SALT CREEK BURN AREA EMERGENCY RESPONSE

GEOLOGY REPORT

SHASTA-TRINITY NATIONAL FOREST

By

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August 13, 2012

Attachments:

Salt Creek Fire_BAER_20120809.pptx

Purpose

The purpose of this document is to identify existing geological hazards and resources, along with future potential geological hazards caused by the 2012 Salt Creek Fire (CA-SHF-002521). The Salt Creek Fire is a 980 acre wildland fire located approximately 20 miles north of Redding, along the I-5 corridor. The vegetation consists of conifer mixed with pine/oak woodland.

Method

Methods to identify geological hazards and resources consisted of field reconnaissance of the burned area (Melanie Stevens, Dave Young, Brad Rust, and Philip Brownsey on 8/7/2012 and 8/8/2012), review of colored 2003 aerial photos (Photo line 55, 603-260:263), review of Google Earth Imagery (1993-2010), review of GIS geomorphic database, and review of previous geologic mapping.

Review of Geological and Geomorphology Mapping

The Salt Creek Fire is underlain by the Redding terrane which consists of the Bragdon formation (metasediments) in the western and northern areas of the fire, and Baird formation (metavolcanics) in the southeastern area of the fire (Figure 1). Geomorphology mapping from the GIS database shows two rotational-translational slumps in the northern section of the fire area and one rotational-translational slump along the south edge of the fire and headwall basins on the eastern edge of the fire. Coal Creek and an unnamed tributary to Salt Creek are mapped as being located within inner gorges. One large rotational slide was mapped during aerial photo review on the eastern edge of I-5, along with a debris flow in the headwater of Coal Creek and along Forest Service Road U34N12C. Two additional active landslide features were mapped during field reconnaissance on 8/7/2012. There are no other active features mapped within the fire perimeter (Figure 2).

Google Earth Imagery and Aerial Photos

Google Earth imagery was reviewed for the following years: 1993, 1994, 1998, 2005, 2006, 2009, and 2010. One debris slide was observed in the headwaters of Coal Creek in the 1993 and 1994 imagery, located near the top of the ridge to the confluence of Coal Creek, measuring approximately 1300 feet, but there is no observable channel scour in Coal Creek. A second debris slide is observed in the 1993 Google Earth imagery, measuring approximately 200 feet. This debris slide crosses Forest Service Road U34N12C. No other obvious landslides, debris slides and/or channel scour was observed during these years. In the 2003 aerial photos, the same debris slides mentioned above were observed in the aerial photo 603-262, photo line 55. A large rotational landslide was mapped to the south of Coal Creek drainage with the bench at PG&E power-line corridor.

Field Reconnaissance

On 8/7/2012, Brad Rust (BAER Team Lead), Dave Young (BAER Soil Scientist), and Melanie Stevens (BAER Geologist) conducted a field visit of the burned area to identify values at risk and potential hazards that could affect these areas. Thomas Ranch Road on the western edge of the fire was driven get an overview of the burned portion on the east side of Interstate 5. Coal Creek Road was driven to PG&E power line road and then to Lakeview Drive. The drainage behind House #1 (as indicated on Figure 2) along the perennial tributary Coal Creek up to PG&E power line was driven and hiked. The large dormant landslide mapped during air photo reconnaissance was hiked from PG&E power line road to the southern edge of the feature. As indicated in the BARC imagery most of this landslide was burned at moderate to high soil burn severity. Two additional landslides were observed to the south of the large dormant landslide and were mapped. The first was a slump feature with observable eroded scarp, approximately 100 feet wide by 300 feet long located in a high soil severity burn area of the fire, on a southwest facing slope. A second landslide feature, headwall, was mapped in the same drainage, approximately 100 feet wide by 300 feet long, in a high soil severity burned area of the fire on a southwest facing slope, GPS point 10. Forest Service Road U34N12C was driven and hiked until it intercepted the PG&E power line road. The slopes near the road where mostly low soil burn areas with a couple of moderate and one high severity burn area observed. The hillslopes above and below the road are steep (>30%) but no obvious landslide features were observed. Gilman Road was driven to Valley Road (private road). *Mailbox* Road (fire nicknamed road) and Valley Road were drive to identify possible risks. No immediate risks were observed from potential landslides, debris flows, debris slides and rockfalls.

