

**MINISTRY OF FORESTS: POST-WILDFIRE NATURAL HAZARD RISK ANALYSIS –
RECONNAISSANCE REPORT**

NOTE: The results given on this form are reconnaissance in nature and are intended to be a warning of potential hazards and risks. It is not a detailed risk analysis and further work may alter the conclusions. Please read the appendix of this report for important limitations. Contact the author for more information.

FIRE NUMBER: N72255 Glacier Creek		FIRE YEAR: 2022	DATE OF REPORT: October 11, 2022
AUTHOR: Sarah Crookshanks, P.Geo., Ministry of Forests			
REPORT PREPARED FOR: Southeast Fire Centre, District Manager			
FIRE SIZE, LOCATION, AND LAND OWNERSHIP: 139 ha. Burned Crown and private land 40 km north of Kaslo.			
VALUES AT RISK: Land improvements on private property and Forest Service Road.			
WATERSHEDS AFFECTED	TOTAL AREA	AREA BURNED	BURN SEVERITY (% of <u>burned</u> area)
Glacier Creek	27900 ha	139 ha (0.5%)	0.6 % H, 11% M <i>*See discussion in Comments</i>
SUMMARY OF POST-FIRE HAZARD AND RISK			
<p>1. Hazard = P(H), the probability of occurrence of a hazardous event 2. Probability of spatial impact, P(S:H), the probability of a hazard reaching or affecting an element at risk 3. Partial Risk, the probability of a hazard occurring and affecting an element at risk = P(H) x P(S:H) 4. Location with the highest risk rating given; at other locations the risk may be lower</p>			
Landslide impacting Forest Service Road			
Hazard P(H) ¹ = low Probability of spatial impact P(S:H) ² = high Partial Risk ^{3,4} = moderate			
<p>The terrain through the fire is very steep (> 70%) with cliff bands, and there are several draws through the fire zone that may be small debris flow and/or avalanche paths (Figure 3). Base mapping shows several creeks along this slope; however, no evidence of overland flow was found at any of the creek locations. While the terrain is certainly steep to generate landslides, the incremental effect of the fire is low due to the low vegetation burn severity.</p>			
<p>A landslide at 14.5 km along Glacier Creek FSR has been previously documented (Nicol, 2007) and is delineated on the attached map. The landslide appears to be a translational debris slide with a volume of approximately 5000 m³ and contained within the surficial talus. Significant movement was documented in 2007. Slide monitoring was undertaken for several years, and the road was built up to provide toe support to the slide. Since the mitigation works were constructed, minimal movement was observed, and the monitoring program was ended. This landslide was reviewed in the October 2022 by the undersigned and no additional movement or signs of recent instability were observed. The area immediately above this slide has patchy moderate soil burn severity and low/unburned vegetation burn severity. The likeliest time of year to see slide movement at this site is during the spring melt when the slope is saturated. Wildfire can increase snow accumulation and the rate of snowmelt through changes to the forest canopy. Because this fire had minimal impacts to the forest canopy above the slide, the incremental effect of this fire on movement at this site is expected to be low.</p>			
Landslide impacting private property land improvements			
Hazard P(H) ¹ = low Probability of spatial impact P(S:H) ² = moderate Partial Risk ^{3,4} = low			
<p>The drainage area above the dwelling was delineated using lidar data; 15% of this area is moderate burn severity and 4% is high burn severity. Despite base mapping showing several creeks above the private</p>			

property, no stream channels were documented. The landowner confirmed that there is no history of overland flow impacting their private property, even during the spring runoff season. Given the low burn severity, lack of creek channels and no history of overland flow there is a low likelihood that the wildfire will contribute to the initiation of a landslide that would impact this dwelling.

Glacier Creek – impacts to drinking water or campground

Negligible incremental hazard

The fire burned only a very small portion (0.5 %) of the Glacier Creek watershed and no creek drains the fire area; therefore, the likelihood of downstream impacts is negligible.

FURTHER ACTIONS

- RDCK to forward this report to the affected landowners.
- Closure of the FSR is not recommended at this time.

