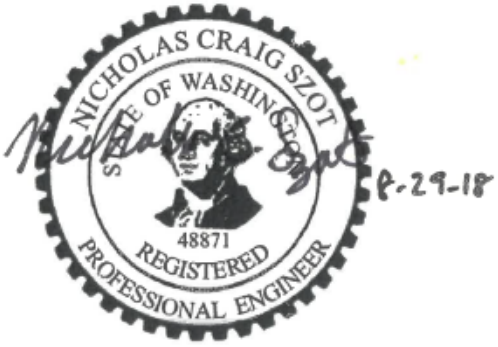
MEMORANDUM

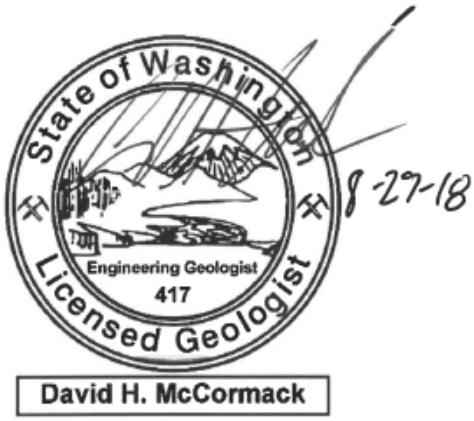
Project No.: 170566

August 29, 2018

To: Ben Alworth, Wheeler Ridge, LLC

From:





Nicholas Szot, PE
Senior Geotechnical Engineer
nszot@aspectconsulting.com

David McCormack, LHG, LEG
Principal Engineering Geologist
dmccormack@aspsectconsulting.com

Re: **Section 16 and 17 Upper Wheeler Road Reconnaissance and Planning-Level Geotechnical Considerations—Revised**

Introduction and Project Description

At the request of Wheeler Ridge, LLC (WR), Aspect Consulting, LLC (Aspect) has prepared this memorandum to provide planning-level geotechnical considerations for realignment of Upper Wheeler Road (road) in portions of Section 16 and 17, Township 21, Range 20 EWM in Chelan County, Washington (Site). The Site, Existing Wheeler Road Alignment and Proposed Road Alignment with stationing (with units of feet) are shown on Figure 1.

As part of a Washington Department of Natural Resources (DNR) Forest Practices Application/Notification (FPA), Aspect previously completed a desk study and Site reconnaissance to observe and delineate geologic hazards consisting of landslides. Aspect produced a memorandum titled *Slope Stability Reconnaissance* dated October 30, 2017 (Aspect, 2017) to summarize and describe Site geology, landslide features, and associated risks with orchard development and road building and/or realignment at the Site. The 2017 Slope Stability Reconnaissance memorandum is included as Attachment 1.

This memorandum utilizes conclusions from the Slope Stability Reconnaissance (Aspect, 2017) and additional Site observations made on June 15, 2018, by the geotechnical engineer to provide planning-level geotechnical considerations for realignment of the road.

From discussion with WR, we understand the road realignment plan generally consists of:

- Straightening the road to remove curves from Existing Wheeler Road Alignment from Station 0+00 (start) to 38+00.
- Abandoning Existing Wheeler Road Alignment from Station 38+00 to 98+00.
- Relocating the road alignment to the location shown on Figure 1 from Proposed Road Alignment Station 0+00 to 69+00.
- Designating it as an unpaved, primitive road to be used primarily for agricultural purposes.

This memorandum does not provide design-level geotechnical recommendations for elements such as final cut and fill slope angles or roadway section materials.

Site Reconnaissance

We visited the Site on June 15, 2018, to observe surface conditions near the existing road and proposed realignment areas. We observed the ground surface, which consists of forested land with native grasses, brush, and evergreen trees. We also observed the existing roadway, which consists of bare soil and gravel in places. Subsurface explorations were not completed, but from the exposed existing roadway surface, drainage ditch cuts, and bare soil areas, we observed that the upper soil generally consists of mixtures of silt, sand, and gravel with variable cobble and boulder material consistent with mass wasting deposits.

In addition to the landslide feature delineation presented in the Slope Stability Reconnaissance (Aspect, 2017), we also observed some additional surficial indications that past landslide activity or slow ground creep may have occurred to the north of delineated Deep-Seated Landslides shown on Figure 1, and between Proposed Road Alignment Station 2+00 to 25+00. These indications consist of tilted or pistol-butted evergreen trees and areas of depressed or hummocky terrain. These surface features in our opinion, indicates landslide activity or ground creep has occurred consistent with those described in the Slope Stability Reconnaissance (Aspect, 2017).

