Forest Practices Board

Impacts of Wildfire and Harvesting Near Silver Hills

Complaint Investigation 20032

FPB/IRC/242

January 2022

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Board Commentary

The legal framework for forestry in BC permits forest licensees to exercise discretion in their forestry practices, as long as they achieve the required results. To do this—and to protect public interest on Crown land—licensees rely on qualified professionals to plan and oversee forest practices with limited oversight by government.

Forest practices can create risks to other values such as water. These risks can be assessed at both the cutblock and watershed level. Sound forest practices based on recommendations from professional assessments can reduce, but not eliminate, risk.

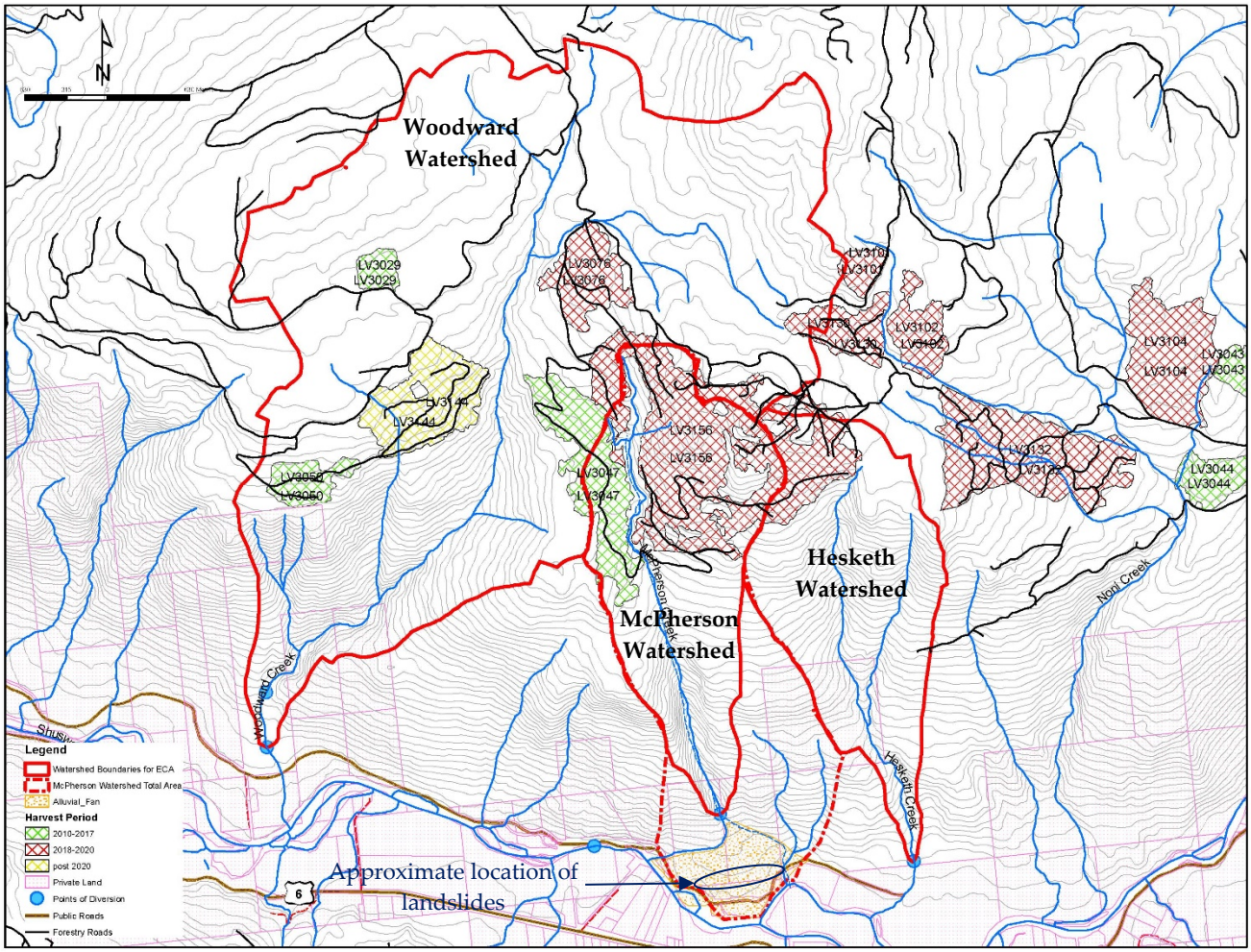
In the circumstances of this complaint, where four landslides occurred, there were significant resource values at risk downstream of fire salvage cutblocks in the McPherson Creek watershed. The forest licensee (Tolko) conducted an appropriate assessment at the cutblock level and implemented the recommendations to manage risk. However, Tolko did not assess the potential risk of its activities at the watershed level. A watershed assessment would have been reasonable, given the values at risk, and may have led to more detailed work and a better understanding of the incremental impact of salvage harvesting, which may have driven some different practices. A watershed assessment may not have prevented the landslides from occurring, but would have helped instill public confidence in Tolko's ability to manage the forest resource.