Geological Hazards and Resources

Geological hazards that have been identified as having the potential to occur within one to three years post fire (BAER Assessment Process in Steps, 2011) are rock falls, debris slides and debris flows.

Rock falls have a *likely*[1] occurrence of occurring were bedrock is visible. These areas are limited to the surrounding steep slopes of moderate to high severity soil burn areas and road cuts along I-5 corridor, PG&E power-line road, Gilman Road and Coal Creek Road. Rockfalls have a *possibility* of occurring were there are low severity fires but all the ground cover has been removed or burned off.

Debris slides have a *possible* of occurring were steep slopes, >36 degrees[2] having moderate to high burned soils according to the Burn Severity Soils Map due to the ground vegetation being removed during the fire and limiting the evapotranspiration and root strength that will occur as vegetation recovers. A *likely* occurrence of a debris slide will occur were previous landslide features have been identified and a rating of moderate to high soil burn severity has occurred (Figure 3). This area includes the large landslide, south of House #1 (indicated on the map). Debris flows can be initiated from the toes of large, deep, slow moving landslides during wet conditions such as intense summer storms and the first heavy rains of the fall (Reid, Brien, LaHusen, Roering, de la Fuente, & Ellen, 2003). The two small debris slides south of the large landslide also have a *likely* occurrence of reactivating and initiating debris flows.

The potential for these geologic hazards will be greatest with the first heavy rains of the fall or with intense summer storms and then decrease over the next few years, as vegetation in the area recovers. A second possible trigger for these geologic hazards would be an earthquake with strong local ground shaking.

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[1] See Table 1: Qualitative terminology for use in assessing risk to property (modified by Koler from Fell et al., 2005)
[2] According to *Land Management Handbook # 18*, "Slopes >36 degrees (>73%) tend to be highly unstable" (Chatwin, Howes, Schwab, & Swanston, 1991)

No geologic resources have been identified within the fire perimeter.

Values at Risk

Potential values at risk from geologic hazards have been identified as the following:

1. Two private residences located along Coal Creek from potential debris flows triggered by debris slides due to the moderate to high burn severity of the upper watershed and past landslide features. House #1 has a higher potential of risk due to the immediate location of the house adjacent to the stream and the confined channel of less than 1 foot. If any debris flow is initiated up slope of the drainage there is a high likelihood that the flow will flow through the house, to the confluence of Coal Creek below. Once the debris flow is initiated, escape from the house will need to be immediate due to the fast moving nature of the flow. House #2 has a slightly decrease risk, relative to House #1, due to the flood plain located up stream of the house and the relief between the stream and the house, approximately 2-3 feet.
2. Water quality and aquatic habitat in Coal Creek from potential debris flows triggered by debris slides due to the moderate to high burn severity of the upper watershed and past landslide features.
3. Interstate 5, PG&E power-line road, Gilman Road and Coal Creek Road from potential rockfalls, debris slides and/or debris flows from the moderate to high severity burns located along and upslope of these roads.

Table 1: Resources at Risk Rating

Resources at Risk	Table 1 Likelihood Descriptor	Table 1 Consequence Descriptor	Risk Rating
Private Residences along Coal Creek	Likely	Major	High
Water quality and aquatic habitat for Coal Creek	Possible	Medium	Moderate
Interstate 5, PG&E power-line road, Gilman Road and Coal Creek Road	Possible	Medium	Moderate

Limitations

This report is a rapid assessment for the emergency response to the 2012 Salt Creek Fire. The intent is to identify immediate geologic hazards and resources that have been directly and/or indirectly affected by fire and/or fire suppression efforts located within the fire boundary and within a one to three year period.