COMMENTS

The Glacier Creek fire began on September 3 near ridgetop and burned a face along Glacier Creek (Figures 2 and 3). The fire continued to produce smoke into October, though limited growth was observed after mid-September. An aerial overview of the fire was completed on September 26, and a site visit was undertaken on October 5.

Burn severity mapping was produced for this fire in late September by regional geomatics staff using Sentinel-2 satellite imagery. The satellite-derived burn severity within the fire perimeter generally corresponds with the visual determination of vegetation burn severity from aerial photos; however, considerable unburned area was mapped within the BCWS-derived fire perimeter. The field visit in early October verified that along lower slopes of the fire there were patches of moderate soil burn severity with virtually intact vegetation canopy overhead that were showing up as unburned on the satellite-derived map (e.g. Figure 4). BCWS staff confirmed that the fire backed down the slope at night, producing fingers of burned soil and understory extending downslope. The patchiness of this burn may have also made it more difficult for the Sentinel-2 satellite to detect the burned area, as its pixel size is 10 m.

The burn severity numbers reported here are almost certainly underreporting soil and understory burn severity on the lower slopes of the fire. However, more accurate burn severity mapping would require significant field work, which is not warranted given the risks. Considering the information provided by BCWS and field observations by the undersigned, it is likely safe to assume that the unburned area within the fire perimeter on the lower slopes is composed of patchy unburned, low, and moderately burned soil and understory.

SIGNATURE, SEAL, FIRM PRACTICE #

Original signed and sealed.

