GEOTECHNICAL ENGINEERING STUDY

Proposed Huntington Ridge Apartments
906 Croy Road
Kelso, Cowlitz County, Washington

Prepared for:
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Exp. 1/20/2021

Project No. G0141800
{Revised March 2020}

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INTRODUCTION

General

This report presents the results of the geotechnical engineering study completed by Soil and Water Technologies, Inc. (SWT) for the proposed Huntington Ridge Apartments located in Kelso, Cowlitz County, Washington. The general location of the site is shown on the *Vicinity Map, Figure 1.* Our approximate exploratory boring locations are shown in relation to the site on the *Site Plan, Figure 2.*

The purpose of this study is to explore and evaluate subsurface conditions at the site and provide geotechnical recommendations for the proposed construction based on the conditions encountered. These recommendations include site specific geotechnical parameters for foundation support, earthwork grading, utility trench backfill, roadway construction, drainage, erosion control, a seismic hazard evaluation with liquefaction analyses and a slope stability analysis.

Project Description

It is SWT understanding that you plan to construct a total of eight, three-story wood-framed apartment buildings consisting of a total of ninety-six (96) living units. The project will also include associated underground utilities, asphalt paved roadways and parking areas at the approximate ten-acre parcel. Although no specific grading plan was available during the time of our study, we understand that the proposed grading plan for the site will include an approximate cut of five feet at the upper northwest portion of the site, and that the cut materials are planned to be used to fill and level out the lower southeastern portions of the site. In total, we anticipate that earthwork cuts and fills will not exceed approximately five feet in thickness across the site. Each of the proposed apartment buildings will be constructed close to proposed grade with slab on grade foundations.

Specific structural design loads for the proposed apartment buildings were not available at the time of the preparation of this report, and so our recommendations are based on the local experience with similar projects.

If any of the above information is incorrect or changes, we should be consulted to review the recommendations contained in this report. In any case, it is recommended that Soil and Water Technologies perform a general review of the final design.

SITE CONDITIONS

Surface

The irregularly shaped property is located at the northwest corner of the intersection of the Interstate 5 (Exit 40) southbound off-ramp and North Kelso Avenue in Kelso, Washington. The subject property is bordered on the north by a forested parcel, on the east by Interstate 5, on the south by North Kelso Avenue and on the west by Drainage Improvement District No. 1 Ditch and by single family residences beyond.

The topography across the site consists of a bluff that formerly consisted of an ancient river terrace that was orphaned by the cutting of the adjacent hillsides to the east during the construction of Interstate 5. The proposed project site itself is relatively flat, sloping down moderately to the south at an approximately 20H:1V (horizontal: vertical) slope gradient. Steeper terrace slopes along the west side of the property boundary include average slope gradients around 30 to 40 percent, with a steeper portion along the northwest boundary, where slopes gradients up to 80 percent exist. The maximum total elevation change across the site is approximately 40 to 50 feet. During the time of our site study the property was covered with pasture grass, blackberry brambles, native trees and shrubs.

Subsurface

On February 26th, 2018 the site was explored excavating a total of three mud-rotary borings, designated B-1 through B-3, that were drilled to depths ranging from 26.5 to 51.5 feet below the existing ground surface (bgs). On April 6th, 2018 we also observed the exploration of seven additional test pits with an excavator, designated TP-1 through TP-7. All exploration locations were selected by SWT to determine subsurface conditions in the vicinity of the proposed apartment buildings and pavement areas. The approximate locations are shown on the *Site Plan, Figure 2.*

All soil was classified in general accordance with the *Unified Soil Classification System (USCS).* Soil samples obtained from the borings and test pits were returned to our office for additional evaluation and laboratory testing. Descriptions of field and laboratory procedures are included in Appendices A and B, respectively.

The following is a generalized description of the subsurface units encountered.

SURFACE MATERIALS:	Surface materials encountered in the explorations consisted of deteriorated gravel and asphalt pavements in the northern portion of the site, and 4 to 10 inches of organic topsoil in the southern portion of the site.
CLAY FILL:	Undocumented fill consisting of silty Clay (CL) with occasional rock fragments, trace sand and other variable debris, was encountered below the surface materials in borings B-2 and B-3, extending to depths 16 and 21 feet, respectively. The fill was also encountered in test pits TP-2 through TP-7, extending to the termination depth of all at 10 feet bgs, except TP-2 and TP-7, where it extended to depths of 2.5 in both. In general, the clay fill was light brown to blue-gray, low plasticity and moist. The consistency of the clay fill was highly variable, ranging from very soft to stiff, based on of SPT N-values ranging from 0 to 7. The moisture content of samples from this unit ranged from 22 to 34 percent.
SILTY SAND:	Native silty sand (SM) was encountered at the surface in boring B-1, and below the clay fill in borings B-2 and B-3, and well as test pits TP-1, TP-2 and TP-7, to the termination depth of these explorations. In general, the silty sand was light brown to gray, fine grained, and loose to dense, based on SPT N-values ranging from 8 to 42, increasing in density and coarseness with depth. The percent fines content of tested samples of the silty sand ranged from 32 to 48. The moisture content of samples from this unit varied from 12 to 44 percent, however these moisture values in the looser portions of the unit are likely artificially high due to the mud rotary drilling technique used. In Test Pit TP-7, the silty sand became cleaner (fines content of 14 percent) below 7 feet bgs, and remained so to the termination depth at 10 feet bgs.

Please refer to our test pit logs, Plates A2 through A8 and boring logs, B1 through B3 for a more detailed description of the conditions encountered at each location explored.

Groundwater

No groundwater or groundwater seepage was encountered to the maximum depth of exploration at our test pits or borings. Our review of water well logs from the Washington Department of Ecology database indicates that the static groundwater level in the area is greater than fifty feet (50') below the surface.

It is important to note that groundwater conditions are not static; fluctuations may be expected in the level and seepage of flow depending on the season, amount of rainfall, surface water runoff, and other factors. Generally, the groundwater level is higher and seepage rate is greater in the wetter winter months (typically October through May). The static groundwater level may approach the ground surface during these months.

General Regional Geology

General information about geologic conditions and soil in the vicinity of the site was obtained by reviewing the Washington Division of Geology and Earth Resources Geologic Map of the Mount St. Helens Quadrangle, Washington and Oregon, and the USDA web soil survey.

In the vicinity of the subject property, underlying bedrock is unexposed Oligocene epoch (34 to 23 mya) basalt and basaltic andesite flows emplaced by flood basalts that represent the early formation of the regional segment of the Cascade volcanic arc. The bedrock's appearance is usually limited to steep cliff faces, landslide scarps, and streambeds and is extensively overlain by Neogene-Quaternary period (23 to 2.5 mya) alluvial and glacial till.

In the Late Pleistocene (17 -13 kya), a series of floods caused by the failure of the ice dam at Glacial Lake Missoula in western Montana caused the deposition of suspended sediments from floodwaters throughout the lower Columbia River Basin

The native material encountered in our borings and test pits consists predominantly of native Sand and Silt consistent with Pleistocene-age terrace deposits of fine sand and silt formed from the sequence of undercutting and subsequent filling of the ancient alluvial Columbia River floodplain deposits.

Geologic Hazards

The following provides a geologic hazard review for the subject site. The geologic hazard review as based on our site reconnaissance and explorations, as well as a review of publicly available published literature and maps.

Slope and Landslide Hazards:

A review of the Cowlitz County Online Planning Clearance (EPIC) for the site and the "Digital Landslide Inventory of the Cowlitz County Urban Corridor" for the Kelso Quadrangle (Wegmann, 2006), and City of Kelso Critical Areas Map (source KMC18-20-070) do not indicate any identified active or inactive landslides at the subject property. However, any slopes taller than 10 feet with a gradient greater than 33 percent as potential landslide hazard areas, pending review by a qualified professional.

Seismic Hazards:

The following seismic hazards have been considered as part of our geologic hazards review for the project site:

Ground Motion Amplification: Based on a review of the "Site Class Map of Cowlitz County, Washington" (Palmer et al. 2004), portions of the site are designated as both seismic Site Class "C" and "D". Based on our field explorations and recommendations below, it is our opinion that a Site Class "D" is appropriate for use at the site. Our seismic design criteria, which are partially based on the site class designation, are included in the Geotechnical Design Recommendations portion of this report.

Liquefaction: Structures are subject to damage from earthquakes due to direct and indirect action. Shaking represents direct action. Indirect action is represented by foundation failures and is typified by liquefaction. Liquefaction occurs when soil loses all shear strength for short periods of time during an earthquake. Ground shaking of sufficient duration then results in the loss of grain-to-grain contact as well as a rapid increase in pore water pressure. This causes the soil to assume the physical properties of a fluid.

To have potential for liquefaction a soil must be loose, cohesion-less (generally sands and silts), below the groundwater table, and must be subjected to sufficient magnitude and duration of ground shaking.

Based on the anticipated groundwater table depth (greater than 50 feet bgs), as well as the relative density and fines content of the expected bearing soils, we consider the potential for liquefaction within the site boundaries to be low. Indeed, the site as mapped as having a "very low to low" liquefaction susceptibility based on the "Liquefaction Susceptibility Map of Cowlitz County, Washington" (Palmer et al., 2004).

Fault Rupture: There are no seismogenic faults mapped within thirty (30) miles of the property boundaries (WA Dept. of Natural Resources Geological Information Portal).

Volcanic Hazards:

According to the "Volcanic Hazard Zonation for Mount St. Helens, Washington" (Wolfe & Peterson, 1995), the site does not lie within a flowage-hazard zone resulting from a potential volcanic eruption.

Slope Stability Analysis

For the purposes of this study, we performed quantitative slope modeling and slope stability analysis of the steepest portions of the northwest slopes. The analysis was based on the geologic cross section A-A' shown in Figure 5. We used topography provided by you in the preliminary site plan and subsurface data compiled from our exploratory borings to create the cross section.

We used the software SLIDE 2018 version 8.011 developed by Rocscience Inc., of Toronto, Ontario, Canada to evaluate the cross section. The software uses Spencer's method of slices to evaluate the static equilibrium of the model for both force and moment equilibrium while assuming that resultant inter-slice forces are of constant orientation throughout the sliding mass. This method of analysis is valid for circular and non-circular failure surfaces.

The internal friction angles (phi), moist unit weights, and cohesions intercepts assigned to each unit are included with the results provided with the A-A’ cross section in Figures 5a & 5b. The values were chosen conservatively based on generally accepted correlations with soil texture, and standard penetration tests conducted in the soil borings.

We used a pseudo-static analysis to evaluate slope stability under seismic conditions. Pseudo-static analysis represents the effects of earthquake shaking by accelerations that create inertial forces. We estimated the seismic coefficient based on a mean peak ground acceleration for the site of 0.2 g.

The limits of the static and pseudo-static analysis were adjusted until factors of safety were greater than the generally accepted minimum factors of safety of 1.5 and 1.1, respectively, for existing or engineered slopes. Failure planes at these minimum factors of safety were found to be located at a minimum distance of 25 feet from the top of the steepest northwest slope. The graphical output of the slope model analysis for static and pseudo-static (seismic) is provided with the A-A’ cross sections in Figures 5a & 5b, respectively.

GEOTECHNICAL DESIGN RECOMMENDATIONS

General

Based on the results of our study, it is our opinion the proposed apartment buildings can be constructed as planned, provided the geotechnical recommendations contained in this report are incorporated into the final design. The primary geotechnical concerns at the site are steeper slopes along the northwest boundary of the proposed project site and soft undocumented fill within the southern portion of the site.

