Forest Practices Board

Harvest Planning and Practices in the Hunaker Creek Watershed

Complaint Investigation #121022

FPB/IRC/191

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Introduction

The Complaint

In July 2012, the Forest Practices Board received a complaint that a BC Timber Sales (BCTS) logging operation in the Hunaker Creek Watershed had affected the flow of a seasonal stream, which in turn caused damage to the complainant's property. The complainant also claimed that the logging operations led to contamination of a well and that the BCTS public consultation efforts were inadequate, both for harvest planning and for notification about burning waste wood piles.

What is BCTS?

BCTS is a government organization that auctions Crown timber to registrants in the BCTS program. BCTS prepares operational plans and issues timber sale licences (TSL) to successful bidders. The TSL holder is responsible for harvesting according to BCTS's plans while BCTS is responsible for the pre-harvest (planning and major road development) and some post-harvest activities (reforestation).

Background

Characteristics of the Hunaker Creek Watershed

The Hunaker Creek Watershed is small—less than 500 hectares in size—with the portion upstream of the complainant's home covering 289 hectares. The watershed is relatively flat with a slight northern aspect and elevation ranges from 550 to 600 metres above sea level.

About 85 percent of the watershed upstream of the complainant's home is on Crown land and is within BCTS's operating area. The remainder is private land, most of which is owned by the complainant.

An unpaved public road, Tatlow Road, crosses the watershed in its lower reaches. On the upper side of the road is Hunaker Spring, which nearby residents sometimes use as a domestic water source. Above the spring, Hunaker Creek is a seasonal watercourse that, according to the complainant, usually flows for a month or two in the spring and remains dry for the remainder of the year.

Prior to the mid-2000s, Hunaker Creek Watershed was heavily forested, with 70 percent of the area featuring mature lodgepole pine as the leading species and the remainder mostly deciduous forest (primarily aspen).

Presently, about 33 percent of the watershed upstream of the complainant's property is in a clearcut state, with the remaining 67 percent in conifer or deciduous mature forest cover. The conifer portion of the mature cover (about 35 percent of the watershed) is dominated by lodgepole pine and is also impacted by mountain pine beetle (MPB).

