

Return To:

Kassidie Cummings
150 NW IMAD CEMETERY RD
Stevenson, WA 98648

GEOLOGIC HAZARD AREA NOTICE

Grantor: Joshua and Kassidie Cummings
Grantee: The Public 08-07-36-3-3-0201-00
Tax Parcel #: ~~03-07-36-3-3-0201-00~~ ✓
Legal Description: LOT 1 OF THE H. REHAL SHORT PLAT (Bk3 Pg156)

NOTICE: This site lies within a geologic hazard area. Restrictions on use or alteration of the site may exist. For more information contact the City of Stevenson Planning Department.



KLEIN & ASSOCIATES, INC.
Engineering, Land Surveying, GIS & Home Design

Hood River, OR
1411 13TH ST. 97031
(541)386-3322

Camas, WA
2517 252ND AVE, 98607
(360) 687-0500

Bingen, WA
PO Box 786, 98605
(509) 493-3111

May 12, 2017

Re: Geotechnical Investigation
Site: 150 NW Iman Cemetery Road
Stevenson, WA 98648

Dear Mr. Cummings,

Klein & Associates is pleased to provide this geotechnical investigation report for the proposed Short Plat at Parcel 03073633020100 (Site) Stevenson, Washington. This report has been prepared at your request under the direction of the City of Stevenson to address the potential geologic and geotechnical risks associated with subdivision of the Site. A preliminary topographic survey was completed by Klein & Associates, Inc. on February 1, 2017 and a Short Plat Application was submitted to the City of Stevenson on March 23, 2017.

During review of the Short Plat Application, it was noted that a steep slope hazard area exists within proposed lots 3 and 4. A Geotechnical Investigation was requested by the City of Stevenson to evaluate the potential constraints to development in these proposed lots.

Scope

The goal of this investigation is to research and analyze geologic and geotechnical site conditions, determine the potential constraints to development, identify potential hazards and make recommendations based on our findings. This report describes the processes and findings of the investigation and provides recommendations for future site development. Findings and recommendations are based on research of existing information available through established publications of the area, interviews with local contractors, and a site visit. The site visit was performed to review topography, soil types, vegetation, and drainage patterns in addition to observing test pit explorations in the steep slope hazard area. A detailed map of the Site is provided in the Appendix and includes exploration locations, a geologic map, a soil mas and well logs.

Site Description

The Site is located in Stevenson, Washington in a residential area west of downtown Stevenson. The proposed Short Plat will subdivide the 2.01 acre lot into four lots ranging from 0.28 acres and 0.72 acres in size. The lot is currently host to a manufactured home, garage, and outbuilding all located within proposed Lot 1. The Site is generally rectangular with dimensions of approximately 378 feet (+/- 1 ft.) in the east-west direction and approximately 123 feet in the north-south direction. Site grades range from flat areas to steep hills. Approximate elevations on Site range from 284 feet above sea level (ASL) in the northwest corner to 260 feet ASL in the southeast corner.

The Site is bound to the west Iman Cemetery Rd and to the north by Angel Heights Rd, respectively. The topography presents a natural draw, channeling runoff from the Site towards the southeast. Some steep slopes exist in parts of this draw and may pose some risk to future site development. Vegetation on site is primarily grasses in the upper site areas above the steep draw area and trees within the draw.

Site Geology

The Site is located northwest of the City of Stevenson, in southwest Washington. The city of Stevenson is located at the confluence of Rock Creek and the Columbia River, situated along the Cascade Mountain Range (CMR), a cluster of steep, volcanic mountains related to regional volcanism created by the Cascadia subduction zone. Soils in the area are comprised of landslide deposits from multiple successive landslides in the area as well as sedimentary deposits related to the Missoula floods. Specifically, the Site is directly on large landslide deposit that has been identified as part of the Red Bluffs landslide which originated from the mountains to the north and northwest of the Site. Several landslides in the area have occurred or shown signs of movement within the last 20 years¹. Specifically, the Piper Road Landslide, occurred approximately 1,500 feet northeast of the Site on the east bank of Rock Creek, just below a large waterfall and bend in the creek. Bedrock in the immediate area of the site is relatively deep as indicated by local well logs, indicating that the landslide deposits are several hundred feet thick in the area near the Site. A recent study published by the USGS indicates that many landslides may experience a reactivation triggered by a large magnitude earthquake, such as a magnitude 8.5 Cascadia subduction zone earthquake.

