

MINISTRY OF FORESTS: POST-WILDFIRE NATURAL HAZARD RISK ANALYSIS
PONDEROSA FSR - LEVEL 2 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. A more detailed report will follow and may alter the conclusions. Please read the appendix of this report for important limitations. Contact the author for more information.

FIRE NUMBER: N51069 Ponderosa FSR	FIRE YEAR: 2024	DATE OF REPORT: September 11, 2024	
AUTHOR: Sarah Crookshanks, P.Geo., Ministry of Forests			
REPORT PREPARED FOR: Southeast Fire Centre, District Manager			
FIRE SIZE, LOCATION, AND LAND OWNERSHIP: 1860 ha on provincially managed public land and private land southeast of the village of Slocan			
VALUES AT RISK:			
<ol style="list-style-type: none"> 1. Private residences and/or potentially occupied buildings along Highway 6 and Martens Road 2. Domestic surface water quality on creeks originating from within the fire 3. Highway 6 and Austyn, Martens and Springer Roads 			
WATERSHEDS AFFECTED	TOTAL AREA	AREA BURNED	BURN SEVERITY (% of watershed area)
<i>Lemon Creek</i>	20200 ha	664 ha (3%)	0% H, 1% M
<i>Ringrose Creek</i>	126 ha	85 ha (67%)	0% H, 25% M
<i>O'Shea Creek</i>	128 ha	74 ha (57%)	0% H, 16% M
<i>Vincent Creek</i>	50 ha	22 ha (43%)	4% H, 28% M
<i>Unnamed Creek N of Vincent</i>	50 ha	23 ha (45%)	0% H, 19% M
<i>Shook Creek</i>	73 ha	29 ha (39%)	0% H, 22% M
<i>Grant Creek</i>	79 ha	41 ha (52%)	1% H, 27% M
<i>Erhard Creek</i>	74 ha	29 ha (39%)	4% H, 28% M
SUMMARY OF POST-FIRE HAZARD AND RISK			
<ol style="list-style-type: none"> 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 			
Debris flow or flood on Ringrose Creek impacting private residences			
Hazard P(H) ¹ = moderate Probability of spatial impact P(S:H) ² = moderate Partial Risk ^{3,4} = moderate			
<p>Ringrose Creek is a small catchment with a small, round alluvial fan midslope above the valley bottom that spans the highway. The watershed is short and steep (640 - 1700 m) with a Melton ratio of 0.9. The morphology of the watershed and fan would suggest that it is subject to debris flows. However, the degree of watershed activity appears to be low. Most of the burn in this watershed is low, but the patches of moderate burn severity are located on steep ground in the drainage headwaters; therefore, the debris flow hazard is rated as moderate. Several houses are located on the Ringrose Creek fan, but none are located near its apex. Field investigation as part of a more detailed (level 3) assessment is recommended to confirm the probability of spatial impact and risk of avulsion.</p>			

Debris flow or flood on Ringrose Creek impacting Highway 6

Hazard $P(H)^1 = \text{moderate}$ Probability of spatial impact $P(S:H)^2 = \text{high}$ Partial Risk^{3,4} = high

The highway crosses the fan a third of the way downslope from the apex. Ringrose Creek passes under the highway through a 500 mm culvert. If a debris flow or flood event were to occur on Ringrose Creek, the highway would almost certainly be impacted given the steep fan gradient, small culvert, and limited storage capacity in the ditch upslope of the highway.

Debris flow or flood on O'Shea Creek impacting private residences and Highway 6

Hazard $P(H)^1 = \text{low}$ Probability of spatial impact $P(S:H)^2 = \text{moderate}$ Partial Risk^{3,4} = low

O'Shea Creek is a small catchment (1.3 km²) with a large (0.6 km²) fan at its outlet. The watershed is short and steep (700 - 1760 m), and the catchment's sidewalls are highly gullied with patches of exposed soil and rock that were exposed before the fire. Lidar hillshade imagery shows evidence of historical channels across the fan's surface. The morphology of the watershed would suggest that it is subject to debris flows, though the fan may indicate a greater susceptibility to debris floods. Additional field work is required to confirm the dominant process. Due to the mostly low burn severity in the O'Shea Creek watershed, the debris flow or debris flood hazard in this catchment has only slightly increased post-fire and is thus rated as low.

