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August 5, 2021

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Critical Areas Report – Geologic Hazard Areas
Clearing and Grading Within a Landslide Hazard Buffer
15215 – 162nd Avenue Southeast
King County, Washington
PN: 7806450070
Doc ID: Lunday.162ndAveSE.GHA

INTRODUCTION

This critical areas report presents the results of our geological hazard assessment and site review in response to unpermitted clearing and grading activities within a landslide hazard buffer. The site is located at 15215-162nd Avenue Southeast in the Cedar River valley of King County, Washington. The approximate location of the site is shown on the Site Location Map, Figure 1.

Our understanding of the project is based on our email and phone conversations with Mr. Ron Lunday; our review of the available geologic and soil literature for the site; our June 22, 2021 site visit our review of the King County Permitting Division *PREA20-0252-EnFR20-0444, parcel 7806450070 Critical Area Requirements*; our understanding of the King County Code Critical Areas and Resource Land Ordinance 180, Section 08, Geologically Hazardous Areas; our review of the provided residential site plan by Valor Civil Engineering, and our experience in King County. The violation was from unpermitted 2019 landscaping and drainage adjustments completed in a mapped landslide buffer zone located in the northern to central portions of the site. The landscaping alterations included adding new plants, replacing the existing pathways, and adding a gazebo and fence. Some trees and brush were removed to keep leaves and other brush from clogged the existing drainage ditch. Two existing ponds were also dredged of sludge. A copy of the site plan prepared by Valor Engineering is included as Figure 2.

The violations were for King County Code Sections 21A.24.280, clearing and grading activities within a landslide hazard area buffer. This *Critical Areas Report* addresses K.C.C. 21A.24.280 and other critical areas impacted by the landscaping and drainage alterations in the northern to central portions of the site and offers buffer recommendations from applicable critical areas.

SCOPE

The scope of our services was to evaluate the surface and subsurface conditions across the site as a basis for developing geotechnical recommendations and conclusions. Specifically, the scope of services included the following:

1. Reviewing the available geologic, hydrogeologic, and geotechnical data for the site area;

2. Performing a site reconnaissance; and,
3. Preparing this *Critical Areas Report* in accordance with the King County Critical Areas Ordinance Chapter 21A.24.280.

Our services were performed in general accordance with the scope of services described in our *Proposal for Services* dated June 14, 2021. We received written notice to proceed from you on the following day.

SITE CONDITIONS

Surface Conditions

As mentioned above, the site consists of a single King County parcel at 15215 – 162nd Avenue Southwest in the Cedar River valley of King County, Washington. The site measures about 115 to 150 feet wide (east to west) by about 230 to 245 feet long (north to south) and encompasses about 0.82 acres. The site is bounded by a tract lot to the north, by a cul de sac to the south, and by residences to the east and west.

The site is situated in the Cedar River valley, at the toe of a south facing valley slope. According to King County 5-foot elevation contours from King County iMap and our site observations and measurements, the site is located on a level to slightly sloping grade. The grade slopes up at under 5 percent across the site to the northern site boundary. At the northern site boundary, the grade steepens to slopes of 75 to 85 percent with a vertical relief on the order of 90 to 110 feet. These slopes form a section of the south facing Cedar River valley slope. The vertical relief across the site is on the order of less than 5 feet.

The vegetation across the site generally consists of landscaped perennials and shrubs with scattered ferns and blackberries. The most common tree at the valley slope toe located adjacent to the northern site boundary is birch, with scattered fir and maple. The understory vegetation at the valley slope toe is very dense and consistent with a wet environment, with the most common plants being ivy, ferns, horsetails, and blackberries. The site configuration and existing topography are shown on the Site Plan, Figure 2 and the Site Vicinity Map, Figure 3.

The Washington State National Hydrography Dataset (NHD) maps the Cedar River about 750 feet east and 900 feet south of the site. Two springs were observed to be flowing and draining to a ditch system connected to two ponds located in the northern portion of the site. These springs likely originate from the toe of the steep valley slope that slopes up from the northern site boundary, but we were not able to confirm this in the field. According to the homeowner and a provided King County Surface Water Management Division Drainage Investigation Report, the site has a history of flooding because of the spring(s). During the winter of 1996, the site and other properties experienced a flooding issue attributed to the spring(s). According to the provided investigation report, the discharge from the spring(s) was measured to be about 2 to 3 cubic feet per second at the time of the 1996 flooding issues. At the time, a small keystone block wall was placed in the backyard and an 8-inch pvc pipe was installed to help divert the water to the existing plat road and protect landscaping. King County made improvements to the plat drainage system as a result, extending the drainage to the end of the cul de sac and adding a storm catch basin.

Site Soils

The USDA Natural Resource Conservation Service (NRCS) Web Soil Survey maps the soils underlying the site as Alderwood and Kitsap soils, very steep (AkF) and Puyallup fine sandy loam (Py) A copy of the NRCS Web Soil Survey for the site and surrounding area is attached as Figure 4.

