Kaslo & District Community Forest Society
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Date: February 9, 2009
File: DE08-0749

Attn: Mr. Rainer Muenter, RPF

Re: **Hydrologic Assessment Update for 2009,**
Kemp Creek Community Watershed

Dear Rainer:

This letter-report provides an update of the Hydrologic Assessment for the Kemp Creek Community Watershed. Several previous reports prepared for the Kemp Creek Community Watershed have separately presented assessment information regarding a variety of watershed hydrologic characteristics.

This hydrologic assessment continues previous hydrologic studies conducted under the Interior Watershed Assessment Procedure (IWAP) and the Reconnaissance Channel Assessment Procedure (ReCAP).

1.0 REPORT SCOPE

This update report presents a summary of current conditions of key hydrologic indicators. Comparison is made to previous indicators, impacts of recent developments, and analysis of hydrologic risk factors.

Interpretations are based on previous reports, air photo interpretation, and spatial (GIS mapping) analysis. No field work was conducted by the writer for the purpose of this study. Previous field work by the writer in the Kemp Creek areas was conducted for the purposes of terrain stability and erosion hazard assessments in the alluvial fan and on the ridge at the east side of the watershed.

2.0 PREVIOUS REPORTS

Reference has been made to all of the available reports, which are listed in Appendix 1. A brief overview of development / disturbance history in the Kemp Creek Watershed was presented by M. Carver in the 2001 Kemp Creek Reconnaissance Channel Assessment.

A fire in 1939 or 1940 (there is discrepancy between the air photo history and the Forest Cover Inventory descriptors) was perhaps the largest disturbance to forest cover in the watershed. Some logging activity was reported to have occurred in the 1950's to 1960's in the east side of the watershed.

3.0 RECENT DEVELOPMENTS

Of particular interest for this update report was the occurrence of a wildfire in the summer of 2007 occurring in the central part of the watershed (Kemp Creek Fire, N70171). The total area encompassed by the fire is approximately 233 hectares.

A Post-Wildfire Risk Analysis was prepared by Mr. Peter Jordan, P.Geo. for the BC Ministry of Forests and Range and the Southeast Fire Centre. That report identified risk factors associated with the fire, and made recommendations regarding Moderate Risks to water quality and supply over a period of 3 to 5 years.

Subsequent to the fire, the Kaslo and District Community Forest Society has proposed some timber salvage logging (CP 15 Block 2) within a portion of the fire. This update report describes that development and provides analysis of hydrologic risk factors associated with the proposed development. Proposed cutblock areas for CP 15 have been finalized, and are included in the ECA estimates for 2009.

4.0 EQUIVALENT CLEARCUT AREA SUMMARY

ECA estimates for past, current, and post-development conditions are summarized below on Table 1.0. Note that weighted ECA estimates are calculated by adding 50% additional to disturbance areas above the H60 elevation of 1,860 metres. This weighted ECA approach is consistent with the ECA analysis conducted for the initial IWAP conducted in 1997 by Kokanee Forests Consulting. Total watershed area is 1,181 hectares.

Table 1.0
ECA Summary - Kemp Creek

Disturbance Factor	Area (ha)	ECA Area (Weighted)	ECA %
Burn Area Above H60 – High and Moderate Intensity	44.3 ha	66.4 ha	5.6 %
Burn Area Above H60 – Low Intensity	14.9 ha	11.2 ha	0.9 %
Burn Area Below H60 – High and Moderate Intensity	63.1 ha	63.1 ha	5.3 %
Burn Area Below H60 – Low Intensity	110.9 ha	55.5 ha	4.7 %
Total for Burned Area	**233.2 ha**	**196.2 ha**	**16.6 %**
CP 15 Block 2 Area (net of reserves)	3.6 ha	1.8 ha *	0.15 %
Post Development ECA			**16.8 %**

* Note: CP 15 Block is in a Low intensity burn that has already been counted as burn area below H60. The net ECA impact of logging is and additional 50% of the cutblock area.

The estimation of hydrologic recovery of logged areas uses height - based assignments as described in the Interior Watershed Assessment Procedure (IWAP), summarized below on Table 2. There are no previously logged openings in the Kemp Creek watershed. The old (1939) burned areas are presumed as being fully recovered and are not included in the ECA estimate.