The following sections present detailed recommendations and parameters pertaining to the geotechnical engineering design for this project.

Limitation of structures

To reduce the risk of slope instability at the site, we recommend that residential structures be set back at least 25 feet from the top of slope break at steeper slopes in the northwest portion of the site, as indicated on the Site Plan, Figure 2. The limitation recommendation is intended to reduce potential for slope instability by limiting the dynamic and static loading resulting from construction and permanent structures.

The setback is based on the horizontal distance of the outside base of footings from the adjacent slope. With increased embedment depth of the footings, structures may be founded closer to the adjacent top of slope, providing the horizontal distance from the slope face is maintained.

To reduce the risk of slope instability, clearing, grading, soil stockpiling, utility installation and other major construction activities should not be permitted within the limitation area or along the slopes themselves. The probability for slope instability increases with disturbance or alteration of existing slope vegetation. The setback zone is not intended to be an undisturbed conservation area, and small disturbances such as minor landscaping or construction of decks or fences are acceptable. The recommendations provided are intended to address the geotechnical aspects of construction within the recommended limitation zones.

Foundations

Based on the encountered subsurface soil conditions, preliminary building design criteria, and assuming compliance with the preceding *Site Earthwork and Grading* section, the proposed building foundations may be supported on conventional shallow spread footings bearing either on undisturbed medium dense native silty sand, or in the case of the lower southern portion of the site where soft undisturbed fill is present, on 12-inch-thick geo-grid reinforced granular mat, as described below.

Individual spread footings or continuous wall footings providing support for the proposed building may be designed for a maximum allowable bearing value of 1,500 pounds per square foot (psf). Footings for one level structures should be at least 12 inches in width. Footings for two level structures should be at least 15 inches in width. Footings for three level structures should be at least 18 inches in width. All footings should extend to a depth of at least eighteen (18) inches below the lowest adjacent finished sub grade.

These basic allowable bearing values are for dead plus live loads and may be increased one-third for combined dead, live, wind, and seismic forces. It is estimated that total and differential footing settlements for the relatively light residential buildings will be approximately one and one-half inches, respectively.

Geo-grid Reinforced Granular Mats:

Due to the soft soil conditions encountered within lower southern portion of the site and the potential for unrecognized softer zones within this are, we recommend that the building foundations in this portion of the site be supported on conventional shallow spread footings that bear upon a geo-grid reinforced “granular mat”. This type of foundation system will reduce the potential for differential settlement and act to bridge softer areas below foundations. The mat should consist of an twelve-inch thick layer of granular material placed and compacted above a geo-textile grid such as Tensar TriAxial TX160 or equivalent. The mat should extend a minimum of two feet beyond the building footprint.

By constructing the proposed building on a geogrid-reinforced gravel mat, the potential for differential settlement will be significantly reduced. However, if no degree of differential settlement risk can be assumed by the owner then it will be necessary to support the entire building and floor slab on a deep foundation system. A deep pile foundation system design can be provided at the owner’s request.

Slab on Grade

If concrete floor slabs are desired, then any disturbed soils must be re-compacted prior to pouring concrete. Satisfactory subgrade support for lightly-loaded building floor slabs can be obtained on the undisturbed native soil or on engineered structural fill. A subgrade modulus of 125 pounds per cubic inch (pcf) may be used to design floor slabs.

A minimum 6-inch-thick layer of free draining fill should be placed and compacted over the prepared subgrade to assist as a capillary break and blanket drain.

It is also suggested that nominal reinforcement such as “6X6-10/10” welded wire mesh be employed, near midpoint, in new concrete slabs. In areas where slab moisture is undesirable, a vapor barrier such as a 6-mil plastic membrane should be placed beneath the slab.

Site Drainage

The site should be graded so that surface water is directed off the site. Water should not be allowed to stand in any area where buildings or foundations are to be constructed. Loose surfaces should be sealed at the end of each workday by compacting the surface to reduce the potential of moisture infiltrating into the soils. Final site grades should allow for drainage away from the building foundations.

The ground should be sloped at a gradient of three percent for a distance of at least ten feet away from the buildings. We recommend that a foundation footing drain be installed around the perimeter of the buildings. The drain should consist of a four-inch diameter perforated pipe with holes facing down and installed in an envelope of clean drain rock or pea gravel wrapped with free draining filter fabric. The drain should be a minimum of one-foot-wide and one-foot-deep with sufficient gradient to initiate flow. The drain should be routed to a suitable discharge area and rock spalls placed at the outlet to dissipate flow from the system. Details for the footing drain have been included as *Figure 3, Granular Mat System w/ Subdrain Detail.*

Under no circumstances should the roof down spouts be connected to the perimeter building drain. We suggest that clean outs be installed at several accessible locations to allow for the periodic maintenance of the drain system.

Pavement Areas

Asphaltic Cement (AC) and Crushed Rock Base (CRB) materials should conform to WSDOT specifications. All pavement area subgrades should be compacted to at least 95 percent of the ASTM D1557 modified proctor laboratory test standard. We recommend that a minimum of 3 inches of AC underlain by 8 inches of compacted CRB in the vicinity of all parking stalls.

In the area of the proposed onsite roadways and drive aisles, we recommend 3 inches of AC underlain by 12 inches of compacted CRB.

Exterior concrete slabs that are subject to vehicle traffic loads should be at least four inches in thickness. It is also suggested that nominal reinforcement such as “6x6-10/10” welded wire mesh be installed, near midpoint, in new exterior concrete slabs and paving. Fiber mesh concrete may be used in lieu of welded wire mesh.

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section.

The subgrade and the pavement surface should have a minimum ¼ inch per foot slope to promote drainage. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the base layer.

AC and CRB materials should conform to WSDOT specifications. All CRB should be compacted to at least 95 percent of the modified proctor *ASTM D-1557* laboratory test standard.

Seismic Design Criteria:

Supportive foundation soils encountered at the site are classified as a type “D” soil in accordance with “Site Class Definitions (IBC 2006, Section 1613, Table 1613.5.2; page 303). For more detail regarding soil conditions refer to the soil logs in Appendix A of this report.

The seismic design criteria for this project found herein is based on the International Building Code (IBC) 2012/2015 and the USGS website. A summary of IBC seismic design criterion is below.

Table 1. 2012/2015 IBC Seismic Design Parameters

Location (Latitude:46.158052°, Longitude:-122.903561°)	Short Period	1-Second
Maximum Credible Earthquake Spectral Acceleration	S_s = 0.954g	S_1 = 0.439g
Site Class	D	
Site Coefficient	F_a = 1.119	F_v = 1.561
Adjusted Spectral Acceleration	S_{MS} = 1.067g	S_{M1} = 0.685g
Design Spectral Response Acceleration Parameters	S_{DS} = 0.711g	S_{D1} = 0.457g

g – acceleration due to gravity

CONSTRUCTION RECOMMENDATIONS

Site Earthwork and Grading

Clearing and Grubbing:

Prior to grading, the project area should be cleared of all rubble, trash, debris, etc. Any buried organic debris, undocumented fill or other unsuitable material encountered during subsequent excavation and grading work should also be removed. Excavations for removal of any existing footings, slabs, walls, utility lines, tanks, and any other subterranean structures should be processed and backfilled in the following manner:

- Clear the excavation bottom and side cuts of all loose and/or disturbed material.
- Once the organic topsoil has been adequately removed, the upper one foot of native soil shall be scarified to twelve (12) inches in depth and dried to within 2 percent of its optimal moisture content and re-compacted. Density testing shall be performed prior to placement of additional fill.
- Prior to placing backfill, the excavation bottom should be moisture conditioned to within 2 percent of the optimum moisture content and compacted to at least 95 percent of the ASTM D-1557 laboratory test standard.
- Backfill should be placed, moisture conditioned (i.e., watered and/or aerated as required and thoroughly mixed to a uniform, near optimum moisture content), and compacted by mechanical means in approximate 6-inch lifts. The degree of compaction obtained should be at least 95 percent of the ASTM D-1557 laboratory test standard, as applicable.

It is also critical that any surficial sub grade materials disturbed during initial demolition and clearing work be removed and/or re-compacted in the course of subsequent site preparation earthwork operations.

It is important to note that all soft, undocumented fill is to be over-excavated and replaced with suitable structural fill. Supporting the proposed buildings on homogeneous material will significantly decrease the potential for differential settlement across the foundation area. In order to create uniform sub grade support conditions, in the vicinity of undocumented fill areas, the following earthwork operations are recommended:

- Over-excavate existing soils to a competent native subgrade below the bottom of the proposed foundations. The excavations should extend at least one-half width laterally beyond the foundation footprint, or as constrained by existing structures. In addition, native soil removal shall extend to a minimum depth so that a maximum 2:1 ratio of differential structural fill thickness is maintained below all building spread foundation systems.
- The fill soils placed shall consist of clean soils with an expansion index (EI) less than twenty (20), and be free of organic material, debris, and rocks greater than three inches in maximum diameter. Based on the field observations and laboratory testing, the existing native soil is suitable for use as structural fill so long as the material does not exceed three (3) inches in diameter and is within two percent (2%) of its optimum moisture content prior to compaction.
- The backfill shall consist of minimum ninety-five percent (95%) compacted fills (Note: ASTM D1557). In addition to the relative compaction requirements, all fills shall be compacted to a firm non-yielding condition.
- Import soils should be sampled, tested, and approved by SWT prior to arrival on site. Imported soils shall consist of clean soils (EI of 20 or less) free from vegetation, debris, or rocks larger than three inches in maximum dimension.

Subgrade Verification and Proof Rolling

After clearing and grading the site, it is possible that some localized areas of soft, wet or unstable sub grade may still exist. Before placement of any base rock, the sub grade should be scarified eight inches in depth and compacted with suitable compaction equipment. Yielding areas that are identified should be excavated to medium dense material and replaced with compacted two inch-minus clean crushed rock. All building and pavement areas should be compacted to a dense non-yielding condition with suitable compaction equipment. This phase of earthwork compaction shall be performed prior to the placement of any structural fill, at the bottom of all foundation excavations and along the roadway sub-grade, before the placement of base rock.

Wet Weather Construction & Moisture Sensitive Soils:

Field observations and laboratory testing indicates that both native silty Sand (SM) and undocumented fill consisting of silty Clay (CL) encountered at the site are moisture sensitive materials. As such, in an exposed condition, moisture sensitive soil can become disturbed during normal construction activity, especially when in a wet or saturated condition. Once disturbed, in a wet condition, these soils will be unsuitable for support of foundations, floor slabs and roadways.

Therefore, where soil is exposed and will support new construction, care must be taken not to disturb their condition. If disturbed soil conditions develop, the affected soil must be removed and replaced with structural fill. The depth of removal will be dependent on the depth of disturbance developed during construction. Covering the excavated area with plastic and refraining from excavation activities during rainfall will minimize the disturbance and decrease the potential degradation of supportive soils.

Utility Support and Backfill

Based on the conditions encountered, the soil to be exposed by utility trenches should provide adequate support for utilities. Utility trench backfill is a concern in reducing the potential for settlement along utility alignments, particularly in pavement areas. It is also important that each section of utility line be adequately supported in the bedding material. The backfill material should be hand tamped to ensure support is provided around the pipe haunches.

