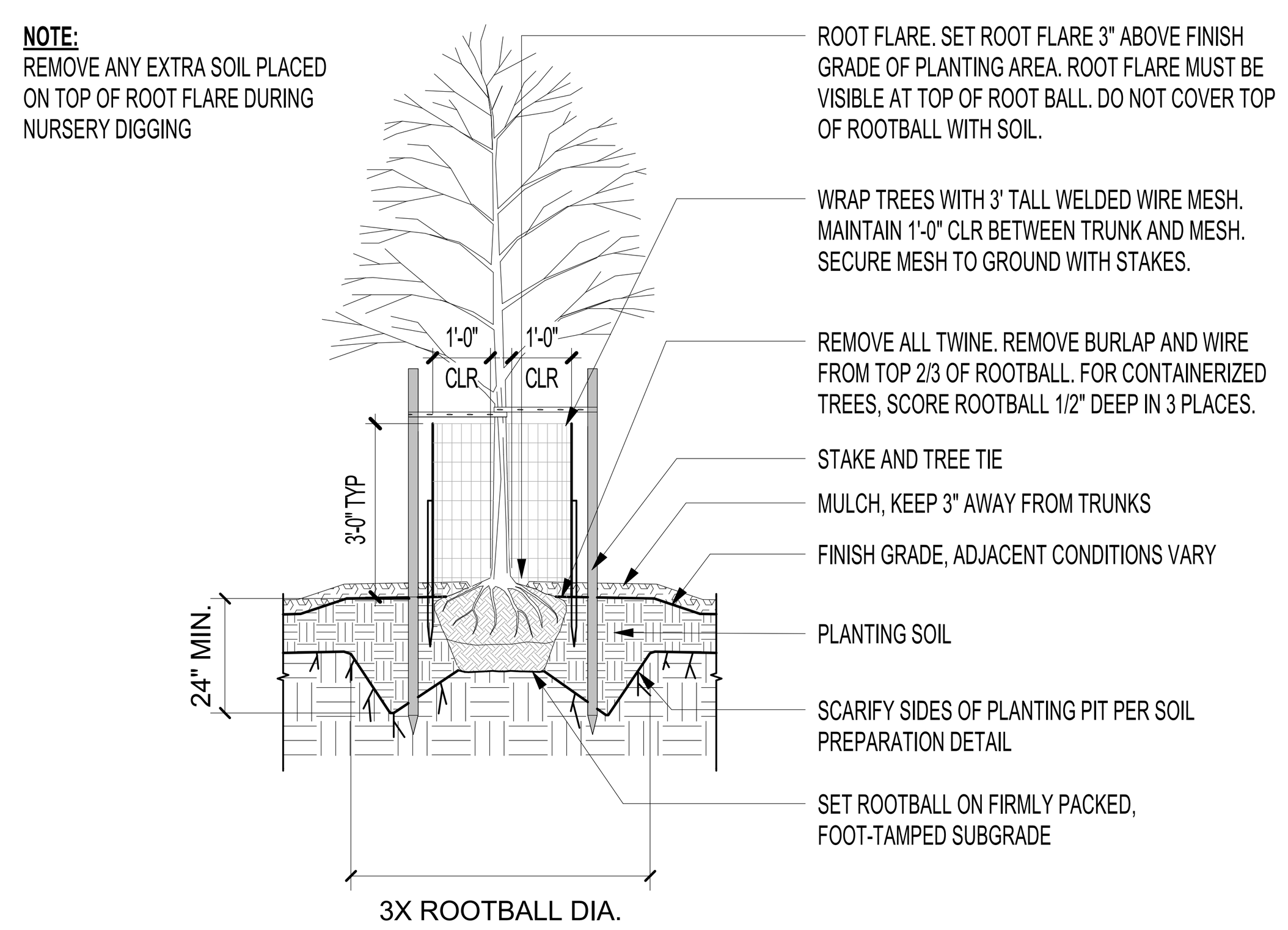


4 SHRUB PLANTING
NTS

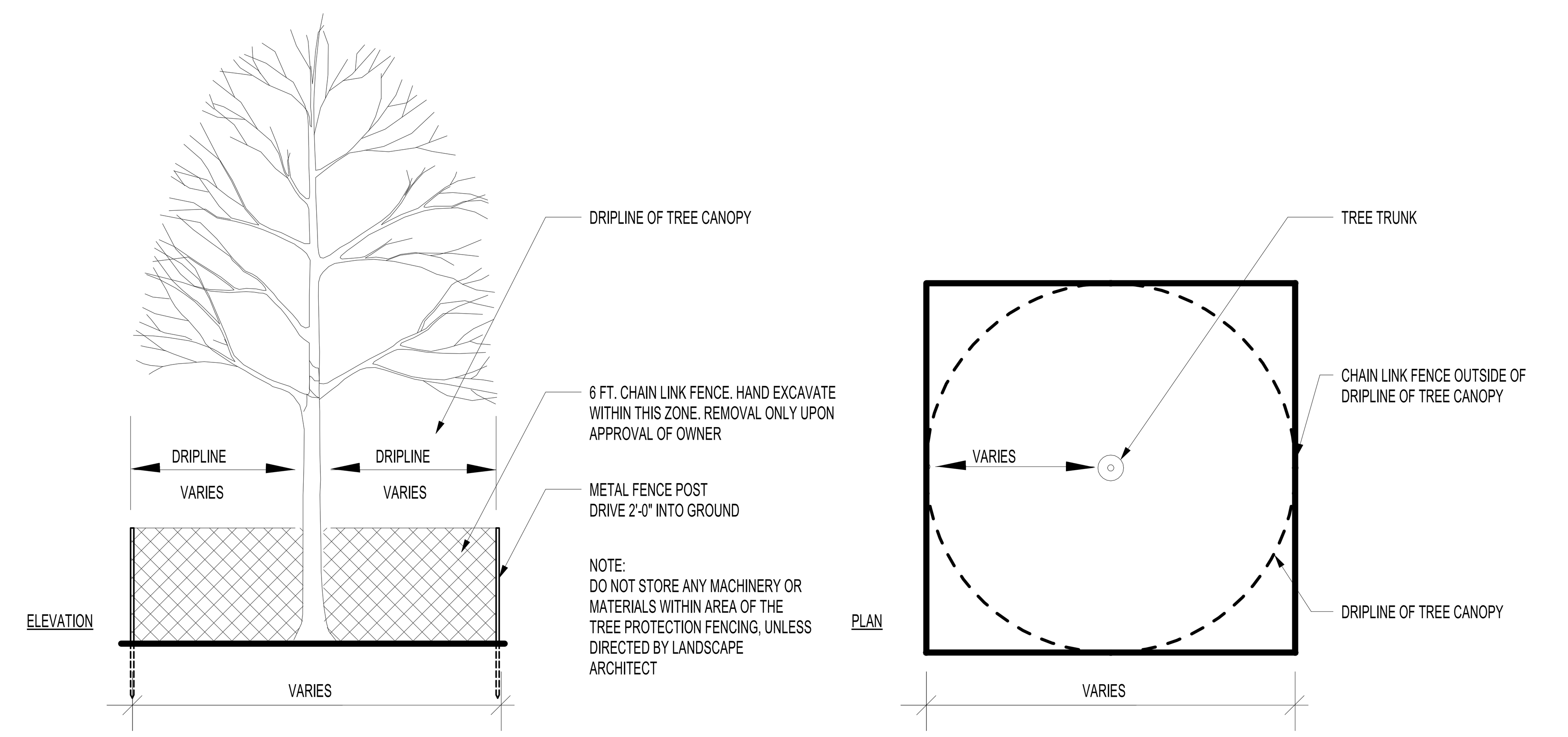

ROOTBALL DIAMETER
SET TOP OF ROOT CROWN 1-1/2" ABOVE FINISH GRADE
MULCH. KEEP 1" AWAY FROM STEM
FINISH GRADE
IMPORTED PLANTING SOIL
GRAVEL
DRAIN MAT AND WATERPROOFING, S.A.D.
ON STRUCTURE
ROOTBALL DIAMETER
SET TOP OF ROOT CROWN 1-1/2" ABOVE FINISH GRADE
MULCH. KEEP 1" AWAY FROM STEM
FINISH GRADE
IMPORTED PLANTING SOIL, 12" MIN. SEE GENERAL NOTES ON L0.01
SLOPE TO DRAIN
SCARIFY SIDES OF PIT 4" DEEP MIX 50/50 WITH PLANTING SOIL
12" MIN
ON GRADE

NOTE: ALL AT GRADE PLANTING AREAS MUST CONTAIN A MINIMUM OF 12" OF AMENDED OR SPECIALTY SOIL COVERING UNDERLYING NATIVE SOIL IN ORDER TO COMPLY WITH HEALTH CODE ARTICLE 31.

6 SHRUB PIT-PLANTED ON SLOPE
1/2" = 1'-0"


NOTE:
REMOVE ANY EXTRA SOIL PLACED ON TOP OF ROOT FLARE DURING NURSERY DIGGING
ROOT FLARE. SET ROOT FLARE 3" ABOVE FINISH GRADE OF PLANTING AREA. ROOT FLARE MUST BE VISIBLE AT TOP OF ROOT BALL. DO NOT COVER TOP OF ROOTBALL WITH SOIL.
WRAP TREES WITH 3' TALL WELDED WIRE MESH. MAINTAIN 1'-0" CLR BETWEEN TRUNK AND MESH. SECURE MESH TO GROUND WITH STAKES.
REMOVE ALL TWINE. REMOVE BURLAP AND WIRE FROM TOP 2/3 OF ROOTBALL. FOR CONTAINERIZED TREES, SCORE ROOTBALL 1/2" DEEP IN 3 PLACES.
STAKE AND TREE TIE
MULCH, KEEP 3" AWAY FROM TRUNKS
FINISH GRADE, ADJACENT CONDITIONS VARY
PLANTING SOIL
SCARIFY SIDES OF PLANTING PIT PER SOIL PREPARATION DETAIL
SET ROOTBALL ON FIRMLY PACKED, FOOT-TAMPED SUBGRADE
1'-0" CLR
1'-0" CLR
3'-0" TYP
24" MIN.
3X ROOTBALL DIA.

7 TREE PLANTING WITH STAKES
3/8" = 1'-0"


DRIPLINE OF TREE CANOPY
DRIPLINE
DRIPLINE
VARIES
VARIES
