MEMORANDUM

Project No. 180274

July 24, 2020

To: Ben Alworth, Wheeler Ridge, LLC

From:

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

07/24/2020

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

07/24/2020

William Sullivan, LHG, CWRE
Senior Hydrogeologist
wsullivan@aspectconsulting.com

Re: **Section 17 Follow-On Geotechnical Reconnaissance**

Introduction and Project Description

At the request of Wheeler Ridge, LLC (WR), Aspect Consulting, LLC (Aspect) has prepared this memorandum to document observations from our site reconnaissance performed by Aspect's Bill Sullivan (geologist) and Nick Szot (geotechnical engineer) and Wheeler Ridge staff on July 2, 2020, in portions of Section 17, Township 21, Range 20 EWM in Chelan County, Washington (Site). The purpose of the follow-on Site reconnaissance was to delineate areas in Section 17 related to the realignment of Upper Wheeler Road (road) and a proposed irrigation reservoir in order to verify that the relocated road segments, reservoir, and worker-housing and shop buildings would be located in areas that would have minimal risk of experiencing slope failure during the project's 50-year estimated lifespan. The existing and proposed Wheeler Road Alignment and proposed reservoir and buildings location are shown on Figure 1.

Background

WR proposes to develop a commercial cherry orchard on approximately 250 acres within privately owned land in Section 17 (Project). In addition to orchard trees, the Project is proposed to consist of irrigation sprinklers, and cover grass for the orchard, fencing, gravel-surfaced roads, several small buildings associated with seasonal-worker housing and a shop, and an irrigation storage reservoir planned for less than 10 acre-feet (ac-ft) volume and erected less than 5 feet above existing grade. Water will be conveyed to the Site, via new buried pipeline, from lower elevation sources northeast of the Site. The Project requires improving and rerouting Upper Wheeler Ridge Road, a primitive county road. Except for the county road, the Site is currently undeveloped.

Existing Studies

Three studies documenting slope stability and earth conditions at the Site have been completed related to the Project. Another study was completed addressing slope stability for a nearby similar project.

Aspect produced a memorandum for the Project titled "Slope Stability Reconnaissance" dated October 30, 2017, to summarize and describe Site geology, landslide features, and associated risks with orchard development and road building and/or realignment at the Site (Aspect, 2017). This report supported WR submitting a Washington Department of Natural Resources (DNR) Forest Practices Application/Notification (FPA) to harvest timber on approximately 250 acres and convert land use to a commercial cherry orchard.

Aspect produced a memorandum titled "Section 16 and 17 Upper Wheeler Road Reconnaissance and Planning-Level Geotechnical Considerations" dated August 7, 2018, providing planning-level geotechnical considerations for realignment of Upper Wheeler Road at the Site and in adjacent Section 16 (Aspect, 2018a). The geotechnical memorandum was revised on September 12, 2018, to reflect changes in road realignment (Aspect, 2018b).

Aspect produced a memorandum for the Project titled "Section 17 Geological Hazard Assessment" dated May 20, 2020, consistent with the Geologically Hazardous Overlay District (GHOD), Chapter 11.86 of the Chelan County Code, addressing the potential for geological hazards at the Site (Aspect, 2020).

Aspect's previous studies concluded that although slope movement processes are expected to continue due to natural processes in portions of the Site during the Project's design life, there is very low life-safety risk from landslide activity, provided that Aspect's recommendations are followed. Aspect also concluded that there is moderate likelihood that ground creep-induced movement will negatively affect some portions (totaling approximately 7,000 linear feet, estimate) of the Proposed Road Alignment over the 50-year design life of the road (Aspect, 2018b). In our opinion, this could result in periodic maintenance of the roadway, but does not present a threat to life-safety or property.

Follow-On Site Reconnaissance

1. This effort was undertaken at the request of WR in response to comments received from agencies and the public during permitting and environmental review for the Project. Some comments expressed concern about potential impacts from the Project on slope stability and impacts to the proposed county road realignment and reservoir from potential slope instability.

Recognizing that there are very few sites in Chelan County where the risk of slope movement is zero, Aspect's goal for the follow-on Site reconnaissance was to identify areas where the risk is minimal for landslide processes to negatively impact the county road realignment, proposed reservoir, and wood-framed worker-housing and shop buildings.

During Aspect's follow-on Site reconnaissance, we marked a traverse line near the top of slope of Wheeler Ridge using flagging and global positioning system (GPS) points (Figure 1). This traverse line represents our professional estimate of the delineation between Site areas having some risk of experiencing significant slope movement on the downslope side during the 50-year design life of the Project from areas having minimal risk of slope movement on the upslope side. Our delineation was determined based on examination of aerial photography, light detection and ranging (LiDAR), and field observations. These delineations include the absence of geomorphological features potentially indicating past or ongoing apparent slope failure and ground-creep slope movement (e.g., tilted or pistol-butted evergreen trees, scarps, sag ponds, areas of depressed or hummocky terrain, bare soil, and colluvium) and low slope angle (less than 10 percent) on the upslope side of the traverse.

Conclusions and Recommendations

The conclusions and recommendations discussed below draw from our understanding of the Project, work completed during previous studies at the Site, and observations from our follow-on Site reconnaissance detailed above. Recommendations listed in our previous studies still apply and should be reviewed during planning and construction.

