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MEMORANDUM

DATE: December 7, 2015

TO: CJ Dens Lacamas I, LLC
Attention: Mr. Carl Lawson

FROM: Daniel J. Trisler, PE
Rachel Pirot, LG, LEG

RE: **Initial Site-Specific Evaluation of Geohazard Areas A and C**
Camas Subdivision – Leadbetter Road
Camas, Washington
15948-02

CC: Mackenzie – Brian Hollenback, Todd Johnson
HFI Consultants – Tim Halme-

Rachel Pirot

Introduction

Hart Crowser, Inc. is pleased to submit this memorandum to CJ Dens Lacamas I, LLC, summarizing our evaluation of Geohazard Areas A and C at the proposed subdivision development along Leadbetter Road in Camas, Washington. The proposed subdivision is an undeveloped property on the northeast side of Leadbetter Road, north of Leadbetter Lake, as described in our Critical Areas Report – Update (CAR Update) for the development, dated March 19, 2013.

Two specific geohazard areas were identified and described in the CAR Update that required further site specific-evaluation: Geohazard Areas A and C. The purpose of this evaluation was to gather additional information and provide recommendations to help you assess the general economic feasibility of developing these two areas. Our specific scope of work was detailed in our contract change agreement with you, dated October 14, 2015, and generally included a geologic reconnaissance of the two areas, test pit explorations, an evaluation of the hazards based on our field work, and preparation of this memorandum summarizing our evaluation and recommendations.

The location of the site is shown on Figure 1. The locations of Geohazard Areas A and C and our recent test pit explorations are shown on Figure 2.

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Site Conditions

We conducted a geotechnical reconnaissance and completed test pits at the two sites on November 23, 2015. Our updated findings from these investigations are described in detail below.

Surface Conditions

Site conditions in the general area of Geohazard Areas A and C consist of a northwest-trending slope abutting the north side of Leadbetter Road with flat slopes on the south side of the road leading to Lacamas Lake. The overall gradient of the northwest-trending slope is moderate, but with locally variable landforms and resulting gradients that are gentle to steep. Elevations range from approximately 190 feet above mean sea level (MSL) at Leadbetter Road to 320 feet MSL at the top of the northwest-trending slope, above both geohazard areas. Although gradients are variable, landforms are generally well-weathered and without abrupt transitions or other features indicative of accelerated erosional processes or earth movement. Prior to current logging activities, the area was forested with a dense mostly coniferous second-growth stand of timber and the ground surface well-vegetated with native understory plants. Conditions at each area specifically are described separately below.

Geohazard Area A

Geohazard Area A consists of an arcuate-shaped landform extending perpendicular to the predominant southwest-facing slope. The feature includes a steeper arcuate upper slope and convex lower toe slope that could be interpreted as the headscarp and toe, respectively, of a landslide.

During our reconnaissance, we observed these and associated features. We noted that the slope of the potential headscarp is only minimally steeper than adjacent slopes and the landform is not well-formed. No exposed soil or ground cracks were observed within it. Slopes in the body of the landform were gentle, approximately 25 to 30 percent. No developed stream channels, seeps or springs were observed within or adjacent to the feature. The area has irregular topography and several trees were observed to have experienced wind throw. The root balls of these trees were exposed and shallow bedrock was observed entangled with the roots. Relatively flat benches cut across the slopes in this area and are interpreted as old logging roads. At the toe of the slope, the cut for Leadbetter Road exposes volcanic rock that holds a vertical face and appears in-place.

The area is heavily vegetated with conifer to approximately 12 to 24 inches in diameter. The conifer trees are straight-trunked except immediately adjacent to Leadbetter Road, where they lean and exhibit bowed trunks. The bowed and leaning conifers continue along Leadbetter Road throughout the area and are not limited to Geohazard Area A.

Geohazard Area C

Geohazard Area C is a complex and irregular landform divided into a lower portion ("Older Debris Flow") and an upper portion ("Recent Debris Flow"). The upper portion is a narrow swale that extends to a distinct break in the southwest-facing slope at about elevation 270 feet MSL. The lower portion is a broader fan with very gentle slopes on both sides of Leadbetter Road.