Planning-Level Geotechnical Considerations

In our opinion, there is no level of Site reconnaissance or analysis that can guarantee all areas of the Existing Wheeler Road Alignment or Proposed Road Alignment positioned within or near mapped/observed landslide features will be free from landslide or ground creep-induced movement in this geologic setting.

With those general risks stated, it is our opinion that there is relatively low likelihood that vertical and horizontal roadway movement from landslide activity will affect the proposed ‘straightened’ Existing Wheeler Road Alignment from Station 0+00 to 38+00 or the Proposed Road Alignment from approximately Station 32+00 to 42+00 over the design life of the road (assumed about 20 to 30 years).

Due to the proximity to delineated landslide activity, it is our opinion that there is an increased, moderate likelihood that landslide activity will negatively affect the Proposed Road Alignment

from approximately Station 0+00 (start) to 30+00, and 42+00 to 69+00 (end) over the design life of the road.

We estimate landslide or ground creep-induced movement could manifest as tension cracks and depressed/sagging areas, or as vertical movements causing offsets of the roadway. For these small movements, we anticipate that the roadway and drainages can be repaired/re-leveled with ongoing maintenance by WR after it occurs. A more extreme, but less likely, scenario is large-scale roadway movement on the order of several feet or more such that it might be most economical to WR to abandon the roadway and realign it further away from landslide activity.

In our opinion, there is a low life-safety risk from landslide activity along the Existing Wheeler Road Alignment and Proposed Road Alignment.

We recommend WR frequently inspect the roadway alignment to identify areas and drainages that might require repair or re-leveling.

We recommend utilities not be located in the Proposed Road Alignment so they don't become broken/severed and become a hazard (electrocution, erosion from water line break, etc.) or exacerbate landslide activity.

Working under these recommendations, WR must be willing to accept that ongoing road maintenance or road realignment to areas located further from observed landslide activity may be required over the design life of the road.

As described in the Slope Stability Reconnaissance (Aspect, 2017), maintaining natural drainage patterns to the extent practicable and limiting concentrated drainage collection and outflows is recommended to avoid exacerbating landslide activity at or near the road alignment. This could be accomplished by grading the new road to more-continuously shed water along its length, as opposed to collecting it in ditches and discharging concentrated flows using culverts or swales.

Similarly, we recommend the roadway realignment aim to limit the cuts and fills made to form a roadway prism to less than a few feet tall, with cut and fill slopes as flat as possible (our initial consideration is 2H:1V [horizontal:vertical] or flatter). This may not be possible in all areas, and slopes steeper than about 2H:1V should be addressed and evaluated in tandem with the project civil engineer (SCJ Alliance) on a case-by-case basis during the design-level phase.

Detailed recommendations for roadway section materials, compaction, and subgrade preparation are beyond the scope of this memorandum. In general, we envision the roadway sections will consist of native compacted subgrade that is proof rolled with heavy equipment to identify soft areas, then overlain with at least a foot of crushed rock or ballast and a crushed rock wear surface. We envision thicker sections of crushed rock, or inclusion of geosynthetic reinforcement grid or geotextile separator fabrics, may be advantageous in alignment areas observed to be persistently soft, wet, or prone to slow creep movement.

Limitations

Work for this project was performed for Wheeler Ridge, LLC, and this report was prepared consistent with recognized standards of professionals in the same locality and involving similar conditions, at the time the work was performed. No other warranty, expressed or implied, is made by Aspect Consulting, LLC (Aspect). The information above is for preliminary, planning-level design and should not be used for final design or construction.

Recommendations presented herein are based on our interpretation of site conditions, geotechnical engineering calculations, and judgment in accordance with our mutually agreed-upon scope of work. Our recommendations are unique and specific to the project, site, and Wheeler Ridge, LLC. Application of this report for any purpose other than the project should be done only after consultation with Aspect.

Variations may exist between the soil and groundwater conditions reported and those actually underlying the site. The nature and extent of such soil variations may change over time and may not be evident before construction begins. If any soil conditions are encountered at the site that are different from those described in this report, Aspect should be notified immediately to review the applicability of our recommendations.

Risks are inherent with any site involving slopes and no recommendations, geologic analysis, or engineering design can assure slope stability. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the client.

It is the Wheeler Ridge, LLC's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, and agents, are made aware of this report in its entirety. At the time of this report, design plans and construction methods have not been finalized, and the recommendations presented herein are based on preliminary project information. If project developments result in changes from the preliminary project information, Aspect should be contacted to determine if our recommendations contained in this planning level memorandum should be revised and/or expanded upon.

