



**TO:** William Galloway, Unit Forester  
Deming Unit, Baker District  
Northwest Region

**FROM:** John McKenzie  
Licensed Engineering Geologist  
Forest Resources Division  
Northwest Region

**SUBJECT:** **MEMORANDUM**  
In and Around Landslides  
Twayblade Timber Sale

**DATE:** October 17, 2016

This memorandum briefly discusses geologic issues related to "in and around" landslides associated with the Twayblade Timber Sale (Sale). These issues include landslides down slope of the proposed Sale, landslide hazard zonation of portions of the Sale, and a brief discussion of mountain-side-scale landslide processes in the area of the Sale.

The Twayblade Timber Sale is located in portions of Sections 12 and 14, T37N, R4E, and portions of Sections 7 and 18, T37N, R5E, about 1½ miles southwest of Acme in Whatcom County (Figure 1). It is composed of one unit. These discussions are based on review of various GIS layers (including the Forest Practices Landslide Inventory layer) in the DNR database; review of pertinent maps and publications in my office files [including the work by Powell, Lingley, and Anderson (2010, *Reconnaissance study of landslides related to the January 2009 storm in the Acme watershed: Washington State Department of Natural Resources, Forest Practices Division, dated January 2010*)], review of pertinent stereoscopic aerial photographs and orthophotographic images on file at Northwest Region Office, field reconnaissance, and discussions with you. Field reconnaissance was conducted on September 19, 2016.

The Sale is located on generally gentle to moderately-steep east-facing slopes south of Jones Creek. Steep to very-steep north-facing hillside topography characterizes the inner-gorge terrain between the Sale and Jones Creek (Figures 1 and 2). The Sale avoids these slopes.

The bedrock geology underlying the Twayblade Timber Sale is mapped as Jurassic age Darrington phyllite (Lapen, T.J.; 2000; *Geologic map of the Bellingham 1:100,000 quadrangle, Washington; Washington Division of Geology and Earth Resources Open File Report 2000-5; scale 1:100,000*). These rocks are in turn overlain by landslide deposits of varying size, thickness, and activity.

The proposed prescriptions will be, in effect, a treatment, and are designed to retain the dominate and co-dominate crown-class. Approximately 73 trees per acre of the smallest diameter class will be removed, leaving approximately 160 trees per acre of the larger diameter class, as just noted. These two actions will result in maintaining a large degree of the existing canopy, resulting in preservation of much of the crown interception and evapotranspiration, and a high state of hydrologic maturity. This will greatly reduce any potential increase in groundwater into the area beneath the Sale and to the hillside slopes between the Sale and Jones Creek.

As noted above, there are three issues this memorandum addresses. These issues are:

1. Landslide processes on the steep north-facing slopes above Jones Creek.
2. The landslide hazard zonation (LHZ) characterization of slopes in the Sale.
3. Mountain-side-scale landslide processes.

The issues are discussed below in the order just listed above.

### **1. Landslide processes on the steep north-facing slopes above Jones Creek**

Review of the Forest Practices Landslide Inventory (FPLI) database and the LiDAR generated topography shows deep-seated landslide processes are common on the north-facing slopes above Jones Creek. The locations of the FPLI database landslides on the slopes on the south side of Jones Creek are shown on Figure 2. They are numbered 9975 and 12423. Landslides on the same north-facing slopes recognized from review of aerial photographs, interpretation of LiDAR derived topography, and field review are also shown on Figure 2. These landslides were reviewed in the field. (The correlation of the landslides in the FPLI database to the landslides recognized during interpretation of the LiDAR topography and review of aerial photographic imagery, and shown on Figure 2, should not be considered exact. It is assumed that where the landslides from the two different mapping efforts coincide they are the same landslide, though the shape may be somewhat different.) Over all they can be characterized as generally subdued and do not exhibit jack-strawed trees, disturbed stumps, ground cracks, etc. suggestive of recent or on-going movement. However, locally active landslides were also observed. The active landslide observed is labeled with "A" on Figure 2, and is about 600-feet north of the boundary of the Sale. Based on the office and field evidence the non-active landslides could be characterized as dormant-distinct to dormant-indistinct (*Forest Practices Manual, Section 16, Guidelines for Evaluating Potentially Unstable Slopes and Landform, 5/2015*) or, using nomenclature developed by Keaton and DeGraff (1996, *Surface observations and geologic mapping, in Turner, A.K., and Schuster, R.L., editors, Landslides – Investigation and mitigation: Transportation Research Board, National Research Council, National Academy Press, Washington, D.C.*), dormant-young to dormant-mature.