At the time the salvage harvesting was proposed, forest professionals were not provided with clear expectations about whether watershed level assessments should be done for watersheds such as McPherson Creek. However, in 2020, the ABCFP and EGBC released *The Joint Professional Practice Guidelines – Watershed Assessment and Management of Hydrologic and Geomorphic Risk in the Forest Sector.*[1] The guidelines provide expectations with respect to the degree of effort, due diligence, and standard of practice to be followed when identifying and managing watershed risks and carrying out watershed assessments in BC.

[1] https://www.egbc.ca/getmedia/8742bd3b-14d0-47e2-b64d-9ee81c53a81f/EGBC-ABCFP-Watershed-Assessment-V1-0.pdf.aspx

Overview of Silver Hills Development

Map 1. Overview of Silver Hills showing watersheds and harvesting by period.



Introduction

The Complaint

The Forest Practices Board (Board) received a complaint on July 24, 2020, from the Silver Hills Watershed Watch (SHWW) about harvesting in the Silver Hills area between Lumby and Cherryville. The complainant alleges that forest development by Tolko Forest Industries Ltd. (Tolko) over the past few years has impacted the range resource, increased peak flows that contributed to four landslides[2] (slope failures), and increased sedimentation of streams used for domestic water consumption.

Background

The Silver Hills area lies on the north side of the Shuswap River between Lumby and Cherryville, BC. The main drainages in the area are Woodward Creek, McPherson Creek, Hesketh Creek, and Noni Creek, which all flow into the Shuswap River. Government has issued domestic water licences on all but Noni Creek. A local resident holds cattle grazing rights and Tolko conducts forestry activities in the Silver Hills area.

The valley bottom includes glaciofluvial terraces beside the Shuswap River with overlying alluvial fans. The topography rises steeply from the river for about one and a half kilometres until slope gradients ease to plateau type terrain. The creeks are confined in steep, incised draws between the plateau and the alluvial fans below.

The plateau was extensively harvested in the 1980s. In 2010, Tolko returned to the Silver Hills area and has been conducting forestry activities since 2015 (Map 1 and Table 1). Tolko harvested cutblock LV3047 on the west side of McPherson Creek in 2015. In August 2018, a wildfire burned an area on the east side of McPherson Creek across from LV3047. Most of the fire was on the plateau where most water originates during spring freshet.

Table 1. Area Harvest by Cutblock, Year and Watershed

Cut Block	LV3044 (ha)	LV3047 (ha)	LV3050 (ha)	LV3101 (ha)	LV3102 (ha)	LV3104 (ha)	LV3029 (ha)	LV3076 (ha)	LV3130 (ha)	LV3132 (ha)	LV3144 (ha)	LV3156 (ha)	TOTAL (ha)	Watershed Area Above POD* (ha)
Harvest Year	2010	2015	2015	2018	2018	2019	2010	2019	2019-20	2019-20	2020-21	2018-20		
Hesketh Ck												34.1	34.1	304
McPherson Ck		31.3										111.9	143.1	330
Woodward Ck		28.2	16.7	0.4			8.4	32.0	5.2		51.6	23.6	166.2	1425
Noni Ck	9.3			8.0	19.3	25.6			19.0	84.0			165.2	

*Point of Diversion or POD is a layer from the British Columbia Geographic Warehouse and is intended to display the location of water rights points of diversion, as licensed, under the *Water Act*. The mapped location do not always reflect the actual location of the water intake.

Tolko began layout of cutblock LV3156 in October 2018 to salvage the burned timber. LV3156 is 170 hectares with 112 hectares on the plateau of the McPherson Creek watershed, 34 hectares on the plateau of the Hesketh Creek watershed, and the reminder in the Woodward Creek and Noni Creek watersheds. Tolko harvested LV3156 between December 2018 and July 2020.

[2] Landslide is a general term used to describe the downslope movement of soil, rock, and organic materials under the effects of gravity and include mudflows ("mudslides"), earth slumps, rockfalls, and other types of landslides.

Four landslides occurred on private land on the McPherson Creek alluvial fan in late April and early May of 2020, and one landslide became the focus of this investigation (see Photos 1 & 2). Also in May 2020, water users on Woodward and Hesketh creeks experienced what they considered to be extreme amounts of sediment in their water systems. Harvesting on the plateau over the last few years has also overlapped a range tenure. Tolko and the range tenure holder have been working to mitigate the impacts of harvesting on the range resource.

Photo 1. Debris from a landslide which crossed the Shuswap River Road, a private driveway and deposited some sediment into the Shuswap River.

Photo 2. Landslide across a private driveway.

Since 2015, the SHWW held several meetings with Tolko to discuss concerns about the Silver Hills development. On July 3, 2020, the SHWW met with the Ministry of Forest Lands and Natural Resource Operations and Rural Development (FLNRORD), the Regional District of North Okanagan, and the local MLA to discuss the landslides and options to address their concerns.

Following this meeting, on July 24, 2020, the SHWW submitted this complaint to the Board.

The Investigation

The investigation considered whether Tolko complied with legal requirements to mitigate impacts to the range resource, ensure that its activities did not cause landslides, and protect water quality.

Issue 1: Range

The complainant alleged that Tolko's harvesting and roads damaged range barriers in the Silver Hills area. (Note that the range tenure holder did not join this complaint.)

The investigation considered whether Tolko met legal requirements of the *Forest Planning and Practices Regulation* (FPPR) and addressed them in its forest stewardship plan[3] (FSP). Section 18 of the FPPR requires licensees to specify measures to mitigate the effect of 'removing or rendering ineffective' natural range barriers.