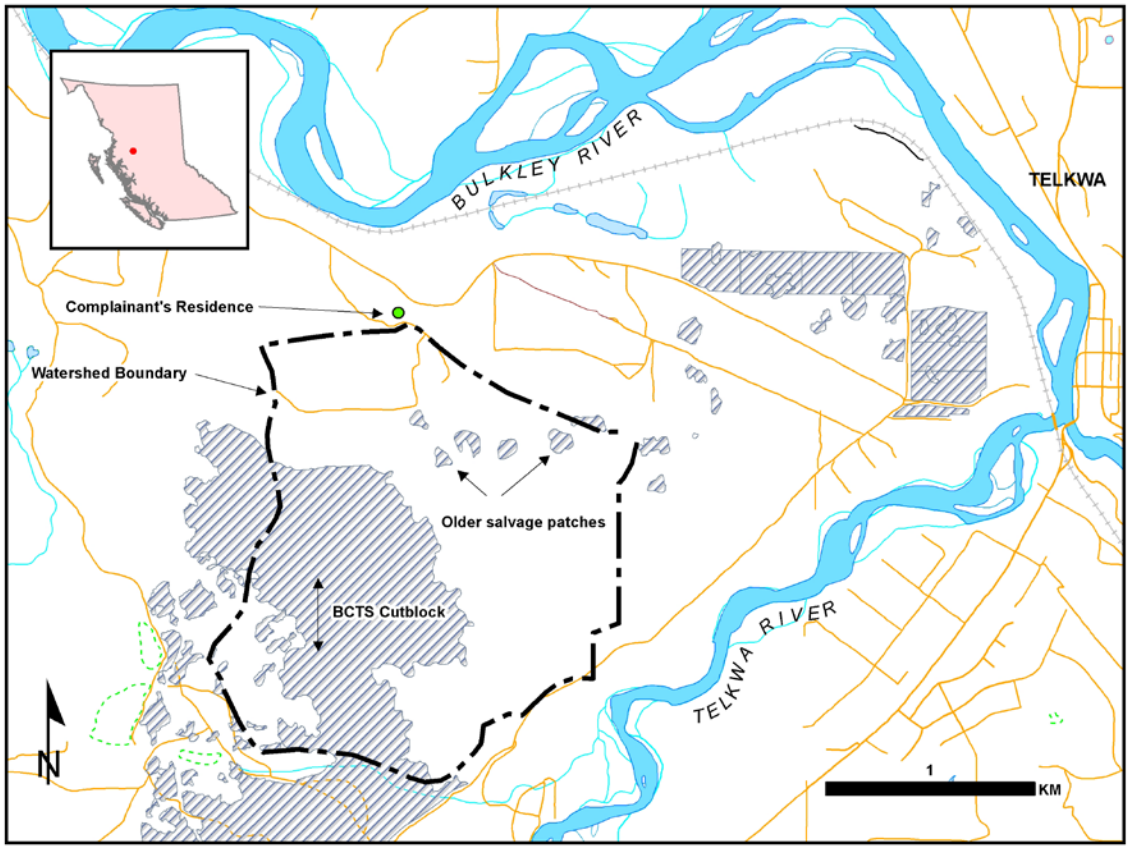

Figure 1. Location map showing the portion of the watershed upstream of the complainant's house.

The Complainant's Property

The complainant's 60-hectare property lies in the lower portion of the Hunaker Creek Watershed near the community of Telkwa, south of Smithers (see Figures 1 and 2). The complainant lives on the property and uses it for farming and recreation. The property backs onto Crown land.

Hunaker Creek passes near the complainant's house and garden. Downstream of the house and garden, the streambed has gravel exposed by water flow, which, under the *Forest and Range Practices Act* (FRPA), is a characteristic of the definition of a stream. However, upstream of the house and garden, the watercourse is difficult to discern (it is dry for much of the year, has very shallow banks, and has very little observable alluvial deposition) and does not meet the FRPA definition of a stream.[1]

The BCTS cutblock that is the subject of the complaint is more than 500 metres upstream from the complainant's house and 280 metres from the property boundary. Given that the portion of Hunaker Creek in the upper watershed doesn't qualify as a stream under the FRPA definition, no watercourses were identified in the site plan for the harvest area.

In about 1990, a previous owner of the property diverted the creek to lead it from the east gully to the west gully (Figure 2). The current owner says that when he took up residence in 2004, he saw no

[1] Stream is defined in the *Forest Planning and Practices Regulation* as "a watercourse that contains water on a perennial or seasonal basis, is scoured by water or contains...mineral alluvium and that has continuous channel bed that is 100 m or more in length..."

erosion evident and high spring peak flows only started eroding the gully in 2009, leading to formation of a fresh alluvial fan in the lower field.

Figure 2. Site details.

Sequence of Events

Events leading up to the submission of the complaint are described below.

2004 to 2008

The complainant observed that the peak flows in spring were not high enough to cause erosion or inconvenience. The stream remained in its channel, most of the stream water soaked into the ground before entering the west gully, and seasonal pools that formed south of the garden area dissipated by late spring.

MPB populations began to build in the watershed, and lodgepole pine mortality became significant. A timber cruise completed in 2007 indicated that 20 percent of the timber in the BCTS proposed cutblock was attacked by MPB and the infestation was increasing. In 2007 and 2008, some small salvage patches (less than three percent of the watershed) were harvested to address the infestation.

BCTS held a public meeting in 2008 regarding its harvest plans and the proposed cutblock in the watershed.

2009

The complainant noted spring season peak flows in Hunaker Creek that were higher than previously experienced. He also noted some related erosion in the west gully.

Later that year, a timber sale licence holder harvested the BCTS cutblock under TSL A82781, bringing the total clearcut area within Hunaker Creek Watershed to 33 percent. Access roads were deactivated following harvest.

2010

In spring of both 2010 and 2011, high flows continued to erode the sidewalls of the west gully, creating a sediment fan and a seasonal pool of water in the complainant's lower field. As well, seasonal pools and flows upstream of the garden were greater in volume and more persistent, interrupting the complainant's recreational trail system on his property.

The cutblock was planted in spring 2010.

The wood waste piles remaining from the harvesting operations were burned in October 2010.

