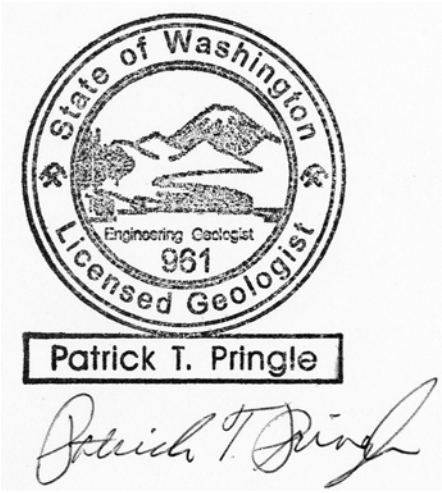
Memorandum

To: Laura Vaugeois, Karl Wegmann
From: Patrick Pringle
Subject: Sinlahekin River WAU
4/1/2005



I have completed a review of the mass wasting assessment for the Sinlahekin River watershed. This mass wasting assessment, comprising a report and map, was prepared by Lee Benda and Associates, Inc, and included in a more comprehensive report by R2 and Associates in April, 2002. Benda and Associates delineated 5 Mass Wasting Map Units (MWMUs) having high-to-low hazard rating. They also noted 11 landslides based on reconnaissance of aerial photographs and field work, and delineated these as simple numbered locations.

Methodology

I evaluated Benda and Associates's hazard map using stereoscopic examination of 1989 and 1992 aerial photographs for most of the watershed. I then compared the mapped hazard areas of Benda and Associates with a 1:100,000-scale geologic map of the area by Keith Stoffel, a map delineating certain potentially hazardous areas based on the landform model SLPSTAB, and with my own field observations made on a reconnaissance of the area with DNR Forester Tim Vugteveen. As part of my review of the Sinlahekin, I delineated map areas where landslides or sites of possible past slope failures visible on aerial photos had no corresponding MWMU delineated by Benda and Associates in their hazard assessment.

During my field reconnaissance, I noted the presence and distribution of geologic materials such as debris flow deposits, till, and stratified glacial drift that did not appear on the geologic map. There is a lack of detailed large-scale geologic mapping in the most of the watershed. Because of this mapping limitation, I also consulted online soils maps of the DNR's "soilsall" coverage in order to attempt to evaluate where mapped geologic

parent material also coincided with areas having slopes greater than 78 percent (as per 2003 written commun. from Domini Glass).

Results

Using the aerial photographs, I could not identify areas where disturbed or distinctive vegetation possibly indicated "shallow rapid" landslides had occurred in the past (into a Class 4 streams) and that were not mapped by Benda at all. However, I do suggest the following two new entries to MWMUs in T37N R24E.

36. Off the south toe of Timothy Ridge in the SW ¼ of Sec 6 and NW ¼ of Sec. 7 T37N R24E (Benda and Associates mapped a recent debris flow (#11) in an area of convergent topography southeast of an unnamed peak at the south Toe of Timothy Ridge (6595 ft elev.) that drains to Sinlahekin Creek. I delineated that area and suggest it be added to the "most susceptible" category of MWMUs (#1 of Benda).

37. I suggest delineating a polygon to be added to the deep-seated landslide hazard MWMU (#4 of Benda). This area is on the west flank of Woodpile Ridge and is described below.

Also, a recent landslide should be added to the landslide inventory. This is a small, slump earthflow from a roadcut on the lower west flank of Woodpile Ridge that moved northwest onto the road but did not impact a steam. It is situated within MWMU 27, which I suggest be added to the MWMU database. I entered this small slump earthflow into the table of landslides as item 12.

I was unable to access stereo pairs of aerial photos for the area steep slopes along the Sinlahekin Valley, however I did examine georeferenced digital orthophotos of that area. I noticed a number of lobate features near Blue Goat Mountain and south of Blue Lake that may represent debris flow lobes or lobes of colluvium. This area is within MWMU 3, rock fall/avalanche zones.