[3] An FSP is a key planning element in the *Forest and Range Practices Act* framework and the only plan subject to public review and comment and government approval. The province has approved legislation that will require preparation of a forest operations map, which will require public review and comment on proposed blocks and roads, but that has not been brought into force at the time of writing.

Tolko's FSP addresses section 18 by committing to:

- refer proposed harvesting and road construction to the range tenure holder to identify natural range barriers that will be removed or rendered ineffective by proposed development;
- make reasonable efforts to reach an agreement with the range tenure holder regarding the nature and timing of mitigation measures; and
- undertake the identified measures.

Tolko referred proposed development to the range tenure holder. The range tenure holder provided comments to Tolko regarding the impact of harvesting on natural range barriers. The impacts and recommended mitigation measures are documented in emails and in Tolko's site plans, and Tolko implemented those measures.

Finding

Tolko complied with section 18 of the FPPR and met the commitments in its FSP with respect to mitigating the impact of its forestry activities on natural range barriers.

Issue 2: Did Tolko's activities cause a landslide?

The complainant alleged that forest development by Tolko over the past few years has increased peak flows that contributed to four landslides on the McPherson Creek alluvial fan.

Section 37 of the FPPR requires licensees to ensure that a primary forest activity does not cause a landslide that has a material adverse effect on a forest resource.[4] Harvesting and road construction are primary forest activities, and soils and water are forest resources.

Cause of the landslides

The investigator reviewed the likely cause of the landslides with three independent qualified individuals (two professional geoscientists and a hydrologist) who had visited the landslide areas. The failure scars exposed deep layers of permeable sand and gravel on top of a relatively impermeable silt or clay layer. Surface water on the alluvial fan infiltrates permeable materials and moves downward reaching less permeable layers. This eventually saturates material above the less permeable clay and silt, and forces water to move laterally. This likely caused all of the landslides. Investigators also observed older and similar landslides along the edge of the terrace and overlying fan associated with McPherson Creek, but did not establish their age (see Photos 3 and 4).

[4] A forest resource is defined in section 149(1) of FRPA and includes soils, visual quality, timber, forage and associated plant communities, water, fish, wildlife, biodiversity, recreation resources, resource features and cultural heritage resources.

Photo 3. One of the landslides in the terrace along the toe of the McPherson Creek alluvial fan. The face of the landslide shows the depth of the sand and gravel material above the less permeable silt or clay layer.

Photo 4. Old landslide immediately adjacent to the recent landslide in photo 1.

Potential Contributing Factors

The potential factors that contributed to the landslides on the alluvial fan are discussed below.

Alluvial Fan

Alluvial fans are the cone-shaped deposits of sediment formed where stream channels leave the confines of mountain valleys.[5] Fans are desirable sites for development because of their gentle gradients and workable materials. Several residences are located on the McPherson Creek alluvial fan.

Alluvial fans are sensitive to small changes in hydrology, and are prone to landslides and debris flows due to their natural characteristics.[6] The sensitivity of the McPherson alluvial fan is evident from the past and recent landslides.

Wildfire

Wildfires can result in changes in vegetation cover and soil properties, which in turn can affect hydrology and slope stability.[7] Reductions in forest cover caused by wildfire increase ground snow accumulation and snow melt rate. Because there is no forest canopy, snow accumulation and the snow melt rate in burned stands are higher than adjacent forest, but lower than adjacent clearcuts, suggesting a somewhat intermediate situation.[8]

Further, wildfire can cause a water-repellent layer below the soil surface, known as hydrophobic soils, which reduces water infiltration and increases overland flow. This layer can persist for many years until it degrades naturally or is disturbed by human activities such as ground disturbance associated with harvesting. Finally, live trees uptake groundwater for growth. When the trees are killed (in this case by wildfire) the uptake ceases and the moisture level in the soil increases.

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[5] Wilford, D.J., M.E. Sakals, W.W. Grainger, T.H. Millard, and T.R. Giles. 2009. B.C. Min. For. Range, For. Sci. Prog., Victoria, B.C. Managing forested watersheds for hydrogeomorphic risks on fans. Land Manag. Handb. 61. Available from www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh61.htm

[6] https://www.for.gov.bc.ca/hfd/pubs/docs/lmh/Lmh61.pdf

[7] Scott, D. and R.G. Pike. 2003. Wildfires and Watershed effects in the Southern BC Interior. Streamline Watershed Management Bulletin.

[8] Winkler, R., Spittlehouse, D., Boon, S., & Zimonick, B. 2015. Forest disturbance effects on snow and water yield in interior British Columbia. Hydrology Research, 46(4), 521-532.

The combined effects of these changes can result in increases in snow accumulation, snow melt rate, overland flow and stream discharge. The magnitude of the increase is dependent on the severity of the burn, over-story condition (proportion of dead and live trees) and intensity of the ground fire, which can be assessed after the fire and before any salvage occurs. In this case, the Board did not observe the severity of the wildfire since the salvage harvesting was completed prior to the Board review in 2020.

Water Inputs

Precipitation

The investigators reviewed two factors related to water input; precipitation and soil moisture or groundwater. The investigators reviewed the precipitation data from the Silver Star and Park Mountain Weather stations.[9]

Generally, more snow on the ground means more water is available for runoff and streamflow during spring snow melt. The records indicate that the 2019 to 2020 winter had higher than average snowpack at both sites (refer to Appendix 1 for graphs).