2011

The complainant lodged a complaint with the Association of BC Forest Professionals (ABCFP) regarding the conduct of two forest professionals involved with this timber sale. The allegation was that the debris piles were burned without notifying the public and large volumes of smoke and ash affected nearby residents. Concerns were also expressed about damage from peak flows and severe noise from industrial operations and all-terrain vehicles. The ABCFP complaint was resolved through a mediated agreement that required the forest professionals to address the complainant's concerns.

BCTS developed plans to address concerns raised in the ABCFP complaint, including rerouting the stream, which was done in 2012.

2012

Before the 2012 spring freshet, BCTS rerouted the stream to the location it was in prior to the 1990 diversion, the east gully. Since this redirection back to the east channel, there has been no additional erosion in the west gully or soil deposition in the lower field.

A rare phenomenon occurred during the spring 2012 freshet. On April 14, water-logged snow acted like a dam, inhibiting water flow in Hunaker Creek and causing flooding and overland flow on the complainant's property. The pooled water flowed over the hillcrest in a new location—a slope above Tatlow Road—where it caused a minor landslide and washout, temporarily closing Tatlow Road. The location of the overland flow is shown on Figure 2.

The complainant tested the well water, revealing unsafe levels of E. coli and total coliforms. The complainant has been using the same well since purchasing the property in 2004 and tests he conducted in previous years had always been free of both E. coli and total coliforms. The previous owner had detected coliforms, but not E. coli, shortly after it was dug in 2000.

The complaint was filed with the Forest Practices Board in July 2012.

Table 1. Relationship between peak flow events, mountain pine beetle incidence and logging events in Hunaker Creek Watershed

Year	Hunaker Creek spring peak flows and related events*	Mountain Pine Beetle (MPB)	Logging within the watershed
2004	Low		
2005, 06	Low	MPB apparent within the watershed.	
2007	Low	Timber cruise identifies 20% of lodgepole pine are dead or dying.	Harvest commences on small salvage patches (December).
2008	Low		Harvest continues on small patches to salvage MPB-affected trees. Cumulative harvest in watershed is less than 3%.
2009	- Moderate to high - Erosion in west gully creates fan in lower field (prior to harvest of TSL).	Greater than 50% of lodgepole pine are dead or dying in cutblock prior to harvest.	Summer 2009: TSL harvested, cumulative harvest in the watershed is 33%.
2010	High		
2011	High		
2012	- Very high spring peak flow. - Overland flow of April 14 leads to a washout and temporary road closure on Tatlow Road.	Mortality in remaining pine stands is significant and there are still new MPB-attacked trees.	
2013	Low to moderate		

** This is a subjective measure of peak flows as recalled by the complainant.*

Discussion

To answer the complainant's concerns about logging-related damage and inadequate consultation, the Board considered the following questions:

1. Did BCTS and the TSL holder meet the requirements for managing water in and around forest operations?
2. Were planning and practices reasonable in addressing potential hydrological impacts in the Hunaker Creek Watershed?
3. Was public consultation regarding forest operations effective?

The complainant was also concerned that his well became contaminated as a result of the logging, but the Board found too many uncertainties to say whether it was related to the logging. This issue is discussed later in this section, as well as in the discussion on forest management around licensed water works.

To investigate these questions, the Board conducted interviews, reviewed available literature, visited the site, and consulted with hydrology experts. Past Board reports with subject matter related to MPB hydrology and MPB forest planning were also considered. The affect of MPB on forests in the Hunaker Watershed is not unique. The MPB epidemic has been progressing through the BC interior over the last decade and the Board has investigated several situations where hydrological changes have occurred after MPB attack or salvage of affected stands.[i] The Board has also investigated instances where salvage harvesting was thought to impact other resource values.[ii]

Did BCTS and the TSL holder meet the requirements for managing water in and around forest operations?

The *Forest Planning and Practices Regulation* (FPPR) contains a number of provisions for water and riparian management, but some of these provisions apply only in special circumstances, such as in a community watersheds or fisheries-sensitive watersheds. The Hunaker Creek Watershed is not a designated community watershed, nor is it a fisheries sensitive watershed.