- *Alderwood and Kitsap soils, very steep (AkF)*: Alderwood and Kitsap soils, very steep are derived from basal till with some volcanic ash, has a severe erosion hazard when exposed and is included in hydrologic soils group B. This soil is mapped to underlie central to northern portions of the site.
- *Puyallup fine sandy loam (Py)*: The Puyallup fine sandy loam is derived from alluvium, has a slight erosion hazard when exposed, and is included in hydrologic soils group A. This soil is mapped to underlie the level to slightly sloping southern portion of the site.

Site Geology

The 1:24000 scale *Surficial Geologic Map of the Maple Valley Quadrangle, King County, Washington* by D.B. Booth (1995) maps the geology of the site as younger alluvium deposits (Qyal) and mass wasting deposits (Qmw). An excerpt of the digitized referenced geologic map is attached as Figure 5.

- *Younger Alluvium Deposits (Qyal):* The alluvium deposits generally consist of clay, silt, sand, and gravel deposited in streambeds and floodplains. Younger alluvial soils are recent deposits that were generally deposited along major rivers and stream. Because of the depositional environment, the alluvium soils are generally in a normally consolidated state and exhibit low to moderate strength and moderate to high compressibility characteristics, depending on grain size. The younger alluvium deposits are mapped to underlie the site to northwestern corner.
- *Mass Wasting Deposits (Qmw):* Mass wasting deposits generally are Holocene age (previous 10,000 years) colluvium consisting of a poorly sorted mix of clay, silt, sand, and gravel with scattered to abundant organics deposited from landslide failures. These deposits have an indistinct geomorphology and are found along the Cedar River valley. The mass wasting deposits are generally encountered in a normally to loosely consolidated state and exhibit low strength and compressibility characteristics where encountered. This geologic unit is mapped to underlie the northwest corner of the site.

We reviewed two sources of literature regarding mass wasting and landslide landforms for Washington State. We reviewed the WA Department of Natural Resources (WA DNR) 2017 Landslide Compilation - which consists of mapped landslides compiled from a variety of sources including 1:24,000 and 1:100,000-scale surficial geologic maps, landslide hazard zonation studies, watershed analyses, reconnaissance-scale landslide mapping from winter storm landslide events and a lidar-based study of near-shore landforms. We also reviewed the Washington State Department of Natural Resources (WA DNR) 2017 the WA DNR Landslide Inventory Map which maps landslide landforms based on criteria provided in the *Protocol for Landslide Mapping from LiDAR Data in Washington State* (Slaughter, et al, 2017) and the Oregon Department of Geology and Mineral Industries (DOGAMI) protocol described in Special Paper 42 (Burns and Madin, 2009).

The WA DNR Landslide Inventory maps a landslide deposit with “moderate” confidence (confidence is on a 1 to 10 scale, with 1 being lowest and 10 being highest) about 680 feet to the east of

the site. The deposit is mapped to have a failure depth of about 82 feet and a head scarp height of 100 feet. The deposit is considered prehistoric in age (greater than 150 years) and was not confirmed in the field. No landslides are mapped by the WA DNR Landslide Compilation to within 300 feet of the site. An alluvial fan is mapped with "moderate" confidence to fan out across the northwest portion of the stie. The WA DNR Landslide Inventory for the site and surrounding area is included as Figure 6.

Groundwater Conditions

We observed two springs in the northern portion of the site, flowing to a drainage system that consists of ditches and two ponds with an overflow to an existing stormwater system. Based on conversations with you, we understand that one of the springs had a change in flow direction around 2017. Based on our site observations, the site is likely prone to a perched groundwater table following periods of prolonged wet weather. Perched groundwater typically develops when the vertical infiltration of precipitation through a more permeable soil is slowed at depth by a deeper, less permeable soil type, such as the deeper low permeability soils. We anticipate fluctuations in the local groundwater levels will occur in response to precipitation patterns, off-site construction activities, and site utilization

CONCLUSIONS & RECOMMENDATIONS

The King County clearing and grading violation was for landscaping and drainage alterations within a mapped landslide hazard area buffer. Based on the results of our data review and site reconnaissance, it is our opinion the landscaping and drainage alterations did not adversely impact the natural drainage path nor create destabilizing conditions to the steep valley slope in proximity to the site. The northern boundary of the site is considered a landslide hazard area per the King County Title 21A.06.280. An approximately 25-foot area of existing vegetation at to the toe of the steep slope located adjacent to the northern site boundary was left untouched following the landscaping and drainage changes. It is our opinion that this 25-foot area of existing vegetation is sufficient as a buffer from the mapped landslide hazard area. The residence is setback more than 15 feet from the buffer zone. In our opinion, the drainage alterations will improve the flow path of water from the springs, help mitigate flooding during the wet season, and should improve the stability of the toe of the steep valley slope adjacent to the northern site boundary.