Subsurface Explorations

Subsurface explorations were performed during a site visit on April 23, 2016 under the supervision of Luke Maddux of KA geotechnical department. Excavation of test pits was performed by Josh Cummings using a CAT 305E2 CR excavator. Three (3) test pits were excavated to rock refusal, approximately seven feet below ground surface (BGS). Test pits were backfilled with 1-2 foot lifts of

¹ Pierson, T.C., Evarts, R.C., and Bard, J.A., 2016, Landslides in the western Columbia Gorge, Skamania County, Washington: U.S. Geological Survey Scientific Investigations Map 3358, scale 1:12,000, pamphlet 22 p., <<http://dx.doi.org/10.3133/sim3358>>

cuttings and lightly compacted using the excavator bucket. A map detailing the approximate test pit locations is provided in the Appendix.

Test pits 1 & 2 were excavated on the north end of the Site on the upper terrace adjacent to Angel Heights Road. Test pit 3 was excavated at the midpoint of the natural draw on an area determined to be undocumented fill. Soils identified during the subsurface explorations were similar throughout the site. Groundwater was not observed in any test pits during the explorations observed by KA on April 23, 2016.

Soil types identified during our subsurface explorations are as follows:

- Topsoil (all test pits):
 - Approximately 0 – 1 feet BGS
 - Dark brown sandy silt soil, not very stiff. Minor amounts of root structures present.
- Sandy silt with gravel and boulders up to 18”:
 - Approximately 1 – 7 feet BGS
 - Medium brown sandy silt soil with clay. Not very stiff with very minor root structures present.
- Large boulders:
 - Approximately 6-7 feet BGS
 - Boulders up to four feet in diameter.
- Undocumented fill (Test Pit 3):
 - Approximately 1 - 6 feet BGS
 - Dark brown to black sandy silt soil, large quantities of decaying organic matter, cinder blocks, trash. Moderately stiff. Potentially historic native topsoil and undocumented fill.

The Natural Resource Conservation Service (NRCS) soil maps² indicate the site is located within the “Stevenson Loam” and “Skamania very fine sandy loam” soil units. Soil maps have been included in the Appendix. NRCS soil descriptions are as follows:

- 103 – Skamania very fine sandy loam, 0-8% slopes
 - 5-10% Clay, 64-79% Sand
- 128 – Stevenson loam, 15-30% slopes
 - 23-28% Clay, 37-40% Sand

² Web Soil Survey. NRCS – USDA National Cooperative Soil Survey Soil Map. SSURGO Export: 2015-09-18.
<<http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>>.

The observed soil at the Site is mostly consistent with the published NRCS soil map data. The fine sandy loam was identified in test pits 1 & 2 and included boulders up to 18 inches in diameter. Test pit excavations were terminated at rock refusal by what was identified as very large boulders (>4 ft. in diameter). A layer of undocumented fill material was identified beneath the current ground surface in test pit 3 down to rock refusal at approximately six feet BGS. Undocumented fill material consisted of sandy silt soil underlain by boulders, wood, and construction debris. The dark brown to black soil color may indicate that the fill included organic material during placement. The undocumented fill soils were not present in test pits 1 & 2, where the observed soils more closely match the published NRCS data. All test pits were excavated to rock refusal and groundwater was not encountered any of test pits.

Additional explorations were conducted along the bottom of the natural draw in lot 3 but access difficulties prevented a detailed subsurface exploration at the toe of the slope in proposed lot 4. The bottom and slopes of the draw were traversed to look for signs of soil creep or other landslide movement. Some minor signs of soil creep were observed along the south facing slopes in lot 3 that presented as curved tree trunks and fallen shrubs and vegetation. A four foot steel soil probe was pushed into the ground surface at the bottom of the draw and on the slopes in lot 3 and 4. The probe was unable to penetrate more than three feet due to rock refusal.