Several sections of the FPPR apply to forest management around licensed water works**,** including a requirement to, "ensure the primary forest 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," through a licensed waterworks (FPPR Section 59). Section 60 of the FPPR contains a requirement to not, "damage a licensed water works." The complainant does have a water licence on Hunaker Spring, but does not divert it for human consumption. The complainant has a well that provides drinking water, but is not considered a "licensed water works" under FRPA.[2] Therefore, these sections of the FPPR do not apply to the situation at Hunaker Creek.

Section 39 of the FPPR requires a licensee to maintain natural surface drainage patterns during and after road construction. The roads in Hunaker Creek were well constructed and have now been deactivated. There is no evidence that road building or maintenance in the watershed adversely affected drainage patterns.

Division 3 of the FPPR and the results and strategies in BCTS's forest stewardship plan (FSP) call for special management around riparian areas. The logging and road activities examined by investigators were in compliance with both the regulation and the FSP.

Finding

BCTS and the TSL holder met the legal requirements for managing water in and around forest operations.

Were planning and practices reasonable in addressing potential hydrological impacts in the Hunaker Creek Watershed?

In addition to looking at compliance with the legal requirements, the Board considered reasonableness of planning and practices. Just as a driver can follow all the rules of the road, yet still have a mishap, a forest operation can be compliant with the laws and regulations yet still cause adverse impacts.

The Board could not address this question without examining potential factors that can affect runoff generation, magnitude, timing and duration of high or peak flow events. In the case of Hunaker Creek, those factors include logging, but also include annual snow accumulation and snowmelt patterns, as well as changes in forest cover from natural events.

[2] In the FPPR, "**licensed waterworks**" means a water supply intake or a water storage and delivery infrastructure that is licensed under the *Water Act* or authorized under an operating permit issued under the *Drinking Water Protection Act*. Wells and groundwater are currently not licensed under the *Water Act* and wells supplying one residence do not require an operating permit under the *Drinking Water Protection Act*.

Annual Snow Accumulation and Snowmelt Patterns

The magnitude and duration of high or peak flow events in interior snowmelt dominated systems are determined most often by annual snow accumulation and snowmelt patterns.[iii] Abnormal weather events, such as significant storms, can also produce peak flows. The complainant has observed springtime peak flows on Hunaker Creek since 2004 and reports low peak flows from 2004 to 2008, moderate to very high peak flows from 2009 to 2012 and low to moderate peak flows in the spring of 2013.

Daily snow depth and weather conditions recorded at the Smithers airport are comparable to snow and weather conditions in the Hunaker Creek Watershed. The airport is at a similar elevation, is in close proximity (14 kilometres to the north) and has records covering the period of time over which observations were made by the complainant.

An examination of weather data from the Smithers airport reveals wide variation in snow accumulation and snowmelt patterns from year to year. For example, the spring freshet in 2012 was preceded by very high snow accumulation over the winter and rapid melt in the spring. This was a year with unusually high spring peak flows, including the rare overland flow event that subsequently washed out Tatlow Road. Conversely, the spring of 2004, observed by the complainant as a low peak flow year, had a low snow pack (Figure 3).

Not all of the peak flow events in Hunaker Creek conform to this pattern of high winter accumulation and rapid spring melt, but three of the four years with high peak flows reported by the complainant did have above average snowpack followed by rapid melt.