All construction on or adjacent to slopes involves risk, only part of which can be mitigated through qualified engineering, proper construction techniques, and temporary and permanent erosion control and vegetation plans. Favorable performance of structures in the near term does not imply a certainty of long-term performance, especially under conditions of adverse weather or seismic activity.

Landslide Hazard Area per King County Title 21A.06.680

King County defines a landslide hazard area as an area subject to severe risk of landslide, such as:

A. An area with a combination of:
    1. Slopes steeper than fifteen percent of inclination;
    2. Impermeable soils, such as silt and clay, frequently interbedded with granular soils, such as sand and gravel; and,
    3. Springs or groundwater seepage;

B. An area that has shown movement during the Holocene epoch, which is from ten thousand years ago to the present, or that is underlain by mass wastage debris from that epoch;
C. Any area potentially unstable as a result of rapid stream incision, stream bank erosion or undercutting by wave action;
D. An area that shows evidence of or is at risk from snow avalanches; or
E. An area located on an alluvial fan, presently or potentially subject to inundation by debris flows or deposition of stream-transported sediments.

The northern site boundary is located at the toe of a south facing valley slope that has a history of slope movement. Mass wasting deposits are mapped by the above referenced geologic map to extend along the toe of the valley slope. A landslide deposit mapped with moderate confidence is located by the WA DNR Landslide Inventory to be 650 feet east of the site. This deposit was not confirmed in the field. We observed two springs at the toe of the valley slope that was draining to a pond and ditch in the northern to central portions of the site. An alluvial fan is mapped by the WA DNR Landslide Inventory to fan out across the northwest portion of the site. The fan is likely the result of sediment being carried by springs and other surface drainage that likely originates at the toe of the valley slope near the northern site boundary. The valley slope is steeper than 15 percent with a total vertical height of about 230 feet.

Based on the above, the site has multiple indicators of a landslide hazard area per King County Title 21A.06.680. (King County Title 21A.06.680 indicators A, B and E). It is our opinion the valley slope that extends across the northern site boundary is a landslide hazard area. In accordance with King County Title 21A.06.680 a buffer zone and 15-foot building setback from the buffer zone from the landslide hazard area will be required. The recommended buffer distance is addressed in the "Recommended Buffers" section.

Steep Slope Hazard Area per King County Title 21A.06.1230

King County defines a steep slope hazard area as an area on a slope of forty percent inclination or more within a vertical elevation change of at least ten feet. For the purpose of this definition, a slope is delineated by establishing its toe and top and is measured by averaging the inclination over at least ten feet of vertical relief. Also, for the purpose of this definition:

A. The "toe" of a slope means a distinct topographic break in slope that separates slopes inclined at less than forty percent from slopes inclined at forty percent or more. Where no distinct break exists, the "toe" of a slope is the lower most limit of the area where the ground surface drops ten feet or more vertically within a horizontal distance of twenty-five feet; and

B. The "top" of a slope is a distinct topographic break in slope that separates slopes inclined at less than forty percent from slopes inclined at forty percent or more. Where no distinct break exists, the "top" of a slope is the upper-most limit of the area where the ground surface drops ten feet or more vertically within a horizontal distance of twenty-five feet. (Ord. 15051 § 101, 2004: Ord. 10870 § 286, 1993).

The valley slope to the north of the site is considered a steep slope hazard area per King County Title 21A.06.1230. It is our opinion that the 25-foot buffer zone recommended for the

landslide hazard area is sufficient for the steep slope hazard area. The recommended buffer is expanded upon in the following section.

Recommended Buffers

Buffers are typically used to protect critical areas from disturbance while also protecting development from damage due to the potential hazard. The King County Code Section 21A.06.122 defines a buffer as a "designated area contiguous to a steep slope or landslide hazard area to protect slope stability, attenuation of surface water flows and landslide hazards or a designated area continuous to and intended to protect and be an integral part of an aquatic area or wetland." It is our opinion that the valley slope that extends across the northern site boundary and slopes up to the north is a landslide hazard area. Per King County Code Section 21A.24.280, a buffer is required from all edges of a landslide hazard area. The following discussions regarding recommended critical area buffers are based on the King County Code Section 21A.06.122.

Vegetated Buffers

Buffers typically consist of an undisturbed area of native vegetation, retained or established, that extend from the edge of the critical area or hazard. The width of the buffer should be a reflection of the potential hazard and associated risks. Buffer widths are generally measured from the edge of the critical area being protected, in this case top of slope.

As described above, it is our opinion that the valley slope that extends along the northern site boundary and steepens to the north is a landslide hazard area. The valley slope is also considered a steep slope hazard area. We recommend that a 25-foot buffer of native vegetation be established from the landslide hazard and steep slope hazard area. Based on our site observations and measurements, it appears a dense zone of vegetation is currently established in the recommended buffer zone. The approximate buffer distance is labeled on the Site Plan, Figure 2.