The proposed treatment discussed above will result in little increase in additional groundwater being delivered to the slopes between the Sale and Jones Creek. It is anticipated that the small amount of additional groundwater would not likely have an adverse impact on the stability of the dormant landslides on the slopes between the Sale and Jones Creek. Because of the distance

between the active landslides and the Sale, it is judged that the small increase in groundwater would likely be attenuated over the distance between the sale and the active landslides, and, in my opinion, would have little, if any, effect on the active landslides.

## **2. Landslide hazard zonation (LHZ) characterization of slopes in the Sale.**

Landslides Hazards Zonation (LHZ) mapping for the Acme watershed was prepared by Forest Practices. It appears it was derived from Mass Wasting Map Units (MWMU) delineated during preparation of the Acme Watershed Analysis (WSA) prepared by Crown Pacific Limited Partnership (1999, Revised May 1999). The MWMU map, upon which the MWMU are delineated, was prepared from interpretation of aerial photographs and landslide mapping on contour maps less accurate than current-day LiDAR derivative topography. Thus some inaccuracies are present with respect to the boundaries of the MWMUs and subsequently the LHZ mapping in the PF LHZ database.

The hillside areas that now underlie the Twayblade Timber Sale were included in the project area of the Acme WSA. Review of the FP LHZ mapping shows that, save for a two small areas along the northern margin of the Sale, the Twayblade Timber Sale is underlain by slopes characterized by a Low Landslide Hazard rating. The two small areas that intrude into the Sale from the north are shown on Figure 2. They are mapped as High Hazard areas in the FP LHZ mapping; one in the western area of the Sale (#1), the other in the eastern portion of the Sale (#999). The one in the western area is defined as inner gorge with a High Landslide Hazard rating. In fact, within the Sale the relatively gentle terrain labeled by the WSA as inner gorge is clearly not characterized by inner-gorge topography. Inner-gorge topography was bounded out of the Sale when it was set up. Thus the areas identified as inner-gorge topography should more appropriately be classified as an area of gentler slopes and a Low Landslide Hazard rating would apply. The eastern area is bounded out and characterized as an area of unknown instability potential in the FP LHZ database. The portion of this area that extends into the Sale is characterized by gentle to locally moderately-steep slopes, but not steep slopes prone to instability. The steep slopes are bounded out. Again it would be more appropriate to reclassify the portion of this hazard zone in the Sale as having a Low Hazard rating.

## **3. Mountain-Side-Scale Landslide Processes**

Review of aerial photographs, LiDAR derived topography and other imaging, and field reconnaissance show the area of the Twayblade Timber Sale is underlain by a very large mountain-side-scale landslide (Figure 1). This landslide is about 2-miles long and up to about 2-miles wide. It could be up to hundreds of feet thick. It is likely moving but at an imperceptible rate. Landslides of this scale are not judged to be sensitive to timber harvest. They are so large that the impacts of timber harvest on the stability of such landslides is judged to be essentially negligible. In addition, the potential increase in groundwater from the treatment of the Twayblade Timber Sale is judged to be so minor, if any, that, in my opinion, it is very unlikely to have an impact on the mountain-side-scale landslide.

Memorandum  
In and Around Landslides  
Twayblade Timber Sale

Baker District  
Deming Unit

If you have any questions, please call.