Discussion

The Sinlahekin ("Shineleckingen" of Willis (1887)) River valley, which runs along the east margin of the watershed, was a major meltwater channel for the Okanogan lobe of the later Fraser continental ice sheet (Freeman, 1933). The eastern margins of the Sinlahekin watershed were glaciated by the western portion of the Okanogan lobe, which left striations and drift as high as 7000 ft. on Chopaka Peak (Hibbard, 1962). This glacial history is undoubtedly more complicated than previously thought, and likely resulted in damming of river systems that previously flowed north and capture of drainage basins as noted by Riedel and Haugerud (1994). The glacial advances, damming, and outwash was thus largely responsible for the cutting of the relatively steep slopes of the Sinlahekin River valley and some of its tributaries, and for deposition of the fragmental deposits mentioned above.

Most of the areas where deep-seated landslide hazards were noted by Benda and Associates are mapped as Evt, tuff breccia of Eocene age. According to Stoffel (1990), this unit was deposited unconformably on rocks of pre-Tertiary age. In 1962 Hibbard had described these volcanic rocks as "mildly tectonically deformed" and noted that locally they were "deposited on a surface of considerable relief". Deep-seated landslides are notably common in volcaniclastic rocks throughout the Pacific Northwest. Some of the

major factors that influence their mass wasting are rock quality (degree of hardness), spacing and density of discontinuities, such as fractures and joints, dip of the beds, and paleosoils (ancient soils between layers). Subsurface hydrologic factors are important as well, but these can be difficult to quantify. Subvertical joints are common in the volcanic beds in the Sinlahekin basin. It is possible that areas of lower rock quality that have a relatively high density of discontinuities (fractures) exist here because of the proximity of a shear zone. Hibbard (1962) described the Chopaka fault zone, a north-trending structure that passes along the east boundary of the watershed. He noted that "smaller faults and shears are common" near this fault, and this therefore suggests there will be areas where rock quality may be poor and the rock may be densely cut by discontinuities (fractures). One such area was observed in field reconnaissance in the Toats watershed.

Small lakes situated on the west upper flank of Woodpile Ridge lie in a mountaintop topographic low that could represent a sackung feature (splitting and sagging mountain). During field reconnaissance on October 1, 2003, we observed a recent slump earthflow from a roadcut on the lower west flank of Woodpile Ridge northwest of, and downslope from the ponds mentioned above. I suggest adding this small landslide as number 12 in the database . The material that failed, and that composes the slope, is poorly-sorted, matrix-supported and composed of angular volcaniclastic rock (fragmental volcanic debris). This material is likely a till or flow till deposit, although alternatively, it could be part of a deep-seated landslide deposit. The compact matrix of the deposit suggests it contains a relatively high percentage of fines, which make it susceptible to future slumping and slump earthflows. As a result, I suggest delineation of one additional area of MWMU 4, deep-seated earthflow hazard, on the west flank of this Woodpile Ridge from this location to Sinlahekin Creek.

Assessment of Hazard Map

1. <u>Did the author(s) adequately identify the majority of landslides in the basin?</u>

Yes, I think the report assesses the majority of landslides in a thorough manner, however, and area of previously documented mass wasting in Sec. 7 T37N R24E (noted above) was not included in any MWMU.

2.

<u>Do the mass wasting units delineated by the author seem to reflect reasonable assumptions based on a review of the geology and landslides in the basin?</u>

In large part the landslides delineated by Benda and Associates do reflect the geology of the area and extent of documented landslides. However, as noted, geologic mapping of the area is limited, thus, the full extent of fragmental geologic material and rock quality inhomogeneities is not known in detail.

<u>Are the hazard ratings assigned to the Mass Wasting Map Units reinforced by the distribution of landslides as shown in the Landslide Inventory for the WAU?</u>

Yes, with the exception that I could not identify deep-seated landslides with certainty.

<u>Are there landforms that seem to have a large number of landslides, but no associated Mass Wasting Map Unit?</u>

No.

Does the text describing the Mass Wasting Map Units do an adequate job in presenting the landform / geology information that a forester using this map would need to identify the features on the ground?

Yes.

Reviewers Assessment:

As soon as the suggested MWMU unit additions are reviewed, accepted, and added, this assessment is ready for external review.

References

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