Site Drainage

The springs at the toe of the steep valley slope intersect a ditch system in the northern portion that connects to two ponds. The ponds are interconnected by a ditch, and one of the ponds has a 6-inch diameter overflow pipe that discharges to the existing plat stormwater system. According to the homeowner, the ditch was moved further north during the site improvements and the ditch was deepened from 1 foot to 3 feet below existing grade. At the time of our site visit, the drainage system appeared to be working as designed. It is our opinion the new drainage system that controls the flow of water from the springs is an improvement and necessary addition to control flooding across the northern to central portion of the site. All ground surfaces from the site improvements should be sloped away from the structures. Surface water runoff should be controlled by a system of curbs, berms, drainage swales, and or catch basins, and conveyed to an appropriate discharge point.

LIMITATIONS

We have prepared this report for use by Mr. Ron Lunday and other members of the design team, for use in the design of a portion of this project. The data used in preparing this report and this report should be provided to prospective contractors for their bidding or estimating purposes only. Our report, conclusions and interpretations are based on our literature review, data from others and limited

site reconnaissance, and should not be construed as a warranty of the subsurface conditions. Variations in subsurface conditions from the mapped stratigraphy is possible and may occur with time.

The scope of our services does not include services related to environmental remediation and construction safety precautions. Our recommendations are not intended to direct the contractor's methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design.

If there are any changes in the loads, grades, locations, configurations or type of facilities to be constructed, the conclusions and recommendations presented in this report may not be fully applicable. If such changes are made, we should be given the opportunity to review our recommendations and provide written modifications or verifications, as appropriate.

◆ ◆ ◆

We have appreciated the opportunity to be of service to you on this project. If you have any questions or require additional services, please contact us at your earliest convenience.

Respectfully submitted,
GeoResources, LLC

Erik Fina, GIT
Staff Geologist-in-Training

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EJF:KEB:EWH/ejf
Doc ID: Lunday.162ndAveSE.RG
Attachments:
Figure 1: Site Location Map
Figure 2: Site Plan
Figure 3: Site Vicinity Map
Figure 4: NRCS Soils Map
Figure 5: Geologic Map
Figure 6: WA DNR Landslide Compilation & Inventory

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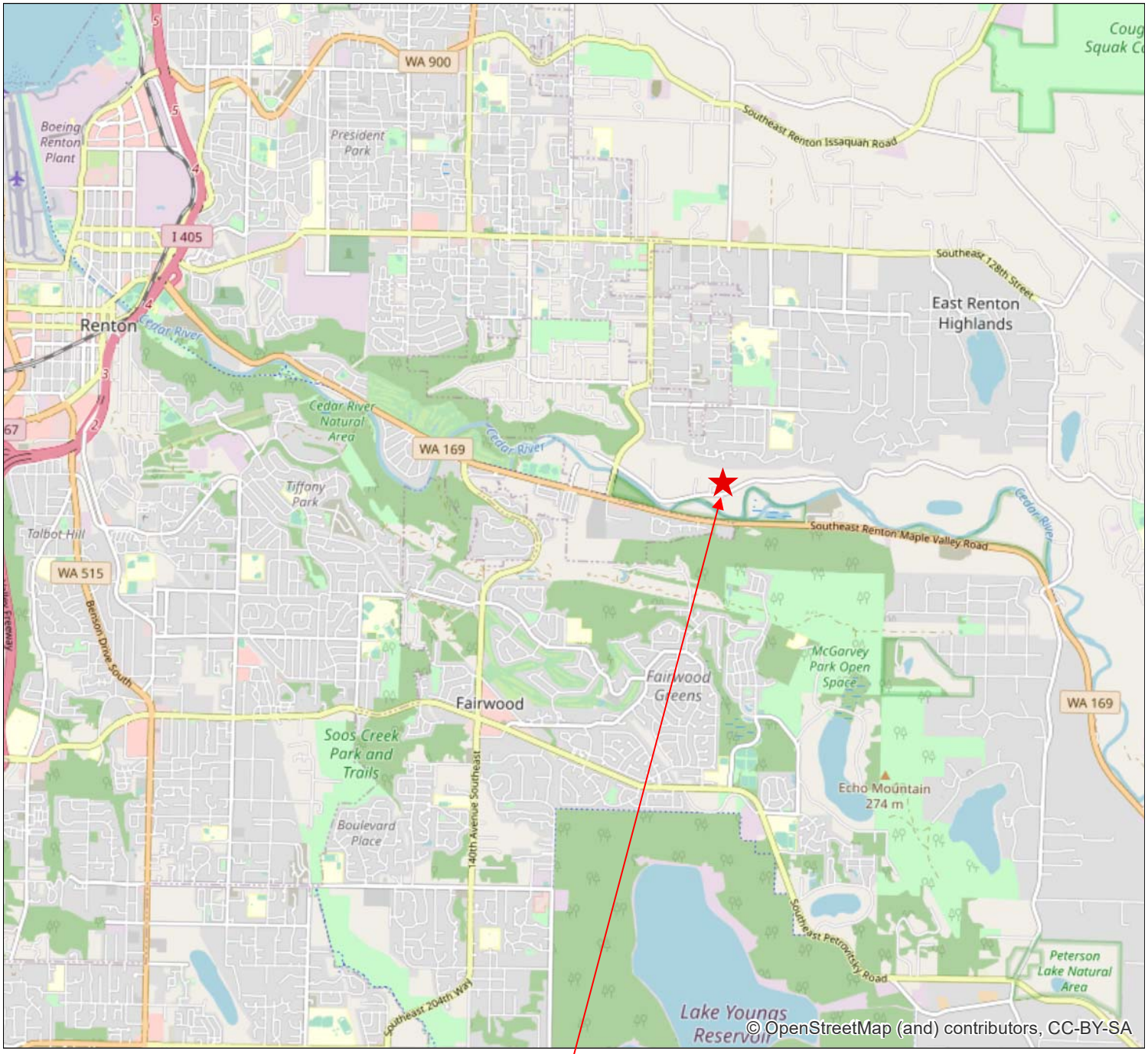