ATTACHMENTS

Map, Photos and Appendix

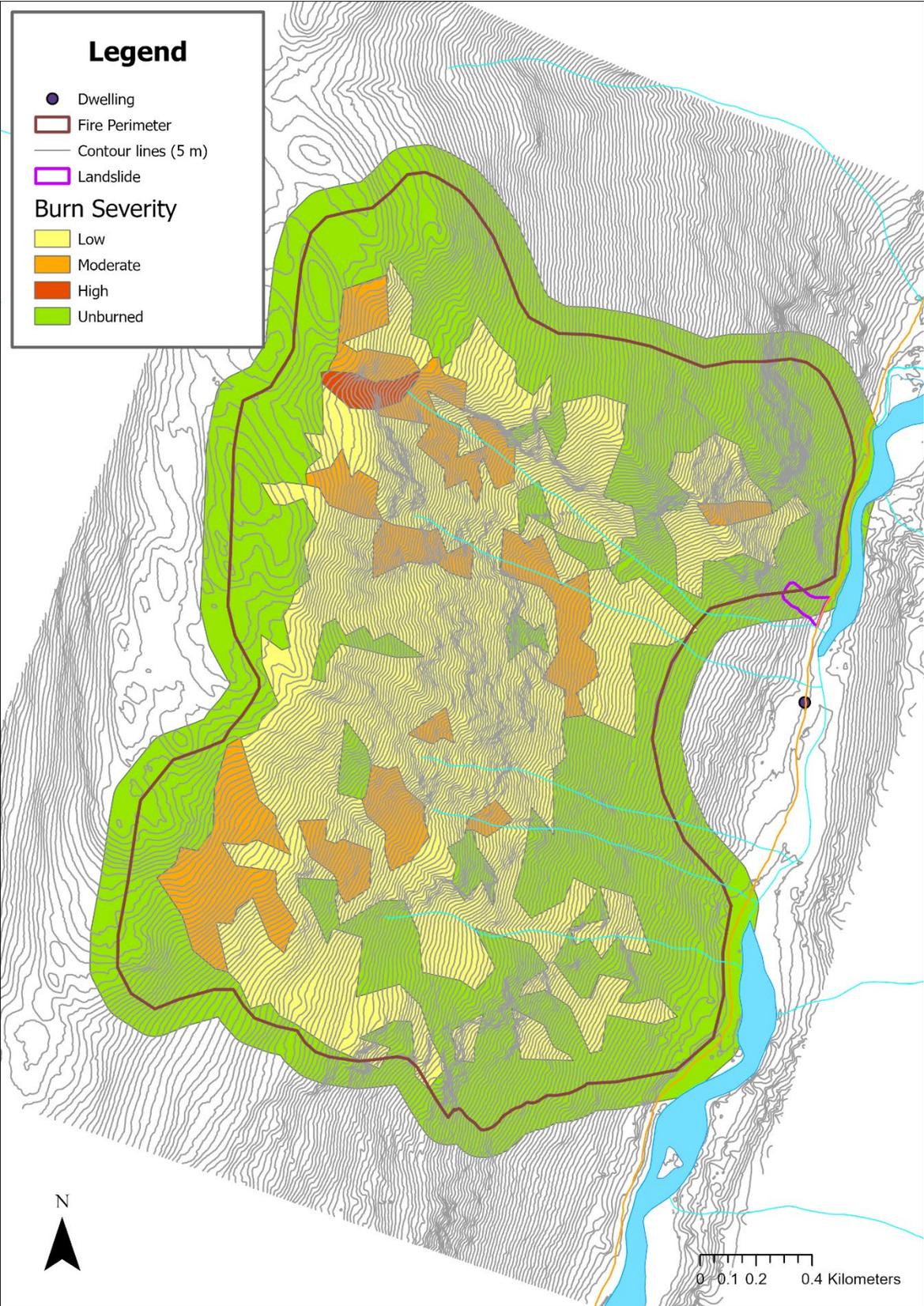


Figure 1 Burn severity map of the Glacier Creek fire showing estimated classes derived from Sentinel-2 imagery (prefire: 2022-08-17, post-fire: 2022-09-21).



Figure 2 Glacier Creek fire looking downstream along Glacier Creek towards Duncan Lake.

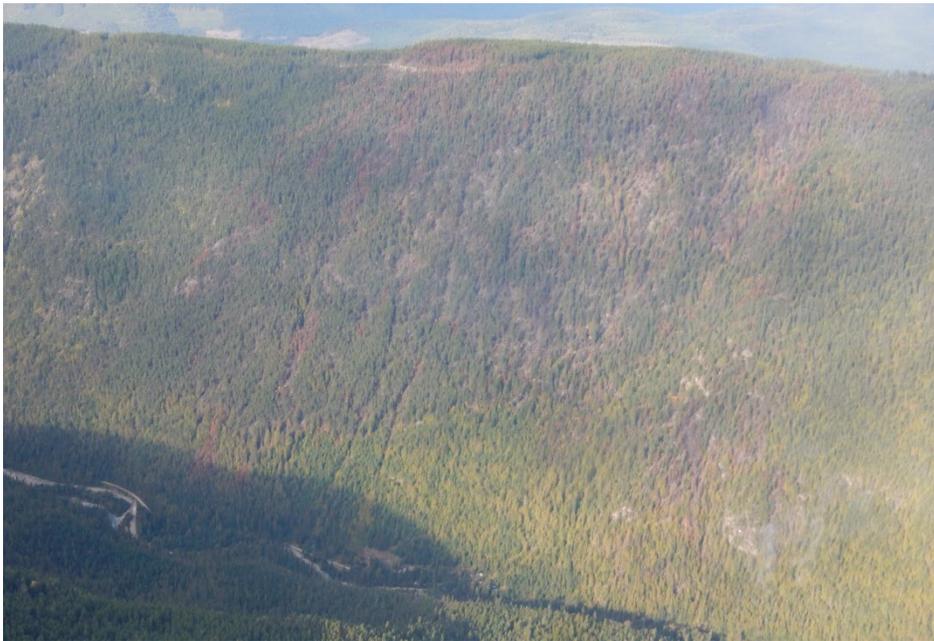


Figure 3 Glacier Creek fire looking west.



Figure 4 Patches of moderate soil burn severity in an area that is mapped as unburned in Figure 1.