6 FT. CHAIN LINK FENCE. HAND EXCAVATE WITHIN THIS ZONE. REMOVAL ONLY UPON APPROVAL OF OWNER
METAL FENCE POST DRIVE 2'-0" INTO GROUND
NOTE:
DO NOT STORE ANY MACHINERY OR MATERIALS WITHIN AREA OF THE TREE PROTECTION FENCING, UNLESS DIRECTED BY LANDSCAPE ARCHITECT
ELEVATION
VARIES
TREE TRUNK
CHAIN LINK FENCE OUTSIDE OF DRIPLINE OF TREE CANOPY
VARIES
DRIPLINE OF TREE CANOPY
PLAN
VARIES

8 TREE PROTECTION
1/4" = 1'-0"

PLANT PALETTE

	BOTANICAL NAME	COMMON NAME	O.C. SPACING	SIZE
	Nyssa sylvatica 'David Odom'	AFTERBURNER TUPELO	AS SHOWN	2" CAL MIN
PLANTING MIX A				
	Seslaria autumnalis	AUTUMN MOORGRASS	18-24" OC, TYP	50% 2 GAL, 50% 1 GAL
	Hakonechloa macra 'All Gold'	ALL GOLD JAPANESE FOREST GRASS	18-24" OC, TYP	50% 2 GAL, 50% 1 GAL
	Cornus sericea 'Kelseyi'	KELSEY DOGWOOD	18-24" OC, TYP	50% 2 GAL, 50% 1 GAL
	Veronicastrum virginicum	CULVER'S ROOT	18-24" OC, TYP	50% 2 GAL, 50% 1 GAL
PLANTING MIX B				
	Achillea millefolium	YARROW	24-36" OC, AVERAGE	50% 2 GAL, 50% 1 GAL
	Ceonothus 'Joyce Coulter'	CREEPING MOUNTAIN LILAC	24-36" OC, AVERAGE	50% 2 GAL, 50% 1 GAL
	Cistus hybrida	CISTUS 'LITTLE MISS SUNSHINE' (WHITE)	24-36" OC, AVERAGE	50% 2 GAL, 50% 1 GAL
	Leymus mollis	AMERICAN DUNEGRASS	24-36" OC, AVERAGE	50% 2 GAL, 50% 1 GAL
	Glehnia leiocarpa	AMERICAN SILVERTOP	24-36" OC, AVERAGE	50% 2 GAL, 50% 1 GAL
	Lathyrus littoralis	SILKY BEACH PEA	24-36" OC, AVERAGE	50% 2 GAL, 50% 1 GAL
	Poa macrantha	SEASHORE BLUEGRASS	24-36" OC, AVERAGE	50% 2 GAL, 50% 1 GAL
	Sisyrinchium striatum	PALE-EYED YELLOW GRASS	24-36" OC, AVERAGE	50% 2 GAL, 50% 1 GAL
PLANTING MIX C				
	ECO-LAWN			
PLANTING MIX D				
	Grasspave-per manufacturer's recommendations			