The scope of work does not include services related to construction safety precautions. Site safety is typically the responsibility of the contractor, and our recommendations are not intended to direct the contractor's site safety methods, techniques, sequences, or procedures. The scope of our work also does not include the assessment of environmental characteristics, particularly those involving potentially hazardous substances in soil or groundwater.

All reports prepared by Aspect for the Wheeler Ridge, LLC's apply only to the services described in the Agreement(s) with the Wheeler Ridge, LLC's. Any use or reuse by any party other than the Wheeler Ridge, LLC's is at the sole risk of that party, and without liability to Aspect. Aspect's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

Please refer to Attachment 2 titled "Report Limitations and Guidelines for Use" for additional information governing the use of this report.

We appreciate the opportunity to perform these services. If you have any questions please call Nick Szot, Senior Geotechnical Engineer, at 509.888.7218.

Attachments:

Figure 1 – Site Map and Landslide Hazard Delineation
Attachment 1 – Aspect Consulting, LLC, 2017 Slope Stability Reconnaissance Memorandum
Attachment 2 – Report Limitations and Guidelines for Use

V:\170566 KMO\Deliverables\Revised Geotechnical Memo\Geotechnical Recon Memo - Revised_20180829.docx

Proposed Road Alignment
Stationing (ft)
Proposed Road Alignment
Existing Wheeler Road Alignment
Stationing (ft)
Existing Road Alignment
Forest Unit
Road
Township/Range/Section
Hillshade derived from Colockum 2014 LiDAR.

T21N R20E S8
T21N R20E S17
T21N R20E S9
T21N R20E S16
T21N R20E S18
T21N R20E S17
T21N R20E S17
T21N R20E S20
T21N R20E S16
T21N R20E S21

HALLOWS
Mike's Canyon
CONVERGENT HEADWALL
Tributary
UNIT 1
120 acres
ADJOINING LANDSLIDES AND HALLOWS
Wheeler Ridge
UPPER WHEELER RD
ADJOINING LANDSLIDES
DEEP-SEATED LANDSLIDES
Orr Creek Tributary
ORR CREEK ROAD
BENCHED SLOPES
UNIT 2
130 acres
Orr Creek

0+00 5+00 10+00 15+00 20+00 25+00 30+00 35+00 40+00 45+00 50+00 55+00 60+00 65+00 70+00 75+00 80+00 85+00 90+00 95+00 100+00

0 600 1,200
Feet

GIS Path: T:\projects_8\KirkeMathisonOrchards_170566\Delivered\Site Map and Landslide Hazard Delineation.mxd || Coordinate System: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet || Date Saved: 8/28/2018 || User: rpepin || Print Date: 8/28/2018

Site Map and Landslide Hazard Delineation

Section 16 and 17 Upper Wheeler Road
Geotechnical Reconnaissance
Chelan County, Washington

Aspect Consulting	AUG-2018	BY: WMS / RAP	FIGURE NO. 1
	PROJECT NO. 170566	REVISED BY: NCS / RAP	

ATTACHMENT 1
Aspect Consulting
2017 Slope Stability
Reconnaissance Memorandum

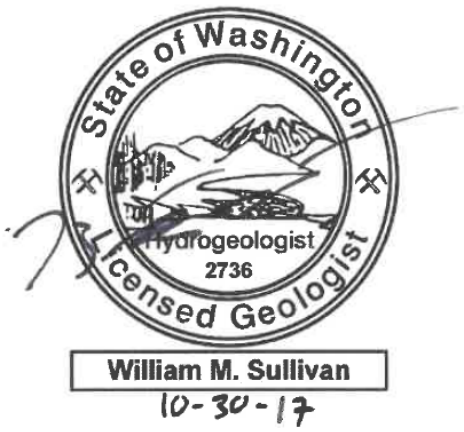
MEMORANDUM

Project No.: 170566

October 30, 2017

To: Ben Alworth, Wheeler Ridge, LLC

From:



Bill Sullivan, LHG
Senior Hydrogeologist
bsullivan@aspectconsulting.com

Dave McCormack, LEG, LHG
Principal Engineering Geologist
dmccormack@aspectconsulting.com

Re: **Slope Stability Reconnaissance**

Aspect Consulting, LLC (Aspect) prepared this letter and accompanying figure to document findings and recommendations of our slope reconnaissance for the region within and adjacent to proposed forestry practices in Section 17, T 21, R 20 EWM in Chelan County, Washington (Site).

Background and Project Understanding

Wheeler Ridge, LLC (WR) is submitting a Washington Department of Natural Resources (DNR) Forest Practices Application/Notification (FPA) to harvest timber on approximately 250 acres of privately-owned land in Section 17 for conversion to commercial cherry orchard. Proposed Site improvements include rehabilitation and decommissioning of existing unpaved roads and construction of new gravel-surfaced roads to facilitate orchard operations.