Fill should be carefully placed and hand tamped to about twelve inches above the crown of the pipe before any compaction equipment is used. The remainder of the trench back fill should be placed in lifts having a loose thickness of eight inches.

A typical trench backfill section and compaction requirements for load supporting and non-load supporting areas is presented on *Figure 4, Utility Trench Backfill Detail*.

Imported granular material or on-site native soil to be used as backfill should be submitted to our laboratory at least one week prior to construction so that we can provide a laboratory proctor for field density testing. If native soil is planned for use as backfill, additional testing will be required to determine the suitability of the material.

Temporary Excavations

The following information is provided solely as a service to our client. Under no circumstances should this information be interpreted to mean that SWT is assuming responsibility for construction site safety or the contractor’s activities; such responsibility is not being implied and should not be inferred. In no case should excavation slopes be greater than the limits specified in local, state and federal safety regulations.

Based on the information obtained from our field exploration and laboratory testing, the onsite soils expected to be encountered in excavations will most likely consist of native medium dense to very dense Sand (SM/SP). The soil would be classified as a type “C” soil. Therefore, temporary excavations and cuts greater than four feet in height, should be sloped at an inclination no steeper than 1½ H:1V (horizontal to vertical).

If slopes of this inclination, or flatter, cannot be constructed, or if excavations greater than four feet in depth are required, temporary shoring may be necessary. This shoring would help protect against slope or excavation collapse and would provide protection to workmen in the excavation. If temporary shoring is required, we will be available to provide shoring design criteria, if requested.

LIMITATIONS

Our recommendations and conclusions are based on the site materials observed, selective laboratory testing, engineering analyses and other design information provided to Soil and Water Technologies as well as our experience and engineering judgment. The conclusions and recommendations are professional opinions derived in a manner consistent with that level of care and skill ordinarily exercised by other members of the profession currently practicing under similar conditions in this area. No warranty is expressed or implied.

The recommendations submitted in this report are based upon the data obtained from the test pits. Soil and groundwater conditions between the test pits may vary from those encountered. The nature and extent of variations may not become evident until construction. If variations do appear, Soil and Water Technologies should be requested to reevaluate the recommendations contained in this report and to modify or verify them in writing prior to proceeding with the proposed construction.

ADDITIONAL SERVICES & EARTHWORK MONITORING

Soil and Water Technologies will be available to provide consultation services related to review of the final design to verify that the recommendations within our purview have been properly interpreted and implemented in the approved construction plans and specifications. A representative from our office will be available to attend a pre-construction meeting to discuss and/or clarify all geotechnical issues related to the proposed project.

In addition, it is suggested that our office be retained to provide geotechnical services during construction to observe compliance with the design concepts and project specifications and to allow design changes in the event subsurface conditions differ from those anticipated. Our construction services would include monitoring and documenting the following:

- Verify the removal of organic strippings and other deleterious material.
- Verify over-excavation and replacement of undocumented fills, where encountered.
- Observe the placement and compaction of structural fill at building areas, utility trenches and roadways.
- Perform laboratory tests on structural fill source and roadway base rock materials.
- Observe the installation of geotextile grid at foundation footing areas.
- Perform density tests on structural fill and utility trench backfill.
- Monitor proof rolling of roadway subgrade and base rock.
- Perform density testing on roadway base rock and asphalt pavement.
- Concrete Testing (i.e. Temp., Slump, Air, Compressive Strength), if required.
- Provide certified erosion control design, monitoring and consulting.
- Provide written field reports and electronically submit to all associated parties.

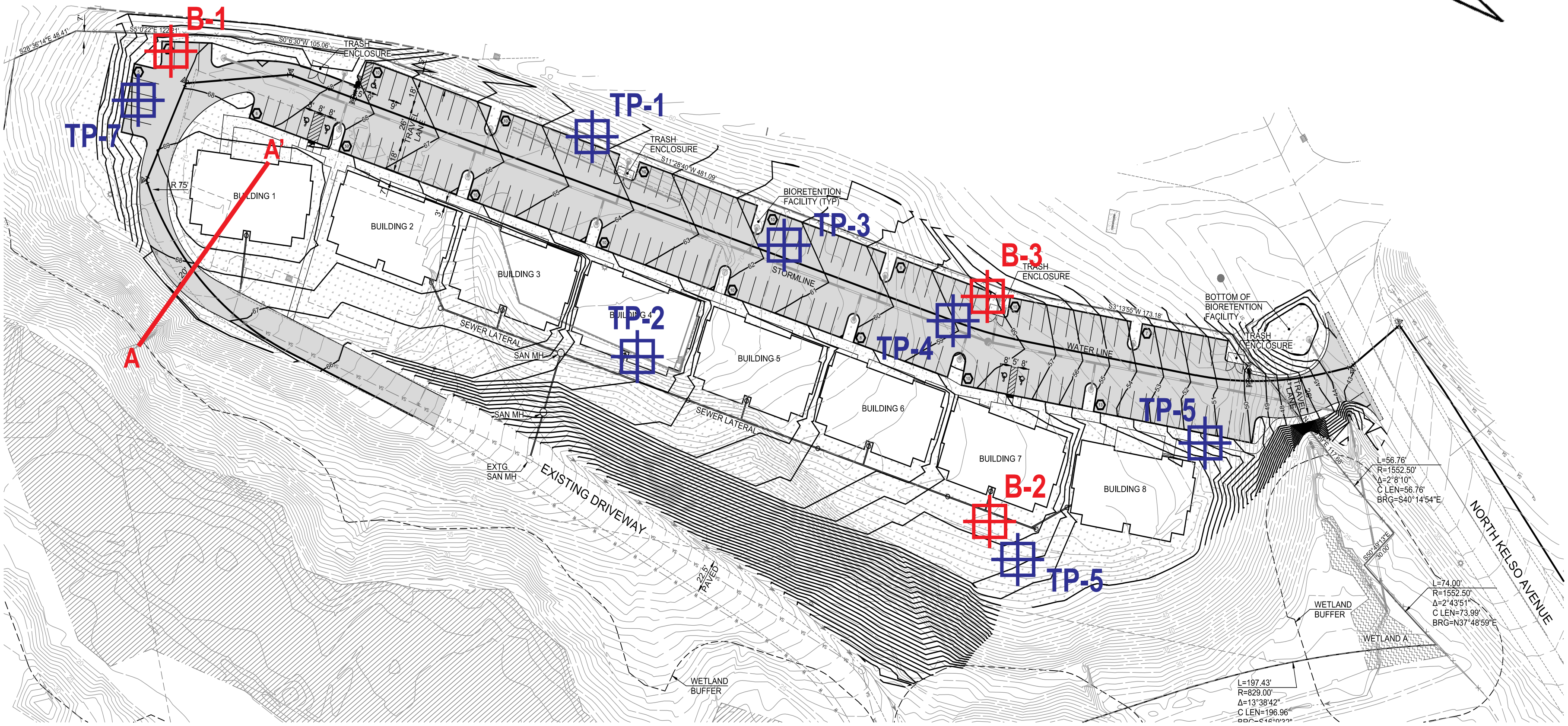
VICINITY MAP

N

Not to Scale

Soil and Water Technologies, Inc PO Box 59 Vancouver, WA 98666 PH: 360 281-5406 www.swt.ski	*CLIENT:* Mr. Jesse Brand	*DRAWN:*	JR
	PROJECT: Huntington Ridge Apts. 906 Croy Road Kelso, WA 98626	*DATE:*	3/14/2018
		FIGURE:	1
		PRO. #:	G0141800

Site Plan



Legend

B-1 ⌖ Boring Location

TP-1 ⌖ Test Pit Location

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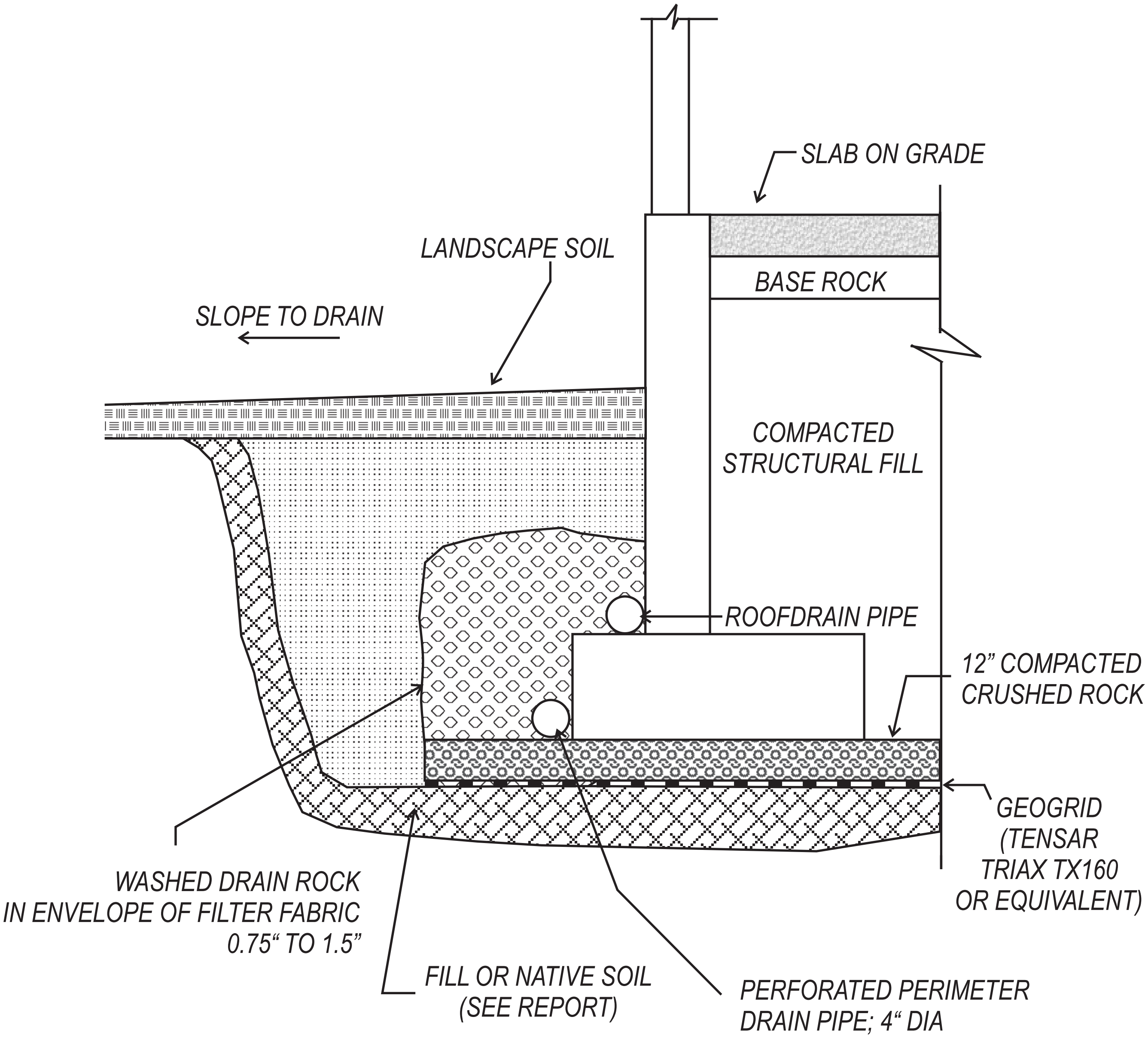
PROJECT: Huntington Ridge Apartments
906 Croy Road
Kelso, WA 98626