During our reconnaissance we traversed up the upper portion and found it to consist of a saddle or swale in the otherwise continuous ridgetop. The saddle was slightly arcuate but landforms appeared mature and slopes were 25 to 35 percent. The upper portion of the saddle opened up to flat ground above, and no potential source area for past or future debris flows was observed. The ridgetop was weathered and rounded with gentle slopes and subdued features. The previously mapped geohazard area had a grade of approximately 25 percent in the upper slopes, which flattened to 10 to 20 percent downhill. The lower portion of the slopes were dominated by a wide, relatively flat bench with gentle undulating hummocks. No seeps or springs were observed, and no streams or erosive process at the toe of the slope of deposits were observed. No outcrops exposed bedrock geology directly within Geohazard Area C.

The lower portion of Geohazard Area C was thickly wooded with straight trunked conifers while the upper portion was characterized by a lack of mature conifers and was primarily forested with deciduous trees. Conifer trees where present were predominately straight throughout the area. Timber age and type were generally consistent between Geohazard Area C and other areas of the site.

Subsurface Conditions

Our understanding of the subsurface conditions is based on research and information collected from our field explorations completed for this project. Our explorations consisted of nine test pits and four potholes. (Potholes were test pits that encountered bedrock at very shallow depth, and for which formal test pit logs were not created.) The locations of the explorations are shown on Figure 2. Attachment A presents logs of the test pits. Samples of the soils were collected during the explorations for potential future laboratory testing, though no laboratory testing was conducted as part of this current scope of work.

Soil and Bedrock

Geohazard Area A

The bedrock geology at Geohazard Area A was interpreted to be Basaltic Andesite of Elkhorn Mountain, as discussed in our March 19, 2013 CAR Update. Test pits TP-7 and TP-8 and two additional potholes in this area exposed moderately strong bedrock at 2 to 4 feet below ground surface (bgs). In place jointing of the basaltic andesite was observed in the test pit walls. The overlying material encountered was colluvial gravel, cobbles, and silt. Two additional potholes adjacent to Geohazard Area A encountered a thin (1 to 3 feet) veneer of colluvium over what appeared to be in-place basaltic andesite. We observed no definitive signs of past landsliding or slope movement within the materials exposed in the test pits and pot holes.

Geohazard Area C

Our test pits in Geohazard Area C encountered fine-grained silty soils over sandy residual soil which transitioned into Volcaniclastic Sedimentary bedrock. The surficial silty soil had a disturbed texture, although we observed no definitive signs of disturbance from landsliding (e.g., slickensides, etc.). In place bedding structures were observed in the residual soil and bedrock. Our test pits in this area encountered bedrock at between 3 and 13 feet bgs.

Groundwater

Groundwater and signs of groundwater (e.g., mottling, etc.) were not encountered in our test pits. Based on the previous Level 1 Hydrogeologic Assessment, dated March 19, 2013, depth to the regional groundwater level is expected to vary from approximately 50 to 100 feet bgs. However, we anticipate that locally perched groundwater will be encountered above the bedrock materials encountered at the site.

Conclusions

Based on our geotechnical reconnaissance and limited subsurface investigation it is our opinion that Geohazard Areas A and C do not present geologic hazards to the project that cannot be reasonably mitigated. We did not observe surface or subsurface signs of active landsliding and the potential for future landsliding in these areas appears low. It is our opinion, based on the observed surface and subsurface conditions, that future development of these areas is feasible with limited mitigation measures, which can be finalized during final design. Therefore, immediate logging of these areas is acceptable, as they can be included within the overall subdivision development.

Slopes across the site and within the previously mapped geohazard areas are gentle with weathered landforms and subdued topographic expression. No significant source areas or geomorphic processes, such as stream erosion or rapid downcutting, were observed that might cause slope movement in either area. Timber age and type are consistent across the site without significant differences within the geohazard areas. Bowed and tilted conifer trees were only observed adjacent the full length of Leadbetter Road, and therefore, suggest the cause of the bowing and tilting is related to the roadway, not slope movement from landsliding.

In Geohazard Area A, shallow bedrock was encountered in the test pits and previously mapped adjacent outcrops also indicate shallow bedrock depths. Bedrock was also exposed in the root balls of wind thrown trees. The hummocky features observed are likely due to wind throw of trees in shallow soils and grading of old logging roads across the area. It is our opinion, based on the observed features and shallow bedrock encountered in our explorations, that the landform mapped as Geohazard Area A was not formed by a landslide, but the result of bedrock geologic conditions and normal weathering processes. In our opinion Geohazard Area A can henceforth be considered similarly with the rest of the development and specific mitigation for geohazards is not needed in this area. This area is suitable for future development, provided that the recommendations outlined below are followed.