Appendix to PWNHRA Reconnaissance Reports

Scope of reconnaissance reports

Reconnaissance reports are primarily intended to identify whether post-wildfire hazards are likely to occur and need detailed investigation to protect identified elements at risk. Identified elements at risk are generally limited to public safety and infrastructure. Reconnaissance reports may also be used to assess safety conditions for wildfire fighters. In some cases, the MOF District Manager may request assessments for non-standard elements at risk or for other reasons.

Definitions of hazard and risk

Wildfire may produce conditions conducive to a suite of hazards. Debris flows, debris floods, and floods are often the most important hazards, but other types of landslide hazards including rockfall, debris slides and earthflows can also occur in response to wildfire. Wildfire can also cause snow avalanches and may affect water quality, cause erosion and result in sedimentation. Terrain, watershed, and channel conditions that produce post-wildfire hazards may also produce similar hazards in unburned conditions; these hazards may be mentioned, but are not evaluated in this report.

P(H), P(S:H) and partial risk are presented for each identified elements at risk. Multiple types of channel hazards (debris flows, debris floods, floods) may affect an element at risk. These hazards are ranked by severity, with debris flow as the most damaging and destructive and flood as the least damaging and dangerous, and ratings are given for the highest rating hazard that may affect an element at risk. For example, where a channel has the potential for a debris flow and an element at risk may be affected, the lower ranking debris flood and flood hazards are not rated, since discharge and velocity are likely to be less than for a debris flow. These processes may cause erosion or sedimentation that affects the element at risk. Hazards that are unlikely to affect an identified element at risk are not discussed.

Table A1 is a matrix which combines the hazard likelihood with the spatial impact likelihood to determine partial risk.

Table A1. Post-wildfire risk matrix partial risk matrix.

Hazard likelihood (Table A1)	Spatial impact likelihood (Table A2)		
	H	M	L
H	VH	H	M
M	H	M	L
L	M	L	VL

Report Standards

MOF Land Management Handbook 69 is the primary standard followed in this report. LMH 69 describes the process to complete a detailed report. This reconnaissance report uses the framework of LMH 69 but does not follow it where detailed assessment procedures are described.

Land Management Handbook 69 Post Wildfire Natural Hazards Risk Analysis in British Columbia 2015
<https://www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh69.htm>

Additional guidance is provided in the MOF SOG for PWNHRA and the 2014 MOF Landslide Risk Management Procedure.

Other professional guidance standards that may be used for the preparation of reconnaissance reports are listed below. These guidelines have similar report content to this reconnaissance assessment, but are for different purposes, have different levels of appropriate effort, and do not recognize the potential emergency nature of this reconnaissance assessment. These guidelines include:

EGBC Guidelines for TSA in the Forest Sector 2010
<https://www.egbc.ca/getmedia/684901d7-779e-41dc-8225-05b024beae4f/APEGBC-Guidelines-for-Terrain-Stability-Assessments.pdf.aspx>

EGBC Guidelines for Legislated Landslide Assessments 2010
<https://www.egbc.ca/getmedia/5d8f3362-7ba7-4cf4-a5b6-e8252b2ed76c/APEGBC-Guidelines-for-Legislated-Landslide-Assessments.pdf.aspx>

Legislated Flood Assessments in a Changing Climate in BC 2018
<https://www.egbc.ca/getmedia/f5c2d7e9-26ad-4cb3-b528-940b3aaa9069/Legislated-Flood-Assessments-in-BC.pdf>

Watershed Assessment and management of hydrologic and geomorphic risk in the Forest Sector
<https://www.egbc.ca/app/Practice-Resources/Individual-Practice/Guidelines-Advisories/Document/01525AMW2ATQA5BSODHJAKBAGZDYTRL6FJ/Watershed%20Assessment%20and%20Management%20of%20Hydrologic%20and%20Geomorphic%20Risk%20in%20the%20Forest%20Sect>

Other standards may also apply, depending on the professional qualifications of the writer.

References

Nicol, D.R. 2007. Glacier Creek 15 km Review. Prepared for Ministry of Forests and Range Kootenay Lake Forest District. Project 511.003.