Subsurface Conditions Discussion

The conditions present at the Site are typical of large debris flow or debris avalanche type landslides. Grain sizes are poorly sorted and landslide deposits consist of a wide range of material types. Material types range from large boulders to sand, silt and clay. In the process of lateral translation, the slide debris is deposited as a mostly unconsolidated mass of material, in this case, several hundred feet thick. The documented age of the landslide material indicates that the slide is between 1,000 & 15,000 years old and has mostly settled, but some movement may still be possible as a result of earthquake induced ground motion. The soil cover over the boulders is relatively thin in many locations on-site and the tops of large buried rocks can be observed at the surface. Curved tree trunks and fallen vegetation also imply that some soil creep has occurred, but this is primarily superficial sloughing of the uppermost soil horizon.

The undocumented fill area in the vicinity of test pit 3 also presents a concern for future site development. The undocumented fill contains unsuitable fill materials that may allow for differential settlement of a building foundation, which can destroy homes beyond repair and be potentially dangerous to occupants. The extent of the undocumented fill has not been decisively identified, however, the area is likely rather small and confined to the top of the draw area in proposed lot 3. Any undocumented fill present within a future building footprint should be removed and replaced with structural fill prior to establishing building subgrades. It is recommended that a professional review plans and excavation at the time of building permit application on Lot 3 and Lot 4.

Regional Geological Hazard Assessment

Erosion

The Site is not within FEMA flood risk zones but is within a natural drainage zone. The current owner indicated that no moving water has been encountered within the draw. Large rain events may add surface flow or underflow to the area and increase erosive potential within the Site. No underflow was observed during test pit excavations. Erosion hazard associated with this site is primarily related to stormwater runoff. Currently the topography on-site allows stormwater to infiltrate and sheet flow into the natural draw down gradient to the southeast. Sheet flow can transform into erosion along steep slopes in the form of rill or gullies. Proper vegetation and stormwater design should be incorporated into the site plan and reviewed by a professional engineer at the time of building permit submission.

Site development should collect all stormwater from impervious surfaces to a storm system. The stormwater system should also divert stormwater from contributing areas off-site such as Iman Cemetery Road and Angel Heights Road. The stormwater system should reroute storm flows away from structures and slopes to an approved stormwater collection system. Stormwater should not be released on, above or at the toe of any steep slopes.

Landslide

The anticipated building sites for the proposed lots are in an area that may be affected by landslides. Site excavation will likely include cutting a flat area for the building subgrade. Any undocumented fills shall be removed within at least five feet of the any proposed structures. During excavation and construction, local landslide or sloughing risk will be inherent. Excavation and construction activities shall be performed during periods of dry weather to mitigate risk on Lot 3 and Lot 4. It is recommended a geotechnical engineer or geologist be retained to oversee excavation efforts. Localized landslides and erosion control issues can be prevented with proper design and construction methods.

Seismic Hazard

The Pacific Northwest region is an area with regularly tracked and documented seismic events. Seismicity in the region is generally related to mapped fault movement and regional volcanism. Seismic events pose a significant hazard to the region and new construction should address the potential risks posed by seismic activity. Specifically, soil liquefaction resulting from ground shake amplification and oversaturation of soils can be responsible for unpredictable foundation settlement and movement, and trigger sloughing or sliding in areas with steep slopes. Proper seismic design considerations will assist in mitigation of this risk type. Building on firm native soils and properly compacted structural fill will also mitigate this risk. The scope of work for this project did not include testing soils on-site for susceptibility to liquefaction. Earthquake induced ground shaking may also trigger new landslides or re-activate existing landslides that have been previously identified as dormant. Seismic hazards are an inherent risk to all structures in the area.

Site Development Recommendations

We have concluded that the proposed Short Plat and future development of the Site is feasible with proper design and review by a professional review. Proposed lots 3 and 4 will require special considerations with respect to future development, Including:

- A horizontal steep slope setback of 10 feet shall be maintained for all excavation and construction.
 - Under no circumstances shall any buildings be constructed closer to the slope areas without a detailed geotechnical analysis conducted by a licensed Geotechnical Engineer or Geologist and specifically tailored to the intended construction plan.
- No construction shall take place above the undocumented fill area in proposed lot 3
 - Construction in this area may be feasible following undocumented fill removal and replacement with properly placed and compacted structural fill material.
- Seismic design shall be incorporated for any proposed construction.
- A stormwater management plan shall be implemented to protect steep slopes and be reviewed by a professional engineer prior to installation of a stormwater management system.
- All subgrade soils 12 inches beneath building foundations shall be scarified and re-compacted to 95% of the materials maximum dry density as determined by ASTM D-698.
- Subgrade shall be reviewed by a Geotechnical Engineer or Geologist prior to construction

Excavation

The topsoil and undocumented fill identified on site are not suitable for foundation subgrade and should be removed prior to construction. Bedrock was not encountered during test pit explorations. Approximate bedrock elevations are likely very deep, as indicated by local well logs published by the State of Washington Department of Ecology. Any subgrade excavations may be difficult due to the presence of large boulders near ground surface. Excavations may require terracing, retaining earth structures, or buttressing to reduce landslide susceptibility.