In Geohazard Area C, the disturbed soil and fan morphology observed on site are likely the result of very old debris flows and/or colluvial processes. However, slopes in this area have been extensively modified by weathering since those processes were active. Landforms within the mapped Geohazard Area C exhibit very weathered and rounded topography with gentle slopes. Active driving processes for slope movement, such as streams or erosion at the toe of the deposit, were absent. No obvious source areas were observed for future debris flows. Additionally no discrete failure zone was identifiable in the test pits. Currently conditions to result in debris flows and landsliding appear to be low. This area is suitable for future development, provided that the recommendations outlined below are followed.

Based on our observations and evaluation, it is our opinion that the proposed development is feasible in both Geohazard Areas A and C. Development in these areas in accordance with the *Preliminary Recommendations* section of this memorandum should not adversely affect the stability of the site or neighboring properties. Final design should include additional evaluation and final recommendations related to these areas.

Preliminary Recommendations

As outlined in the CAR Update, general hillside development guidelines should be followed during the design and construction stages. Final geotechnical design recommendations will be developed at the time a full geotechnical investigation is completed. However, a summary of the anticipated general guidelines is provided below.

- Hillside grading methodologies shall be employed for earthwork in all sloping areas, including previously mapped Geohazard Areas A and C. This will likely include keys and benches, installation of sub drains where seepage is encountered, and installation of all material as a compacted structural fill. Limits on fill depths may also be necessary in some areas.
- A detailed erosion and sediment control plan will be required as part of the proposed development.
- In general, we anticipate that homes will be supported by conventional spread footings. However, homes near existing or new steep slopes may require the use of deepened footings, drilled piers, or larger slope setbacks.

- We recommend against the use of infiltration systems for disposal of stormwater from the site. Foundation subdrains may be required around homes to reduce the potential for water seepage in crawlspace areas.