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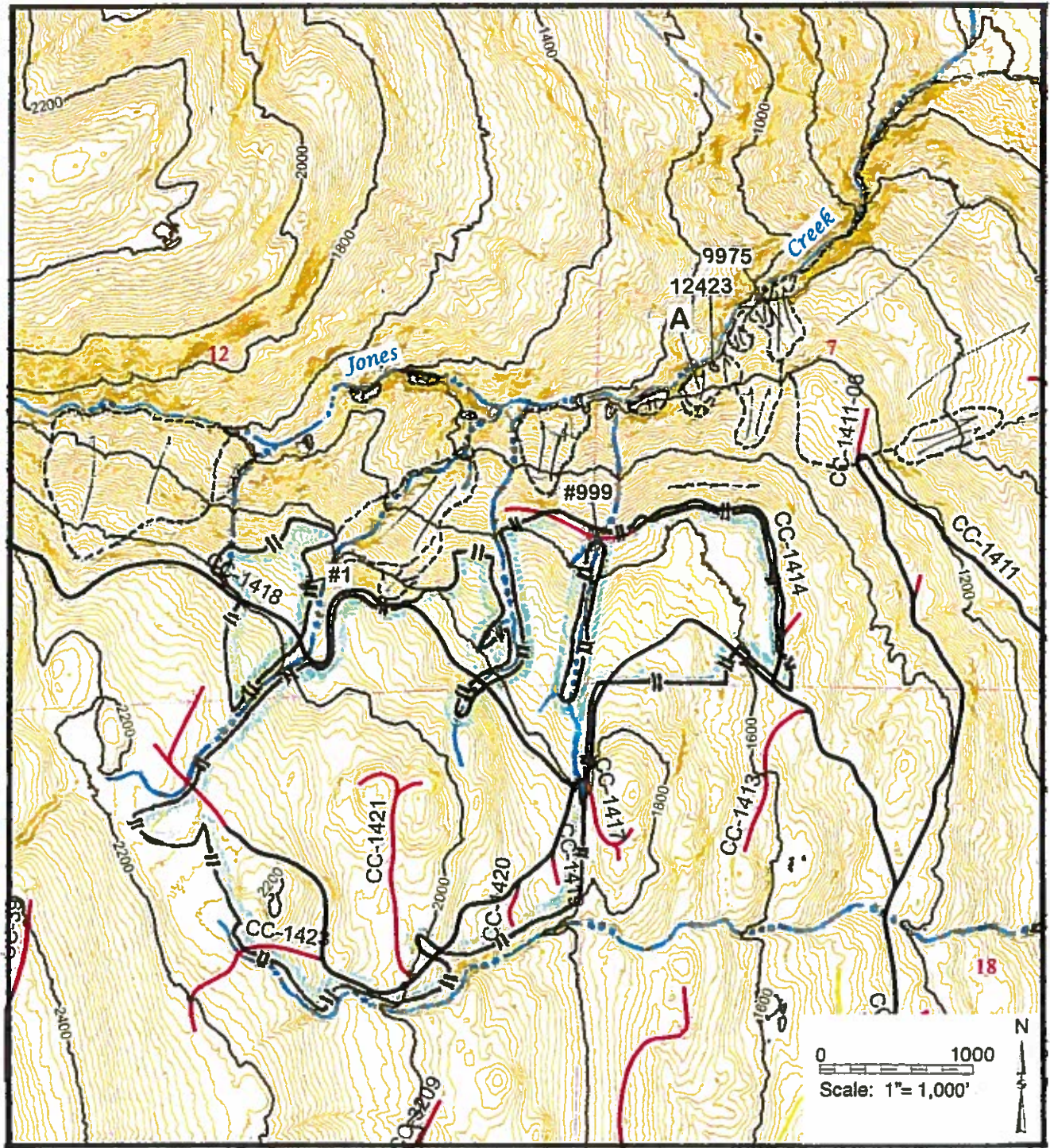
John M. McKenzie

*10/18/16*








Attachments:

- Figure 1 Location Map
- Figure 2 Landslide Map
- Figure 3 Explanation for Figures 1 and 2





**FIGURE 2 LANDSLIDE MAP**  
Twayblade Timber Sale

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9975
Landslide from Forest Practice Landslide Inventory
  
- 
Landslide recognized during this assessment where uncertain
  
- A**
Active landslide
  
- 
#999
Portion of high hazard area extending in to Sale
  
- 
Subdued shallow graben
  
- 
Stream
  
- 
Timber sale boundary
  
- 
Road, red are abandoned

**FIGURE 3 EXPLANATION FOR FIGURES 1 AND 2**  
Twayblade Timber Sale