WASHINGTON STATE DEPARTMENT OF
Natural Resources

DOUG SUTHERLAND
Commissioner of Public Lands

MEMORANDUM

To: Laura Vaugeois – Forest Practices
Karl Wegmann - Geology

From: Bill Lingley – Geology

Date: Dec. 6, 2003

Subject: Newaukum River Watershed Analysis -- Review

Summary

The Mass Wasting Assessment of the Upper South Fork Newaukum River Watershed Analysis (Goetz and Clark, 1998) contains a particularly accurate compilation of shallow landslides. The authors map fifteen large deep-seated landslides in the Upper South Fork as well as about 100 shallow failures, almost all of which are related to inner gorges or other convergent topography. During this Priority #1 - Watershed Analysis Review, nine additional landslides were mapped, but all of these appear to post-date the watershed analysis. Goetz and Clark define five mass wasting map units, but in several instances, landslides originate outside of the two high-hazard mass wasting map units. Analysis suggests that adding a new Mass Wasting Map Unit defined on the basis of convergent topography could markedly reduce the frequency of these failures. The Goetz and Clark report should be sent out for final external review after the new landslides and Mass Wasting Map Unit (#6) have been added to the Landslide Hazard Inventory.

Introduction

This memorandum has been prepared as part of the Landslide Hazard Zonation project (Vaugeois and others, 2002) and follows the protocol for Priority #1 Watersheds Review developed by you (Wegmann and Vaugeois, 2003). These reviews are brief checks covering watershed analyses that are nearly complete, and that primarily address State and fee lands within these drainage basins.

The draft Upper North Fork and Upper South Fork Newaukum River Watershed Analysis (Weyerhaeuser Company, 1998) has been completed except for the external review. I have been asked to map obvious landslides in watershed that are not included in the Landslide Hazard Inventory and to review the Mass Wasting Module (Goetz and Clark, 1998). Only

minor federal ownership is present in the Newaukum watershed, so this review covers the entire watershed.

Methods

Findings from the *Upper North Fork and Upper South Fork Newaukum River Watershed Analysis, Mass Wasting Assessment* (Goetz and Clark, 1998) have been compared with stereoscopic interpretation of alternating flight lines from DNR Color Photo set SW-C-99 acquired during July of 1999. This method resulted in exclusion of three north-trending, 1000-foot wide swaths across the watershed. The eastern end of the watershed was not analyzed in detail. Note that these photo sets were acquired after completion of the Goetz and Clark work. Additional rule-identified unstable slopes including some inner gorges, convergent headwalls, and bedrock hollows were defined using topographic mapping (U.S. Geological Survey, 1985a, b) and a slope/convergence map (SLPSTAB) of the area produced by Laura Vaugeois. Following this work, geologic mapping of the watershed (Schasse 1987a, b) was compared with the mass wasting map units and mapped landslides. This review was spot-checked by Karl Wegmann.

Key Questions

1. *Are the majority of landslides in the basin adequately identified?*

   Yes

   Goetz and Clark (1998) identified about 100 shallow landslides and 15 deep-seated slides using seven photo sets acquired between 1959 and 1997. The authors' field checked about ten percent of these failures. Most of these are road and harvest related. Some of the deep-seated landslides are very difficult to recognize with 1:12,000 aerial photography, I assume because these can be verified only with fieldwork or high-altitude photography.

   During this review, only eight additional shallow failures were identified and all of these failures appear to post-date the Goetz and Clark study. (See attached spreadsheet and preliminary maps.) No new deep-seated failures were located.

2. *Do the Mass Wasting Map Units reflect reasonable assumptions based upon your review of the geology and landslides in the basin?*

   No.

   Mass Wasting Map Unit #1 "*Steep Stream-Adjacent Slopes Including LPD Toes and Inner Gorges*" does not extend far enough up slope to capture all of the landslides that originate in inner gorges, convergent headwalls, and moderate to steep draws. Almost all of the debris flows and shallow rapid landslides in the watershed originate in inner gorges or other strongly convergent topography in or directly up slope from Type 4 or 5 drainages. Twenty-eight of 108 debris flows and shallow rapid landslides mapped by Goetz and Clark are in Mass Wasting Map Units # 4 and #5, both of which are assigned a "low" hazard rating. This concern was also noted by Krogstad (1998), who pointed out that about 55% of the landslides in the combined Upper South Fork and Upper North Fork Newaukum Watersheds are located in moderate or low hazard rating MWMUs.

3. *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?*

No.

See Question #1 above.

4. *Are there landforms that seem to have a large number of landslides, but no associated Mass Wasting Map Unit?*

Yes.

See Question #1 above.

5. *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.

However, the text and captions for the Mass Wasting Map Units are a little confusing because it is difficult to determine which LPDs are associated with which Mass Wasting Maps Units. Also, it would have been helpful to have histograms summarizing the distribution of landslides with landform, geologic unit, stand age, and elevation. (Some of these exercises were performed in order to assess this mass-wasting module.)

6. *Are there additions to the mass wasting assessment products?*

Yes.