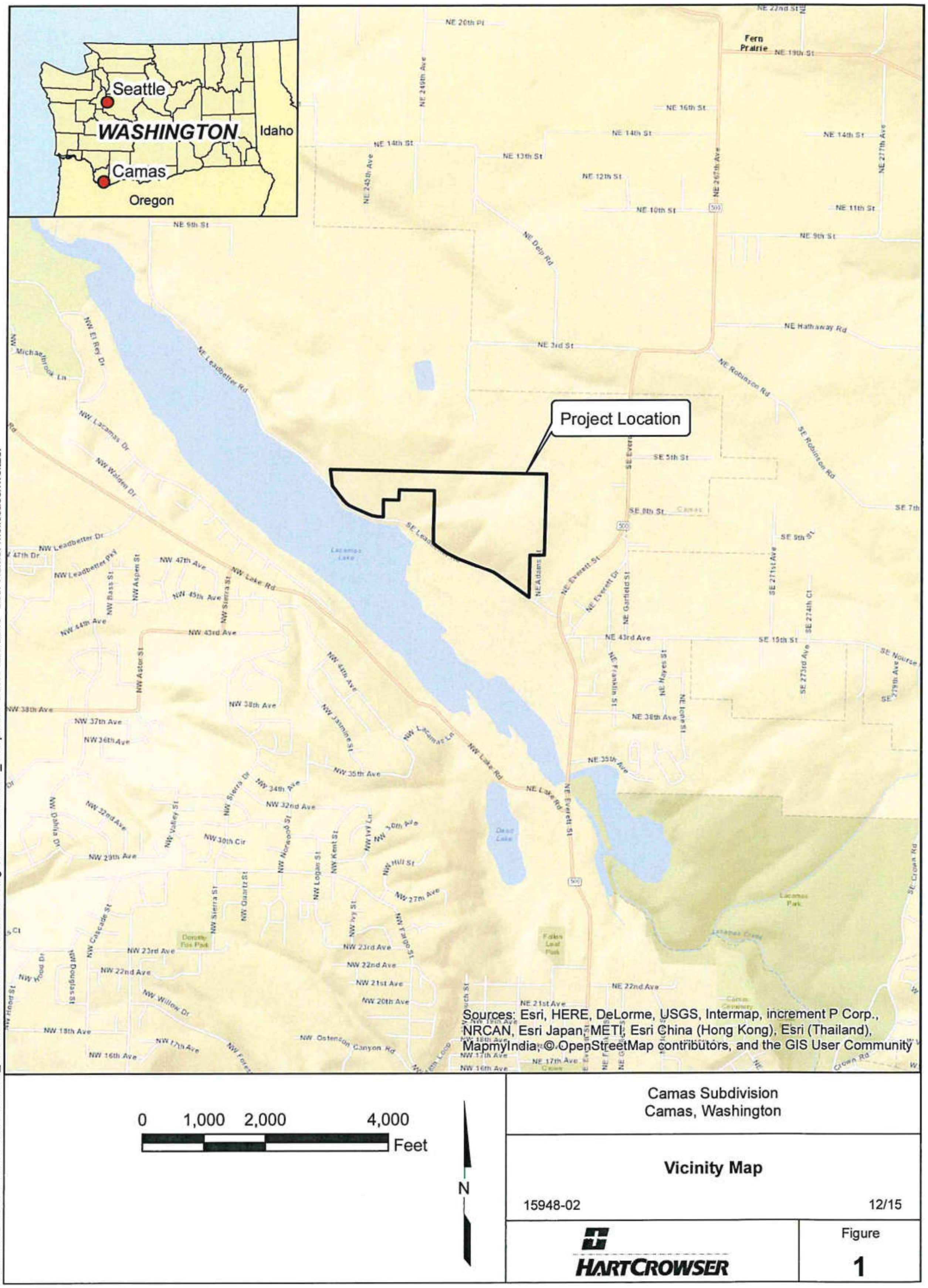
Limitations

We have prepared this memorandum for the exclusive use of CJ Dens Lacamas I, LLC and their authorized agents for this specific site. The scope of our work was in general accordance with our agreement dated October 14, 2015, and is limited to providing the information requested. Our evaluation and conclusions are based on our interpretation of observed site conditions. However, conditions can vary along the slope, and our conclusions should not be construed as a warranty or guarantee of future site performance. This memorandum should not be construed as providing design and construction recommendations for the proposed subdivision. Additional and more detailed geotechnical investigation should be performed before final design-level recommendations may be developed.

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 memorandum was prepared. No warranty, 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 Hart Crowser and will serve as the official document of record.

Attachments:
Figure 1 – Vicinity Map
Figure 2 – Exploration Plan
Test Pit Logs

F:\Notebooks\1594802_Camas Subdivision-Geotech Investigation\Deliverables\Memo-Geohazard Eval 12-07-15\Camas Subdivision Site-Specific Eval.docx



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Camas Subdivision
Camas, Washington

Vicinity Map

15948-02 12/15

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Figure **1**


0
200
400
N
Approximate Scale in Feet
LEGEND
TP-1 Test Pit
Pothole
Geohazard Area
A
TP-7
TP-8
C
TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
TP-9
N.E. LEADBETTER ROAD
DEERHAVEN SUBDIVISION (311-573)
N.E. ADAMS STREET
N.E. 45th
Source: Overall Existing Conditions Plan, Sheet C2.1 from Group Mackenzie, dated 1/19/11.
Camas Subdivision
Camas, Washington
Exploration Plan
15948-02
12/15
Figure
2
HARTCROWSER

KEY TO EXPLORATION LOGS

HARTCROWSER

SOIL CLASSIFICATION CHART

MATERIAL TYPES	MAJOR DIVISIONS		GROUP SYMBOL	SOIL GROUP NAMES & LEGEND
COARSE-GRAINED SOILS >50% RETAINED ON NO. 200 SIEVE	GRAVELS >50% OF COARSE FRACTION RETAINED ON NO 4. SIEVE	CLEAN GRAVELS <5% FINES	GW	WELL-GRADED GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVELS WITH FINES, >12% FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SANDS >50% OF COARSE FRACTION PASSES ON NO 4. SIEVE	CLEAN SANDS <5% FINES	SW	WELL-GRADED SAND
			SP	POORLY-GRADED SAND
		SANDS AND FINES >12% FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE-GRAINED SOILS >50% PASSES NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT<50	INORGANIC	CL	LEAN CLAY
			ML	SILT
		ORGANIC	OL	ORGANIC CLAY OR SILT
	SILTS AND CLAYS LIQUID LIMIT>50	INORGANIC	CH	FAT CLAY
			MH	ELASTIC SILT
		ORGANIC	OH	ORGANIC CLAY OR SILT
HIGHLY ORGANIC SOILS			PT	PEAT