References

Chatwin, S. C., Howes, D. E., Schwab, J. W., & Swanston, D. N. (1991). *A Guide for Management of Landslide-Prone Terrain in the Pacific Northwest.* BC Ministry of Forests.

Fell, R., Ho, K., Lacasse, S., & Leroi, E. (2005). A framework for landslide risk assessment and management. In *Landslide Risk Management* (pp. 3-25). New York: Balkema Publishers.

Reid, M. E., Brien, D. L., LaHusen, R. G., Roering, J. J., de la Fuente, J., & Ellen, S. D. (2003). Debris-flow initiation from large, slow-moving landslides. *Debris-Flow Mitigation: Mechanics, Prediction, and Assessments*, 155-166.

Figures

Figure 1: Geologic terrane of the Salt Creek Fire

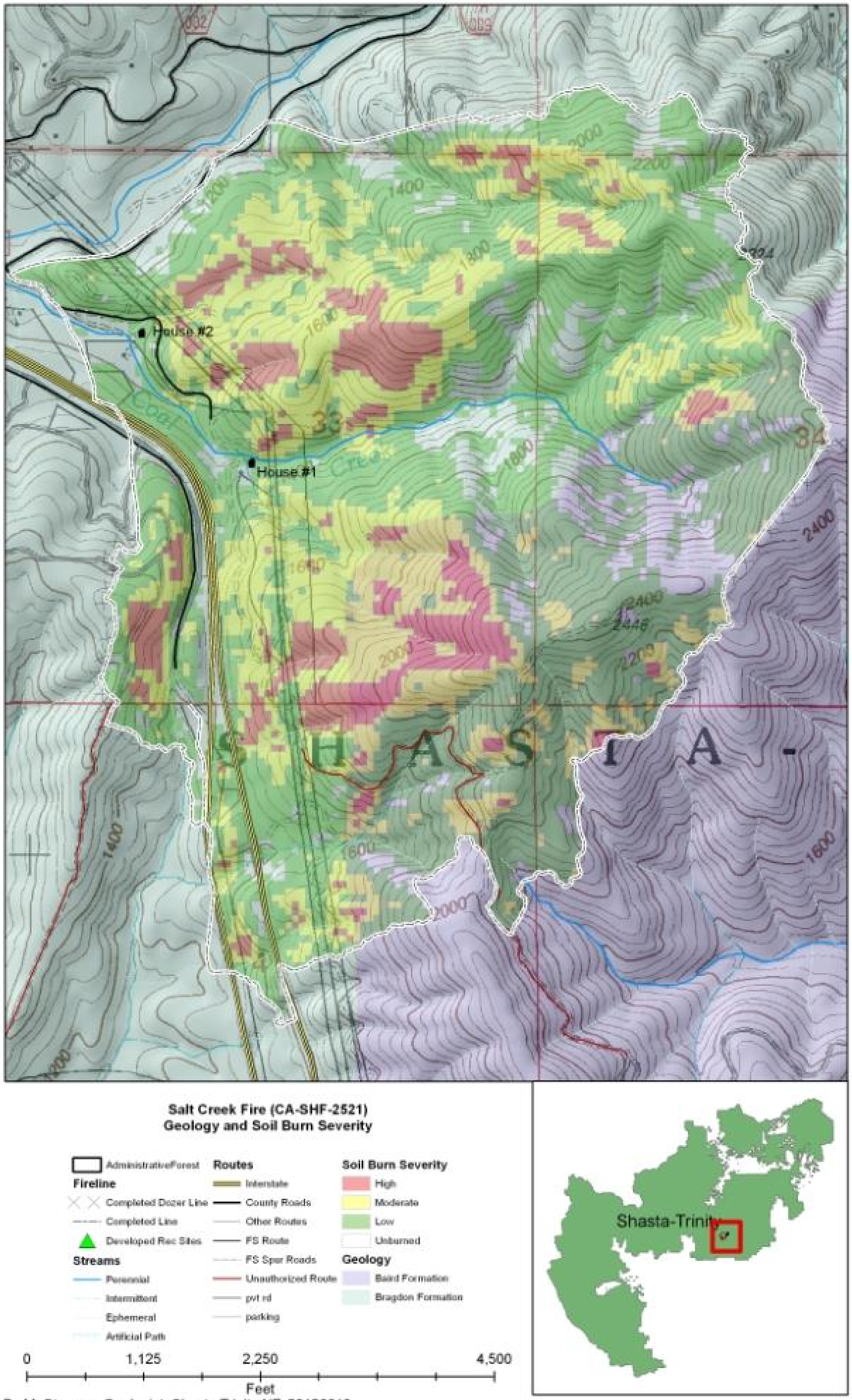


Figure 2: Geomorphology overlain by soil burn severity

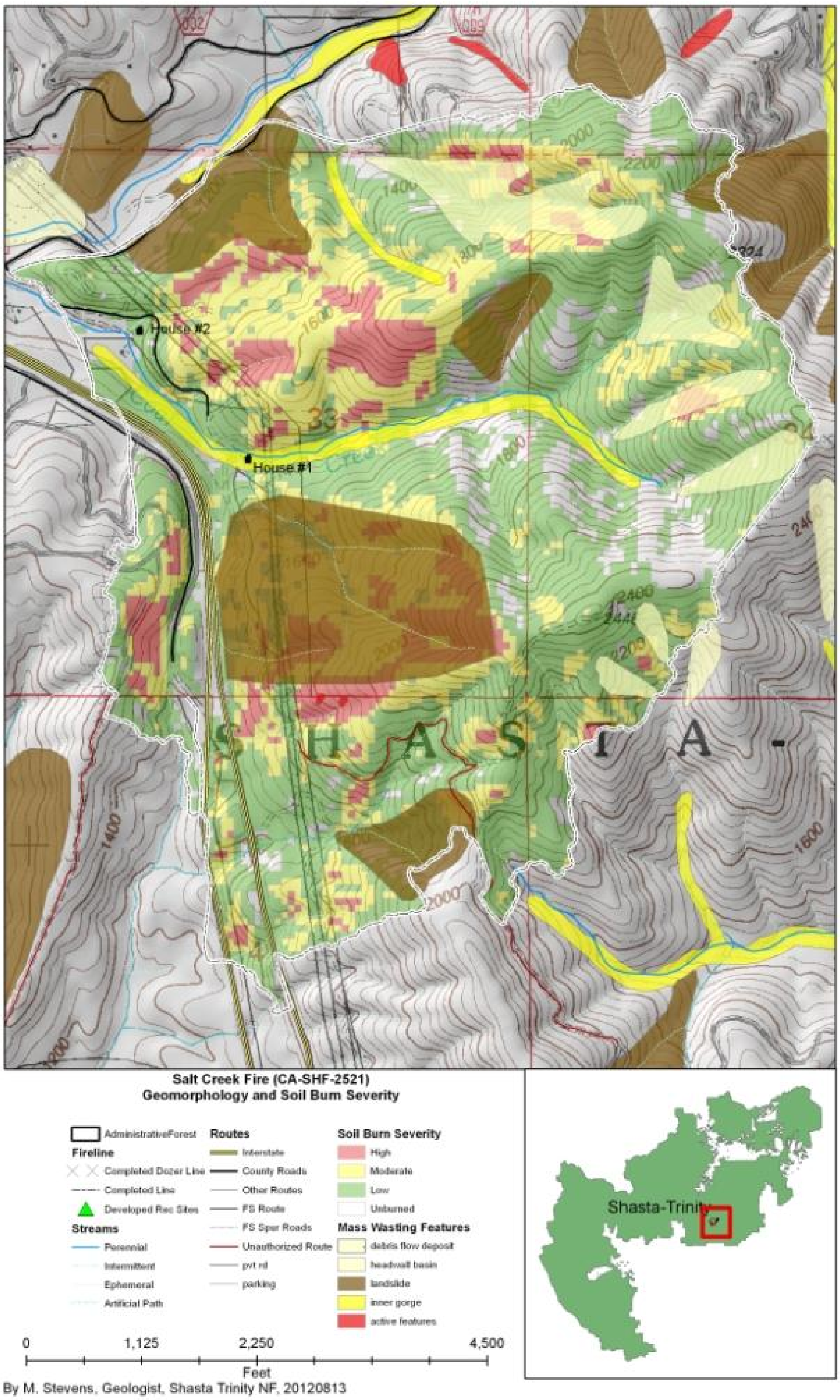
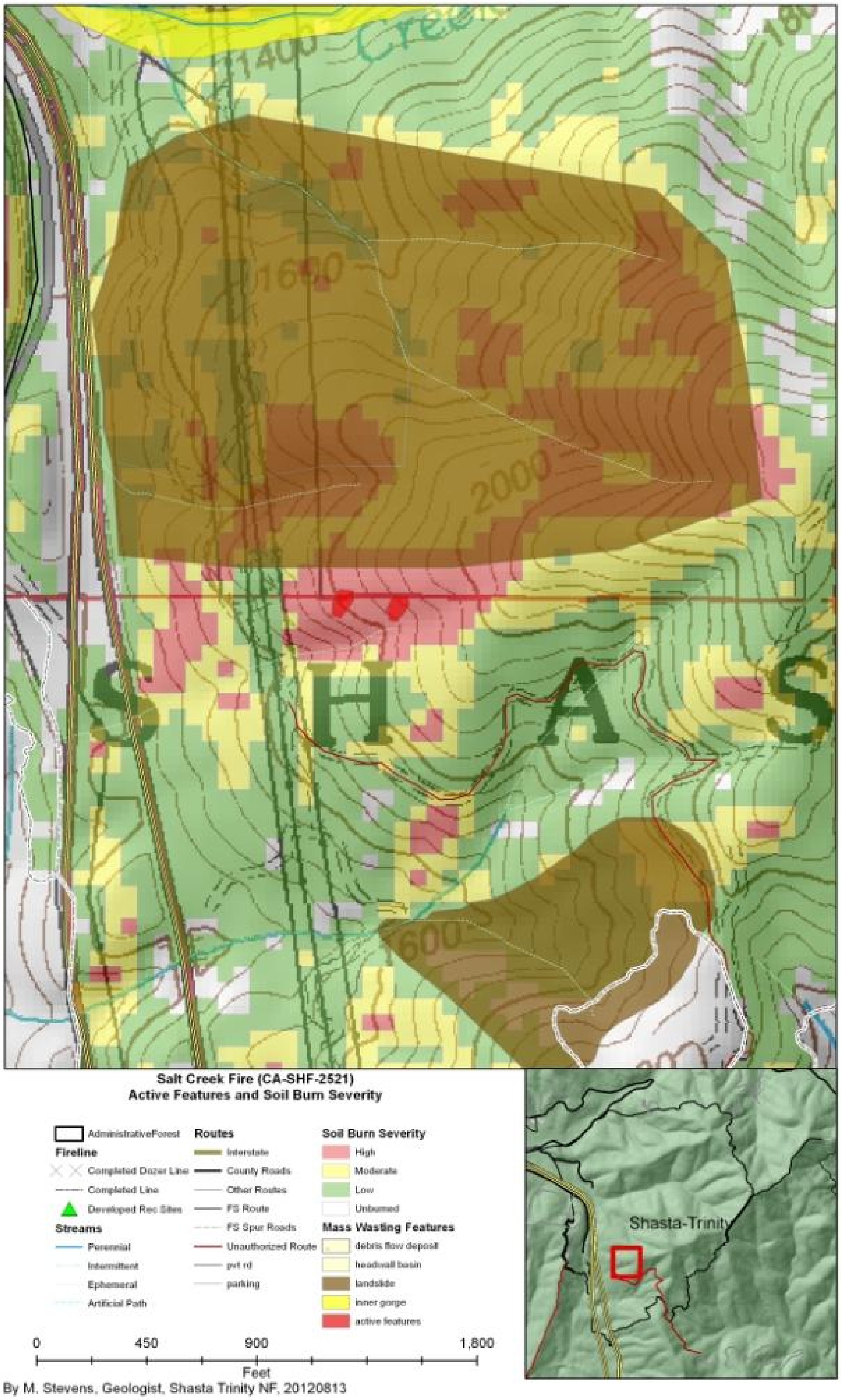