DRAWN: RN

DATE: 3/10/2020

FIGURE: 2

PRO. #: G0141800r



NOTES:

1. PERFORATED OR SLOTTED RIGID PVC PIPE WITH A POSITIVE DRAINAGE GRADIENT
2. FILTER SAND - FINE AGGREGATE FOR PORTLAND CEMENT; SECTION 9=03.1(2)
3. FILTER FABRIC OPTIONAL IF FILTER SAND USED
4. TWELVE INCHES OF COMPACTED CRUSHED ROCK BASE ABOVE A GEOTEXTILE GRID (SEE REPORT)

GRANULAR MAT SYSTEM & SUBDRAIN DETAIL

Not to Scale

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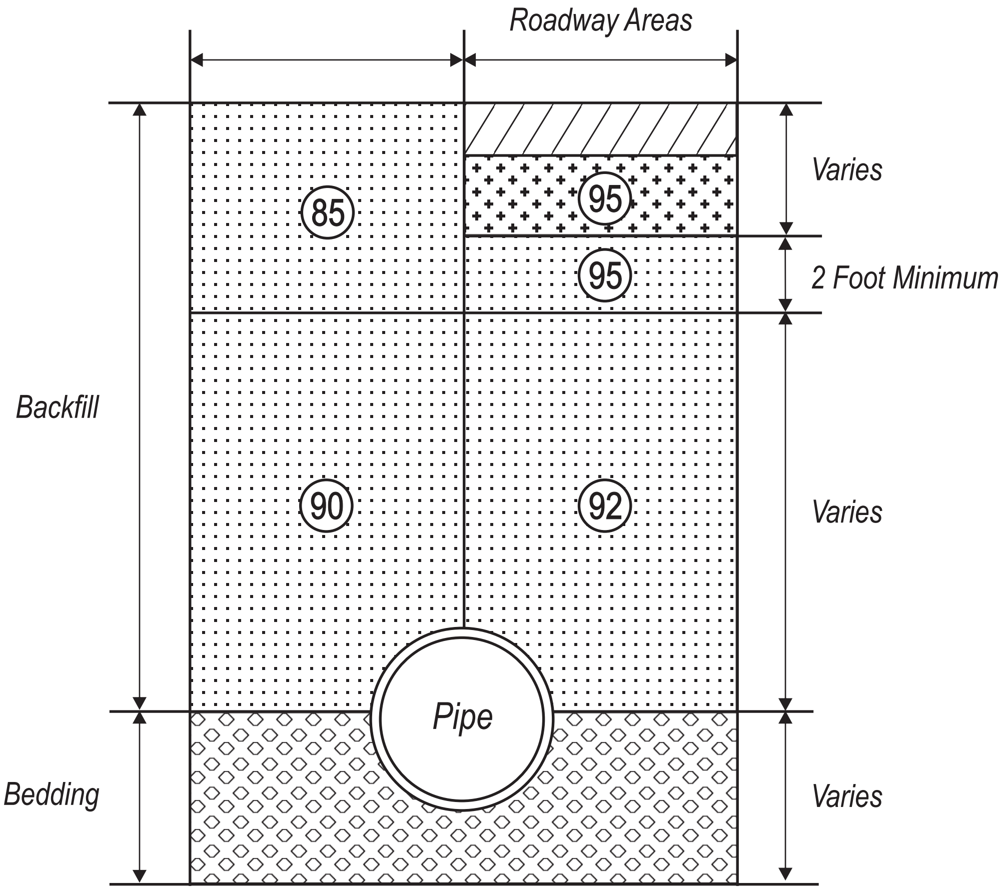
CLIENT:	Mr. Jesse Brand	DRAWN:	JR
PROJECT:	Huntington Ridge Apts. 906 Croy Road Kelso, WA 98626	DATE:	3/14/2018
		FIGURE:	3
		PRO. #:	G0141800



LEGEND

▨ *Asphalt or Concrete Pavement*

✚ *Roadway Base Material or Base Rock*

⁘ *Backfill: Compacted on-site soil or imported select fill material as described in the site preparation of the general Earthwork Section of the attached report text.*

(92) *Minimum percentage of maximum Laboratory Dry Density as determined by ASTM Test Method D1557 (Modified Proctor),unless otherwise specified in the attached report text.*

◇ *Bedding Material: Material type depends on type of pipe and laying conditions. Bedding should conform to the manufacturer's recommendations for the type of pipe selected.*

UTILITY TRENCH BACKFILL DETAIL

Not to Scale

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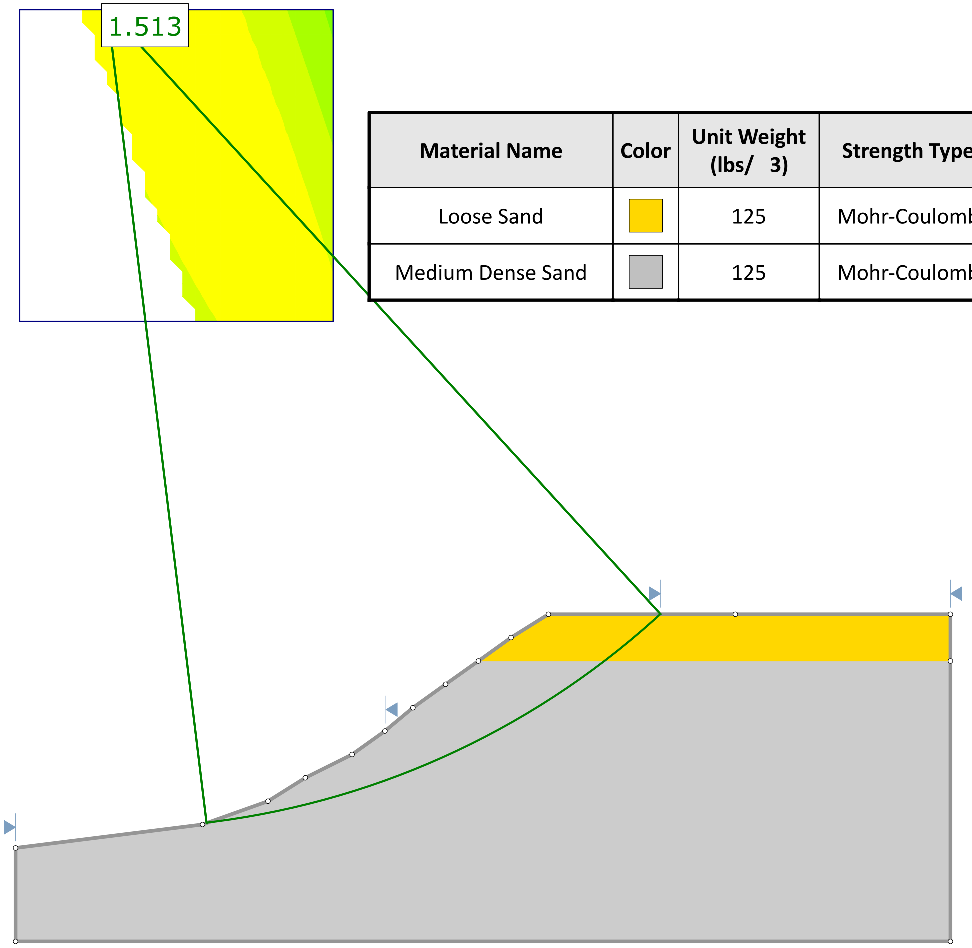
CLIENT:	Mr. Jesse Brand	*DRAWN:*	JR
PROJECT:	Huntington Ridge Apts. 906 Croy Road Kelso, WA 98626	*DATE:*	3/14/2018
		FIGURE:	4
		PRO. #:	G0141800

SLOPE STABILITY ANALYSIS RESULTS - STATIC



Material Name	Color	Unit Weight (lbs/ 3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Loose Sand	🟨	125	Mohr-Coulomb	0	32	None	0
Medium Dense Sand	⬜	125	Mohr-Coulomb	0	37	None	0

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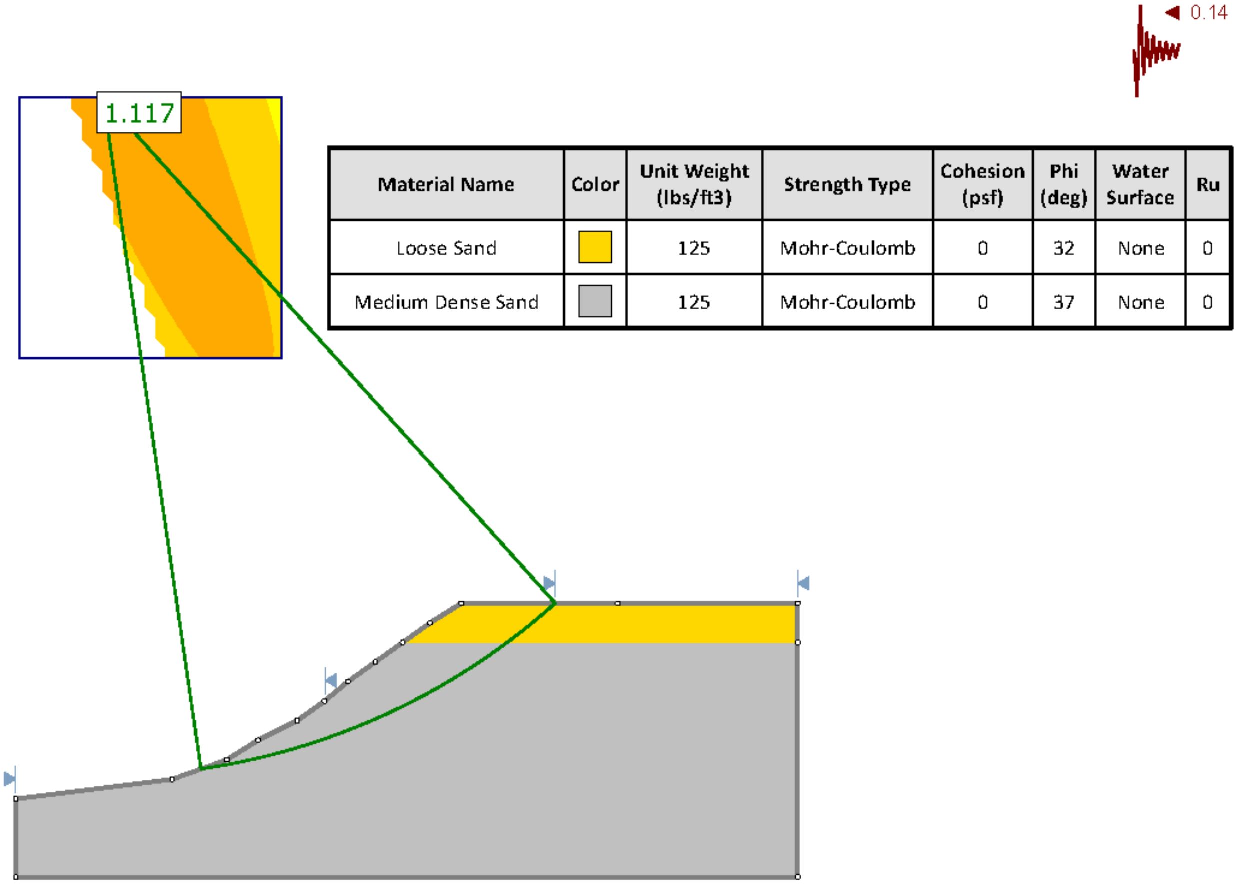
CLIENT: Mr. Jesse Brand
PROJECT: Huntington Ridge Apartments
906 Croy Road
Kelso, WA 98626

DRAWN: JR
DATE: 6/6/2018
FIGURE: 5a
PRO. #: G0141800

SLOPE STABILITY ANALYSIS RESULTS - PSEUDO-STATIC



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Loose Sand	🟨	125	Mohr-Coulomb	0	32	None	0
Medium Dense Sand	⬜	125	Mohr-Coulomb	0	37	None	0

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PROJECT:	Huntington Ridge Apartments 906 Croy Road Kelso, WA 98626	*DATE:*	6/6/2018
		FIGURE:	5b
		PRO. #:	G0141800

APPENDIX A

(FIELD EXPLORATION)

FIELD EXPLORATION

Our field exploration was performed on February 26th and April 6th, 2018. Subsurface conditions at the site were explored by excavating seven test pits to the maximum depth of eleven feet (11.0') below the existing ground surface. The test pits were excavated by the use of a Kubota 121 track hoe. Additionally, by use of a track mounted drill rig, three exploratory borings were excavated to a maximum depth of fifty-one and one-half feet (51.5') below the existing ground surface.