Note: Multiple symbols are used to indicate borderline or dual classifications

OTHER MATERIAL SYMBOLS

- Concrete
- Asphalt
- Topsoil

MOISTURE MODIFIERS

- Dry - Absence of moisture, dusty, dry to the touch
- Moist - Damp, but no visible water
- Wet - Visible free water or saturated, usually soil is obtained from below the water table

SEEPAGE MODIFIERS

- None -
- Slow - < 1 gpm
- Moderate - 1-3 gpm
- Heavy - > 3 gpm

CAVING MODIFIERS

- None -
- Minor - isolated
- Moderate - frequent
- Severe - general

MINOR CONSTITUENTS

- Trace - < 5% (silt/clay)
- Occasional - < 15% (sand/gravel)
- With - 5-15% (silt/clay) in sand or gravel; 15-30% (sand/gravel) in silt or clay

SAMPLE TYPES

- Dames & Moore
- Standard Penetration Test (SPT)
- Shelby Tube
- Bulk or Grab

LABORATORY/ FIELD TESTS

- ATT - Atterberg Limits
- CP - Laboratory Compaction Test
- CA - Chemical Analysis (Corrosivity)
- CN - Consolidation
- DD - Dry Density
- DS - Direct Shear
- HA - Hydrometer Analysis
- OC - Organic Content
- PP - Pocket Penetrometer (TSF)
- P200 - Percent Passing No. 200 Sieve
- SA - Sieve Analysis
- SW - Swell Test
- TV - Torvane Shear
- UC - Unconfined Compression

GROUNDWATER SYMBOLS

- Water Level (at time of drilling)
- Water Level (at end of drilling)
- Water Level (after drilling)

STRATIGRAPHIC CONTACT

- ——— Distinct contact between soil strata or geologic units
- – – – – Gradual or approximate change between soil strata or geologic units

Notes:

Blowcount (N) is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted) per ASTM D-1586. See exploration log for hammer weight and drop.

When the Dames & Moore (D&M) sampler was driven with a 140-pound hammer (denoted on logs as D+M 140), the field blow counts (N-value) shown on the logs have been reduced by 50% to approximate SPT N-values.

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance. Soil density/consistency in test pits and probes is estimated based on visual observation and is presented parenthetically on the logs.

Refer to the report text and exploration logs for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the exploration locations at the time the explorations were made. The logs are not warranted to be representative of the subsurface conditoins at other locations or times.

Figure A-1

KEY TO BEDROCK TERMS (1 of 2)
(WSDOT, 2014)

HARTCROWSER
8910 SW Gemini Drive
Beaverton, Oregon 97008

Weathered State of Rock

Term	Description	Grade
Fresh	No visible signs of rock material weathering; perhaps slight discoloration in major discontinuity surfaces.	I
Slightly Weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering, and may be somewhat weaker externally than in its fresh condition.	II
Moderately Weathered	Less than half of the rock material is decomposed and/or disintegrated to soil. Fresh or discolored rock is present either as a continuous framework or as corestones.	III
Highly Weathered	More than half of the rock material is decomposed and/or disintegrated to soil. Fresh or discolored rock is present either as discontinuous framework or as corestone.	IV
Completely Weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.	V
Residual Soil	All rock material is converted to soil. The mass structure and material fabric is destroyed. There is a large change in volume, but the soil has not been significantly transported.	VI

Relative Rock Strength

Grade	Description	Field Identification	Uniaxial Compressive Strength
R0	Extremely Weak	Indented by thumbnail.	0.04 to 0.15 ksi
R1	Very Weak	Specimen crumbles under sharp blow with point of geological hammer, and can be cut with a pocket knife.	0.15 to 3.6 ksi
R2	Moderately Weak	Shallow cuts or scrapes can be made in a specimen with a pocket knife. Geological hammer point indents deeply with firm blow.	3.6 to 7.3 ksi
R3	Moderately Strong	Specimen cannot be scraped or cut with a pocket knife, shallow indentation can be made under firm blows from a hammer point.	7.3 to 15 ksi
R4	Strong	Specimen breaks with one firm blow from the hammer end of a geological hammer.	15 to 29 ksi
R5	Very Strong	Specimen requires many blows of a geological hammer to break intact sample.	Greater than 29 ksi