Soil Moisture (Ground Water)

The wetter the soils are in the spring, the higher the likelihood a landslide will occur if additional water is introduced. Also, the wetter the soil, the less additional water required to initiate a landslide.

The investigators reviewed soil moisture conditions by reviewing available groundwater well data. This data measures the height or elevation of water levels in wells that are monitored by government (refer to Appendix 2 for graphs). The positive trend line indicates that well water levels, and therefore, the ground water levels, have been increasing in recent years.

Snow pack and runoff from spring snow melt were higher than normal and ground water levels had been increasing over the past few years.

Photo 5. McPherson Creek where it begins flowing down a man-made channel (to the right). The red arrow indicates where the stream jumped this channel and flowed onto the alluvial fan (Photo 4).

The yellow arrow points to the sediment, rocks and log redirecting flow back into its current channel.

Photo 6. McPherson Creek flowing onto the eastern portion of the fan on May 29, 2020, after it jumped the channel shown in Photo 3. (The picture was provided by the complainant.)

[9] Silver Star was chosen because of its proximity (27 kilometres west of Silver Hills and about 400 metres higher in elevation) and data that included temperature, snowfall, snow accumulation and rain. Park Mountain snow weather station (16 kilometres north of Silver Hills and 450 metres higher in elevation) data was used to compare snow accumulation levels only.

Redirection of McPherson Creek

The stability of the alluvial fan is very sensitive to changes in flow or location of McPherson Creek. There is one licensed point of diversion (POD) on McPherson Creek, located near where the creek enters the alluvial fan. McPherson Creek enters the alluvial fan from the north and at the POD runs to the west in what appears to be a man-made channel or diversion ditch. The complainant indicated that this is where McPherson Creek has run since the early 1970s. The hydrologist contracted by the Board indicated that the natural drainage channel of McPherson Creek at one point was near the eastern third of the alluvial fan, but was rechannelled to its current location. Stream coverages from the British Columbia Geographic Warehouse show both locations for McPherson Creek. Regardless, McPherson Creek enters the alluvial fan as surface water but goes underground soon after the POD.

The complainant indicated that McPherson Creek left its current channel in the spring of 2020 and flowed over the eastern portion of the fan (see Photos 5 and 6) close to where the eastern most landslide occurred. The change in the overland flow on the McPherson Creek fan was likely due to fine sediment deposition, or high streamflow levels resulting from above average snow accumulation and/or upslope wildfire and subsequent salvage harvesting. Investigators observed that sediment and debris were placed in McPherson Creek, diverting the surface flows back into its current channel to the west.

Harvesting and Roads (Forestry Activities)

Licensees cannot control natural factors, but they can try to manage risk associated with forestry activities by conducting appropriate assessments and implementing resulting recommendations. The *Forest and Range Practices Act* (FRPA) is results-oriented and provides the forest industry with flexibility on how to achieve desired results. Forest licensees rely on advice from professional foresters to identify the resource values potentially affected by their operations, determine when, where and what type of assessment is needed to address potential risks, what level of risk is acceptable and how those risks will be managed.

Forestry activities alter biophysical characteristics of the watershed, which can affect the amount of exposed soil and snow accumulation, the rate of snowmelt and the infiltration of rainfall. Clearcut forest harvesting removes all or most of the forest canopy so there are few trees to intercept and uptake moisture from rain and snow. In addition, roads and excavated trails intercept subsurface water and concentrate it in ditch lines and move it to streams faster than would occur if no roads were constructed. Together these factors affect the quality, quantity and timing of water flow in a watershed.

The potential impacts of forestry activities can be assessed at the cutblock and watershed level. A well-conducted assessment provides a consistent, scientifically defensible approach to developing recommendations to manage risks.

Cutblock Level

Tolko employed a specialist to complete a terrain stability assessment (TSA) for both LV3047 and LV3156. The assessment identified risks and made recommendations on how to carry out activities to reduce the likelihood of landslide initiation and adverse effects to downstream water quality resulting from the proposed development. These included culvert locations, general operational recommendations, general road and trail recommendations and maintenance and deactivation considerations. The recommendations were primarily related to maintaining natural surface drainage, avoiding concentration of water, and road deactivation and rehabilitation activities.

> ***Terrain Stability Assessment (TSA)*** is an assessment that includes both:
>
> 1) an analysis of landslide hazards and risks as a result of *Operations* within, adjacent to and connected to a *Forest Development* area; and
> 2) recommendations or options to manage landslide hazards and risks, …
>
> *Guidelines For Management Of Terrain Stability In The Forest Sector (2008)*

Tolko followed the recommendations in the TSA and installed drainage structures on surface drainage features,[10] which include streams and non-classified drainages. No landslides related to Tolko's activities were observed in any cutblock or road in the McPherson watershed.

Watershed Level

When the salvage harvesting was proposed, there were no clear expectations about when watershed level assessments should be done. However, in situations where there is a potential for an adverse impact on significant down stream/down slope resource values to occur, forest licensees can use qualified individuals to determine whether the proposed development requires an assessment at the watershed level and, if so, to complete the appropriate assessment. In this case, there were significant down-slope values that could be impacted from changes in hydrology from the wildfire and salvage harvesting. These include McPherson Creek, which is a direct tributary to the fish bearing Shuswap River and to an alluvial fan with several private residences, a public road (risk to life and property) and domestic water infrastructure.