Table 2
Weightings for Hydrologic Recovery of Logged and Burned Areas

Logged Areas Inventory Tree Height	**Hydrologic Recovery**
0 – 3 m	0%
3 – 5 m	25%
5 – 7 m	50%
7 – 9 m	75%
> 9 m	90%
Wildlife tree patches and reserves	100%
Burned Areas	
High Severity	0%
Moderate Severity	0%
Low Severity	50%

Estimates of ECA for burned areas are based on burn severity and the inferred hydrologic function of the remaining live forest within the burned area. Estimates of burn severity and extents of areas affected were described by Jordan in the Post-Wildfire Risk Analysis report. The following classification was used:

– **High** – trees blackened and dead, needles consumed, understory consumed;

– **Moderate** – Trees burned and dead, needles remain, understory mostly burned;

– **Low** – Canopy and trunks partially burned, understory lightly or patchily burned.

Accordingly, all trees are inferred as dead in areas of High and Moderate burn intensity, and the ECA for these areas is assumed to be 100%, i.e. having 0 % recovery.

Areas of Low burn intensity will have some surviving trees in an irregular patchy distribution. The ECA for these areas is assumed to be 50 % of the burn area, recognizing that the surviving trees will have some hydrologic function.

The present equivalent clearcut area (ECA) in the Kemp Creek Watershed, including areas affected by the 2007 wildfire is 16.6 %.

The planned development of CP 15 Block 2 will cover an area of 4.39 hectares, of which 0.8 hectares will be retained as Wildlife Tree Patches. The net cutblock area is 3.6 hectares, all of which is below the H60 elevation. It is noted that CP 15 Block 2 is in an area affected by Low intensity burn. That area has been counted in the total for burn area below the H60 elevation, rated as 50% recovery. The net ECA impact will be 50% of the total cutblock area, being 1.8 hectares, or 0.15% of the total watershed area.

The current level of disturbance is considered a **Low** hazard for peak runoff impacts. The additional ECA created by the proposed salvage logging will be of negligible impact.

The watershed area affected by the 2007 fire is too small to have a measurable impact on peak runoff flows in the spring. Snowmelt runoff from the alpine and subalpine terrain is presumed to dominate peak flows in this watershed. Jordan's post fire risk analysis presented a similar opinion.

Jordan's report discussed the potential for short term fire impacts as overland flows generated by summer or fall rainfall on the burned areas could increase flows in Kemp Creek to a greater extent that would occur without the fire. Flows resulting from that type of rainfall event would likely be less than the typical springtime runoff peak.

It is noted that the rainfall runoff effects will diminish over the period of 3 to 5 years after the fire as the water repellency characteristics decrease and as surface vegetation recovers.

5.0 ROADS

The only roads known to exist in the Kemp Creek watershed are an old logging / mining trail on the ridge on the east side of the watershed. Jordan also reported overgrown skid trails at the bottom of the ridge from old (50's and 60's era) selective logging.

The old road and skid trails are of minimal impact, and are not known to be of significance for hydrologic function through interception or re-direction of surface runoff. The road and trails are not known as sediment sources affecting water supply in Kemp Creek.

No new roads are proposed for the salvage development of CP 15.

6.0 FIRE IMPACTS

The 2007 fire affected 233 hectares, representing approximately 20% of the entire watershed area.

Potential for flooding, erosion, debris flows, debris floods, and snow avalanches in Kemp Creek were described in Jordan's Post Fire Risk Assessment report as follows:

> "The incremental (due to the fire) hazard of a debris flow in the Kemp Creek channel is considered to be low (unlikely to very unlikely, over the next three to

five years). This hazard is probably somewhat higher, but not greatly so, than the pre-fire hazard. The consequence of a debris flow is probably moderate to high (destruction of or damage to the intake is not likely to cause a long-term loss of water supply, as presumably there is some storage capacity in the reservoir). The risk of a large debris flow or debris flood is therefore considered to be moderate.

Risks to water quality are primarily due to increases in turbidity, which are possible due to post wildfire erosion, or to small debris flows in the burned area. For the first several years, the probability of this (i.e. the hazard) is considered to be moderate, as the severely burned area is a small proportion (9%) of the watershed. The duration of increased turbidity would probably be brief. Although this is a community watershed, because the reduction in water quality would probably be short-term, the consequence is considered to be moderate; therefore the risk is moderate. The risk may not be greatly increased over pre-fire conditions, as there are a number of non-fire-related sediment sources in the watershed. However, increased turbidity is likely to occur during mid-summer or fall rainstorms, which is a time when high turbidity would be rare under pre-fire conditions. Risks to public health due to effects of the fire on chemical water quality are low."

7.0 NATURAL DISTURBANCES

The Reconnaissance Channel Assessment Procedure (ReCAP) report described field assessed channel and morphological characteristics of the main (north) branch of Kemp Creek between Airport Road at elevation 755 metres (Reach 1) and Elevation 1,250 metres (Reach 6). Higher elevation reaches were not examined in the field.