Discontinuities

Discontinuity Spacing		Discontinuity Condition	
Description	**Spacing**	**Condition**	**Description**
Very Widely Spaced	Greater than 10 feet.	Excellent Condition	Very rough surfaces, no separation, hard discontinuity wall.
Widely Spaced	3 to 10 feet.	Good Condition	Slightly rough surfaces, separation less than 0.05 inches, hard discontinuity wall.
Moderately Spaced	1 to 3 feet.	Fair Condition	Slightly rough surface, separation greater than 0.05 inches, soft discontinuity wall.
Closely Spaced	2 to 12 inches	Poor Condition	Slickensided surfaces, or soft gouge less than 0.2 inches thick, or open discontinuities 0.05 to 0.2 inches.
Very Closely Spaced	Less than 2 inches	Very Poor Condition	Soft gouge greater than 0.2 inches, or open discontinuities greater than 0.2 inches.

Figure A-2

KEY TO BEDROCK TERMS (2 of 2)
(WSDOT, 2014)

HARTCROWSER
8910 SW Gemini Drive
Beaverton, Oregon 97008

Grain Size

Grain Size	Description	Criteria
Less than 0.04 inches	Fine grained	Few crystal boundaries/ grains distinguishable in the field or with a hand lens.
0.04 to 0.2 inches	Medium grained	Most crystal boundaries/ grains distinguishable with the aid of a hand lens.
Greater than 0.2 inches	Coarse grained	Most crystal boundaries/ grains distinguishable with the naked eye.

Igneous Rock Textures

Texture	Grain Size
Pegmatitic	Very large; diameters greater than 0.8 in.
Phaneritic	Can be seen with the naked eye
Porphyritic	Grained of two widely different sizes
Aphanitic	Cannot be seen with the naked eye
Glassy	No grains present

Pyroclastic Rocks

Rock Name	Characteristics
Pyroclastic Breccia	Pyroclastic rock whose average pyroclast size exceeds 2.5 inches and in which *angular* pyroclasts predominate.
Agglomerate	Pyroclastic rock whose average pyroclast size exceeds 2.5 inches and in which *rounded* pyroclasts predominate.
Lapilli Tuff	Pyroclastic rock whose average pyroclast size is 0.08 to 2.5 inches.
Ash Tuff	Pyroclastic rock whose average pyroclast size is less than 0.08 inches.

Degree of Vesicularity

Designation	Percentage of Cavities (by volume) of Total Sample
Slightly Vesicular	5 to 10 Percent
Moderately Vesicular	10 to 25 Percent
Highly Vesicular	25 to 50 Percent
Scoriaceous	Greater than 50 Percent

OTHER TERMS:

Core Recover (CR) = the ratio of core recovered to the core run length expressed as a percentage.

Rock Quality Designation (RQD) = the percentage of rock core recovered in intact pieces of 4 inches or more in length in the length of a core run. Does not include mechanical breaks caused by drilling.

Fracture Frequency (FF) = the number of natural fractures per foot in the length of core recovered.

REFERENCE:

Washington State Department of Transportation (WSDOT), 2014. *Geotechnical Design Manual*, Publication M 46-03.02, August, 2014.

Figure A-2

Test Pit Log TP-1

Location: Camas, Washington
Approximate Ground Surface Elevation (feet): N/A
Logged By: A. Jones Reviewed By: R. Pirot

Horizontal Datum: N/A
Vertical Datum: N/A

USCS Class	Soil Descriptions	Depth in Feet	Sample
ML	Organic Topsoil	0	
ML	(Soft), moist, brown to dark brown, sandy SILT, roots. (Colluvium/Disturbed Soil)		S-1
MH	(Soft), moist, brown, ELASTIC SILT, some roots, disturbed texture.	5	S-2
SM	(Loose), moist, brown, silty SAND with occasional gravel-sized clasts of subangular to subrounded volcaniclastic fragments, relict rock texture. (Residual Soil)	10	
	Brown, Volcaniclastic Breccia, very weak, R1, medium to coarse grained, highly to moderately weathered. (Volcaniclastic Sedimentary Rock)		S-3
	Bottom of Test Pit at 15.0 Feet. Started 11/23/15. Completed 11/23/15. Completed due to refusal.	15	