Approximate Site Location

Figure created from World Street Map

Not to Scale

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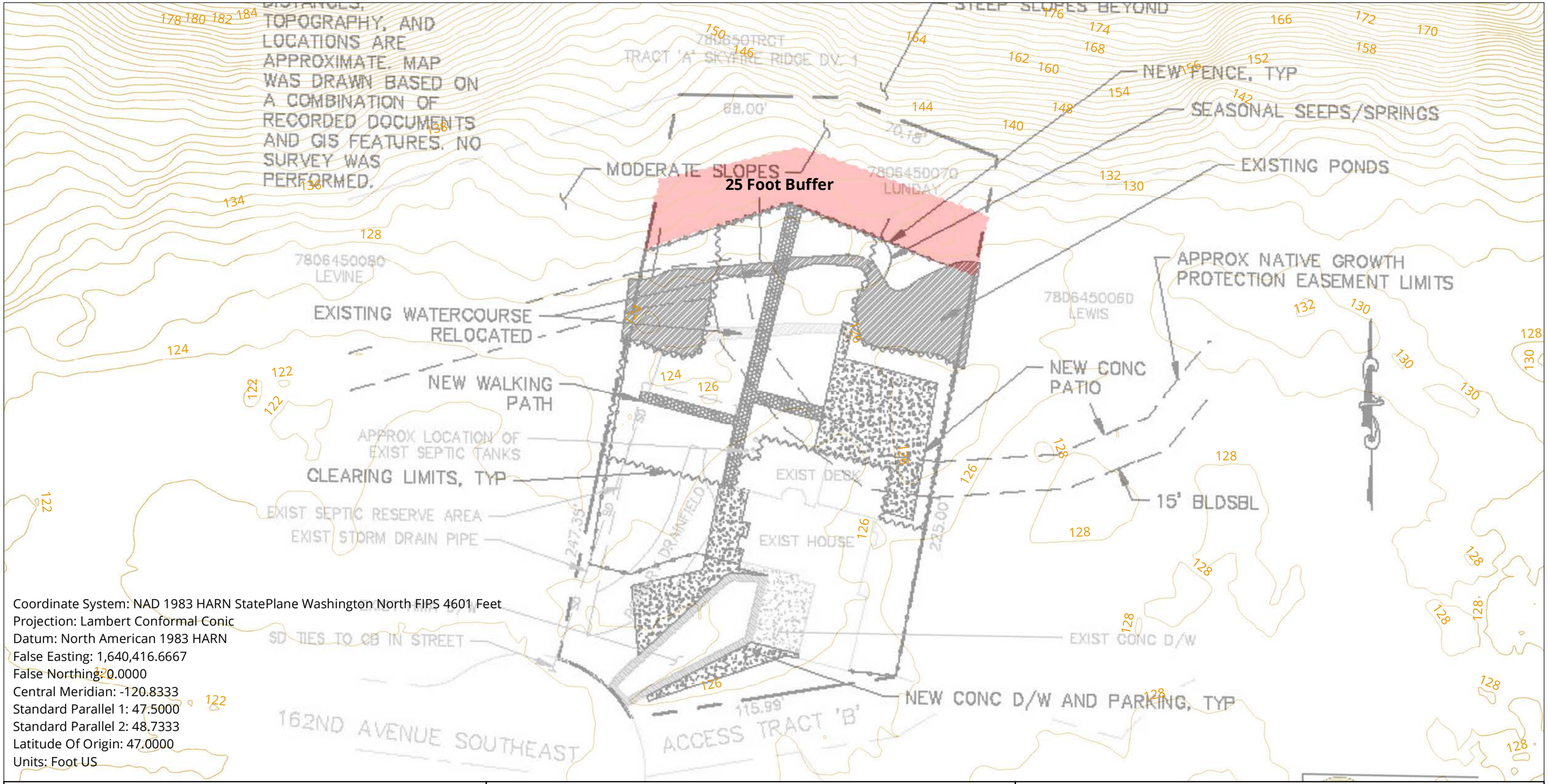
Site Location Map