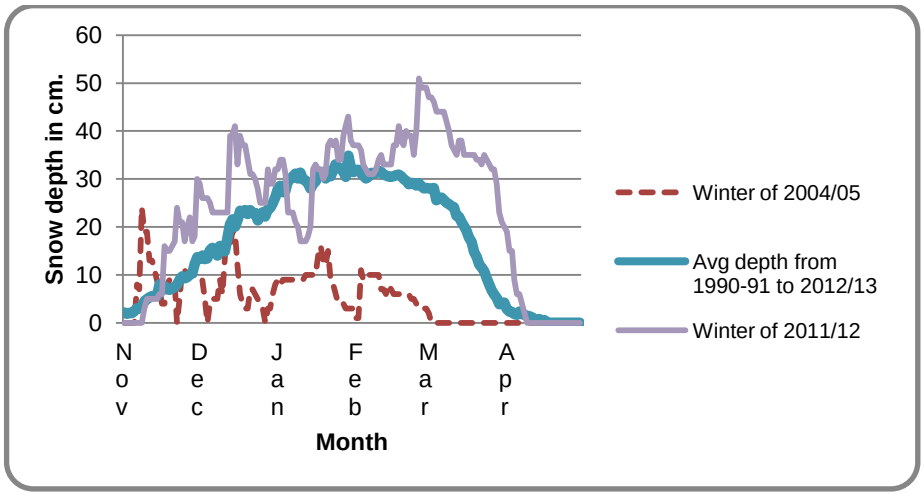

Figure 3. Daily snow depth measured at Smithers airport for a high peak flow year (2011/2012), a low peak flow year (2004/2005) and the 22 year average.

However, while this information suggests that above average snow accumulation combined with late and rapid snowmelt in the Smithers area likely contributed to the above normal peak flow levels on Hunaker Creek, a definitive conclusion on the role snow accumulation and melt has had on Hunaker Creek seasonal flow would require comprehensive records, such as snow water equivalency measurements near the site and objective measurements of flow rate in Hunaker Creek. The best information available for this investigation is limited to snow depth data from a site 14 kilometres away and memories of the nature of the flows since 2004 as recalled by the complainant.

Changes in Forest Cover Due to MPB

Deciduous stands, which comprise approximately 30 percent of the Hunaker Watershed area, typically have more rapid snow accumulation and melt than conifer stands, due to annual leaf fall resulting in an open winter canopy. As MPB affected lodgepole pine trees die and become defoliated, canopy closure is also reduced, resulting in more rapid snow accumulation and snowmelt.[iv]

Figure 4. MPB affected forest near the BCTS cutblock, August 2012.

Recent research also indicates that affected pine cease to transpire (release water vapour) within weeks of being attacked by MPB.[v] The resulting reduction in transpiration makes more water available for runoff and infiltration to groundwater.

MPB damage was clearly evident when the initial timber cruise was completed for the cutblock in 2007. At that time, lodgepole pine, which comprised 91 percent of the timber in the cutblock, was classified as 17 percent green attack (recently attacked) and 3 percent red and grey attack (older beetle attack). By early 2009, 50 percent or more of the lodgepole pine trees in the cutblock had been attacked by MPB.[3] Board staff observed continued MPB activity in unlogged parts of the watershed during site visits in 2012 and 2013.

In the Hunaker Creek Watershed as a whole, approximately 70 percent of the forest had lodgepole pine as the leading species prior to the 2009 harvest. By 2009, all of the lodgepole pine stands within the watershed were affected by MPB. Because of this, transpiration rates for the forest as a whole would have slowed, and snow accumulation and snowmelt rates had likely increased, probably increasing runoff and peak flows.

[3] This is an estimate based upon correspondence with personnel involved in pheromone baiting operations. Prior to logging in 2009, pheromone baits were stapled to un-attacked trees within the cutblock to attract beetles. The trees were then harvested and the beetles destroyed during sawmilling operations. The personnel had difficulties finding un-attacked trees to attach pheromone baits.

Changes to forest cover due to harvesting

By autumn 2009, MPB salvage harvesting in Hunaker Creek had created clearcut conditions in over 33 percent of the watershed. Snow accumulation and snowmelt rates increase with clearcut logging, which can affect runoff and both the timing and magnitude of peak flow events.[vi]

Openings, somewhat similar to those created by logging, would likely have been created naturally anyway, as MPB killed trees fell down over time. However, clearcutting created a large opening immediately, which likely advanced and intensified effects that may have otherwise taken several more years to be realized.

Figure 5. A deactivated road in the cutblock (October 2012). Note the retained deciduous trees and wildlife tree patches in the background.

Forest Planning and Practices

Prior to auctioning this cutblock, BCTS engaged in a planning process typical for forest operations in BC. This involved assessing timber and site conditions at the proposed cutblock and its surroundings. Field crews collected site information and determined locations of boundaries, roads and wildlife tree patches. There were few characteristics evident in the watershed that would lead to the conclusion that adverse hydrological consequences were likely, but BCTS engaged a hydrologist to provide advice.