PA TO REMAIN AND POCKET PLANT WITH APPROXIMATELY (25) QTY 1 GAL CONTAINERS

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PROJECT
ASUW SHELL HOUSE RENOVATION
LOCATION
3655 WALLA WALLA RD SEATTLE, WA 98195
PREPARED FOR
UNIVERSITY OF WASHINGTON

UNIVERSITY *of* WASHINGTON

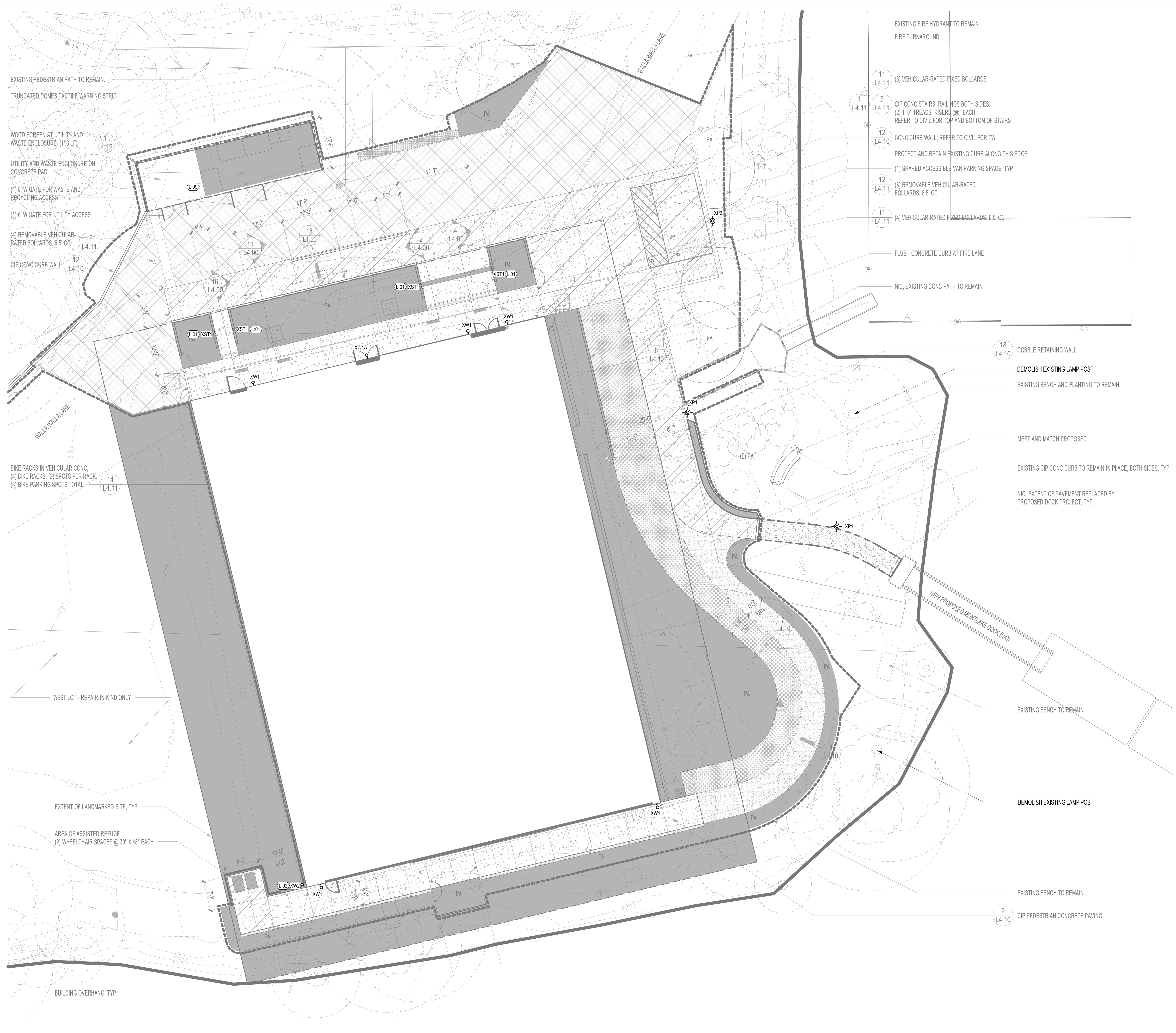
NO DATE REVISION

PARTNER IN CHARGE RF
PROJECT MANAGER EB
PROJECT LANDSCAPE ARCHITECT DK
PROJECT TEAM MEMBERS CSR
CHECK

TITLE
PLANTING DETAILS
PROJECT NO. 2327300 / UW 206756
DATE 06/28/2024
ORIGINAL SHEET SIZE 30" x 42"
SHEET NUMBER
L5.01
30% DESIGN

NOT FOR CONSTRUCTION

6/28/2024 12:47:13 PM



EXISTING FIRE HYDRANT TO REMAIN
FIRE TURNAROUND
EXISTING PEDESTRIAN PATH TO REMAIN.
TRUNCATED DOMES TACTILE WARNING STRIP
WOOD SCREEN AT UTILITY AND WASTE ENCLOSURE, (113 LF)
UTILITY AND WASTE ENCLOSURE ON CONCRETE PAD
(1) 8' W GATE FOR WASTE AND RECYCLING ACCESS
(1) 6' W GATE FOR UTILITY ACCESS
(4) REMOVABLE VEHICULAR-RATED BOLLARDS, 6.5' OC
CIP CONC CURB WALL
(3) VEHICULAR-RATED FIXED BOLLARDS
CIP CONC STAIRS, RAILINGS BOTH SIDES. (2) 1'-0" TREADS, RISERS @6" EACH. REFER TO CIVIL FOR TOP AND BOTTOM OF STAIRS
CONC CURB WALL; REFER TO CIVIL FOR TW
PROTECT AND RETAIN EXISTING CURB ALONG THIS EDGE
(1) SHARED ACCESSIBLE VAN PARKING SPACE, TYP
(3) REMOVABLE VEHICULAR-RATED BOLLARDS, 6.5' OC
(4) VEHICULAR-RATED FIXED BOLLARDS, 6.5' OC
FLUSH CONCRETE CURB AT FIRE LANE
NIC, EXISTING CONC PATH TO REMAIN
WALLA WALLA LANE
COBBLE RETAINING WALL
DEMOLISH EXISTING LAMP POST
EXISTING BENCH AND PLANTING TO REMAIN
MEET AND MATCH PROPOSED
EXISTING CIP CONC CURB TO REMAIN IN PLACE, BOTH SIDES, TYP
NIC, EXTENT OF PAVEMENT REPLACED BY PROPOSED DOCK PROJECT, TYP.
BIKE RACKS IN VEHICULAR CONC. (4) BIKE RACKS, (2) SPOTS PER RACK. (8) BIKE PARKING SPOTS TOTAL.
NEW PROPOSED MONTLAKE DOCK (NIC)
WEST LOT - REPAIR-IN-KIND ONLY
EXISTING BENCH TO REMAIN
DEMOLISH EXISTING LAMP POST
EXTENT OF LANDMARKED SITE, TYP
AREA OF ASSISTED REFUGE (2) WHEELCHAIR SPACES @ 30" X 48" EACH
EXISTING BENCH TO REMAIN
CIP PEDESTRIAN CONCRETE PAVING
BUILDING OVERHANG, TYP
XP1
XP2
XW1
XW1A
XW2
XST1
L:01
L:02
L:09
PA
(E) PA