In the snowmelt-dominated watersheds of the southern interior of BC, measurable changes in water flow timing, magnitude and frequency can occur where more than 20 percent of watershed area has been clearcut harvested and not yet hydrologically recovered (referred to as the equivalent clearcut area (ECA) – see sidebar).[11] These

> ***Watershed Assessment Procedure (WAP)*** The purpose of the WAP is to provide watershed-level recommendations for forest development plans, based on an assessment of the potential for cumulative hydrological effects from past and proposed forest harvesting and road building.
>
> ***Equivalent clearcut area*** is the area harvested, cleared or burned, with consideration given to the silvicultural system, and regeneration. It is an indicator of potential changes in the streamflow regime that may be caused by reductions in forest cover related to forest harvesting, wildfire, and disease.
>
> ***Hydrological recovery*** is the process by which regeneration restores the hydrology of an area to pre-logging conditions. In British Columbia, the most important component of the hydrological recovery involves snow accumulation and melt characteristics (snowmelt recovery) because peak flows in both interior and coastal areas tend to be generated by conditions of radiation snowmelt and rain-on-snow.
>
> *B.C. Ministry of Forests. 2001. Watershed assessment procedure guidebook. 2nd ed, ver. 2.1.*

[10] Surface drainage features include streams (have a continuous channel bed of at least 100 metres, with observable scour or alluvial deposits) and non-classified drainages (a discontinuous seasonal stream that may not have observable scour or alluvial deposits).
[11] https://testwww.for.gov.bc.ca/tasb/legsregs/fpc/FPCGUIDE/wap/WAPGdbk-Web.pdf

effects are most likely when harvesting is focused in the upper half of a watershed, which is the source area for the major snow accumulation and snowmelt peak flows, or in the plateau portion of a watershed when dealing with plateau-type systems such as those that exist in the Silver Hills area.

The McPherson Creek watershed is about 500 hectares[12] with about 330 hectares of the watershed directly above the alluvial fan (refer to map on page 4). Between 2015 and 2020 about 143 hectares of the watershed, including the wildfire burned area, above the alluvial fan was harvested. The Board calculated a post-harvest ECA of 43 percent for the McPherson Creek watershed above the alluvial fan. This is significantly higher than the 20 percent where changes in hydrology can occur. In addition to the high ECA, all of the harvesting occurred on the plateau portion of the watershed, which is the source area for the major snowmelt peak flows, and impacts the hydrology at the cutblock and watershed level.[13] The plateau portion is about 40 percent of the watershed and almost 70 percent of the plateau was damaged by wildfire and/or harvested.

Tolko did not complete a watershed level assessment when planning its salvage activities in the McPherson Creek watershed, and had no legal obligation to do so. However, under the results based legislation/professional reliance management model, licensees can and often do exceed legal obligations.

Finding

Tolko complied with section 37 of the FPPR.

While the investigation identified several potential factors that may have contributed to the landslides, the Board could not quantify their proportional impact. In addition, the Board could not determine the incremental increase in stream flow associated with salvage harvesting versus not harvesting the wildfire area, or if the landslide would have occurred if the burned area was not harvested. Consequently, the Board could not conclude that Tolko's activities caused the landslides.

Tolko undertook a terrain stability assessment for the cutblocks that were harvested but did not conduct a watershed level hydrological assessment.

Winkler, R.D., R.D. Moore, T.E. Redding, D.L. Spittlehouse, B.D. Smerdon, and D.E. Carlyle-Moses. 2010b. The effects of forest disturbance on hydrologic processes and watershed response. In: Compendium of forest hydrology and geomorphology in British Columbia. R.G. Pike, T.E. Redding, R.D. Moore, R.D. Winkler, and K.D. Bladon (editors). B.C. Min. For. Range, Res. Br., Victoria, B.C., and FORREX Forum Res. Exten. Nat. Resourc., Kamloops, B.C. Land Manag. Handb. 66., pp. 179–212. Available from www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh66/Lmh66_ch07.pdf

[12] The Board established watershed boundaries using provincial data for watershed boundaries, contours and streams.

[13] Schnorbus, M. and Y. Alila. 2004. Forest harvesting impacts on the peak flow regime in the Columbia Mountains of southeastern British Columbia: An investigation using long-term numerical modeling. Water Resources Research 40(5):1–16.

Moore, R. Dan and S.M. Wondzell, 2005. Physical Hydrology and the Effects of Forest Harvesting in the Pacific Northwest: A Review. Journal of the American Water Resources Association (JAWRA) 41(4):763-784.

Issue 3: Water Quality

The complainant alleged that Tolko's activities increased sedimentation into Woodward Creek, which is used for domestic water consumption. During the course of the investigation, the Board discovered that Hesketh Creek experienced similar events at the same time.

Section 59 of the FPPR states that an authorized person who carries out a primary forest activity, which includes harvesting and road construction, must ensure that the activity does not cause material that is harmful to human health to be deposited in, or transported to, water that is diverted for human consumption by a licensed waterworks.