Clearing and Grading Violation
15215 – 162nd Avenue Southeast
King County, Washington
PN: 7806450070

DocID: Lunday.162ndAveSE.F	August 2021	Figure 1



Coordinate System: NAD 1983 HARN StatePlane Washington North FIPS 4601 Feet
Projection: Lambert Conformal Conic
Datum: North American 1983 HARN
False Easting: 1,640,416.6667
False Northing: 0.0000
Central Meridian: -120.8333
Standard Parallel 1: 47.5000
Standard Parallel 2: 48.7333
Latitude Of Origin: 47.0000
Units: Foot US

Site Plan Prepared by Valor Engineering

25 Foot Buffer from Landslide Hazard Area

2 ft Elevation contours derived from LiDAR DTM

N

1 in = 40 ft

0 40 80 160 Feet

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Site Plan

Grading and Clearing Violation
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King County, WA
PN: 7806450070

DocID:Lunday.162ndAveSE	August 2021	Figure 2

Approximate Site Location

Figure created from King County 2019 aerial orthoimagery, King County Tax Parcel shapefile and elevation contours from King County GIS Center

Not to Scale

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Site Vicinity Map

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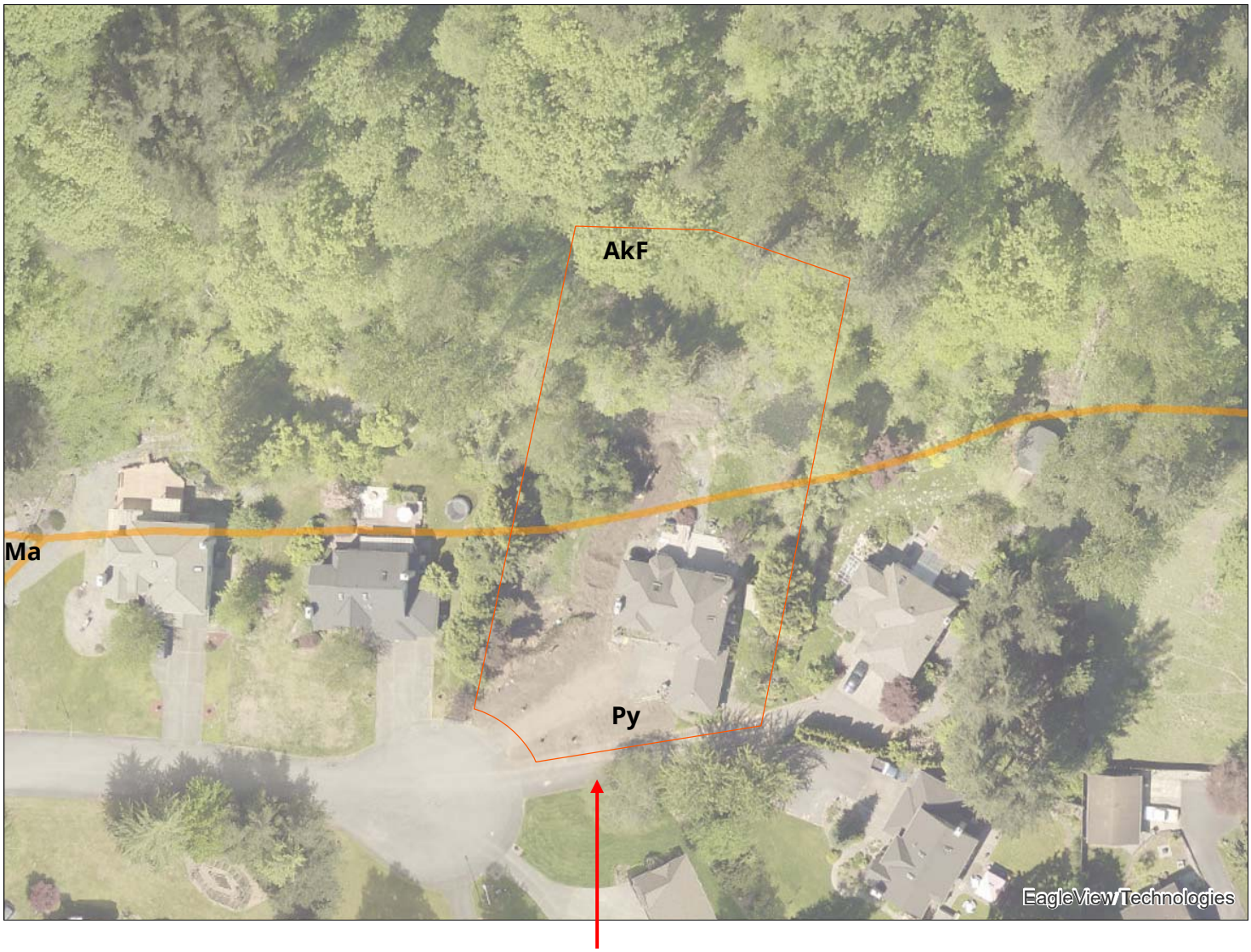
DocID: Lunday.162ndAveSE.F	August 2021	Figure 3