The approximate test pit and boring locations were determined by pacing from existing site features. The locations should be considered accurate only to the degree implied by the method used. These approximate locations are shown on the *Site Plan, Figure 2.*

The field exploration was monitored by two Soil and Water Technologies representatives, who classified the soil encountered and maintained a log of each test pit, obtained representative samples, and observed pertinent site features. Representative soil samples were placed in closed containers and returned to the laboratory for further examination and testing.

All samples were visually classified in accordance with the Unified Soil Classification System (USCS), which is presented on Plate A1. Logs of the test pits and borings are presented in Appendix A. The final logs represent our interpretations of the field logs and the results of the laboratory tests on field samples. The stratification lines on the logs represent the approximate boundaries between soil types. In fact, the transitions may be more gradual.

UNIFIED SOIL CLASSIFICATION SYSTEM
LEGEND

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

Topsoil	▨	*Humus and Duff Layer*
Fill	▦	*Highly Variable Constituents*

SAMPLING DESCRIPTIONS

●	*Grab Sample*
⊠	*SPT Drive Sampler (ASTM D1586)*
▯	*Shelby Tube Push Sampler (ASTM D1587)*
▥	*Dames and Moore Drive Sampler (ASTM D3550)*

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PROJECT:	Huntington Ridge Apts. 906 Croy Road Kelso, WA 98626	*DATE:*	3/19/2018
		PLATE:	A1
		PRO. #:	G0141800

LOG OF TEST PIT **TP-1**

ELEVATION: **+/- 71 feet**
EXPLORATORY EQUIPMENT: **TRACK HOE**
DATE: **4/6/2018**

DEPTH IN FEET	SAMPLES	SOILS CLASSIFICATION	LITHOLOGY (USGS)	COLOR	MOISTURE	CONSISTENCY	MOISTURE CONTENT % OF DRY WEIGHT	PERCENT PASS NUMBER 200
1		~ 10” Organic Topsoil		Dark Brown	Wet	Soft		
2 3	●	sandy **Silt** (ML) {Orange Mottling}		Orange Gray	Moist	Firm	20	-
4 5 6 7 8 9 10	●	silty **Sand** (SM) (Native)		Gray	Moist	Dense	20	-

Bottom of test pit at 10.0 feet below existing ground surface.
No groundwater or groundwater seepage encountered

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PROJECT:	Huntington Ridge Apartments 906 Croy Road Kelso, WA 98626	DATE:	4/13/2018
		PLATE:	A2
		PRO. #:	G0141800

LOG OF TEST PIT **TP-2**

ELEVATION: **+/- 65 feet**
EXPLORATORY EQUIPMENT: **TRACK HOE**
DATE: **4/6/2018**

DEPTH IN FEET	SAMPLES	SOILS CLASSIFICATION	LITHOLOGY (USGS)	COLOR	MOISTURE	CONSISTENCY	MOISTURE CONTENT % OF DRY WEIGHT	PERCENT PASS NUMBER 200
		~ 8" Organic Topsoil	░	Dark Brown	Wet	Soft		
1 2	●	*Undocumented Fill* *Silt, Clay & Concrete/Gravels* *(Fill)*	▨	Gray Brown	Damp	Soft	16	-
3 4 5 6	●	sandy **Silt** (ML) *(Native)*	▥	Brown	Moist	Firm	18	-
7 8 9 10	●	silty **Sand** (SM) *{Orange Mottling}*	▥	Brown Gray	Moist	Dense	29	-

Bottom of test pit at 10.0 feet below existing ground surface.
No groundwater or groundwater seepage encountered

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DRAWN: RN
DATE: 4/13/2018
PLATE: A3
PRO. #: G0141800

LOG OF TEST PIT ***TP-3***

ELEVATION: ***+/- 65 feet***
EXPLORATORY EQUIPMENT: ***TRACK HOE***
DATE: **4/6/2018**

DEPTH IN FEET	SAMPLES	SOILS CLASSIFICATION	LITHOLOGY (USGS)	COLOR	MOISTURE	CONSISTENCY	MOISTURE CONTENT % OF DRY WEIGHT	PERCENT PASS NUMBER 200
		~ 8" Organic Topsoil	░	*Dark Brown*	*Wet*	*Soft*		
1 2 3 4 5 6 7 8 9 10	●	silty **<u>Clay</u> (CL)** some sand *{Mottling}* *(Fill)*	▩	*Brown Gray*	*Very Moist*	*Stiff*	30	-

Bottom of test pit at 10.0 feet below existing ground surface.
No groundwater or groundwater seepage encountered

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PROJECT:	Huntington Ridge Apartments 906 Croy Road Kelso, WA 98626	*DATE:*	4/13/2018
		PLATE:	A4
		PRO. #:	G0141800

LOG OF TEST PIT **TP-4**

ELEVATION: ***+/- 60 feet***
EXPLORATORY EQUIPMENT: ***TRACK HOE***
DATE: ***4/6/2018***

DEPTH IN FEET	SAMPLES	SOILS CLASSIFICATION	LITHOLOGY (USGS)	COLOR	MOISTURE	CONSISTENCY	MOISTURE CONTENT % OF DRY WEIGHT	PERCENT PASS NUMBER 200
		~ 6” Organic Topsoil	░	*Dark Brown*	*Wet*	*Soft*		
1 2 3 4 5 6 7 8 9 10	●	*{Perched water}* *{Rock @ ~ 2.5 ft bgs}* silty **Clay** **(CL)** some sand *(Fill)*	▨	*Brown* *Gray* *Orange*	*Moist*	*Soft* *To* *Firm*	25	-

Bottom of test pit at 10.0 feet below existing ground surface.
No groundwater or groundwater seepage encountered

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PROJECT:	Huntington Ridge Apartments 906 Croy Road Kelso, WA 98626	*DATE:*	4/13/2018
		PLATE:	A5
		PRO. #:	G0141800

LOG OF TEST PIT **TP-5**

ELEVATION: ***+/- 50 feet***
EXPLORATORY EQUIPMENT: ***TRACK HOE***
DATE: ***4/6/2018***

DEPTH IN FEET	SAMPLES	SOILS CLASSIFICATION	LITHOLOGY (USGS)	COLOR	MOISTURE	CONSISTENCY	MOISTURE CONTENT % OF DRY WEIGHT	PERCENT PASS NUMBER 200
		~ 2" Organic Topsoil	░	*Dark Brown*	*Wet*	*Soft*		
1			▩					
2						*Soft*		
3						*To*		
4	●	sandy **Silt** **(CL)**		*Brown*	*Moist*	*Firm*	22	-
5								
6								
7								
8								
9								
10		*(Fill)*						

Bottom of test pit at 10.0 feet below existing ground surface.
No groundwater or groundwater seepage encountered

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DRAWN: RN
DATE: 4/13/2018
PLATE: A6
PRO. #: G0141800

LOG OF TEST PIT **TP-6**

ELEVATION: ***+/- 60 feet***
EXPLORATORY EQUIPMENT: ***TRACK HOE***
DATE: ***4/6/2018***

DEPTH IN FEET	SAMPLES	SOILS CLASSIFICATION	LITHOLOGY (USGS)	COLOR	MOISTURE	CONSISTENCY	MOISTURE CONTENT % OF DRY WEIGHT	PERCENT PASS NUMBER 200
		~ 6" Organic Topsoil	░	*Dark Brown*	*Wet*	*Soft*		
1			▨					
2	●	*{Rocks, gravel, cobbles, concrete @ ~2.5 ft. bgs}*	▨		*Very Moist To*		31	-
3			▨					
4	●		▨	*Light Brown*	*Moist*	*Soft*	26	-
5		silty **<u>Clay</u> (CL)** some sand	▨					
6			▨					
7			▨					
8			▨					
9		*(Fill)*	▨					
10								

Bottom of test pit at 10.0 feet below existing ground surface.
No groundwater or groundwater seepage encountered

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DRAWN: RN
DATE: 4/13/2018
PLATE: A7
PRO. #: G0141800

LOG OF TEST PIT **TP-7**

ELEVATION: ***+/- 72 feet***
EXPLORATORY EQUIPMENT: ***TRACK HOE***
DATE: ***4/6/2018***

DEPTH IN FEET	SAMPLES	SOILS CLASSIFICATION	LITHOLOGY (USGS)	COLOR	MOISTURE	CONSISTENCY	MOISTURE CONTENT % OF DRY WEIGHT	PERCENT PASS NUMBER 200
		~ 4" Organic Topsoil		*Dark Brown*	*Wet*	*Soft*		
1	●	*Gravels, sands & silts* *(Fill)*		*Dark Brown*	*Damp*	*Stiff*	11	12
2	●	sandy **Silt**		*Brown Gray*	*Moist*	*Soft*	25	73
3 4 5 6	 ●	silty **Sand (SM)**		*Light Brown Gray*	*Very Moist*	*Soft*	37	38
7 8 9 10	 ● 	clean **Sand (SP)** *(Native)*		*Gray*	*Very Moist*	*Soft*	31	14

Bottom of test pit at 10.0 feet below existing ground surface.
No groundwater or groundwater seepage encountered

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DRAWN: RN
DATE: 4/13/2018
PLATE: A8
PRO. #: G0141800

LOG OF BORING B-1

Page 1 of 3

DRIVING WEIGHT: **140 lb / 30" drop**
ELEVATION: **~75 feet**
DRILLING EQUIPMENT: **TRACK MOUNTED RIG**
DATE: **2/26/2018**

DEPTH IN FEET	SAMPLES	BLOWS PER FOOT	SOILS CLASSIFICATION	LITHOLOGY (USGS)	COLOR	MOISTURE	CONSISTENCY	MOISTURE CONTENT % OF DRY WEIGHT	PERCENT PASS NUMBER 200
1									
2									
	●	9			Light Brown	Very Moist	Loose	35	44
3									
4			**silty Sand (SM)**						
5	●	6			Light Brown	Very Moist	Loose	35	-
6									
7									
	●	5			Brown Gray	Very Moist	Loose	34	32
8			{Coarser}						
9									
10	●	6			Gray	Moist	Loose	30	-
11									
12									
	●	11			Gray	Moist	Med. Dense	21	32
13									
14									
15	●	11			Gray	Moist	Med. Dense	23	-
16									
17									
18									
19									