Government has issued domestic water use licences for Woodward and Hesketh Creeks. The licences specify a daily volume of water that can be used, but do not guarantee the quality of water. Both creeks likely experienced above average flows during the spring of 2020.

Photo 7. Woodward Creek intake on May 2020. *(Photo provided by the complainant)*

A water user on Woodward Creek indicated that they usually experience some turbid water in the spring, but only for a few days. In the spring of 2020, the turbid water lasted for three weeks and could not be used for domestic purposes during that time. Similar events occurred on Hesketh Creek where the water user stated he had not seen such high flows in the creek in the past and that that he had to pull his intake for three weeks because the water was so dirty.

The TSA and site plan for LV3156 recognized that the cutblock is within a domestic watershed. The site plan indicated that sediment delivery risk is very high, primarily due to the hydrophobic soils associated with the wildfire. However, that risk was not reflected in the operational activities. Investigators observed poor water management practices on roads with ditch runs draining directly into streams used for domestic consumption (see Photo 8 and 9). This permitted direct input of sediments from roads into streams.

The TSA recommended seasonal deactivation of all permanent and temporary roads, and that all proposed and existing trails used for harvesting should be completely rehabilitated and seeded as soon as practicable after harvesting. Roads and excavated trails were not deactivated or rehabilitated when auditors visited the site in the summer of 2020. However, Tolko told the Board that temporary roads were seasonally deactivated in October and November 2020.

It is also important to note that sediment sources were not confined to forestry activities. High snow loads in the plateau portion of the watersheds also contributed to increased spring stream flows. In the spring, the volume and velocity of the water in the creek likely destabilized stream channels and caused some streambank erosion. The field observation also identified two old trail-related slides in Woodward Creek that likely introduced some sediment into the stream channel.

Photo 8 (left) and **Photo 9** (right). These photos show the ditch line flowing directly into a direct tributary of Woodward Creek. The confluence with Woodward Creek is about 600 metres downstream from this crossing.
The yellow line shows the ditch draining directly into the Woodward Creek tributary.

In order to fight the wildfire, excavated fireguard trails were constructed in the Hesketh Creek watershed. The fireguard crossed the natural drainage patterns at the headwaters of Hesketh Creek. Unlike roads, where water is controlled through ditch lines and drainage structures, the fire guards have few if any water management structures. This exacerbates the potential impact on the hydrology of an area and poses a risk of landslides and sediment delivery to watercourses until the fireguards are deactivated or rehabilitated. FLNRORD completed a rehabilitation plan for the fireguard trails that recognized the crossing of Hesketh Creek was a specific area of concern. The rehabilitation plan prescribed full re-contouring and grass seeding of the excavated fireguard trails crossing Hesketh Creek. The rehabilitation was to be completed prior to the 2019 spring freshet. FLNRORD contracted out the rehabilitation of the fireguards and the rehabilitation did not start until after the 2019 freshet.

However, sediment in water does not necessarily mean that the water is harmful to human health. It is the ability of the dirty or turbid water to harbour microorganisms and reduce the effectiveness of many types of water treatment that is a concern. In its 2014 report on Community Watersheds,[14] the Board interpreted "material harmful to human health" to include items such as petroleum products, fertilizers and other harmful chemicals. The report also references other investigations by the Board that describe the risk sediment in water may create and the most recent publication by the Office of the Provincial Health Officer; Clean, Safe, and Reliable Drinking Water[15] confirms the Board's interpretation.

Although sediment is likely the most common risk to drinking water quality posed by forestry operations, the section 59 requirement is not contravened unless the sediment contains pathogens harmful to human health and reaches the intake. Investigators identified instances where sediment was being deposited into streams, but did not determine the sediment contained pathogens harmful to human health. Proving "harm to human health" requires: determining that the material is inherently harmful (e.g., petroleum products); lab analysis of a water sample confirming the presence of pathogens harmful to human health; or actual sickness in which medical evidence confirms the ingestion of the water as the cause.

[14] Forest Practices Board. 2019. Community Watersheds: From Objectives to Results on the Ground, Available at: https://www.bcfpb.ca/wp-content/uploads/2016/04/SIR40-Community-Watersheds-From-Objectives-to-Results-on-the-Ground.pdf.
[15] Office of the Provincial Health Officer. 2019. Clean, Safe, and Reliable Drinking Water.

During the course of the investigation the Board did not find any evidence that Tolko introduced material harmful to human health into any of the creeks.

Finding

Tolko complied with section 59 of the FPPR. Tolko did not cause material that is harmful to human health to be deposited in, or transported to, water that is diverted for human consumption by a licensed waterworks.

Although Tolko complied with legal requirements, its water management on some roads and excavated trails did not mitigate deposition of sediment into water courses.

Conclusions

Range

Tolko complied with Section 18 of the FPPR by incorporating results or strategies in its FSP and following those commitments.

Landslides – McPherson Creek

Tolko complied with section 37 of the FPPR.

Although landslides did occur, the Board could not attribute the landslides to Tolko's activities alone. The investigation identified several potential contributing factors for the landslides on the McPherson Creek alluvial fan. The Board could not quantify the proportional impact of the potential causal factors, determine the incremental increase in stream flow associated with salvage harvesting versus not harvesting the wildfire area, or if the landslides would have occurred even if Tolko did not salvage harvest the burned timber.