The RDCK mapping indicates 11 address points on the O'Shea Creek fan; most are located along the downslope perimeter of the fan, except for one structure located midway up the fan. Field investigation as part of a more detailed (level 3) assessment is recommended to confirm the probability of spatial impact and risk of avulsion.

Debris flow or flood on draws north of O'Shea Creek impacting private residences and Highway 6

Hazard $P(H)^1 = \text{low}$ Probability of spatial impact $P(S:H)^2 = \text{moderate}$ Partial Risk^{3,4} = low

There are several long narrow drainages to the north of O'Shea Creek (Erhard, Shook, Grant and Vincent Creeks) that do not have mapped alluvial fans, yet they are small, steep watersheds with channel gradients averaging around 40%. Field investigation as part of a more detailed (level 3) assessment is recommended to evaluate how active these watersheds have been historically, as well as the probability of spatial impact to elements at risk. Lidar data would be very helpful in delineating the watershed areas of these draws, as well as better evaluating the hazards from these drainages.

Burn severity across these four drainages is mostly low and moderate, with several small high burn severity patches. The headwaters of these drainages remain largely unburned, and the total burned area in these watersheds are 40-50%. The hazard and probability of spatial impact are rated as low for these drainages, but additional work is recommended to better refine these estimates.

FURTHER ACTIONS

A more detailed (level 3) assessment for the Ponderosa FSR fire is recommended to verify the hazard and risk to private residences, infrastructure, and drinking water quality.

COMMENTS

The Ponderosa FSR fire was discovered on July 18, 2024, and burned over 1800 hectares. Only limited field assessment was conducted for this fire, given that a more detailed assessment is forthcoming. This analysis relies on vegetation burn severity mapping which was corroborated with visual observations made during a helicopter overflight of the fire on August 23, and several isolated soil burn severity plots near the south

end of the fire that were collected on August 22. Watersheds were delineated using TRIM topographic data. Lidar data, if available, would significantly improve watershed area estimates.

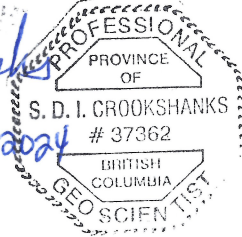
The fire burned the western face between Lemon Creek to the south and Springer Creek to the north. This slope ranges in elevation from 600 m to 1700 m. The drainages to the north exhibit flat-over-steep terrain, where the upper portions of the watersheds are gently sloping and drain into steeper draws below. Ringrose Creek to the south has a more consistent channel gradient from top to bottom.

Due to the proximity to private land and the reliance on surface water for domestic use in the area, further analysis of post-wildfire natural hazards for this fire is recommended. A more detailed report will be released at a later date that will expand on the hazards and risks outlined here and may alter conclusions.

All members of the public, and specifically water users, should avoid spending time in debris flow prone creek channels during or immediately after intense rainstorms, or during periods of rapid snowmelt. Episodic water quality impacts to surface domestic water users on sources originating from within the fire perimeter are anticipated. More detail on this risk will be included in the forthcoming more detailed (level 3) report.

SIGNATURE, SEAL, FIRM PRACTICE #

S. Crookshanks
September 12, 2024



The seal is circular with a scalloped border. The text inside the seal reads: "PROFESSIONAL" at the top, "PROVINCE OF" in the middle, "S. D. I. CROOKSHANKS" and "# 37362" in the center, and "BRITISH COLUMBIA" and "GEO SCIENTIST" at the bottom.