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DRAWN: JR
DATE: 3/19/2018
PLATE: B1-1
PRO. #: G0141800

LOG OF BORING B-1

Page 2 of 3

DRIVING WEIGHT: **140 lb / 30” drop**
ELEVATION: **~75 feet**
DRILLING EQUIPMENT: **TRACK MOUNTED RIG**
DATE: **2/26/2018**

DEPTH IN FEET	SAMPLES	BLOWS PER FOOT	SOILS CLASSIFICATION	LITHOLOGY (USGS)	COLOR	MOISTURE	CONSISTENCY	MOISTURE CONTENT % OF DRY WEIGHT	PERCENT PASS NUMBER 200
20	●	10			Gray	Moist	Loose	22	42
21									
22			**silty Sand (SM)**						
23			*harder drilling*						
24									
25	●	20			Gray	Moist	Med. Dense	29	-
26									
27									
28									
29									
30	●	31			Gray	Damp	Dense	18	-
31									
32									
33									
34									
35	●	29			Gray	Damp	Med. Dense	19	36
36									
37									
38									

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PLATE: B1-2
PRO. #: G0141800

LOG OF BORING B-1

Page 3 of 3

DRIVING WEIGHT: **140 lb / 30" drop**
ELEVATION: **~75 feet**
DRILLING EQUIPMENT: **TRACK MOUNTED RIG**
DATE: **2/26/2018**

DEPTH IN FEET	SAMPLES	BLOWS PER FOOT	SOILS CLASSIFICATION	LITHOLOGY (USGS)	COLOR	MOISTURE	CONSISTENCY	MOISTURE CONTENT % OF DRY WEIGHT	PERCENT PASS NUMBER 200
40	●	30			Gray	Moist	Dense	20	-
41									
42			**silty Sand (SM)**						
43									
44									
45	●	40	{Coarser}		Gray	Damp	Dense	12	-
46									
47									
48									
49									
50	●	42			Gray	Moist	Dense	26	48
51									

Bottom of boring @ 51.5 feet below existing ground surface.
No groundwater or groundwater seepage encountered.

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DATE: 3/19/2018
PLATE: B1-3
PRO. #: G0141800

LOG OF BORING **B-2**

Page 1 of 2

DRIVING WEIGHT: **140 lb / 30" drop**
ELEVATION: **~55 feet**
DRILLING EQUIPMENT: **TRACK MOUNTED RIG**
DATE: **2/26/2018**

DEPTH IN FEET	SAMPLES	BLOWS PER FOOT	SOILS CLASSIFICATION	LITHOLOGY (USGS)	COLOR	MOISTURE	CONSISTENCY	MOISTURE CONTENT % OF DRY WEIGHT	PERCENT PASS NUMBER 200
1				▨					
2				▨					
	●	2	silty **Clay** (CL) {trace sand, rock fragments}	▨	Brown	Very Moist	Soft	32	-
3				▨					
4				▨					
5	●	5		▨	Brown	Moist	Firm	26	-
6				▨					
7				▨					
	●	3	silty **Clay** (CL) {trace sand} Dames & Moore sample collected at 9.0 feet Atterberg Limits: (LL-23 PL-14 PI-9)	▨	Blue Gray	Moist	Soft	26	-
8				▨					
9	●			▨					
10	●	6		▨	Blue Gray	Moist	Firm	24	-
11				▨					
12				▨					
	●	0		▨	Blue Gray	Moist	Very Soft	25	-
13				▨					
14				▨					
15	●	5	(Fill)	▨	Blue Gray	Moist	Firm	28	-
16				▥					
17			**silty Sand (SM)**	▥	Light Brown	-	-	-	-
18				▥					
19				▥					

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PLATE: B2-1
PRO. #: G0141800

LOG OF BORING **B-2**

Page 2 of 2

DRIVING WEIGHT: **140 lb / 30” drop**
ELEVATION: **~55 feet**
DRILLING EQUIPMENT:
DATE: **2/26/2018**

DEPTH IN FEET	SAMPLES	BLOWS PER FOOT	SOILS CLASSIFICATION	LITHOLOGY (USGS)	COLOR	MOISTURE	CONSISTENCY	MOISTURE CONTENT % OF DRY WEIGHT	PERCENT PASS NUMBER 200
20	●	4			Light Brown	Very Moist	Loose	35	-
21									
22			**silty Sand (SM)**						
23									
24									
25	●	8	*Dames & Moore sample collected at 25.0 feet*		Light Brown	Moist	Loose	30	-
26									
27									
28			*harder drilling*						
29									
30	●	19			Light Brown	Moist	Med. Dense	25	-
31									

Bottom of boring @ 31.5 feet below existing ground surface.
No groundwater or groundwater seepage encountered.

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DRAWN: JR
DATE: 3/19/2018
PLATE: B2-2
PRO. #: G0141800

LOG OF BORING B-3

Page 1 of 2

DRIVING WEIGHT: **140 lb / 30" drop**
ELEVATION: **~50 feet**
DRILLING EQUIPMENT: **TRACK MOUNTED RIG**
DATE: **2/26/2018**

DEPTH IN FEET	SAMPLES	BLOWS PER FOOT	SOILS CLASSIFICATION	LITHOLOGY (USGS)	COLOR	MOISTURE	CONSISTENCY	MOISTURE CONTENT % OF DRY WEIGHT	PERCENT PASS NUMBER 200
1 2 3	●	7	silty **Clay (CL)** *{trace sand}* *Dames & Moore sample collected at 2.5 feet* *Atterberg Limits: (LL-36 PL-21 PI-15)*	▨	Brown	Moist	Firm	25	-
4 5 6	●	7	silty **Clay (CL)** *{trace sand and gravel}*	▨	Brown Gray Orange	Moist	Firm	23	-
7 8	●	6		▨	Blue Gray	Moist	Firm	25	-
9 10 11	●	3		▨	Blue Gray	Very Moist	Soft	33	-
12 13	●	4		▨	Blue Gray	Moist	Firm	29	-
14 15 16 17 18 19	●	4	(Fill)	▨	Blue Gray	Moist	Firm	29	-

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CLIENT:	Mr. Jesse Brand	DRAWN:	JR
PROJECT:	Huntington Ridge Apartments 906 Croy Road Kelso, WA 98626	DATE:	3/19/2018
		PLATE:	B3-1
		PRO. #:	G0141800

LOG OF BORING **B-3**

Page 2 of 2

DRIVING WEIGHT: **140 lb / 30” drop**
ELEVATION: **~50 feet**
DRILLING EQUIPMENT:
DATE: **2/26/2018**

DEPTH IN FEET	SAMPLES	BLOWS PER FOOT	SOILS CLASSIFICATION	LITHOLOGY (USGS)	COLOR	MOISTURE	CONSISTENCY	MOISTURE CONTENT % OF DRY WEIGHT	PERCENT PASS NUMBER 200
20 21	●	11	silty **Clay** **(CL)** *{trace sand}* *(Fill)*	▩	Blue Gray	Moist	Stiff	29	-
22 23 24 25 26	●	10	**silty Sand (SM)** *(Native)*	▥	Light Brown	Moist	Loose	27	-

Bottom of boring @ 26.5 feet below existing ground surface.
No groundwater or groundwater seepage encountered.

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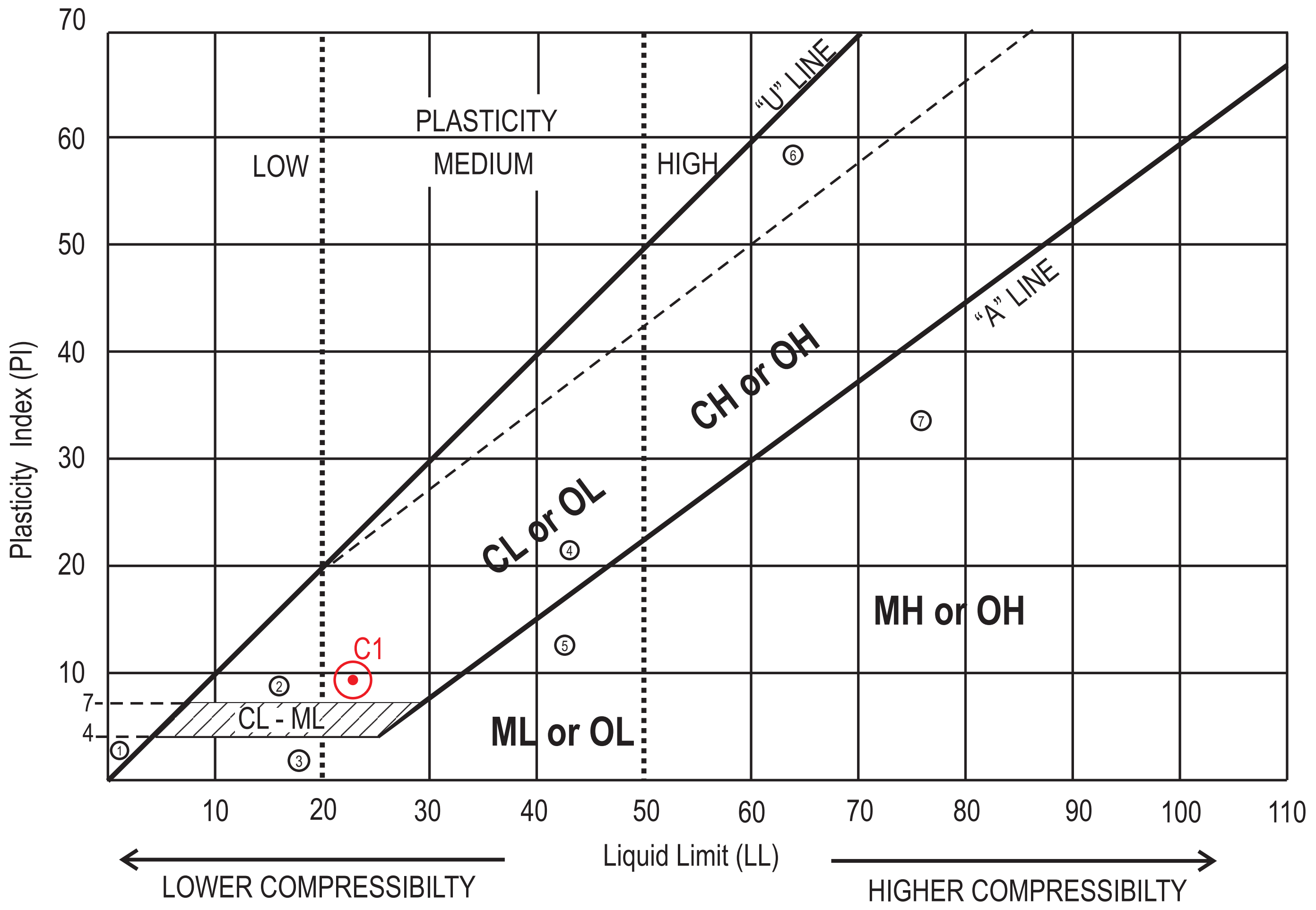
DRAWN: JR
DATE: 3/19/2018
PLATE: B3-2
PRO. #: G0141800

APPENDIX B

(LABORATORY TESTING)

ATTERBERG LIMITS

(ASTM D4318)



Legend

◉ B2 at 9.0 feet - **silty Clay (CL)**

C1 (LL-23 PL-14 PI-9)