Water Content in Percent | PID | LAB TESTS

Test Pit Log TP-2

Location: Camas, Washington
Approximate Ground Surface Elevation (feet): N/A
Logged By: A. Jones Reviewed By: R. Pirot

Horizontal Datum: N/A
Vertical Datum: N/A

USCS Class	Soil Descriptions	Depth in Feet	Sample
ML	Organic Topsoil, roots.	0	
SM	(Medium dense), moist, gray to brown, silty SAND with weathered gravel-sized subangular volcaniclastic fragments. (Colluvium/Disturbed Soil)		S-1
	Brown, Volcaniclastic Breccia, very weak, R1, medium to coarse grained, highly to moderately weathered. (Volcaniclastic Sedimentary Rock)	5	S-2
	Bottom of Test Pit at 6.5 Feet. Started 11/23/15. Completed 11/23/15.	10, 15	

Water Content in Percent | PID | LAB TESTS

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

HARTCROWSER

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Figure A-3

Test Pit Log TP-3

Location: Camas, Washington
Approximate Ground Surface Elevation (feet): N/A
Logged By: A. Jones Reviewed By: R. Pirot

Horizontal Datum: N/A
Vertical Datum: N/A

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Sample	Water Content in Percent	PID	LAB TESTS
ML		Organic Topsoil, roots.	0				
ML		(Stiff), moist, brown, SILT with sand, disturbed texture. (Colluvium/Disturbed Soil)		S-1			
		Brown, Volcaniclastic Breccia, very weak, R1, medium to coarse grained, highly to moderately weathered. (Volcaniclastic Sedimentary Rock)	5	S-2			
		Bottom of Test Pit at 5.5 Feet. Started 11/23/15. Completed 11/23/15.	10, 15				

Test Pit Log TP-4

Location: Camas, Washington
Approximate Ground Surface Elevation (feet): N/A
Logged By: A. Jones Reviewed By: R. Pirot

Horizontal Datum: N/A
Vertical Datum: N/A

USCS Class	Graphic Log	Soil Descriptions	Depth in Feet	Sample	Water Content in Percent	PID	LAB TESTS
ML		Organic Topsoil	0				
ML		(Stiff), moist, brown, SILT with sand, roots, disturbed texture. (Colluvium/Disturbed Soil)		S-1			
		Brown, Volcaniclastic Breccia, very weak, R1, medium to coarse grained, highly to moderately weathered. (Volcaniclastic Sedimentary Rock)	5	S-2			
		Bottom of Test Pit at 6.5 Feet. Started 11/23/15. Completed 11/23/15.	10, 15				

NEW TEST PIT LOG - F:\GINT\OREGON_LIBRARY.GLB - 12/7/15 12:22 - F:\NOTEBOOKS\1594802_CAMAS SUBDIVISION-GEOTECH INVESTIGATION\FIELD DATA\PERM_GINT\1594802_EXPLORATIONS.GPJ

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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15948-02 *12/15*

Figure A-4

Test Pit Log TP-5

Location: Camas, Washington
Approximate Ground Surface Elevation (feet): N/A
Logged By: A. Jones Reviewed By: R. Pirot

Horizontal Datum: N/A
Vertical Datum: N/A

USCS Class	Soil Descriptions	Sample
ML	Organic Topsoil, roots, dark brown.	
SM	(Loose), moist, brown to dark brown, silty SAND, roots, weathered residual soil fragments in fine-grained matrix. (Colluvium/Disturbed Soil)	
CL	(Medium stiff), moist, brown, LEAN CLAY with sand.	S-1
SM	(Loose), moist, brown, silty SAND with hard gravel-sized clasts of subangular to subrounded volcaniclastic fragments, relict rock texture. (Residual Soil)	S-2, S-3
	Brown, Volcaniclastic Breccia, very weak, R1, medium to coarse grained, highly to moderately weathered. (Volcaniclastic Sedimentary Rock)	S-4

Bottom of Test Pit at 13.5 Feet.
Started 11/23/15.
Completed 11/23/15.
Completed due to refusal.