BCTS planned a cutblock that, in conjunction with existing logging, resulted in a clearcut equivalent (hydrologically) of about one third of the watershed. This is not unusual for hydrological management of watersheds in BC. An independent forest hydrologist, when consulted by the Board on this situation, said "I often recommend the three or four pass method for little drainages like this, which takes 25 – 30ish percent bites in each pass so this is not out of the ordinary."

Road construction and ditching can intercept and redirect both surface and subsurface drainage. Where interception and diversion is significant and flows are concentrated into unconditioned areas, the result can be accelerated rates of runoff. The hydrologist that BCTS engaged in planning the harvesting also worked with a geomorphologist to complete a deactivation plan for the roads. The deactivation work was planned to mitigate possible hydrological consequences of the road network.

The road network built to access the cutblock was not excessive and effects on natural drainage patterns were minimal, with any effects corrected through deactivation shortly after harvest.

Based on these observations, it is unlikely that forest road construction and deactivation had a measurable effect on peak flow timing or magnitude. Although the degree to which roads and harvesting contributed to the hydrological results is unclear, BCTS completed a thorough job of the technical aspects of planning and the practices were within industry norms.

Finding
BCTS's and the TSL holder's planning and practices for addressing potential hydrological impacts were reasonable.

Logging likely contributed to increased peak flows in Hunaker Creek, but the situation is complicated by other contributing factors such as above average snow accumulation, late and rapid snowmelt, and natural MPB effects on forest cover.

Was public consultation regarding forest operations effective?

The Board has investigated many situations where public consultation has been at issue and considers that the FRPA legal requirements for consultation are a good starting point, but consultation should be increased, where necessary, to ensure effectiveness. The Board describes effective consultation in a bulletin entitled "Opportunity for Public Consultation under the *Forest and Range Practices Act*."[vii] Effective consultation embodies several principles including: early and meaningful dialogue, inclusive consultation, and continuous communication. The bulletin states:

> *Licensees and timber sales managers are not required to consider public comments on site plans, or to notify the public when site plans are available. Concerns might not be identified until flagging tape is placed on the ground or after logging has occurred. At that point, the public does not have an avenue to address concerns. Potential impacts on forest features and non-timber resources may not be identified in advance of operations and public confidence in forest planning may decline as a result.*

In this case, BCTS began its public consultation process by following legal requirements including advertising the FSP and holding a public open house to review the FSP in late 2006. The FSP and related consultation materials typically do not include information specific to individual cutblocks and that was true in this case. Site specific consultation with the complainant commenced when the complainant contacted BCTS in 2008, after learning independently of the planned logging near his home. As a result of this contact, and public interest and concern, BCTS held a meeting with residents to discuss the planned logging. One outcome of the meeting was that a hydrologist was engaged to review logging and deactivation plans.

Consultation may also have been spurred by the 2011 public complaint lodged against two BCTS professional foresters through the ABCFP, because of concerns about post-logging treatments and effects. The complaint was dropped after mediation led to development of a memorandum of understanding between the complainant and the two BCTS foresters. An effective dialogue resulted from this effort and continues to this day.[4]

[4] The complainant and the BCTS foresters involved in the ABCFP case are the same as in the FPB investigation.

Consultation also brought about several changes to the pre-harvest plans, including moving the falling boundary away from the complainant's private land, changing the road access point, and changing the logging season. After harvest, when peak flow concerns emerged, BCTS staff worked with the complainant to mitigate problems by re-establishing the original watercourse of Hunaker Creek near the complainant's garden and armouring portions of the watercourse.

Unfortunately, at the operational level, neither BCTS nor its TSL holder communicated plans to commence burning debris piles after logging. BCTS had passed fire hazard abatement responsibilities—including disposing of debris piles—to the TSL holder, but the TSL holder did not warn residents before burning numerous piles in autumn 2010. The complainant was surprised and alarmed when dense smoke drifted over his home. Because of health concerns, the complainant left home for a few days while the smoke was thick. Upon return, the house interior and contents smelled strongly of smoke.

Finding

Public consultation was initially ineffective, due to a lack of early effort. Later efforts by BCTS staff improved consultation markedly but this was then marred by the failure of the TSL holder to notify residents of the wood waste pile burning.