1. COHESIONLESS SOILS
2. INORGANIC CLAYS, LOW PLASTICITY
3. INORGANIC SILTS, LOW COMPRESSIBILTY
4. INORGANIS CLAYS, MEDIUM PLASTICITY
5. INORGANIC SILTS AND ORGANIC CLAYS, MEDIUM COMPRESSIBILITY
6. INORGANIC CLAYS, HIGH PLASTISICTY
7. INORGANIC SILTS AND ORGANIC CLAYS, HIGH COMPRESSIBILTY

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DRAWN: JR

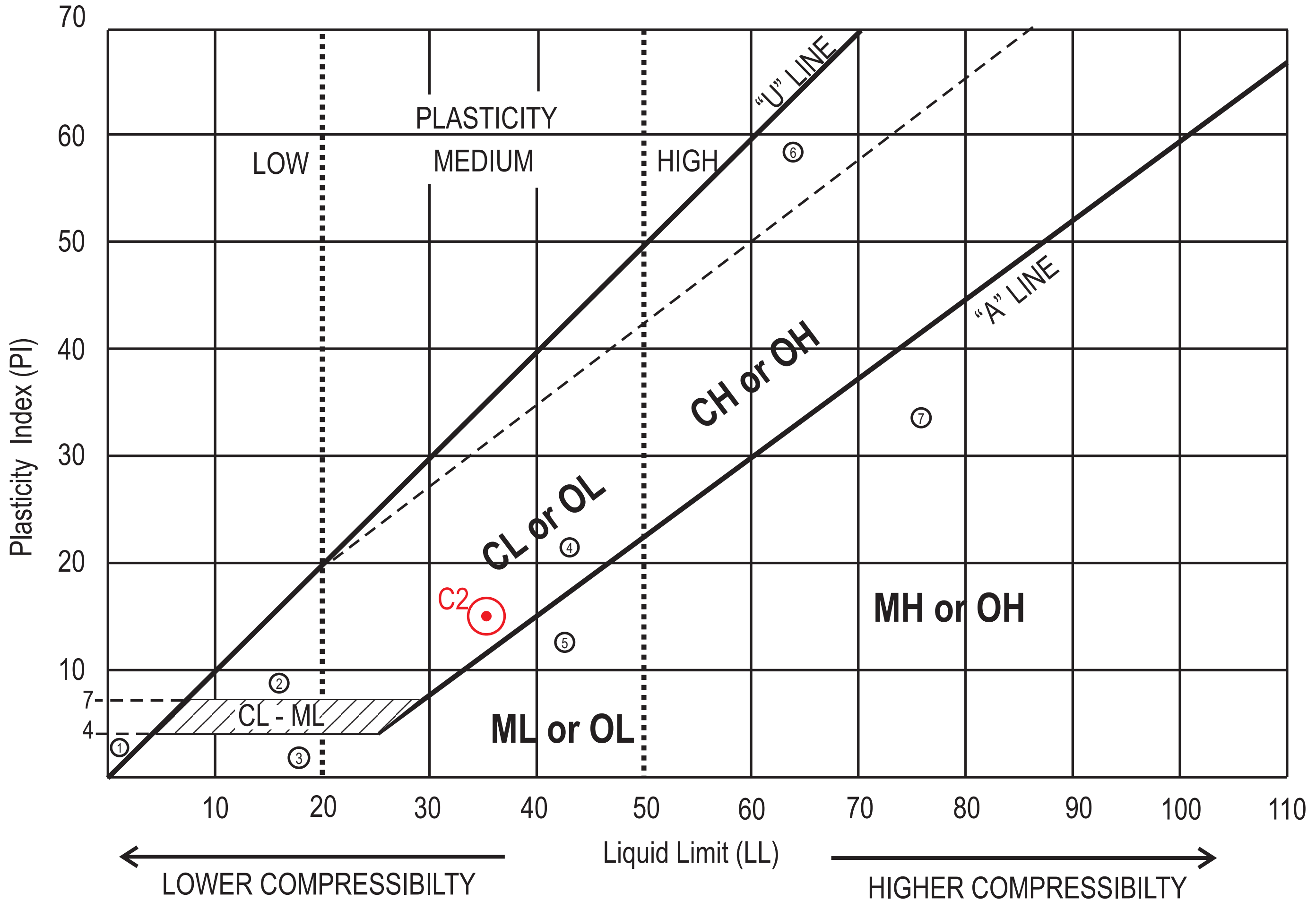
DATE: 4/17/2018

PLATE: C1

PRO. #: G0141800

ATTERBERG LIMITS

(ASTM D4318)



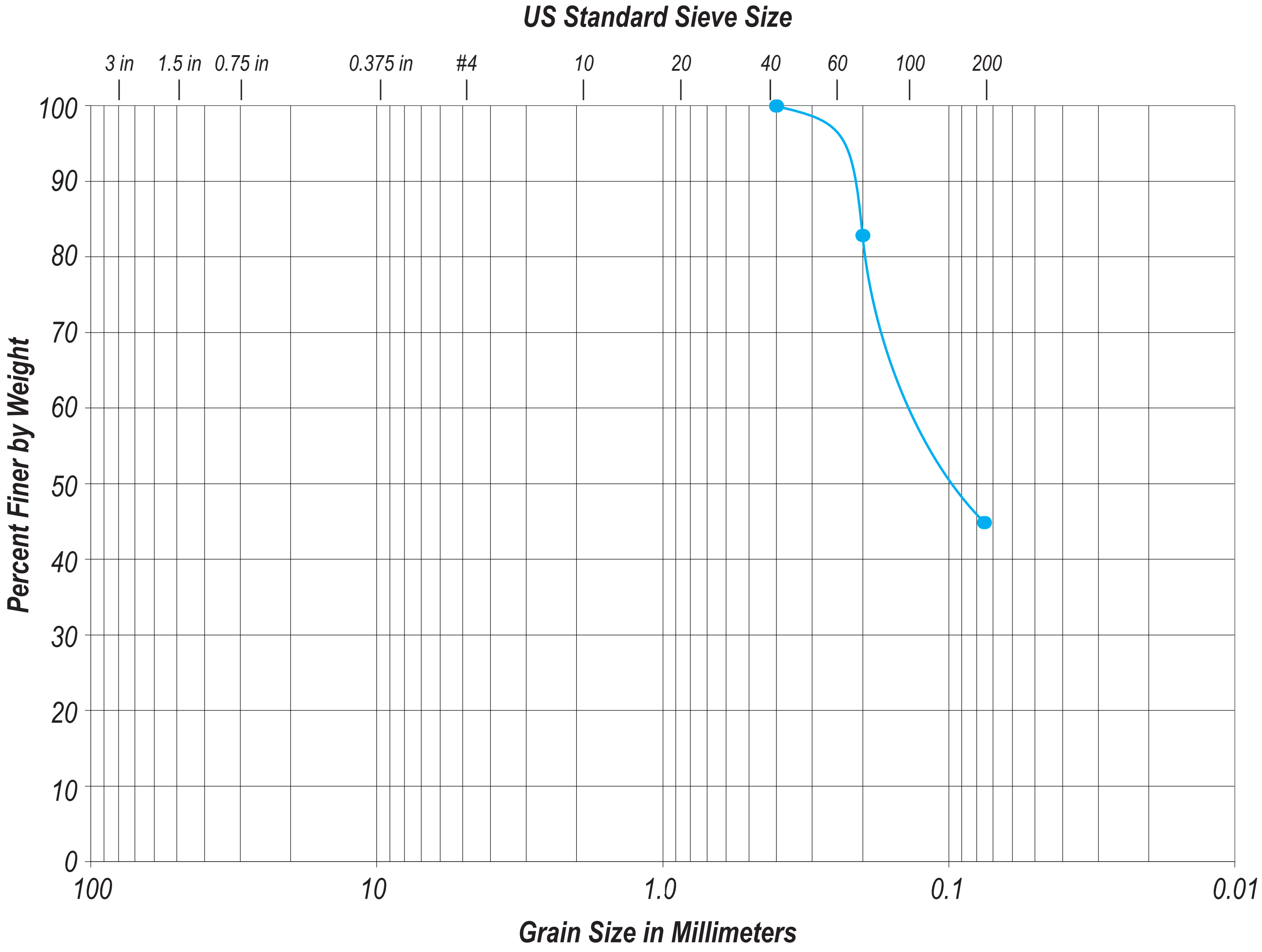
Legend

⦿ C2 B3 at 2.5 feet - **silty Clay (CL)**
(LL-36 PL-21 PI-15)

1. COHESIONLESS SOILS
2. INORGANIC CLAYS, LOW PLASTICITY
3. INORGANIC SILTS, LOW COMPRESSIBILTY
4. INORGANIS CLAYS, MEDIUM PLASTICITY
5. INORGANIC SILTS AND ORGANIC CLAYS, MEDIUM COMPRESSIBILITY
6. INORGANIC CLAYS, HIGH PLASTISICTY
7. INORGANIC SILTS AND ORGANIC CLAYS, HIGH COMPRESSIBILTY

Soil and Water Technologies, Inc
PO Box 59
Vancouver, WA 98666
PH: 360 281-5406
www.swt.ski

CLIENT:	Mr. Jesse Brand	*DRAWN:*	JR
PROJECT:	Huntington Ridge Apartments 906 Croy Road Kelso, WA 98626	*DATE:*	4/17/2018
		PLATE:	C2
		PRO. #:	G0141800