Approximate Site Location

Figure created from Washington State NRCS soil shapefile downloaded from the NRCS Web Soil Survey (http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx)

Soil Type	Soil Name	Parent Material	Slopes (%)	Erosion Hazard	Hydrologic Soils Group
AkF	Alderwood and Kitsap soils, very steep	Basal till with some volcanic ash	NA	Severe	B
Py	Puyallup fine sandy loam	Alluvium	NA	Slight	A

Not to Scale

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NRCS Soils Map

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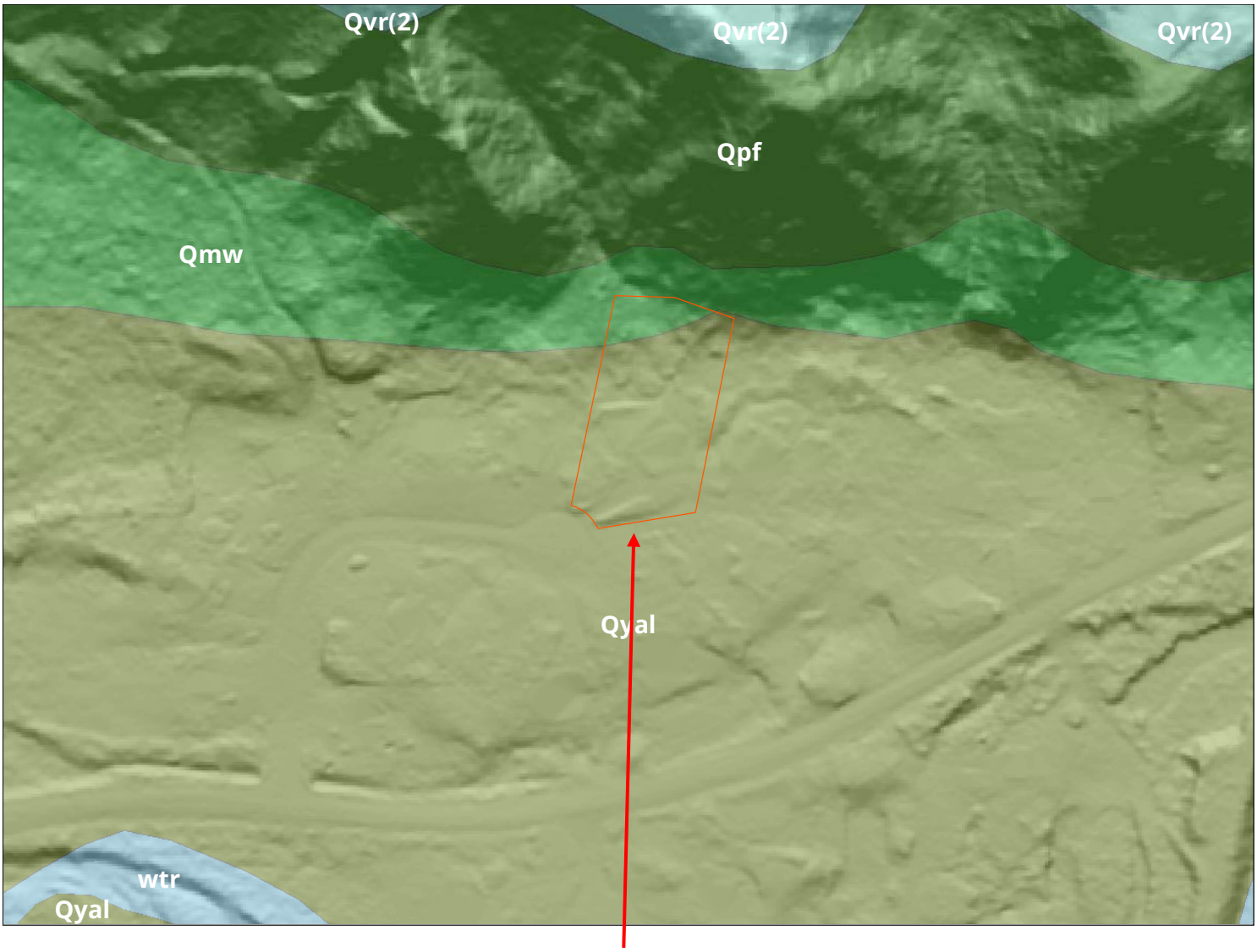