Forestry Units 1 and 2 are proposed for harvest and conversion to commercial orchard. Forestry Units 1 and 2 are 120 and 130 acres, respectively. These units and proposed road alignments are shown in Figure 1. Existing roads not shown in Figure 1 are proposed for decommissioning.

Scope of Work

Consistent with requirements of the FPA, Aspect performed a reconnaissance of potential slope instability that could result from proposed forestry practices, to assist DNR in classifying the forest

practices proposal. We conducted an office study of readily available existing information and a field inspection to identify the presence of potentially unstable landforms as defined by WAC 222-16-050.

During our office study, we examined WR's forest practices proposal, geological maps and reports, topographic maps, aerial photography, and LiDAR hillshade images. On October 12, 2017, an Aspect geologist performed a surface site reconnaissance, including areas within the proposed forestry units and adjacent areas within Section 17. Areas of Section 17 that were not field reviewed include the northwestern third in Squilchuck canyon, along the midslope canyon wall, and the steep slopes in an adjacent drainage, locally known as Mikes Canyon. Forestry Units 1 and 2, proposed new roads, and property lines had been previously marked in the field by WR staff and a land surveyor. Aspect was accompanied by Ben Alworth, WR Project Manager. Weather during the site visit was overcast with temperatures in the 40s and snow-free ground cover.

Site Conditions

The Site lies about 7 miles south of Wenatchee on Wheeler Ridge, and extends for 2.5 miles from the base of Naneum Ridge east to Wenatchee Heights. This ridge forms the topographic divide between the upper portions of the Stemilt and Squilchuck Creek basins. It is bounded to the south by Orr Creek, a tributary of Stemilt Creek, and to the north by Squilchuck Creek.

Forestry Units 1 and 2 are proposed to be located on the broad crest and gently sloping southern flank of Wheeler Ridge in the southeastern two thirds of Section 17. No forestry practices are proposed for the steep slope forming the southern canyon wall of the Squilchuck drainage in the northwestern third of Section 17.

Wheeler Ridge is incised by two drainages flowing west to east across the Site (Figure 1). In the southern portion of Section 17, the upper reaches of a small perennial tributary to Orr Creek run through Unit 2. Further east, this tributary becomes more incised and steeper, forming a topographic barrier separating Units 1 and 2. Topographic relief in this lower reach is about 150 feet. No timber harvest is proposed in the steeper, lower reach of the drainage, and forestry practices there will be limited to improving an existing unpaved road.

In the northern portion of Section 17, a small intermittent drainage runs through Unit 1 forming a tributary to Mikes Canyon, which drains to Squilchuck Creek. Maximum relief in this drainage is about 100 feet at the eastern boundary of Unit 1.

Topography and Slope Angles

Elevations across the Site vicinity range from 2,800 feet above sea level (asl) at Squilchuck Creek to 3,800 feet asl at Wheeler Ridge. Land surface slopes gently on Wheeler Ridge at 10 degrees or less. This includes lands within Units 1 and 2 where most forestry practices are proposed. Drainages incising Wheeler Ridge are between 100 and 150 feet deep. Figure 1 shows areas having slopes of 30 degrees or more. Steep slopes are located along the walls of Squilchuck and Mikes Canyons, in the sidewalls of drainages that incise Wheeler Ridge, and in the canyon walls of Orr Creek.

Development in Section 17 and Adjacent Areas

All of Section 17 is undeveloped except for several unpaved roads. These roads are unimproved and lack regular maintenance. Poorly maintained culverts at one or more small water crossings have resulted in localized erosion, deep ruts, and rerouting of water courses outside of their natural drainage channels.

The area adjacent to Section 17 is a mix of private and public ownership. Land use is in the vicinity is primarily commercial forestry. Commercial agriculture (orchard), an unpaved road (Orr Creek), and a county road (Stemilt Loop) are present within one to two miles downslope to the east and south in the Stemilt basin. Rural residential development, a county road (Squilchuck), and Squilchuck State Park are present along the bottom of Squilchuck canyon, within a half mile downslope.

Geology

Based on regional geologic map data (DNR, 2017[1]; Tabor et. al., 1982[2]), the surficial geology across Section 17 is primarily Quaternary-aged mass-wasting deposits overlying Tertiary continental sedimentary bedrock. Mass-wasting deposits are described as primarily consisting of landslide deposits locally including talus and colluvium. These deposits are mapped over the majority of Section 17 and the adjacent sections to the south, east, and northeast.