- The traverse line shown on Figure 1 represents the delineation of areas having low to moderate risk of slope failure during the design life of the Project from areas on the upslope side having minimal risk during the same period.
- For a county road realignment located upslope from the traverse line shown on Figure 1, we estimate there is very low risk that horizontal and vertical roadway movement from landslide activity will result in significant negative impact to the roadway. A realignment located upslope from the traverse line is not expected to experience large-scale roadway movement on the order of several feet or more, provided that recommendations in our previous studies are followed. Any deformation of the roadway during its design life resulting from slow moving soil creep processes is likely to be localized and on the order of inches, not feet. Should this occur, the resulting small tension cracks and depressed/sagging areas can be repaired by regrading or filling. Potential deformation to the realigned roadway is expected to be no worse than deformation experienced along the current county road alignment which is primitive and unmaintained. The net result of the Project will be, at a minimum, to relocate the road "in-kind" or to improve the condition and safety of the county road over the existing condition.

- The proposed location for the reservoir, shown on Figure 1, lies over 100 feet upslope from the traverse line on ground sloping less than 10 percent to the southeast. The risk of slope movement at this location due to natural processes is very low, and the risk of reservoir failure resulting in risk to life-safety or property is nominal based on the following:
  - We understand the reservoir will be lined and partially excavated into the ground so that approximately one-half of the stored volume will lie below natural grade. We understand the reservoir embankments are planned to be sloped 3H:1V or flatter and comprised from compacted structural fill. This proposed approach to reservoir construction will not increase loading on the top of the slope because the mass of water volume in the reservoir will be offset by the mass of soil excavated below grade. In addition, the reservoir will be substantially set back from the break in the slope, further minimizing any effects from loading. Because the reservoir is not proposed to store 10 acre-feet or more above natural ground surface, it will not be subject to review by Washington State Department of Ecology's Dam Safety Office under Revised Code of Washington (RCW) 90.03.350. A lined and partially excavated reservoir with the general configuration and location described above is not anticipated to require additional geotechnical evaluation.
  - We recommend that the reservoir be constructed with an under-liner sump and drainage system to detect liner leaks and prevent any leaking water from infiltrating into the subsurface beneath the reservoir. Conceptually the sump and drainage system should consist of free-draining sand and gravel beneath the reservoir liner with embedded lengths of perforated pipes to convey any leakage to a tight-line drain pipe daylighted to an area that is away from nearby slopes and can easily be inspected by WR staff.
- The proposed location for the worker-housing and shop buildings, shown on Figure 1, lies upslope from the traverse line on ground sloping less than 10 percent to the east and southeast. The risk of any slope movement at this location due to natural processes is very low.
  - We recommend locating the on-Site septic-system drain field associated with these buildings as far distant from the traverse line as practicable. Additional geotechnical evaluation for the buildings is not anticipated to be required.

References

Aspect Consulting, LLC (Aspect), 2017, Slope Stability Reconnaissance, prepared for Wheeler Ridge, LLC, October 30, 2017.

Aspect Consulting, LLC (Aspect), 2018a, Section 16 and 17 Upper Wheeler Road Reconnaissance and Planning-Level Geotechnical Considerations, prepared for Wheeler Ridge, LLC, August 7, 2018.

Aspect Consulting, LLC (Aspect), 2018b, Section 16 and 17 Upper Wheeler Road Reconnaissance and Planning-Level Geotechnical Considerations—Revised, prepared for Wheeler Ridge, LLC, revised September 12, 2018.

Aspect Consulting, LLC (Aspect), 2020, Section 17 Geological Hazard Assessment, prepared for Wheeler Ridge, LLC, May 20, 2020.

Limitations

Work for this project was performed for Wheeler Ridge, LLC (Client), 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).

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 Client. 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 Client'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 report 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 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. 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 Appendix A 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 Engineering, at 509.888.7218.

Attachments: Figure 1 – Site Map and Landslide Hazard Delineation
Appendix A – Report Limitations and Guidelines for Use

V:\180274 On-Call Services Science & Engineering Technical Support\Deliverables\Section 17 Follow-On Site Recon Memo\FINAL\Follow On Site Recon Memo_07242020.docx

FIGURES

T21N R20E S8
T21N R20E S17

T21N R20E S9
T21N R20E S16

HOLLOWS

POTENTIAL DEBRIS FLOW HAZARD

CONVERGENT HEADWALL

PROPOSED CAMP LOCATION

PROPOSED RESERVOIR LOCATION

ADJOINING LANDSLIDES AND HOLLOWS

UNIT 1
120 acres

LANDSLIDE HAZARD DELINEATION LINE

ADJOINING LANDSLIDES

DEEP-SEATED LANDSLIDES

POTENTIAL DEBRIS FLOW HAZARD

T21N R20E S17
T21N R20E S16

LANDSLIDE HAZARD DELINEATION LINE

UNIT 2
80 acres

BENCHED SLOPES

UNIT 3
60 acres

T21N R20E S17
T21N R20E S20

T21N R20E S16
T21N R20E S21

T21N R20E S18
T21N R20E S17

Ridge

Wheeler

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

Existing Wheeler Road Alignment
Proposed County Road Realignment
Landslide Hazard Delineation
Stationing (ft)
Existing Road Alignment
Forest Unit (approximate)
Township/Range/Section

Hillshade derived from Colockum 2014 LiDAR.

Site Map and Landslide Hazard Delineation

Follow On Site Recon Memo
Wheeler Ridge Section 17
Chelan County, Washington

Aspect Consulting	JUL-2020	BY: WMS / RAP	FIGURE NO. 1
	PROJECT NO. 170566	REVISED BY: EAC	

GIS Path: T:\projects_8\WyleMathison\Orchards_170566\Delivered\Follow On Site Memo\Fig 1 Site Map and Landslide Hazards.mxd || Coordinate System: NAD 1983 StatePlane Washington South FIPS 4602 Feet || Date Saved: 7/24/2020 || User: ecrumbaker || Print Date: 7/24/2020

APPENDIX A

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.