Limitations

This report is limited to the specific location and is not intended to be used to draw conclusions about any other location. Based on our review of available information, our investigation of the property, and our understanding of the general concept of the proposed building design, we have assessed the known geologic hazards and conclude that the hazard risk is low with proper design, undocumented fill removal, structural fill placement, construction of earth retaining features and storm/groundwater drain pipes. Building design should account for risks noted in this report. Stability of slopes on-site will increase with proper storm/groundwater design by providing a safe route for stormwater flows.

If conditions in the field during construction are found to be inconsistent with this report is recommended to notify KA immediately so that this report may be updated with new information. A re-evaluation of the site may be necessary.

We appreciate the opportunity to work with you on this project. If you have any questions or concerns, please feel free to contact us at (541) 386-3322 or email LukeM@kleinassocinc.com



Luke Maddux, G.I.T.
Geotechnical Specialist



Samuel L. Duguay, P.E.
Project Engineer



SSURGO | or608,or051,wa659 | 0.44.seconds | 0.25 cache ratio | BBOX:(-121.95, 45.6785) (-121.8451, 45.7194) | 9179 acres

Site Soil Overview

NRCS NCSS WebSoil Survey Data Overlay

Legend

103 - Skamania Very
Fine Sandy Loam

Site

128 - Stevenson Loam

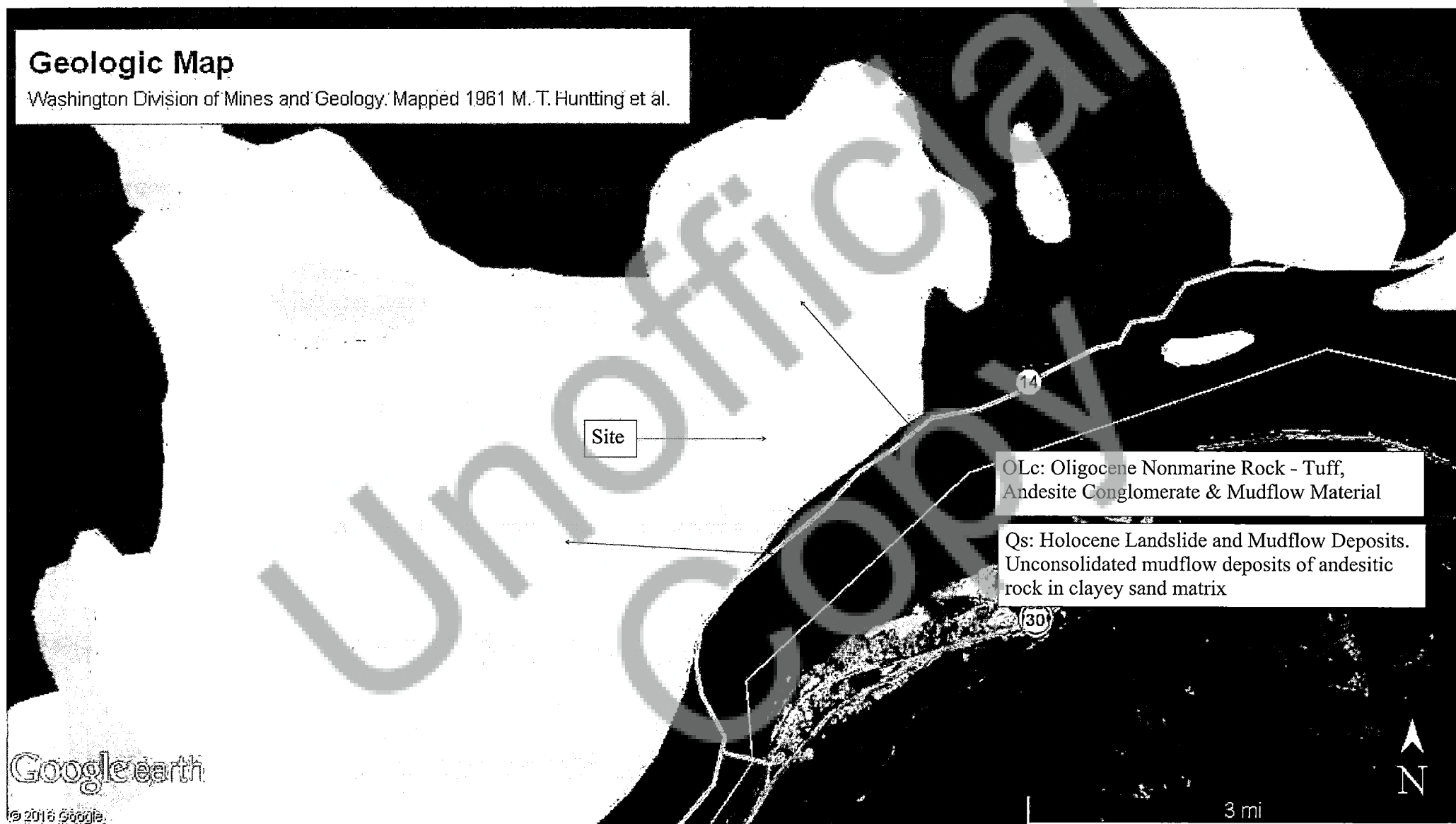
Google Earth

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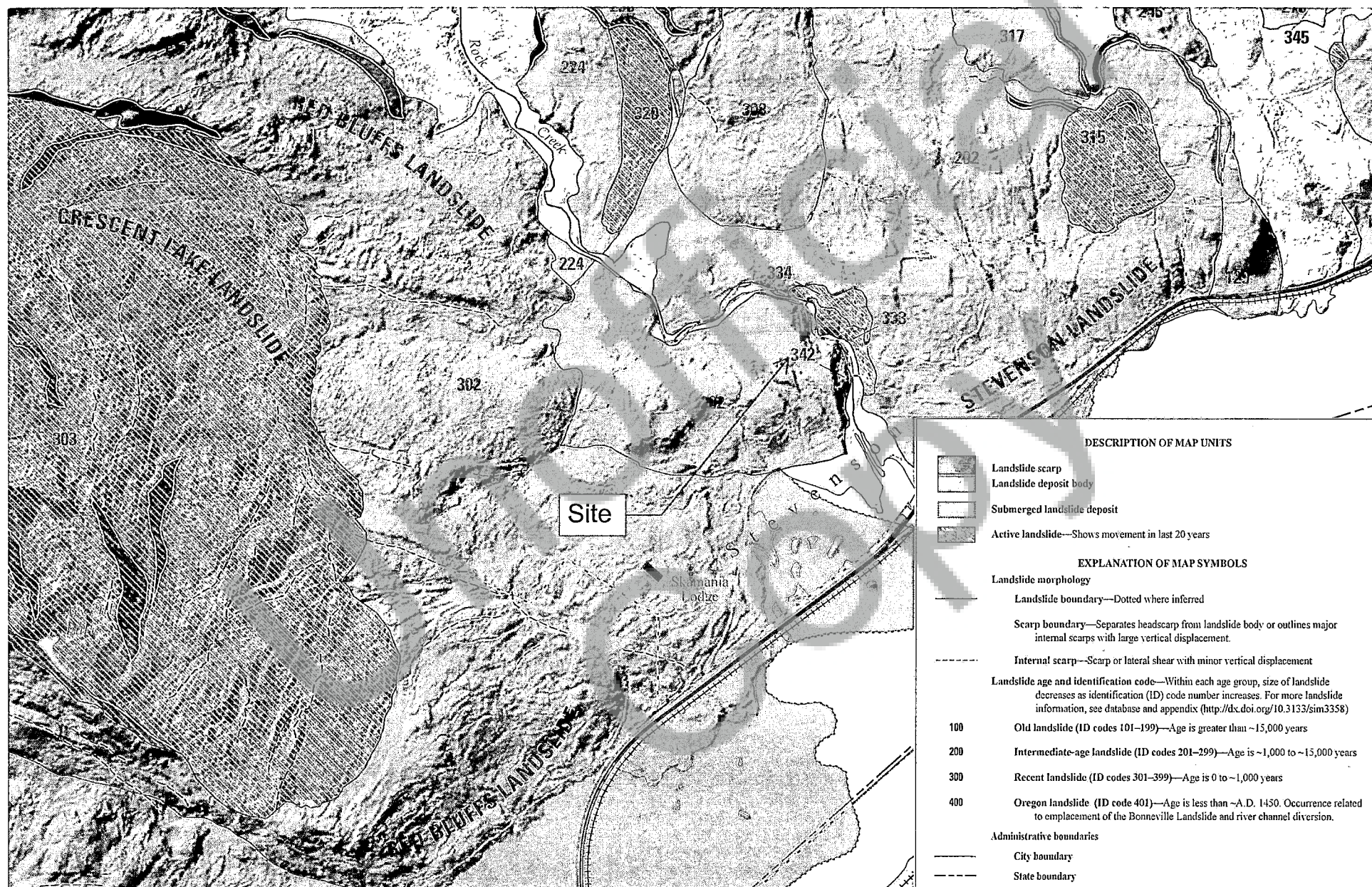