Gravel		Sand			Silt & Clay
Coarse	Fine	Coarse	Medium	Fine	---

GRAIN SIZE DISTRIBUTION

B-1 at 2.5 feet
Native fine silty Sand (SM)
with 44% passing the #200 Sieve

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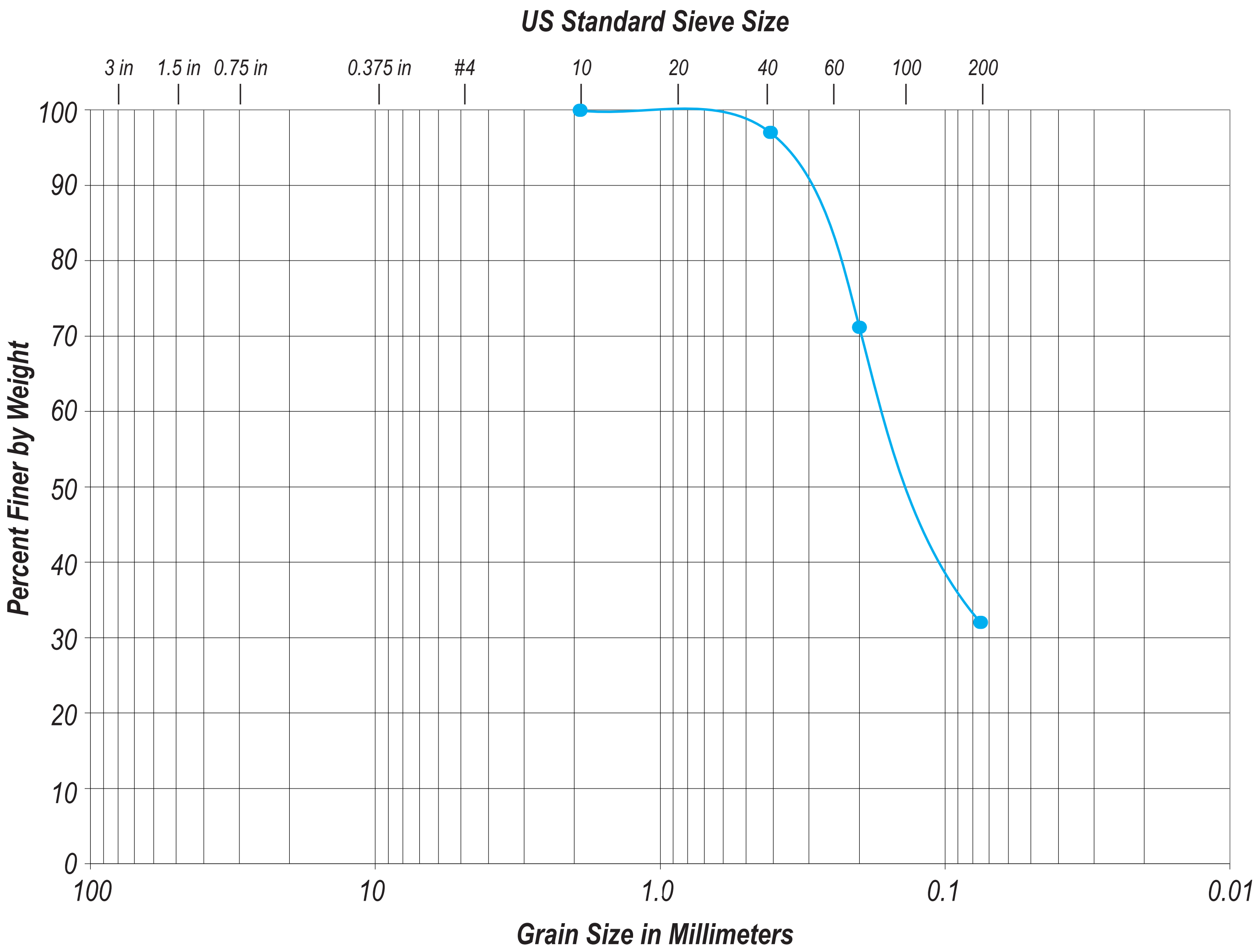
CLIENT:	Mr. Jesse Brand
PROJECT:	Huntington Ridge Apartments 906 Croy Road Kelso, WA 98626

DRAWN:	JR
DATE:	3/19/2018
PLATE:	D1
PRO. #:	G0141800



Gravel		Sand			Silt & Clay
Coarse	Fine	Coarse	Medium	Fine	---

GRAIN SIZE DISTRIBUTION

B-1 at 7.5 feet
Native fine silty Sand (SM)
with 32% passing the #200 Sieve

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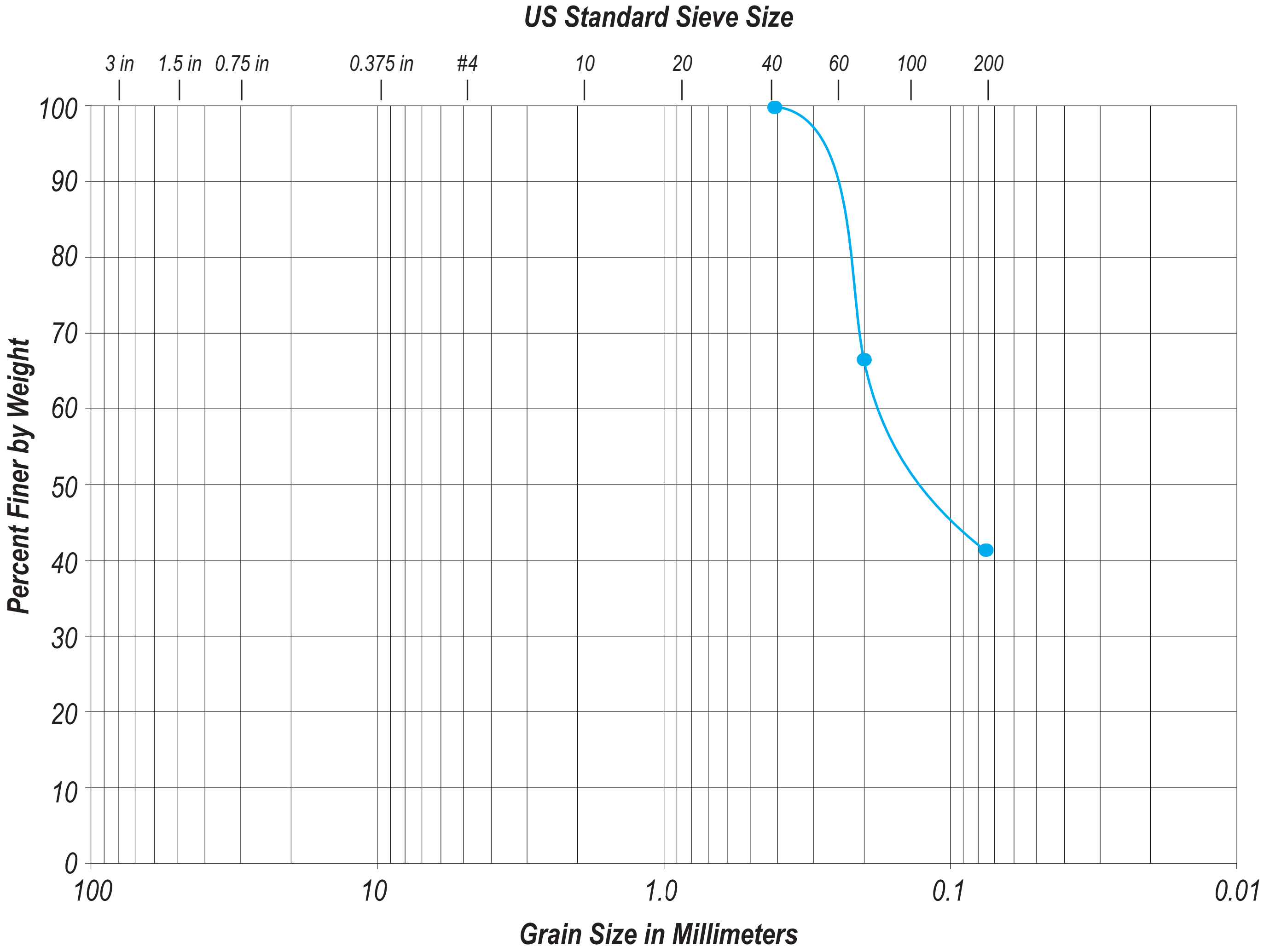
CLIENT: Mr. Jesse Brand
PROJECT: Huntington Ridge Apartments
906 Croy Road
Kelso, WA 98626

DRAWN: JR
DATE: 3/19/2018
PLATE: D2
PRO. #: G0141800



Gravel		Sand			Silt & Clay
Coarse	Fine	Coarse	Medium	Fine	---

GRAIN SIZE DISTRIBUTION

B-1 at 20 feet
Native fine silty Sand (SM)
with 42% passing the #200 Sieve

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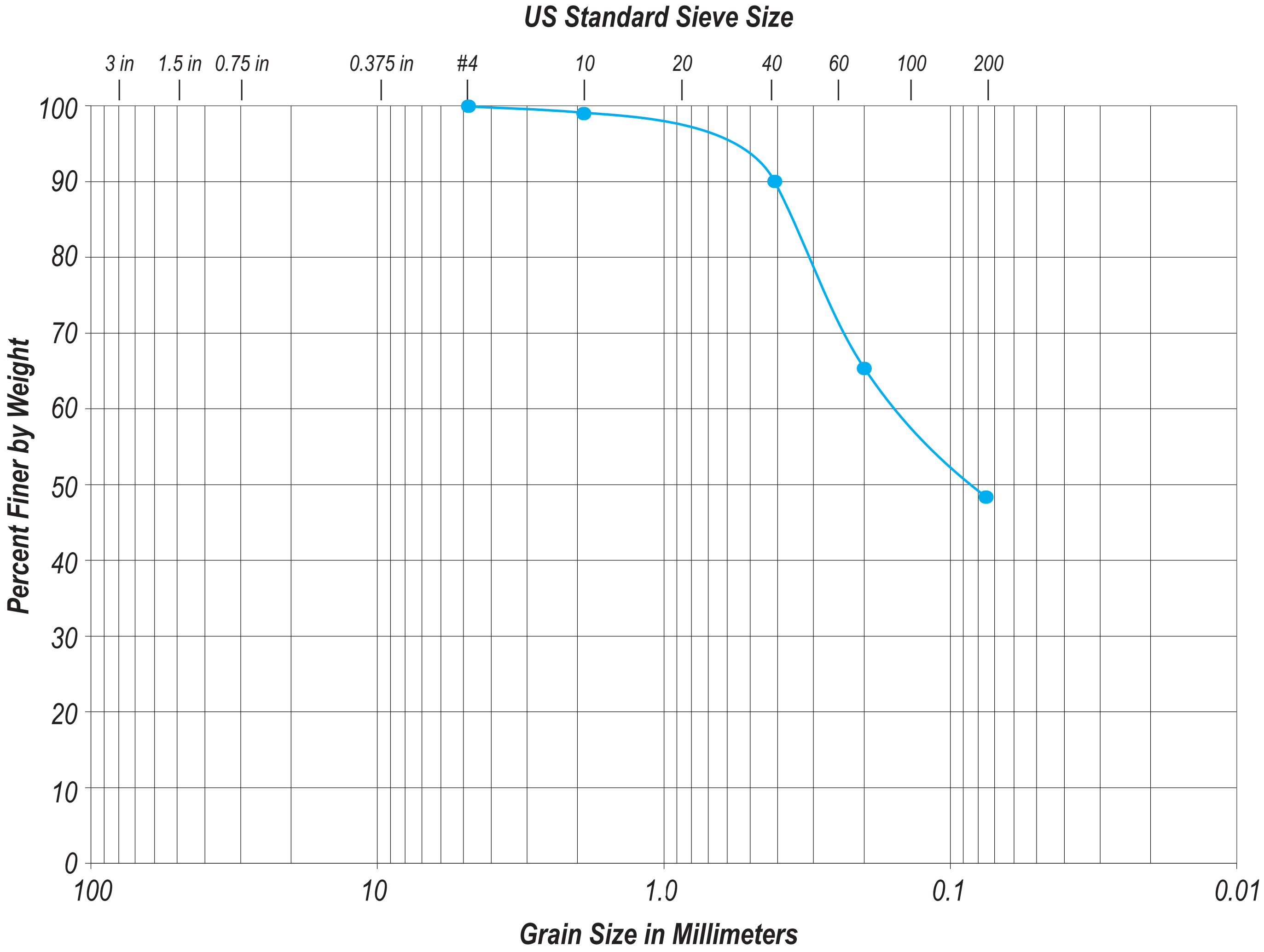
CLIENT:	Mr. Jesse Brand	DRAWN:	JR
PROJECT:	Huntington Ridge Apartments 906 Croy Road Kelso, WA 98626	DATE:	3/19/2018
		PLATE:	D3
		PRO. #:	G0141800



Gravel		Sand			Silt & Clay
Coarse	Fine	Coarse	Medium	Fine	---

GRAIN SIZE DISTRIBUTION

B-1 at 50 feet
Native fine silty Sand (SM)
with 48% passing the #200 Sieve

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CLIENT:	Mr. Jesse Brand	DRAWN:	JR
PROJECT:	Huntington Ridge Apartments 906 Croy Road Kelso, WA 98626	DATE:	3/19/2018
		PLATE:	D4
		PRO. #:	G0141800