Tolko's management at the cutblock level was reasonable, but it did not conduct a watershed level assessment and was not legally obligated to do so.

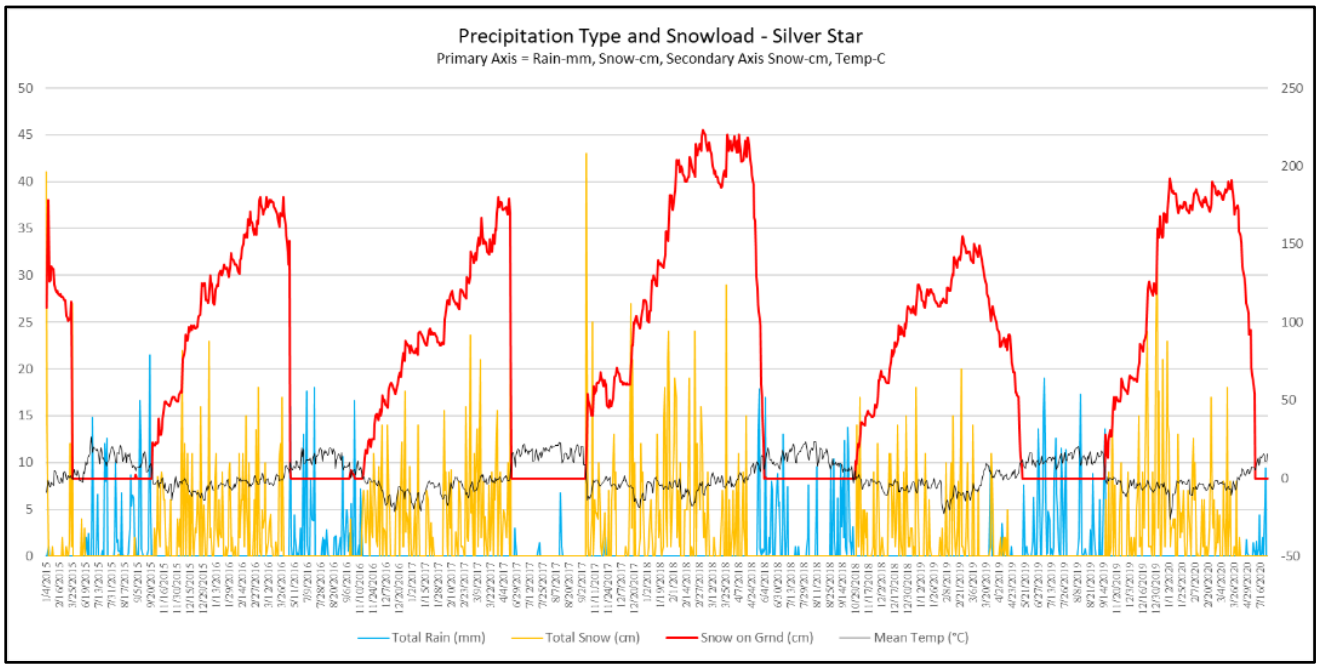
Water Quality – Woodward Creek & Hesketh Creek

Tolko complied with section 59 of the FPPR.

While Tolko's activities contributed sediment to the creeks, sediment is not necessarily harmful to human health. Tolko adequately planned its activities at the cutblock level prior to harvest. While planning identified the risk of sediment, operational activities did not consistently address the risk. Investigators observed poor water management practices on some roads with long ditch runs draining directly into streams used for domestic consumption.

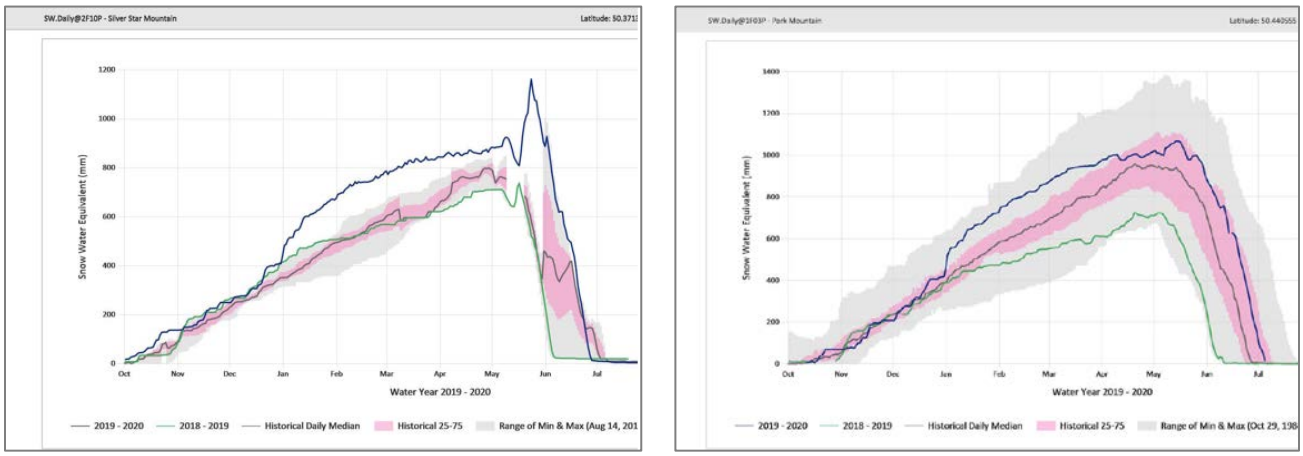
It would be prudent for Tolko to utilize professionals with expertise in soils or hydrology to review existing drainage control and when prescribing and reviewing post harvest road deactivation, given the non-timber values at risk.