Sarah Crookshanks, P. Geo.
Ministry of Forests
Permit to Practice #1003022

Reviewed by: Gareth Wells, P. Geo

ATTACHMENTS

See attached map, photos and Appendix

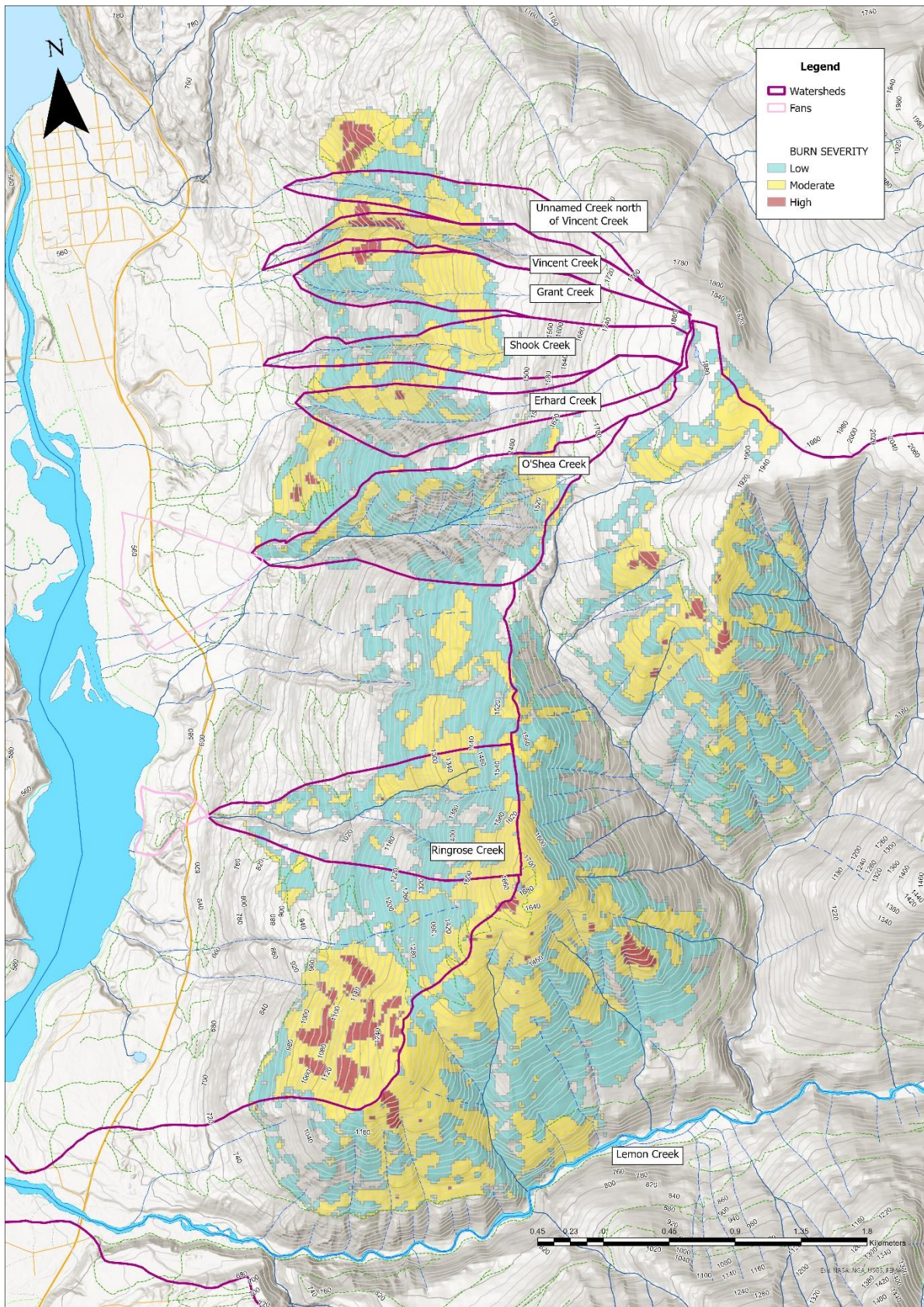


Figure 1 Soil burn severity map of the Ponderosa FSR fire showing estimated classes derived from Sentinel-2 imagery and some limited field work (prefire: July 7, 2024 post-fire: August 11, 2024). Further work may alter the estimated burn severity classes.



Figure 2. Overview of the Ponderosa FSR fire looking north (Photo: T. Giles, SNT Geotechnical).



Figure 3. Overview of the Ponderosa FSR face including O'Shea Creek and Ringrose Creek (Photo: T. Giles, SNT Geotechnical).



Figure 4. Overview of the Ponderosa FSR face including the drainages to the north of the O'Shea Creek (Photo: T. Giles, SNT Geotechnical).