Concern about Well Contamination

The complainant believes that the logging operations led to the 2012 contamination of the well and included that issue in the complaint. In 2012, routine testing of the well revealed unsafe levels of E. coli and total coliforms. The complainant had been using the well since 2004 and previous tests had been free of both E. coli and total coliforms.

The well, dug with an excavator, taps into an aquifer that is in a two or three metre thick layer of gravel and sand that lies on top of relatively impermeable glacial till. There is no impermeable capping on top of the aquifer so it is termed an "unconfined aquifer." This means that contaminants from above can easily leach into it.

The cutblock is over 500 meters away and logging was completed in 2009. There have been no other forestry-related activities since the planting and debris burning operations in 2010. It is unlikely that forestry activities *on the cutblock* could have led to well contamination in 2012.

Contamination occurred after the high peak flow and overland flow events of spring 2012 and cleared up prior to testing in spring 2013. It is conceivable that the high peak flow and overland flow caused contaminants normally found on the ground surface to infiltrate the aquifer. The existence of the cutblock may have influenced the overland flow event, but this possibility is obscured by the deep snowpack and rapid snowmelt of spring 2012 and the MPB effects described earlier. It is not possible to determine if logging contributed to well contamination.

Conclusions

To answer the complainant's concern about logging causing damage and inadequate consultation, the Board considered the following questions:

1. Did BCTS and the TSL holder meet the requirements for managing water in and around forest operations?
2. Were BCTS planning and practices reasonable in addressing potential hydrological impacts in the Hunaker Creek Watershed?
3. Was the public consultation regarding forest operations effective?

The Board concludes that:

1. BCTS and the TSL holder in the Hunaker Creek Watershed complied with all of the relevant FRPA requirements.
2. The Board determined that the planning and practices employed in the Hunaker Creek Watershed were reasonable in addressing the potential hydrological impacts. Logging likely contributed to increased peak flows in Hunaker Creek. However, there were other factors that contributed to the watershed conditions experienced by the complainant—the degree to which logging contributed cannot be determined.
3. There has been considerable improvement in the consultation efforts regarding forest operations relating to this cutblock, but overall effectiveness has been poor because of sparse communication at the planning stage as well as prior to the TSL holder burning debris piles.

The Board believes that earlier and more intensive consultation efforts would have been beneficial here, considering the scale of the forest operations and the adjacency to rural homes.

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[i] FPB, 2010, *Pine Beetle Salvage Logging and Water Flows near Williams Lake, BC*, FPB, 2007, *The Effect of Mountain Pine Beetle Attack and Salvage Harvesting on Streamflows*, FPB, 2011, *Logging and Winter Stream Flow in Twinflower Creek*, FPB, 2012, *Salvage Logging and Water Flows at Cooper Creek*.

[ii] FPB, 2009, *Biodiversity Conservation during Salvage Logging in the Central Interior of BC,* FPB, 2006, *Habitat Retention and Mountain Pine Beetle Salvage in the Fly Hills*.

[iii] L. Uunila, B. Guy, R. Pike, "Hydrologic Effects of Mountain Pine Beetle in Interior Pine Forests of British Columbia: Key Questions and Current Knowledge," In: Streamline, Volume 9, Number 2, 2006.

[iv] J. Rex, *Mountain Pine Beetle, Salvage Logging, and Hydrologic Change: Predicting Wet Ground Areas*, In: Water 2013, 5, 443-461, R. Winkler, et al, 2012, *Snow Accumulation and Ablation response to Changes in Forest Structure and Snow Surface Albedo after Attack by Mountain Pine Beetle*.

[v] R. Hubbard, 2012, *Changes in Water Use and Carbon Balance After MPB*, In: Future Forest Webinar *Small Bugs with Large-Scale Impacts: Ecosystem & Watershed-Level Responses to the Mountain Pine Beetle Outbreak*, http://www.fs.fed.us/rmrs/presentations/future-forests/small-bugs.

[vi] P. Teti, 2008, *Mountain Pine Beetle Working Paper 2008-13: Effects of overstory mortality on snow accumulation and ablation*, Natural Resources Canada, Canadian Forest Service.

[vii] FPB, 2003, Board Bulletin, Volume 3, *Opportunities for Public Consultation Under the Forest and Range Practices Act*.

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
For more information on the Board, please visit our website at: www.fpb.gov.bc.ca