1 EL0.01 **LIGHTING SITE PLAN**
1" = 10'-0"

0 5' 10' 20' 30'
1" = 10'

GENERAL NOTES

1. LIGHTING LAYOUT IS FOR DESIGN INTENT AND PRICING CONFIRMATION ONLY. LUMINIARE LAYOUTS AND SPECIFICATIONS ARE SUBJECT TO CHANGE UPON FURTHER EVALUATION AS DESIGN PROGRESSES.
2. POLE BASE DETAILS T.B.D.
3. WALL LIGHT MOUNTING HEIGHTS INDICATED ARE TO BOTTOM OF THE FIXTURE HOUSING. INSTALL JUNCTION BOXES ACCORDINGLY, TO MAINTAIN THE HEIGHT INDICATED.
4. BASE LIGHTING DESIGN IS SHOWN IN A SCREENED LINEWEIGHT ON THE VALUE ADD SHEETS. VALUE ADD LIGHTING IS SHOWN IN A BLACK LINEWEIGHT ON THE VALUE ADD SHEETS. BOTH THE BASE LIGHTING AND THE VALUE ADD LIGHTING ARE INTENDED TO PROVIDE A COMPLETE LIGHTING DESIGN, FOR THE VALUE ADD LIGHTING DESIGN.
5. SEE SHEET EL6.00 FOR INTERIOR LIGHTING ZONE CONTROL INTENT.

⟨#⟩ KEY NOTES

L:01 XST1 INSTALLED AT 15" ABOVE FINISHED GRADE TO CENTER OF LUMINAIRE.
L:02 XW2 IS CONTROLLED VIA MOTION SENSOR AND SHOULD BE OFF IN NORMAL CONDITIONS. IT ILLUMINATES THE AREA OF REFUGE ONLY WHEN NEEDED.
L:09 LIGHTING FOR UTILITY AND WASTE ENCLOSURE TO BE DESIGNED AND COORDINATED WITH THE DESIGN OF THE ENCLOSURE.

EXTERIOR LIGHTING CONTROL INTENT

ALL EXTERIOR LIGHTING SHALL BE CONTROLLED PER 2021 SEATTLE ENERGY CODE REQUIREMENTS.
1. DAYLIGHT SHUTOFF.
2. FAÇADE/LANDSCAPE LIGHTING SHUTOFF (N/A).
3. LIGHTING SETBACK THAT REDUCES WATTAGE BY MINIMUM 50% DURING ANY PERIOD WHEN NO ACTIVITY HAS BEEN DETECTED FOR 15 MINUTES OR MORE.
4. EXTERIOR TIME-SWITCH.

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LOS ANGELES / 5837 Adams Blvd
Culver City, CA 90232 / 323.937.2150

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PROJECT MANAGER
SRG
PROJECT ARCHITECT

PROJECT DESIGNER
NT
PROJECT TEAM MEMBERS
IA
CHECK

TITLE
LIGHTING SITE PLAN

PROJECT NO.
204822661
DATE
06/28/2024

ORIGINAL SHEET SIZE 30" x 42"