Wheeler Ridge is mapped as mass-wasting deposits, described by Tabor et al. (1982) as being older than mass wasting deposits mapped in adjacent areas (e.g., Stemilt basin) because they stand in relief above younger landslides. Younger landslides are mapped in the Squilchuck canyon along the western portion of Section 17 and within 1 mile to the northeast of Section 17.

Tertiary sedimentary rocks of the Chumstick Formation are described as consisting of sandstone, siltstone, and conglomerate. The Chumstick Formation underlies mass-wasting deposits on Wheeler Ridge and regional maps show it cropping out along steep canyon walls in the northwest and northeast portions of Section 17.

A fault of unknown offset is mapped striking northwest to southeast within a half mile southwest of Section 17.

Observations

The Site shows signs of past slope instability resulting from natural processes. Past failures were observed on slopes of 20 degrees and greater within the geologic unit mapped as mass-wasting deposits. Figure 1 contains mark-ups showing locations where there is evidence of past instability or potentially unstable landforms. These are discussed below.

[1] Washington Department of Natural Resources (DNR), 2017, Division of Geology and Earth Resources, Washington Interactive Geologic Map, online at http://www.dnr.wa.gov/geologyportal.

[2] Tabor, R. W., Waitt, R. B., Frizzell, V.A., Jr., Swanson, D. A., Byerly, G. R., and Bentley, R. D., 1982, Geologic Map of the Wenatchee 1:100,000 Quadrangle, Central Washington, United States Department of the Interior Geological Survey, Miscellaneous Investigations Series Map 1-13311.

We observed rule-identified landforms potentially indicating unstable slopes including convergent headwalls and hollows having slopes greater than 35 degrees, inner gorges, and other areas where evidence cumulatively suggest the presence of unstable slopes. We did not observe rule-identified landforms including deep-seated landslides having toe slopes greater than 33 degrees, groundwater recharge areas for deep-seated glacial landslides, or outer edges of meander bends.

Areas where evidence of past slope instability was observed include:

- **Northeastern corner of Section 17.** Steep slopes exceeding 30 degrees are present adjacent to the eastern boundary of Unit 1. A convergent headwall measuring about 1,000 feet across and one or two hollows and inner gorges are present in the upper reaches of Mikes Canyon along the eastern boundary of Unit 1. Within Unit 1, there is evidence of a small landslide measuring about 50 feet across located on the north sidewall of the tributary drainage to Mikes Canyon.
- **Northwestern third of Section 17.** Steep slopes exceeding 30 degrees are present adjacent to the western boundaries of Units 1 and 2. These slopes drop about 800 feet vertically from Wheeler Ridge to the bottom of the Squilchuck canyon. Several hollows up to between about 100 and 500 feet across are present in the upper portion of the canyon wall along the northwestern boundaries of Units 1 and 2. The upslope extent of these hollows terminates at or slightly within the boundaries of the forestry units.
- **Orr Creek Tributary.** Within Unit 2 in the upper reaches of the Orr Creek tributary, slope failure was observed along the sidewalls of the drainage on slopes of about 20 degrees. On the northern sidewall, benched terrain suggests slow moving creep processes. On the southern sidewall, a small rotational landslide measured about 50 feet across. Further down the drainage in the region between Units 1 and 2, multiple slope failures were observed in sidewalls having slopes of 30 degrees or more. Several adjoining landslides were observed on both sides of the drainage. These landslides lie adjacent to the southern and northern boundaries of Units 1 and 2, respectively. At least two deep-seated rotational slides measuring about 200 feet across were observed with toes extending to the bottom of the drainage. Slope angles at the toes of slides on the Site are less than 33 degrees.

The primary mechanism for slope failure in the Site vicinity is oversteepening of sidewalls resulting from long term drainage incision. No active or recent slope failures were observed. The age of past instability is inferred to be on the order of hundreds of years based on the roundedness of scarp surfaces and the presence of well-developed soils and vegetation (trees) on the landslide deposits. While no recent slope failures were identified, the mechanism driving past slope failures is ongoing. Future slope failures could include reactivation of old landslides and initiation of new ones, especially during periods of wet weather or seismic activity.

Conclusions

Evidence of past slope failures and landforms having potential instability were identified within the Site and vicinity. Most failures occurred in the region mapped as mass-wasting deposits on slopes over 30 degrees and some occurred on slopes as low as 20 degrees (within Unit 2). These are old landslides on the order of 100 years of more. While no recent landslide activity was noted, we expect ongoing drainage incision will continue to oversteepen sidewalls, leading to periodic, natural

slope failures. Subsequent landslides are expected to be no larger than the largest past failures observed at the Site and their impacts are not expected to extend offsite.