Nine post-1998 landslides shown on the attached spreadsheet and maps should be added to the Landslide Hazard Inventory.

A new Mass Wasting Map Unit #6 is recommended to help guide improved resource protection. Mass Wasting Map Unit # 6 covers the moderate to steep convergent topography not included in Mass Wasting Map Unit # 1. Recommended Mass Wasting Map Unit #6 is limited to those parts of the watershed where debris flows and shallow rapid landslides are common. Recommended Mass Wasting Map Unit #6 has "High" mass wasting potential and "High" delivery potential and is therefore rated as "High" hazard potential. This new unit is shown on the attached preliminary maps (the maps will be slightly revised later this month) and described on the attached Form A-2.

7. *Is this mass wasting assessment: (1) acceptable as is, (2) acceptable with revisions, or (3) not acceptable?*

This mass wasting module is acceptable with the minor modifications noted above.

References

Goetz and Clark, 1996, Newaukum watershed analysis, mass wasting assessment, 25 p., 7 tables, 2 appendices, 7 figs. *IN* draft Weyerhaeuser Company, 1998, Upper North Fork and Upper South Fork Newaukum River Watershed Analysis, Federal Way, 1 v.

Schasse, Henry W., compiler, 1987a, Geologic map of the Centralia quadrangle, Washington: Washington Division of Geology and Earth Resources Open File Report 87-11, 28 p., 1 plate, scale 1:100,000.

Schasse, Henry W., compiler, 1987b, Geologic map of the Mount Rainier quadrangle, Washington: Washington Division of Geology and Earth Resources Open File Report 87-16, 43 p., 1 plate, scale 1:100,000.

U.S. Geological Survey, 1985a, Washington Bernier Creek quadrangle; U.S. Geological Survey Map, 1 sheet, scale 1:24,000.

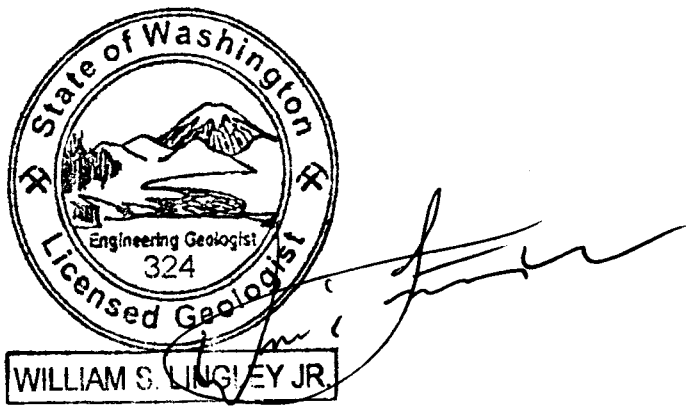
U.S. Geological Survey, 1985b, Washington Onalaska quadrangle; U.S. Geological Survey Map, 1 sheet, scale 1:24,000.

Vaugeois, Laura, Dieu, Julie, Raines, Mary, 2002, Landslide Hazard Zonation – Project status report and proposal. Draft report submitted to the Cooperative Evaluation, Monitoring, and Research Committee, Washington Department of Natural Resources, 38 p.

Weyerhaeuser Company, 1998, draft Upper North Fork and Upper South Fork Newaukum River Watershed Analysis, Federal Way, 1 v.

Wegmann, Karl, Vaugeois, Laura, 2003, written communication, July 15, 2003 -- Landslide Hazard Zonation project, protocol for priority # 1 watersheds; Department of Natural Resources, Division of Geology and Earth Resources.

Respectfully submitted,



William S. Lingley, Jr.

Cc Dave Norman – Geology
Nancy Sturhan – Forest Practices

FORM A-2 MASS WASTING MAP UNIT DESCRIPTION FORM #9

MWMU Number: 6

Description: Inner Gorges, convergent headwalls and other moderate to steep convergent topography adjacent to type 2 to 5 drainages and zero-order basins. Shallow landslides deliver sediment directly to the Chehalis River and its tributaries.

Materials: Mainly bedrock (sandstones, siltstone, and mudstones and heterogeneous volcanic rocks) including parts of the Puget Group (geologic unit Ec) and Lincoln Creek Formation (geologic unit OEm) and the Northcraft volcanics (geologic units Evb, Evc),

Landform: Inner gorges, convergent headwalls, and gullies.

Slope: Moderate to steep, generally 60 to >80%

Elevation: Generally 500 to 3,000 feet

Total Area: Approximately 1000 acres

MW Processes: Debris flows and shallow rapid failures

Forest Practice Sensitivity: Harvest and road maintenance practices

Mass Wasting Potential: High

Delivery Potential: High

Delivery Criteria Used: Moderate to steep slopes issuing directly into Type 2 to 5 waters in areas where shallow landslides are common.

Hazard Potential Rating: High

Trigger Mechanisms: Commonly road- or harvest-related, but also natural failures. Includes failure of side-cast and/or fill material associated with roads and(or) loss of root strength following harvest.

Confidence: At least 90% of identified failures have delivered, mostly to Type 5 or lower order water.