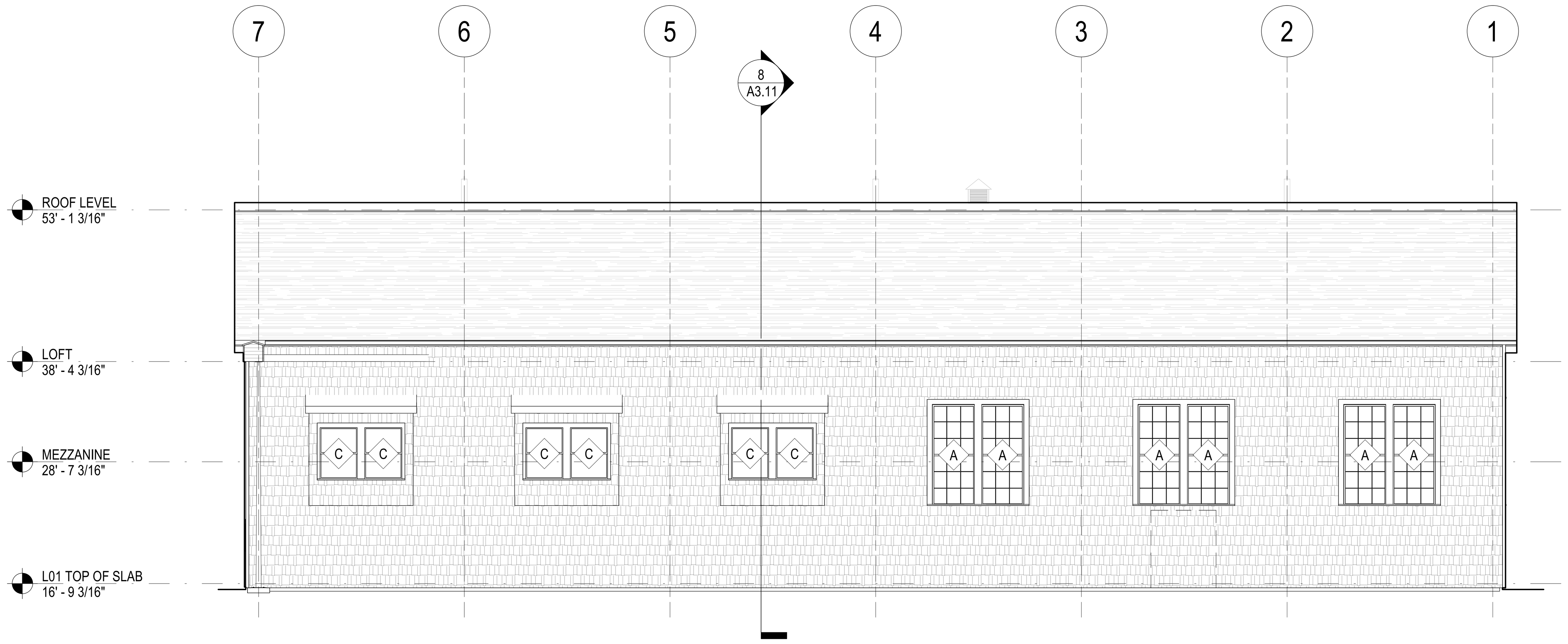
SHEET NUMBER
EL0.01
30% DESIGN

NOT FOR CONSTRUCTION

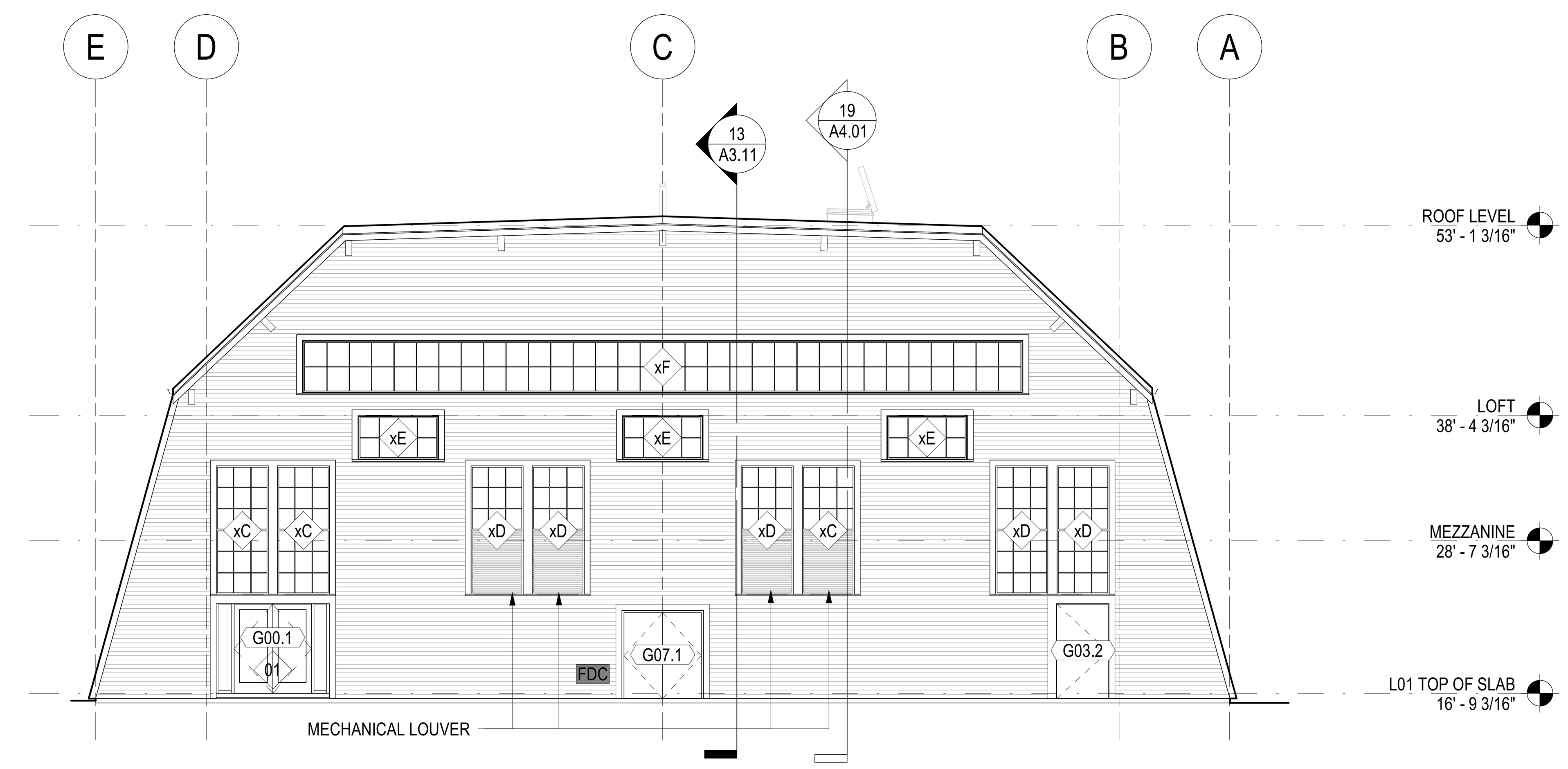
6/28/2024 1:29:13 PM

ROOF PLAN LEGEND