Approximate Site Location

An excerpt of the WA DNR digitized Booth, D. B., 1995, Surficial geologic map of the Maple Valley quadrangle, King County, Washington: U.S. Geological Survey Miscellaneous Field Studies Map MF-2297, 1 sheet, scale 1:24,000, compiled in ERSI ArcMap with a DTM Hillshade

Qmw	Mass Wasting Deposits
Qyal	Younger Alluvium Deposits
Qvr(2)	Vashon Recessional Stage 2 Deposits
Qpf	Glacial sedimentary deposits of pre-Fraser glaciation age

Not to Scale

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Geologic Map

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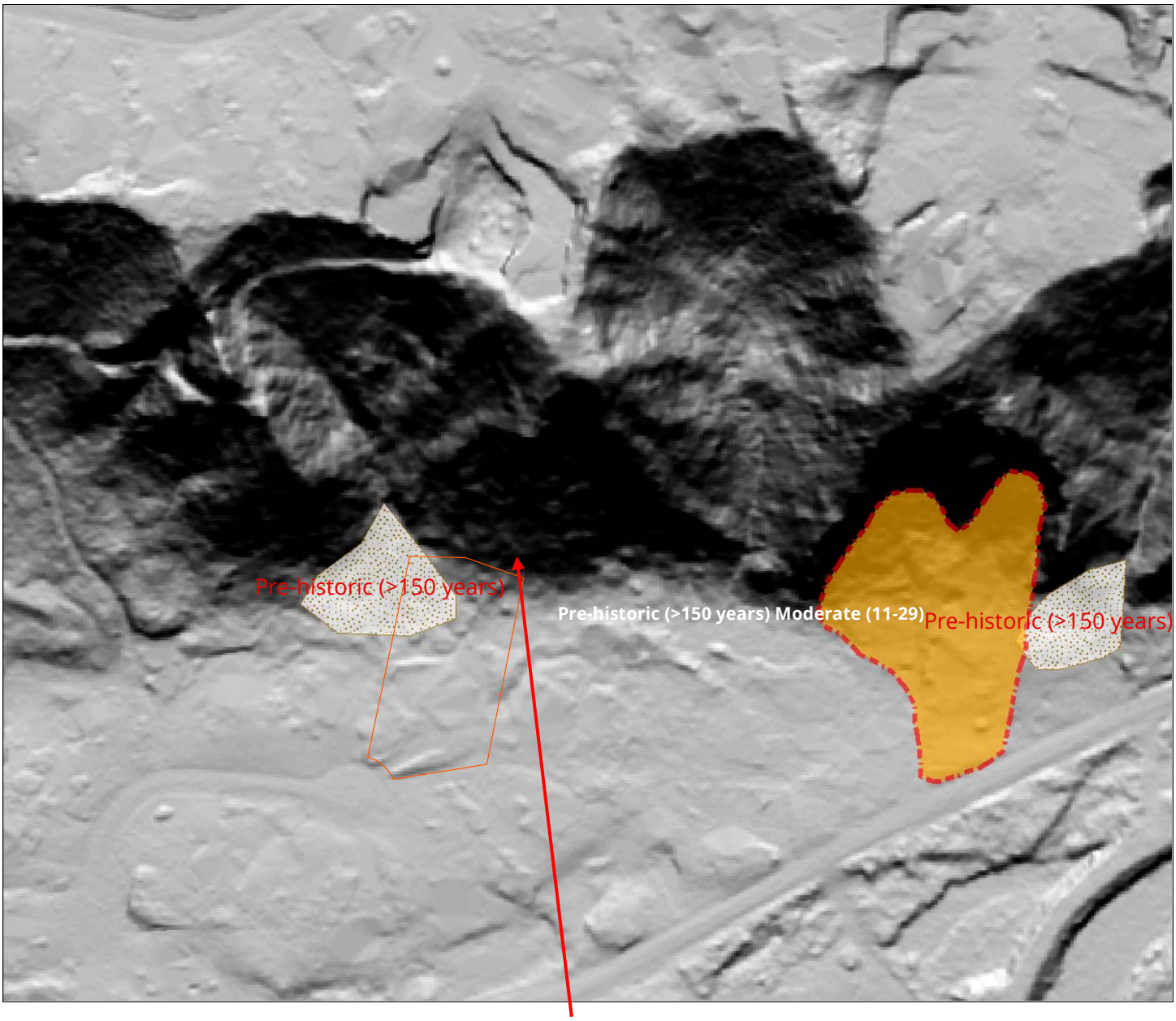

Approximate Site Location

Figure created using the WA DNR Landslide Compilation geodatabase and the Cedar River 2014 DTM 12 Hillshade

	Scarp
	Landslide Deposit
	Alluvial Fan

Not to Scale

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WA DNR Landslide Inventory

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