Considering the recommendations we outline below, we expect the proposed forestry practices will not increase slope instability nor result in impacts to existing development. The overall risk to life safety from the proposed forestry practices is low.

Risks of Unstable Slopes

The potential for further slope instability could be increased through changes to Site hydrology, by removing mature groundcover and changing natural drainage patterns, or by modifying slopes. The greatest potential for instability will be during the first few years following timber harvest and ground clearing, and prior to orchard groundcover becoming established. Increased infiltration and runoff can be expected during this period.

Road construction has the potential to change natural drainage patterns by diverting water in roadside ditches away from natural drainage courses and concentrating flows on steep slopes, resulting in erosion and soil saturation. Additionally, broken or leaking irrigation pipes could increase slope instability by saturating soils. Earth grading, including loading the tops of slopes with fill and oversteepening the toes of steep slopes (e.g., during road construction) could also increase slope instability.

Recommendations

The following recommendations are provided to mitigate risks of increasing slope instability resulting from proposed forestry at the Site:

- Minimize clearing native landcover on slopes of 20 degrees or greater. Where timber must be harvested to support adequate sunlight adjacent to orchard margins, we recommend maintaining natives grass, shrub, and soil to minimize runoff, erosion, and infiltration into the subsurface. Replant disturbed groundcover immediately after clearing.
- Implement adequate roadway drainage design. When constructing roads, use appropriate best management practices (BMPs) for drainage design to minimize saturation of soils on steep slopes and erosion. Designs should consider constructing roadside ditches on the uphill side and providing multiple, properly sized culverts to maintain natural drainage courses avoiding concentrating flows on steep slopes. Culverts should be maintained to avoid clogging/overtopping. Culverts within the Orr Creek tributary should be properly sized and water courses returned to their natural channels to minimize erosion and soil saturation.
- Avoid large fills and steep cuts near steep slopes. Large soil stock piles should not be placed adjacent to the tops of steep slopes. Avoid filling depressions near the tops of steep slopes. In some cases, these are the uppermost expressions of hollows resulting from previous slope movement. Filling these depressions could reinitiate slope movement.

Limitations

Work for this project was performed for Kyle Mathison Orchards (Client), and this memorandum was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

Attachments: Figure 1 – Slope Stability Assessment Form Map
Attachment 1 – Slope Stability Reconnaissance Form

V:\170566 WR\Deliverables\Slope Stability Reconnaissance.docx

T21N R20E S7
T21N R20E S18

T21N R20E S8
T21N R20E S17

T21N
T21N

Squilchuck Creek

SQUILCHUCK RD

Residential Homes

MISSION RIDGE RD

HALLOWS

Mike's Canyon

CONVERGENT HEADWALL

Tributary

UNIT 1
120 acres

UPPER WHEELER RD

ADJOINING LANDSLIDES AND HALLOWS

Wheeler Ridge

ADJOINING LANDSLIDES

DEEP-SEATED LANDSLIDES

Orr Creek Tributary

T21N R20E S18
T21N R20E S17

T21N R20E S17
T21N R20E S16

State Park

BENCHED SLOPES

UNIT 2
130 acres

ORR CREEK ROAD

T21N R20E S17
T21N R20E S20

Orr Creek

Wenatchee River
Columbia River
Wenatchee
Stemilt Creek
Squilchuck Creek
SITE LOCATION

Forest Unit
Slope > 30°
Road
Township/Range/Section

Hillshade derived from Colockum 2014 LiDAR.

0 600 1,200
Feet

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Slope Stability Assessment Form Map

Slope Stability Reconnaissance
Wheeler Ridge, LLC, Section 17, T21 N R20 EWM
Chelan County, Washington

Aspect Consulting	OCT-2017	BY: WMS / RAP	FIGURE NO. 1
	PROJECT NO. 170566	REVISED BY: ---	

GIS Path: T:\projects_8\Section17_170566\Delivered\Site Map.mxd || Coordinate System: NAD 1983 HARN StatePlane Washington South FIPS 4602 Feet || Date Saved: 10/30/2017 || User: rpelin || Print Date: 10/30/2017

Appendix D. Slope Stability Informational Form

Complete and attach this form to your FPA if you answered 'Yes' to FPA Question 11 or 12. Refer to WAC 222-16-050(1)(d) and Forest Practices Board Manual Section 16—*Guidelines for Evaluating Potentially Unstable Slopes* for definitions and descriptions of potentially unstable slopes or landforms.

1. What screening tools were used? ☒ Aerial Photo, ☒ LiDAR, ☒ Landslide Inventory, ☒ Landslide Hazard Zone Polygon, ☒ GIS/Other (describe):

Evaluation of air photo history and published geologic maps.