Depth in Feet: 0, 5, 10, 15. Columns: Water Content in Percent, PID, LAB TESTS.

Test Pit Log TP-6

Location: Camas, Washington
Approximate Ground Surface Elevation (feet): N/A
Logged By: A. Jones Reviewed By: R. Pirot

Horizontal Datum: N/A
Vertical Datum: N/A

USCS Class	Soil Descriptions	Sample
SM/ML	(Loose to medium stiff), dark brown, moist, silty SAND to sandy SILT, roots.	
ML	(Medium stiff), moist, brown, SILT with sand, small roots, disturbed texture. (Colluvium/Disturbed Soil) Abundant roots and rootlets from 3.0 to 4.0 feet.	S-1
SM	(Medium dense to dense), moist, light brown to brown, silty SAND, relict rock texture. (Residual Soil)	S-2
	Brown, Volcaniclastic Breccia, very weak, R1, medium to coarse grained, highly to moderately weathered. (Volcaniclastic Sedimentary Rock)	S-3

Bottom of Test Pit at 9.5 Feet.
Started 11/23/15.
Completed 11/23/15.
Completed due to refusal.

Depth in Feet: 0, 5, 10, 15. Columns: Water Content in Percent, PID, LAB TESTS.

NEW TEST PIT LOG - F:\GINT\OREGON_LIBRARY.GLB - 12/7/15 12:22 - F:\NOTEBOOKS\1594802_CAMAS SUBDIVISION-GEOTECH INVESTIGATION\FIELD DATA\PERM_GINT\1594802_EXPLORATIONS.GPJ

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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Figure A-5

Test Pit Log TP-7

Location: Camas, Washington
Approximate Ground Surface Elevation (feet): N/A
Logged By: A. Jones Reviewed By: R. Pirot

Horizontal Datum: N/A
Vertical Datum: N/A

USCS Class	Soil Descriptions	Sample	Water Content in Percent	PID	LAB TESTS
SM/ML	Organic Topsoil, roots.				
GM	(Loose), moist, brown, GRAVEL with silt and sand. (Colluvium)	S-1			
	Gray, Basaltic Andesite, moderately strong, R3, moderately to slightly weathered. (Basaltic Andesite of Elkhorn Mountain)	S-2			

Depth in Feet: 0, 5, 10, 15

Bottom of Test Pit at 3.5 Feet.
Started 11/23/15.
Completed 11/23/15.
Completed due to refusal.

Test Pit Log TP-8

Location: Camas, Washington
Approximate Ground Surface Elevation (feet): N/A
Logged By: A. Jones Reviewed By: R. Pirot

Horizontal Datum: N/A
Vertical Datum: N/A

USCS Class	Soil Descriptions	Sample	Water Content in Percent	PID	LAB TESTS
SM/ML	Organic Topsoil, roots, dark brown.				
SM	(Loose), moist, brown, sandy SILT with angular to subangular gravel and cobbles. (Colluvium)	S-1			
	Gray, Basaltic Andesite, moderately strong, R3, moderately to slightly weathered. (Basaltic Andesite of Elkhorn Mountain)	S-2			

Depth in Feet: 0, 5, 10, 15

Bottom of Test Pit at 3.5 Feet.
Started 11/23/15.
Completed 11/23/15.
Completed due to refusal.

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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Figure A-6

Test Pit Log TP-9

Location: Camas, Washington
Approximate Ground Surface Elevation (feet): N/A
Logged By: A. Jones Reviewed By: R. Pirot

Horizontal Datum: N/A
Vertical Datum: N/A

USCS Class	Soil Descriptions	Depth in Feet	Sample	Water Content in Percent	PID	LAB TESTS
ML/SM	Organic Topsoil, roots, dark brown.	0				
ML	(Loose), moist, light brown, SILT with sand to sandy SILT, slight iron oxide stains. (Colluvium/Disturbed Soil)		S-1			
	Brown, Volcaniclastic Breccia, very weak, R1, medium to coarse grained, highly to moderately weathered. (Volcaniclastic Sedimentary Rock)	5	S-2			
	Bottom of Test Pit at 6.5 Feet. Started 11/23/15. Completed 11/23/15.					
		10				
		15				

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1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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Figure A-7