Appendix 1: Precipitation Data



Graph 1. Rainfall, snowfall, snow accumulation and daily mean temperature at the Silver Star weather station. Snow accumulation in the 2019-2020 winter is greater than the previous four years with the exception of the 2017-2018 winter.

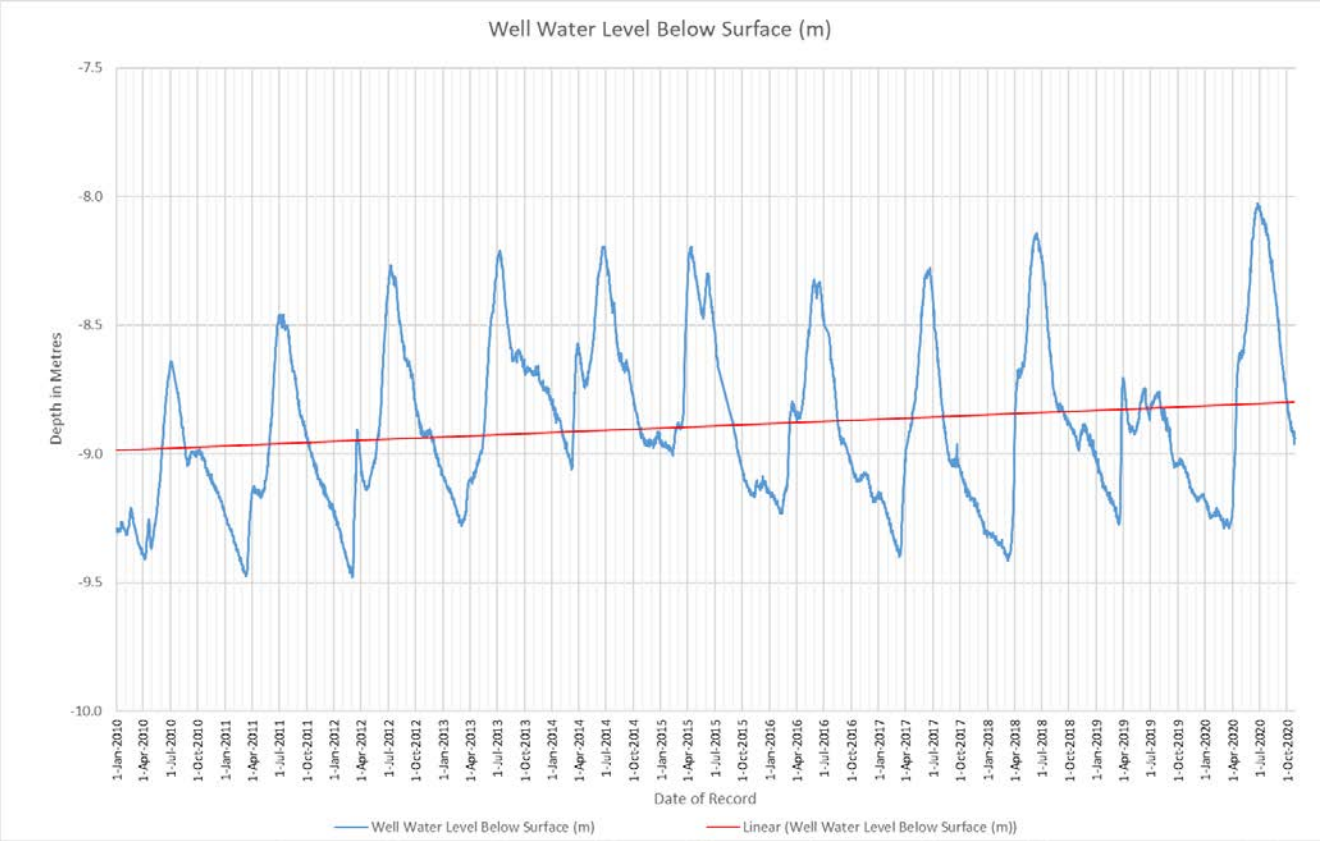
Source: BC Snow Survey Data



Graph 2. Snow Level Graphs for Silver Star Mountain (left) and Park Mountain (right). Both graphs show that the snow levels in 2019 -2020 winter (blue line) were higher than 2018-2019 winter and also higher than the historic daily median.

Source: BC Snow Survey Data

Appendix 2: Groundwater Data



Graph 3. Ground water level from the Lumby Water Well measurements. The Red line is the trend line of the well water level. The vertical axis shows the water surface level below the ground surface. For example, -8.5 means the surface of the well water is 8.5 metres below the ground surface.

The positive sloping trend line shows that the surface of the well water has been getting higher.

Source: Groundwater Level Data Provincial Groundwater Observation Well Network

PO Box 9905 Stn Prov Govt
Victoria, BC V8X 9R1 Canada
Tel. 250.213.4700 | Fax 250.213.4725 | Toll Free 1.800.994.5899
EGBC Permit to Practice #1001000

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