Geologic Map

Washington Division of Mines and Geology. Mapped 1961 M.T. Huntting et al.



Excerpt From: Landslides in the Western Columbia River Gorge, Skamania County, Washington - 2016



WATER WELL REPORT

Start Card No. W211636
 Unique Well I.D. # APT293
 Water Right Permit No.

STATE OF WASHINGTON

272821

(1) OWNER: Name BEA BRIAN & JODY (02194) Address 262 MILLER RD WASHOUGAL, WA 98671-
 (2) LOCATION OF WELL: County SKAMANIA - NW 1/4 SW 1/4 Sec 25 T 3 N., R 7E WM
 (2a) STREET ADDRESS OF WELL (or nearest address) 1.45 LOOP RD, STEVENSON 03-07-2530-0700-00
 (3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one) 1
 Method: ROTARY
 NEW WELL

(5) DIMENSIONS: Diameter of well 6 inches
 Drilled 610 ft. Depth of completed well 610 ft.

(6) CONSTRUCTION DETAILS:
 Casing installed: 6 " Dia. from +1 ft. to 59 ft.
 WELDED & LINER 4.5 " Dia. from 10 ft. to 610 ft.

Perforations: YES
 Type of perforator used SAW
 SIZE of perforations 1/8 in. by 6 in.
 40 perforations from 570 ft. to 610 ft.
 perforations from ft. to ft.
 perforations from ft. to ft.

Screens: NO
 Manufacturer's Name
 Type Model No.
 Diam. slot size from ft. to ft.
 Diam. slot size from ft. to ft.

Gravel packed: NO
 Gravel placed from ft. to ft. Size of gravel

Surface seal: YES To what depth? 18.5 ft.
 Material used in seal CEMENT & BENTON
 Did any strata contain unusable water? NO
 Type of water? Depth of strata ft.
 Method of sealing strata off

(7) PUMP: Manufacturer's Name
 Type H.P.

(8) WATER LEVELS: Land-surface elevation
 Static level 419 ft. above mean sea level ft.
 Artesian Pressure lbs. per square inch Date 08/09/07
 Artesian water controlled by

(9) WELL TESTS: Drawdown is amount water level is lowered below static level.
 Was a pump test made? NO If yes, by whom?
 Yield: gal./min with ft. drawdown after hrs.

Recovery data
 Time Water Level Time Water Level Time Water Level

Date of test 1/1
 Bailer test gal./min. ft. drawdown after hrs.
 Air test 1:5 gal./min. w/ stem set at 600 ft. for 1 hrs.
 Artesian flow g.p.m. Date
 Temperature of water Was a chemical analysis made? NO

(10) WELL LOG

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change in formation.

MATERIAL	FROM	TO
BROWN CLAY	0	28
RED, BLUE & GRAY CLAY	28	54
GRAY TUFT	54	253
BROWN WOOD W/GRAY	253	270
TUFT, SOFT	253	270
GRAY TUFT	270	393
BLACK BASALT	393	406
GRAY & BLUE TUFT	406	561
BLACK & RED BASALT, WATER BEARING	561	597
BLUE TUFT	597	610

RECEIVED

SEP 24 2007

Washington State
 Department of Ecology

Work started 08/06/07

Completed 08/09/07

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME M-K DRILLING CO.
 (Person, firm, or corporation) (Type or print)

ADDRESS PO BOX 470 DALLESPOT, WA

[SIGNED] *Jayla Johnston* License No. 0833,2740,2559

Contractor's
 Registration No. MKDRIC*94807

Date 08/28/07

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.