2. Were there any features identified using the screening tools in #1 that did not exist in the field? If yes, describe:

None.

3. a. What potentially unstable slopes or landforms were identified in the area of your forest practices activity? Check all that apply:

☐ Inner Gorge ☐ Groundwater recharge areas for glacial deep-seated landslides
☒ Bedrock Hollow ☐ Convergent Headwall ☐ Toe of deep-seated landslide
☐ Outer edges of meander bends
☒ Other (Deep-seated landslides or other features of potentially unstable slopes). Describe:

-The heads of some bedrock hollows extend to the top of slope, into the edge of proposed forestry Units 1 and 2.
-Benched slopes observed in Unit 2.
-One small rotational landslide observed in Unit 2.

See attached letter report for additional details.

b. What activities may occur in potentially unstable slopes or landforms? Check all that apply:

☒ Timber harvest ☒ Road construction ☐ Suspending cables ☐ Yarding ☐ Tailholds

4. a. What potentially unstable slopes or landforms were identified around the area of your forest practices activity?

Check all that apply:

☒ Inner Gorge ☐ Groundwater recharge areas for glacial deep-seated landslides
☒ Bedrock Hollow ☒ Convergent Headwall ☐ Toe of deep-seated landslide
☐ Outer edges of meander bends
☒ Other (Deep-seated landslides or other features of potentially unstable slopes). Describe:

Rotational deep-seated landslides, small rotational andslides, benched slopes.

See attached letter report for additional details.

b. What activities may occur around potentially unstable slopes or landforms? Check all that apply:

☐ Timber harvest ☒ Road construction ☐ Suspending cables ☐ Yarding ☐ Tailholds

5. If any features identified in #3.a. and /or #4.a. were bounded out, describe the manner in which the boundary was determined:

Boundaries were delineated based on a combination of aerial photos, LIDAR hillshade, and field observations.

See Figure 1 in the attached letter report for boundaries.

6. Were areas of public use (which may include, but are not limited to: public roads, utilities, designated recreation areas, occupied structures, etc.) identified in or around the area of your proposed forest practices activity? Show these locations on the map in #8.

Section 17, T 21 N, R 20 EWM where forest practices are proposed is undeveloped.

Development in adjacent areas consists of:
-Rural residential homes and Squilchuck State Park within 1/2 mile to the northwest in Squilchuck canyon.
-Orr Creek Road (an unimproved road) adjacent to the eastern boundary of Section 17.

See Figure 1 in the attached letter report.

7. Date of field review: October 12. 1017

Person(s) that conducted field review:

Bill Sullivan	Geologist
Name	Title/position
Ben Alworth	Project Manager
Name	Title/position

8. Show all field reviewed areas for potentially unstable slopes or landforms on a map (may use a forest practices activity map, harvest map or GIS map – See example below). Show locations where areas of public use exist. **This map is intended to be developed by the field practitioner.**