Figure 3: Zoomed in on active features in geomorphology overlain by soil burn severity



Tables

Table 2: Qualitative terminology for use in assessing risk to property (modified by Koler from Fell et al., 2005)

<table>
<tr><td colspan="6">Qualitative measures of likelihood of landsliding</td></tr>
<tr><td>Level</td><td colspan="2">Descriptor</td><td colspan="3">Description</td></tr>
<tr><td>A</td><td colspan="2">Almost certain</td><td colspan="3">The event is expected to occur</td></tr>
<tr><td>B</td><td colspan="2">Likely</td><td colspan="3">The event will probably occur under adverse conditions</td></tr>
<tr><td>C</td><td colspan="2">Possible</td><td colspan="3">The event could occur under adverse conditions</td></tr>
<tr><td>D</td><td colspan="2">Unlikely</td><td colspan="3">The event could occur under very adverse circumstances</td></tr>
<tr><td>E</td><td colspan="2">Rare</td><td colspan="3">The event is conceivable but only under exceptional circumstances</td></tr>
<tr><td>F</td><td colspan="2">Not credible</td><td colspan="3">The event is inconceivable or fanciful</td></tr>
<tr><td colspan="6">Qualitative measures of consequences to the resource</td></tr>
<tr><td>1</td><td colspan="2">Catastrophic</td><td colspan="3">Resource is completely destroyed or large scale damage occurs requiring major engineering works for stabilization</td></tr>
<tr><td>2</td><td colspan="2">Major</td><td colspan="3">Extensive damage to most of the resource, or extending beyond site boundaries requiring significant stabilization</td></tr>
<tr><td>3</td><td colspan="2">Medium</td><td colspan="3">Moderate damage to some of the resource, or significant part of the site requires large stabilization works</td></tr>
<tr><td>4</td><td colspan="2">Minor</td><td colspan="3">Limited damage to part of the resource, or part of the site requires some reinstatement/stabilization works</td></tr>
<tr><td>5</td><td colspan="2">Insignificant</td><td colspan="3">Little damage</td></tr>
<tr><td colspan="6">Qualitative risk analysis matrix – classes of risk to resource</td></tr>
<tr><td></td><td colspan="5">Consequences to the resource</td></tr>
<tr><td>Likelihood</td><td>Catastrophic</td><td>Major</td><td>Medium</td><td>Minor</td><td>Insignificant</td></tr>
<tr><td>Almost certain</td><td>VH</td><td>VH</td><td>H</td><td>H</td><td>H</td></tr>
<tr><td>Likely</td><td>VH</td><td>H</td><td>H</td><td>M</td><td>L-M</td></tr>
<tr><td>Possible</td><td>H</td><td>H</td><td>M</td><td>L-M</td><td>VL-L</td></tr>
<tr><td>Unlikely</td><td>M-H</td><td>M</td><td>L-M</td><td>VL-L</td><td>VL</td></tr>
<tr><td>Rare</td><td>M-L</td><td>L-M</td><td>VL-L</td><td>VL</td><td>VL</td></tr>
<tr><td>Not credible</td><td>VL</td><td>VL</td><td>VL</td><td>VL</td><td>VL</td></tr>
</table>

Legend – VH: very high risk; H: high risk; M: moderate risk; L: low risk; VL: very low risk