WATER WELL REPORT

Original & 1st copy - Ecology, 2nd copy - owner, 3rd copy - driller

Construction/Decommission ("x" in circle)

☒ Construction

☐ Decommission ORIGINAL INSTALLATION Notice

196494 of Intent Number

PROPOSED USE: ☒ Domestic ☐ Industrial ☐ Municipal
☐ De Water ☐ Irrigation ☐ Test Well ☐ Other

TYPE OF WORK: Owner's number of well (if more than one)
☒ New well ☐ Reconditioned Method: ☐ Dug ☐ Bored ☐ Driven
☐ Deepened ☐ Cable ☒ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 6 inches, drilled 760 ft.
 Depth of completed well 760 ft.

CONSTRUCTION DETAILS

Casing ☒ Welded 6" Diam. from +2.5 ft. to 178 ft.
 Installed: ☒ Liner installed 4" Diam. from 9 ft. to 760 ft.
☐ Threaded " Diam. from ft. to ft.

Perforations: ☒ Yes ☐ No

Type of perforator used SAW

SIZE of perfs 125 in. by 6 in. and no. of perfs 80 from 720 ft. to 760 ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location

Manufacturer's Name

Type _____ Model No. _____
 Diam. _____ Slot size _____ from _____ ft. to _____ ft.
 Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel/Filter packed: ☐ Yes ☒ No ☐ Size of gravel/sand _____
 Materials placed from _____ ft. to _____ ft.

Surface Seal: ☒ Yes ☐ No To what depth? 30 ft.

Material used in seal Bentonite chips

Did any strata contain unusable water? ☐ Yes ☒ No

Type of water? _____ Depth of strata _____

Method of sealing strata off

PUMP: Manufacturer's Name _____

Type: _____ H.P. _____

WATER LEVELS: Land-surface elevation above mean sea level 324 ft.

Static level 230 ft. below top of well Date 5/12/2006

Artesian pressure _____ lbs. per square inch Date _____

Artesian water is controlled by _____ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☒ No If yes, by whom?

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Date of test _____

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.

Airtest 5-7 _____ gal./min. with stem set at 745 ft. for 1 hrs.

Artesian flow _____ g.p.m. Date _____

Temperature of water _____ Was a chemical analysis made? ☐ Yes ☒ No

CURRENT

Notice of Intent No. W187065

Unique Ecology Well ID Tag No. AKJ749

Water Right Permit No. _____

Property Owner Name Adam & Sunny Johnston

Well Street Address Ryan-Allen Road

City Stevenson County Skamania

Location NE 1/4-1/4 SE 1/4 Sec 35 Twn 3N R 7 EWM or WWM ☒ check one

Lat/Long (s, t, r) Lat Deg 45° Lat Min/Sec 41.763

Still REQUIRED) Long Deg 121° Long Min/Sec 54.233

Tax Parcel No. 03073514040200

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
top soil	0	5
brown clay & broken rock	4	15
grey rock & clay	15	35
grey rock, seams of grey clay	35	60
grey rock & shale mixed, some brown rock	60	75
light & dark grey & black rock,	75	125
seams of brown rock & shale		
light grey & green shale, some brown rock	125	150
light & dark grey rock & shale mixed,	150	625
layers of reddish brown rock mixed 5'-10' layers		
grey rock & shale hard, some layers,	265	760
reddish brown rock 5'-10' layers, 710-740 WB		

RECEIVED

MAY 24 2006

DEPARTMENT OF ECOLOGY
WELL DRILLING UNIT

Start Date 05/08/2006 Completed Date 05/12/2006

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Jim Hansen

Driller/Engineer/Trainee Signature

Driller or trainee License No. 0171

Drilling Company Person Pump & Well Drilling

Address 166 Rimrock Road

City, State, Zip Goldendale, WA 98620

Contractor's

Registration No. PERSOPW968DP

Date 05/16/2006

IF TRAINEE,

Driller's Licensed No. _____

Driller's Signature _____