The document is a Post-Wildfire Natural Hazards Risk Analysis for the 2023 McDougall Creek Wildfire, assessing risks and recommending mitigation measures for affected areas in British Columbia.

Post-Wildfire Natural Hazards Risk Analysis Overview

The report details the risk analysis of natural hazards following the 2023 McDougall Creek Wildfire, focusing on hydrologic and geomorphic impacts.

Project Background and Objectives

- Clarke Geoscience Ltd. was commissioned by the Ministry of Forests – BC Wildfire Service for a Post-Wildfire Natural Hazard Risk Analysis (PWNHRA).
- The McDougall Creek Wildfire (K52767) burned approximately 140 km^2 from August 15 to September 20, 2023.
- The wildfire affected multiple jurisdictions, including the City of West Kelowna and Westbank First Nation, resulting in the loss of 182 structures.
- The primary objectives include identifying elements at risk, assessing potential hazards, conducting a partial risk analysis, and proposing mitigation strategies.

Post-Wildfire Natural Hazards Identified

- Post-wildfire hazards include hydrologic effects like flooding and geomorphic effects such as landslides and debris flows.
- Hydrologic hazards result from faster runoff and lower infiltration due to vegetation loss and soil-water repellency.
- Geomorphic hazards involve increased soil erosion and landslides, particularly in steep areas.

Risk Analysis Methodology and Results

- The study area was divided into seven catchments, each assigned hazard ratings based on physical characteristics and burn severity.
- Risk ratings were assigned to elements at risk, including infrastructure and water intakes, using a partial risk analysis approach.
- High to very high-risk catchments were identified, with specific sites listed in Watershed Report Cards and shown on a Summary Risk Map.

Recommended Mitigation Measures

- Suggested measures include increasing awareness of post-wildfire hazards and developing early warning systems for floods and debris flows.
- Additional recommendations focus on mitigating flood impacts in large watersheds and addressing debris flow impacts in smaller catchments.
- Strategies also include improving domestic water quality and managing small-scale landslides and erosion.

Study Area Characteristics and Impacts

- The study area is located in the Central Okanagan, primarily affecting the McDougall Creek and Lambly Creek watersheds.
- The wildfire's impact was most significant in small catchments and steep terrain, leading to increased risks of hydrologic and geomorphic hazards.
- The report emphasizes the need for ongoing monitoring and assessment of post-wildfire conditions to manage risks effectively.

Physiography and Hydro-Geomorphic Processes

The study area is characterized by diverse physiographic features that influence hydro-geomorphic processes and natural hazards.

- The area lies within the Southern Interior Plateau, with elevations ranging from 353 m at Okanagan Lake to ~1500 m in the headwaters of McDougall Creek.
- Total relief varies from ~800 m to ~1000 m.
- The Melton Ratio indicates larger watersheds are prone to floods, while smaller, steeper catchments are susceptible to debris floods and flows.
- Physiographic characterization provides insight into pre-wildfire conditions and potential hazards.

Climate and Precipitation Patterns

The climate data reveals significant seasonal temperature and precipitation patterns that affect hydrology and wildfire behavior.

- Average annual precipitation is 386.9 mm, with 311.3 mm as rain and 89 cm as snow.
- The highest recorded daily precipitation was 33.8 mm on July 21, 1997.
- Peak snow accumulation occurs in late April, with rapid melt in May.

- Intense rainfall events (25-38 mm/hr) can trigger debris flows, particularly during 2 to 5-year, 15-minute storms.

Hydrology and Peak Flow Characteristics

Hydrological data indicates the timing and magnitude of peak flows, which are critical for understanding flood risks post-wildfire.

- Peak flows typically occur in mid- to late-May, primarily due to snowmelt.
- The McDougall Creek wildfire may lead to increased peak flows, particularly in snow accumulation zones.
- Historical flood events in 2017 and 2018 highlight the area's vulnerability to flooding.

Geomorphology and Natural Hazards

The geomorphological features and existing natural hazards inform the assessment of post-wildfire risks.

- Terrain stability mapping indicates areas of potentially unstable terrain, particularly on steep slopes.
- Historical landslide and debris flow events have been documented, emphasizing the area's susceptibility to such hazards.
- Areas with high burn severity are more likely to experience post-wildfire instability.

Past Wildfire and Logging Impact

Understanding the history of wildfires and logging helps predict future ecological responses and hazards.

- Previous wildfires have limited the extent and severity of the 2023 McDougall Creek wildfire.
- The area has not been extensively logged, with most forest development occurring at higher elevations.
- Legacy roads from past logging may pose stability issues post-wildfire.

Vegetation and Soil Burn Severity

The assessment of burn severity provides insights into potential hydrologic and geomorphic impacts following the wildfire.

- High burn severity areas are associated with dense forest cover and increased soil water repellency.
- Areas with moderate to high soil burn severity are more likely to experience overland runoff during rain events.
- Many catchments experienced significant burn severity, with some areas showing over 50% high burn severity.

Elements at Risk from Natural Hazards

Identifying elements at risk helps prioritize mitigation efforts and emergency preparedness.

- Elements at risk include residences, public infrastructure, and water supply systems within the study area.
- The assessment highlights the need for further engagement with local communities to identify cultural and archaeological sites.
- Stream crossings along McDougall and Smith Creeks are particularly vulnerable to post-wildfire flooding.

Post-Wildfire Natural Hazard Screening

A systematic approach to assessing post-wildfire hazards identifies areas at risk for debris flows and peak flow increases.

- The screening assessment flagged several catchments with high likelihoods for debris flow and peak flow effects.
- Upland creeks above West Kelowna and tributaries to McDougall Creek are identified as high-risk areas.
- Field verification confirmed the initial screening results, guiding further risk analysis and recommendations.

Preliminary Hydrology Analysis Post-Wildfire

The hydrology analysis estimates changes in peak flows due to the wildfire's impact on watershed conditions.

- Estimated post-wildfire peak flows may increase by 73% for McDougall Creek and 19% for Smith Creek in the first year.
- The analysis indicates a significant increase in peak flows due to soil-water repellency effects.

- These estimates are preliminary and should not inform infrastructure decisions without further validation.