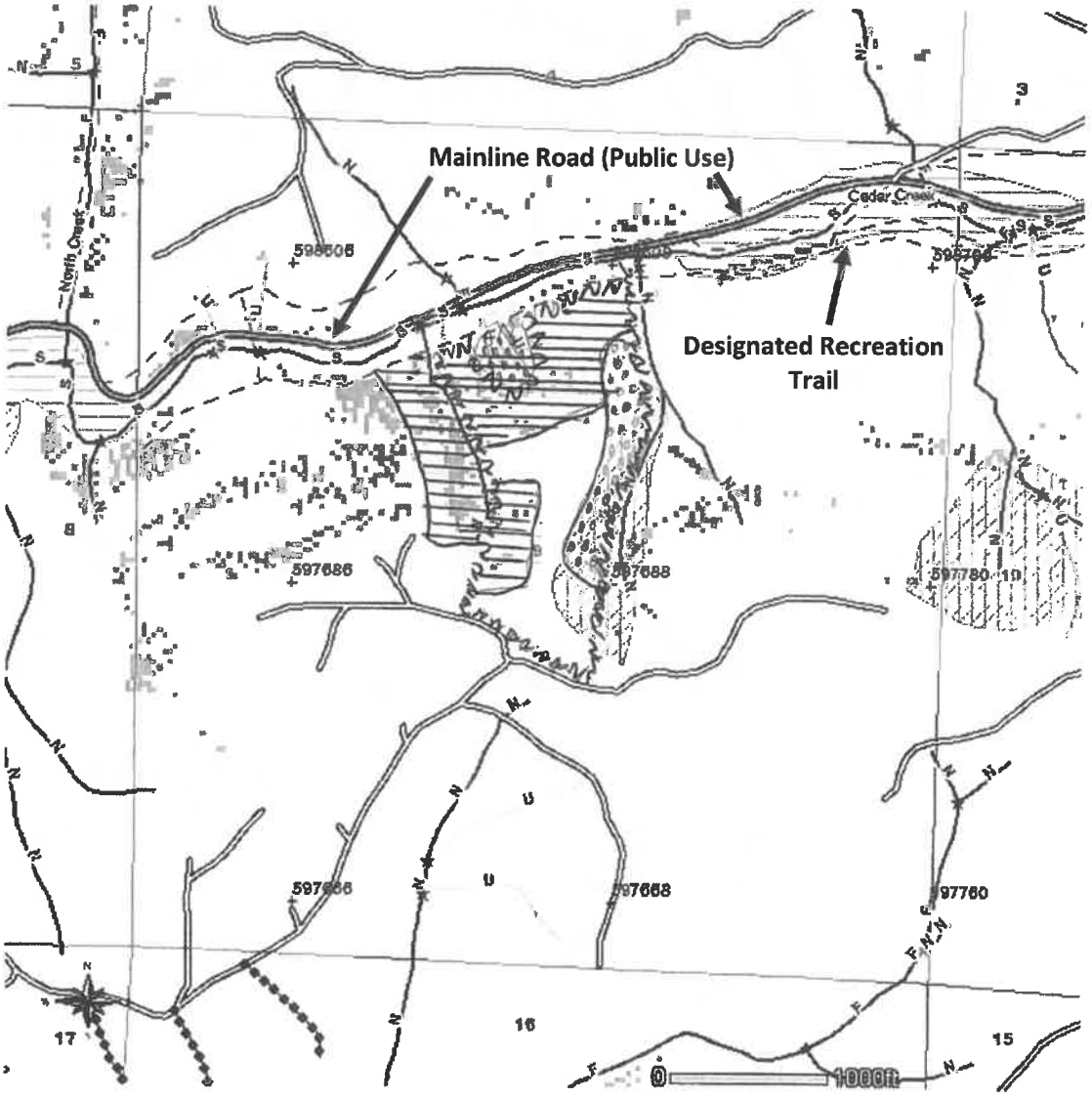
Map Output

FOREST PRACTICE RESOURCE MAP

TOWNSHIP 16 NORTH HALF 0, RANGE 04 WEST (W.M.) HALF 0, SECTION 09

Application #: Example

Slope Stability Assessment Form Map



No Issues of Concern

Thursday, March 20, 2014 7:40:16 AM
NAD 83

Proposed Unit
Areas Field Reviewed
Field Verified Potentially Unstable Landforms

For use with FPA/N dated 6/1/2016 or later

ATTACHMENT 2

Report Limitations and Guidelines for Use

REPORT LIMITATIONS AND GUIDELINES FOR USE

Geoscience is Not Exact

The geoscience practices (geotechnical engineering, geology, and environmental science) are far less exact than other engineering and natural science disciplines. It is important to recognize this limitation in evaluating the content of the report. If you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or property, you should contact Aspect Consulting, LLC (Aspect).

This Report and Project-Specific Factors

Aspect's services are designed to meet the specific needs of our clients. Aspect has performed the services in general accordance with our agreement (the Agreement) with the Client (defined under the Limitations section of this project's work product). This report has been prepared for the exclusive use of the Client. This report should not be applied for any purpose or project except the purpose described in the Agreement.

Aspect considered many unique, project-specific factors when establishing the Scope of Work for this project and report. You should not rely on this report if it was:

- Not prepared for you;
- Not prepared for the specific purpose identified in the Agreement;
- Not prepared for the specific subject property assessed; or
- Completed before important changes occurred concerning the subject property, project, or governmental regulatory actions.

If changes are made to the project or subject property after the date of this report, Aspect should be retained to assess the impact of the changes with respect to the conclusions contained in the report.

Reliance Conditions for Third Parties

This report was prepared for the exclusive use of the Client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against liability claims by third parties with whom there would otherwise be no contractual limitations. Within the limitations of scope, schedule, and budget, our services have been executed in accordance with our Agreement with the Client and recognized geoscience practices in the same locality and involving similar conditions at the time this report was prepared

Property Conditions Change Over Time

This report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by events such as a change in property use or occupancy, or by natural events, such as floods, earthquakes, slope instability, or groundwater fluctuations. If any of the described events may have occurred following the issuance

of the report, you should contact Aspect so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Geotechnical, Geologic, and Environmental Reports Are Not Interchangeable

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

We appreciate the opportunity to perform these services. If you have any questions, please contact the Aspect Project Manager for this project.