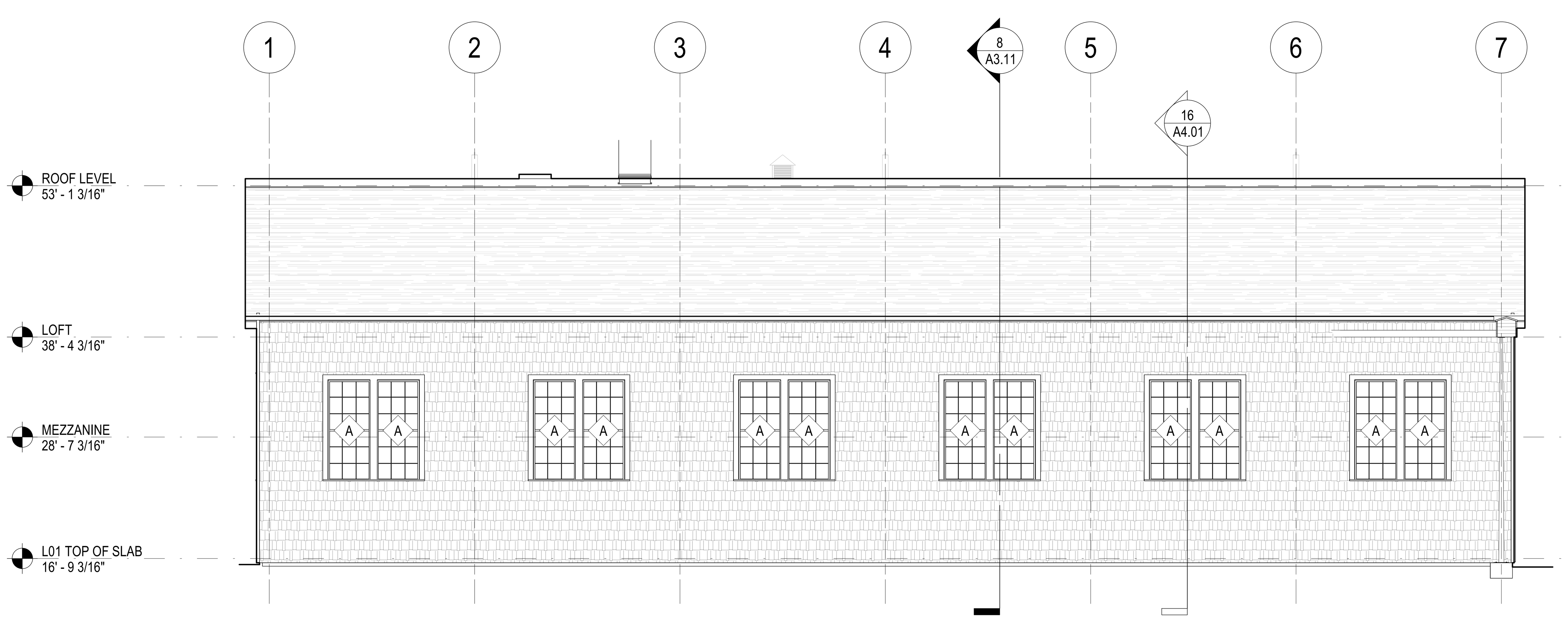
- ASPHALT SHINGLE ROOFING
- CEDAR SHAKE SIDING
- HORIZONTAL FIBER CEMENT LAP SIDING



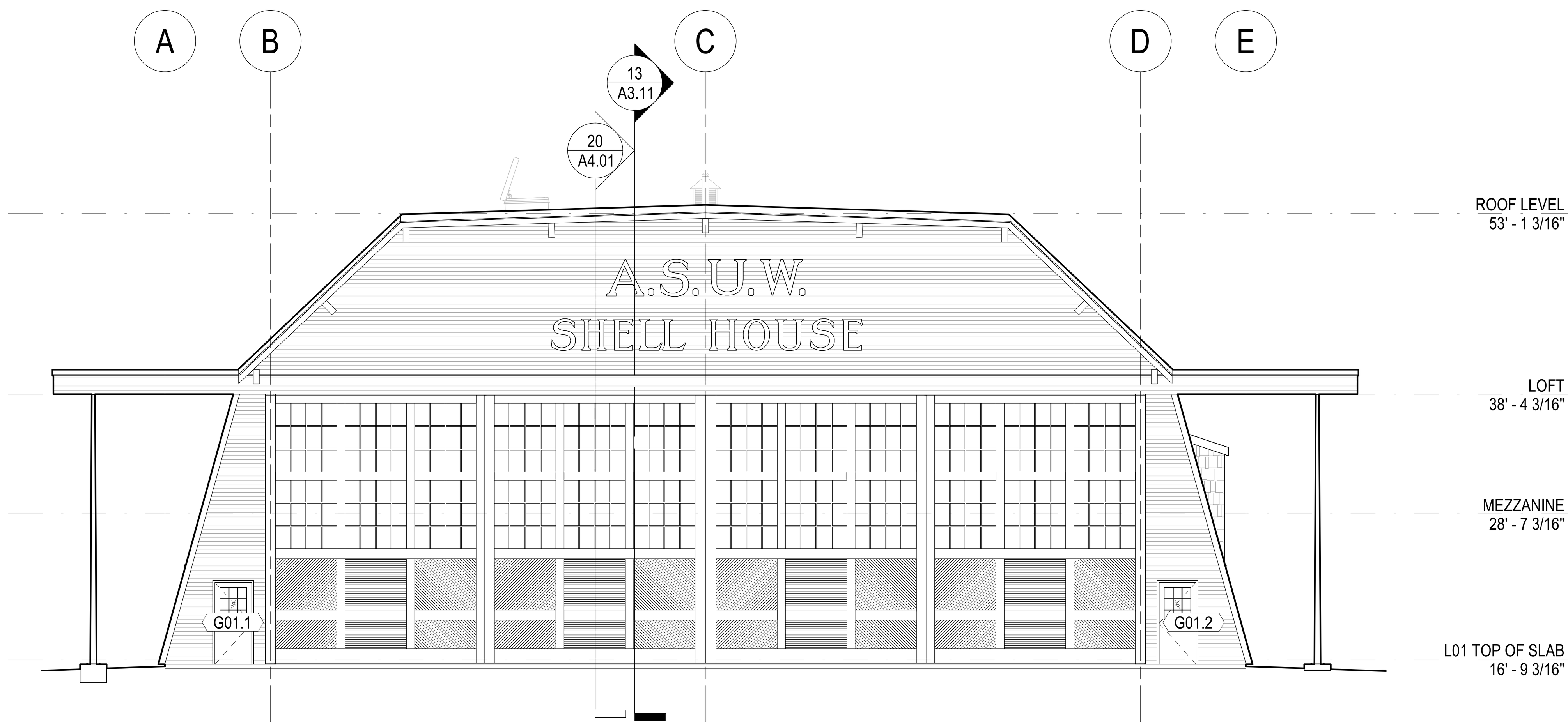
6 EAST ELEVATION
1/8" = 1'-0" | 16/A2.01