Figure 5. Headwaters of Vincent Creek (Photo: T. Giles, SNT Geotechnical).

Appendix to PWNHRA Reconnaissance Reports

Scope of Reconnaissance (Level 2) Reports

Reconnaissance (Level 2) 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 or other MOF personnel 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 shows the annual probability ranges for qualitative definitions of P(H). The probability of the hazard occurrence is for the post-wildfire period of elevated hazard, which in many cases may be less than five years, but in some cases may extend for several more years.

Table A1. Qualitative descriptions of post-wildfire hazard likelihood, hazard criteria, and related quantitative probabilities.

Post-wildfire hazard rating	Description	Annual Probability Range
Very High	An event is expected to occur. Most of the catchment or face unit has burned with a significant proportion burned at moderate and/or high severity	>0.2
High	An event is probable under adverse conditions. Most of the catchment or face unit has burned with a significant proportion (i.e., >50 %) of terrain conducive to post-wildfire natural hazard initiation burned at moderate or high severity. Existing indicators of pre-fire terrain instability within stream channels, on fans or face units.	0.01 - 0.2
Moderate	An event could occur under adverse conditions. It is not probable but possible over a several year period. More than 20% of the terrain conducive to post-wildfire natural hazards in the catchment or on the face-unit has burned with moderate and/or high severity. Historic geomorphic indicators of instability are present.	0.002 – 0.01
Low	An event could occur under very adverse conditions. It is considered unlikely over a several year period. Only a limited proportion of the catchment or face unit has burned. Few or no signs of pre-fire instability present along stream channels, fans or face units.	0.0004 – 0.002
Very Low	An event will not occur or is conceivable though considered exceptionally unlikely. A limited proportion/none of the catchment was burned. No terrain instability indicators are present	<0.0004

Table A2 defines spatial impact to an element of risk. Post-wildfire event magnitude is considered when rating spatial impact.

Table A2. Post-wildfire spatial impact.

Likelihood of spatial impact	Description	Probability range
H	It is probable that the event will impact the element at risk.	>0.5
M	It is possible that the event will impact the element at risk.	0.5 - 0.1
L	It is unlikely that the event will impact the element at risk.	< 0.1.

Table A3 is a matrix which combines the hazard likelihood (Table A1) with the spatial impact likelihood (Table A2) to determine partial risk.

Table A3. Post-wildfire risk matrix partial risk matrix.

Hazard Likelihood P(HA) (Table 1)	Spatial Impact Likelihood (P(S:H)) (Table 2)		
	High	Moderate	Low
Very High	Very High	Very High	High
High	Very High	High	Moderate
Moderate	High	Moderate	Low
Low	Moderate	Low	Very Low
Very Low	Low	Very Low	Very Low

Report Standards

FLNRORD 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 FLNRO 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%20a>

[nd%20Management%20of%20Hydrologic%20and%20Geomorphic%20Risk%20in%20the%20Forest%20Sect](#)

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

Statement of Limitations

Reconnaissance PWNH Level 2 assessments are typically done in constrained timelines where personnel, resources, data collection, and analysis methods are limited. Post-wildfire hydrogeomorphic hazards in BC are not well understood and therefore hazard and risk assessments are estimates only. While probabilities ranges are given in Tables A1 and A2, the state of the science in BC does not allow for precise assessments, particularly near the borders of classes. Numeric probabilities ranges do not imply precision.

Identification of elements at risk relies on BC government data layers, satellite imagery, and perhaps an overview flight. BCWS and the MOF district office may provide additional information. No further confirmation of elements at risk was conducted.

Comments, conclusions, and suggestions contained in this reconnaissance assessment reflect my experience and judgement considering the information available to me at the time that this report was prepared and are considered appropriate for the reconnaissance nature of the review. The review has been carried out in accordance with generally accepted professional practices. This assessment and its contents are intended for the sole use of post-wildfire hazard management by provincial agencies, First Nation governments and local governments. I do not accept any responsibility for the accuracy of any of the data, the interpretation, or the conclusions contained or referenced in the report when the report is used or relied on for any other purpose than specified. Any such unauthorized use of this report is at the sole risk of the user.