8 NORTH ELEVATION
1/8" = 1'-0" | 16/A2.01



16 WEST ELEVATION
1/8" = 1'-0" | 16/A2.01



18 SOUTH ELEVATION
1/8" = 1'-0" | 16/A2.01

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DJ
PROJECT DESIGNER
RF
PROJECT TEAM MEMBERS
ME
CHECK

TITLE
EXTERIOR ELEVATION

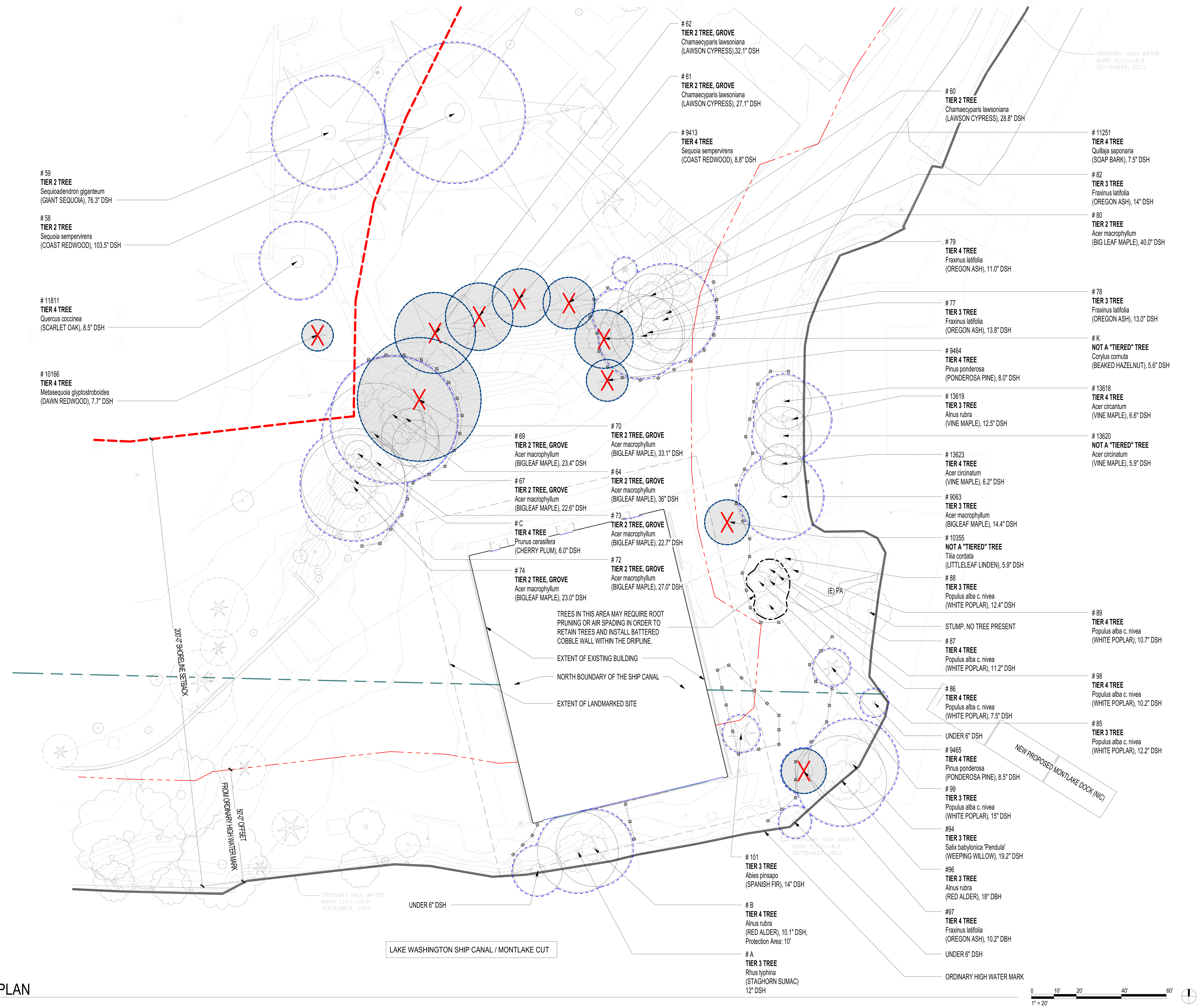
PROJECT NO.
2327300 / UW 206756
DATE
6/28/24

ORIGINAL SHEET SIZE 30" x 42"

SHEET NUMBER
A3.01
30% DESIGN

NOT FOR CONSTRUCTION

8/27/2024 12:42:23 PM



62
TIER 2 TREE, GROVE
Chamaecyparis lawsoniana
(LAWSON CYPRESS),32.1" DSH
61
TIER 2 TREE, GROVE
Chamaecyparis lawsoniana
(LAWSON CYPRESS), 27.1" DSH
9413
TIER 4 TREE
Sequoia sempervirens
(COAST REDWOOD), 8.8" DSH
60
TIER 2 TREE
Chamaecyparis lawsoniana
(LAWSON CYPRESS), 28.8" DSH
11251
TIER 4 TREE
Quillaja saponaria
(SOAP BARK), 7.5" DSH
82
TIER 3 TREE
Fraxinus latifolia
(OREGON ASH), 14" DSH
80
TIER 2 TREE
Acer macrophyllum
(BIG LEAF MAPLE), 40.0" DSH
59
TIER 2 TREE
Sequioadendron giganteum
(GIANT SEQUOIA), 76.3" DSH
58
TIER 2 TREE
Sequoia sempervirens
(COAST REDWOOD), 103.5" DSH
11811
TIER 4 TREE
Quercus coccinea
(SCARLET OAK), 8.5" DSH
10166
TIER 4 TREE
Metasequoia glyptostroboides
(DAWN REDWOOD), 7.7" DSH
79
TIER 4 TREE
Fraxinus latifolia
(OREGON ASH), 11.0" DSH
78
TIER 3 TREE
Fraxinus latifolia
(OREGON ASH), 13.0" DSH
77
TIER 3 TREE
Fraxinus latifolia
(OREGON ASH), 13.8" DSH
K
NOT A "TIERED" TREE
Corylus cornuta
(BEAKED HAZELNUT), 5.6" DSH
9464
TIER 4 TREE
Pinus ponderosa
(PONDEROSA PINE), 8.0" DSH
13618
TIER 4 TREE
Acer circinatum
(VINE MAPLE), 6.6" DSH
13619
TIER 3 TREE
Alnus rubra
(VINE MAPLE), 12.5" DSH
13620
NOT A "TIERED" TREE
Acer circinatum
(VINE MAPLE), 5.9" DSH
69
TIER 2 TREE, GROVE
Acer macrophyllum
(BIGLEAF MAPLE), 23.4" DSH
70
TIER 2 TREE, GROVE
Acer macrophyllum
(BIGLEAF MAPLE), 33.1" DSH
13623
TIER 4 TREE
Acer circinatum
(VINE MAPLE), 6.2" DSH
67
TIER 2 TREE, GROVE
Acer macrophyllum
(BIGLEAF MAPLE), 22.6" DSH
64
TIER 2 TREE, GROVE
Acer macrophyllum
(BIGLEAF MAPLE), 36" DSH
9063
TIER 3 TREE
Acer macrophyllum
(BIGLEAF MAPLE), 14.4" DSH
C
TIER 4 TREE
Prunus cerasifera
(CHERRY PLUM), 6.0" DSH
73
TIER 2 TREE, GROVE
Acer macrophyllum
(BIGLEAF MAPLE), 22.7" DSH
10355
NOT A "TIERED" TREE
Tilia cordata
(LITTLELEAF LINDEN), 5.9" DSH
74
TIER 2 TREE, GROVE
Acer macrophyllum
(BIGLEAF MAPLE), 23.0" DSH
72
TIER 2 TREE, GROVE
Acer macrophyllum
(BIGLEAF MAPLE), 27.0" DSH
88
TIER 3 TREE
Populus alba c. nivea
(WHITE POPLAR), 12.4" DSH
(E) PA
TREES IN THIS AREA MAY REQUIRE ROOT
PRUNING OR AIR SPADING IN ORDER TO
RETAIN TREES AND INSTALL BATTERED
COBBLE WALL WITHIN THE DRIPLINE.
STUMP, NO TREE PRESENT
89
TIER 4 TREE
Populus alba c. nivea
(WHITE POPLAR), 10.7" DSH
EXTENT OF EXISTING BUILDING
87
TIER 4 TREE
Populus alba c. nivea
(WHITE POPLAR), 11.2" DSH
NORTH BOUNDARY OF THE SHIP CANAL
98
TIER 4 TREE
Populus alba c. nivea
(WHITE POPLAR), 10.2" DSH
EXTENT OF LANDMARKED SITE
86
TIER 4 TREE
Populus alba c. nivea
(WHITE POPLAR), 7.5" DSH
85
TIER 3 TREE
Populus alba c. nivea
(WHITE POPLAR), 12.2" DSH
200'-0" SHORELINE SETBACK
UNDER 6" DSH
9465
TIER 4 TREE
Pinus ponderosa
(PONDEROSA PINE), 8.5" DSH
NEW PROPOSED MONTLAKE DOCK (NIC)
50'-0" OFFSET FROM ORDINARY HIGH WATER MARK
99
TIER 3 TREE
Populus alba c. nivea
(WHITE POPLAR), 15" DSH
#94
TIER 3 TREE
Salix babylonica 'Pendula'
(WEEPING WILLOW), 19.2" DSH
101
TIER 3 TREE
Abies pinsapo
(SPANISH FIR), 14" DSH
#96
TIER 3 TREE
Alnus rubra
(RED ALDER), 18" DBH
UNDER 6" DSH
B
TIER 4 TREE
Alnus rubra
(RED ALDER), 10.1" DSH,
Protection Area: 10'
#97
TIER 4 TREE
Fraxinus latifolia
(OREGON ASH), 10.2" DBH
UNDER 6" DSH
LAKE WASHINGTON SHIP CANAL / MONTLAKE CUT
A
TIER 3 TREE
Rhus typhina
(STAGHORN SUMAC)
12" DSH
ORDINARY HIGH WATER MARK
ORDINARY HIGH WATER MARK ELEV.=18.5 SEPTEMBER, 2023
0 10' 20' 40' 60'
1" = 20'

16 TREE RETENTION PLAN
1" = 20'-0"

LEGEND

200'-0" OFFSET FROM ORDINARY HIGH WATER MARK

50'-0" OFFSET FROM ORDINARY HIGH WATER MARK

TREES TO BE REMOVED

REFER TO EXISTING TREE SCHEDULE FOR DETAIL TREE SIZE AND TYP

XXX

XXX

CRITICAL ROOT ZONE, TYP

TREE TYPE, DIA @ DBH

EXISTING TREES TO BE RETAINED

PROTECTION IN PLACE PER TREE PROTECTION DETAIL PER CIVIL

XXX

XXX

CRITICAL ROOT ZONE, TYP

TREE TYPE, DIA @ DBH

TREE MASSING OF TREES TO BE RETAINED

CRITICAL ROOT ZONE, TYP

TREE MASSING OUTLINE

TREE PROTECTION FENCING 8 / L5.01

NOTES:

1. CRITICAL ROOT ZONE (CRZ) IS AN AREA EQUAL TO (1) FOOT RADIUS FOR EVERY INCH DIAMETER FROM A TREE MEASURED AT DIAMETER STANDARD HEIGHT (DSH) UNO.
2. DSH (DIAMETER AT STANDARD HEIGHT) IS MEASURED 4.5 FEET ABOVE GRADE.
3. DSH FOR MULTI-STEM TREES ARE NOTED AS A SINGLE STEM EQUIVALENT, CALCULATED AS THE SQUARE ROOT OF THE SUM OF THE DSH FOR EACH INDIVIDUAL STEM SQUARED.
4. TIERS ARE BASED ON SMC 25.11 AND DIRECTOR'S RULE 7-2023.
5. TREE PROTECTION AREA IS CALCULATED AS 10 TIMES DSH OR GREATER DEPENDING ON TREE SPECIDES, HEALTH, AND AGE.
6. TREE ID IS ASSIGNED BY UW. MOST TREES IN THIS AREA DO NOT HAVE TAGS. LETTERS IDENTIFY TREES THAT ARE NOT LISTED IN THE UW GIS TREE DATABASE.
7. NOT ALL TREES TO BE RETAINED ON THIS SHEET WILL REQUIRE TREE PROTECTION. COORDINATION WITH CONTRACTOR NEEDED TO DETERMINE TREES THAT WILL NEED PROTECTION.
8. PER SMC 25.11.130, A TREE GROVE IS EIGHT OF MORE TREES EACH WITH A DSH OF GREATER THAN 12 INCHES WITH A CONTINUOUSLY OVERLAPPING CANOPIES, EXCLUDING CERTAIN SPECIES AND TREES GROWING ENTIRELY IN "THE PUBLIC PLACE" OR RIGHT-OF-WAY.
9. PLANTING, DISTURBING, OR REMOVING VEGETATION IN SOME ECAS AND THEIR BUFFERS (LANDSLIDE-PRONE CRITICAL AREAS, STEEP SLOPE EROSION HAZARD AREAS, WETLANDS, AND WILDLIFE HABITAT CONSERVATION AREAS) ARE RESTRICTED (SMC 25.09.070). STEEP SLOPES SLOPES BUFFER INCLUDE AREAS WITHIN 15-FEET OF THE TOP AND TOE OF A SLOPE.

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DK
PROJECT TEAM MEMBERS
CSR
CHECK

LANDSCAPE ARCHITECT SEAL

SEATTLE SDCI / DPCD APPROVAL STAMP

TITLE
SEPA EXHIBIT - TREE RETENTION PLAN

PROJECT NO.
2327300 / UW 206756

DATE
08/05/2024

ORIGINAL SHEET SIZE 30" x 42"

SHEET NUMBER
EX L0.02

SEPA