Snow avalanches and accompanying debris inputs are significant disturbance factors in Reaches 6 to 8, with lesser impacts on lower reaches.

Recruitment of sediments from channel sidewall instability and old debris deposits in the valley bottom contribute to mobile bedload, which can cause increases in turbidity during high flow periods.

Impacts of human activity are uncertain, however in the absence of extensive road, logging and mining development activities, such occurrences, if present would not be inferred as widespread.

Recommendations of the ReCAP were to conduct channel and riparian assessments if development is planned in areas draining to Reach 6, and examination of sediment source areas in Reach 5.

The 2007 fire affected areas draining to Reaches 5 and 6. However, the proposed development of CP 15 Block 2 is on the south facing ridge above a tributary branch that drains to Reach 3. Those recommendations appear not to apply this development.

8.0 POTENTIAL FIRE AND DEVELOPMENT IMPACTS

Potential impacts on water supply and water quality in Kemp Creek from the 2007 wildfire and the proposed development of CP 15 Block 2 are discussed below on Table 3

Table 3 Summary of Watershed Hazard Indicators

Watershed Indicator	Development Factors	Hazard Rating
Peak Flows	Following the 2007 fire, the weighted ECA reached an estimated 16.6 %. The proposed salvage logging of CP 15 Block 2 will raise this incrementally to 16.8%. The watershed area affected by the 2007 fire is too small to have a measurable impact on peak runoff flows.	**Low** Increased substantially from pre-fire conditions.
Sediment Hazards	Sediment hazards are related to natural disturbances, primarily affecting reaches 5 and 6, but also affecting reaches 3 and 4. The **Moderate** hazard rating also acknowledges the widespread occurrence of erodible soils in the watershed. Proposed development of CP 15 Block 2 will have no significant impact on this hazard rating.	**Moderate** Sediment movements pose a risk to water quality and may affect the water intake structure.
Slope Stability	Landslide hazards will increase incrementally within areas affected by Severe and Moderate fire intensity. The most probable area affected is a steeply gullied area at the north side of the fire above reaches 5 and 6. This area is mapped as Terrain Stability Class V. Likely impacts are for sediment inputs to Kemp Creek. Less likely outcomes are a debris flow or debris flood. The hazard remains Low, but is increased incrementally from pre-fire conditions. Development of CP 15 Block 2 will be of no significance to this hazard rating.	**Low** Incremental increase from pre-fire conditions.
Stream Channel Stability	The ReCAP report describes a channel resilient to gross changes due to disturbances. Mobile sediments have impacts on water quality. Those characteristics combined with a Low peak flow hazard suggest a Low hazard rating for channel stability. Possible accelerated inputs of sediments from erosion and debris slides would increase the amount and mobility of in-stream sediments, affecting water quality. Development of CP 15 Block 2 will be of no significance to this hazard rating.	**Low** Incremental increase from pre-fire conditions.

9.0 CONCLUSIONS

- It is expected that the 2007 wildfire will have no measurable impact on peak runoff flows.
- Runoff from summer and fall rainstorms may increase and be noticeable due to the effect of water repellent soils. This effect will persist for a period of 3 to 5 years after the fire.
- Risks to water quality and to the intake structure were noted in the post fire risk analysis by Jordan. This report concurs with those findings.
- The proposed salvage development of CP 15 Block 2 poses no significant hazards related to peak runoff flows, sediment hazards, slope stability, or channel stability.

10.0 RECOMMENDATIONS

Timber harvest:

The proposed salvage development of CP 15 Block 2 pose no significant concerns for watershed impacts. There are no recommendations for changes to harvest plans on the basis of hydrologic considerations.

Water Quality Issues

Increased runoff from burned areas, new inputs of sediments from upland areas affected by the fire, and movement of in-stream soil materials may pose risks to water quality and to the intake structures.

These findings are **consistent** with the conclusions made by the Wildfire Risk Analysis Report prepared for the BC Ministry of Forests and Range.

It is recommended that communications be conducted with water users to advise of the potential degradation of water quality.

11.0 CLOSURE

We trust this update report provides the information you require. Estimates of the extents of burned areas are based on the most recent information on watershed conditions. Some reliance has been placed on the accuracy of the digital information and the software / operations that have been applied to compile and summarize this information.

Yours truly,

Deverney Engineering Services Ltd.

Norman L. Deverney, P.Eng.

Attachments: Appendix 1

Appendix 1 References

Air Photos: 30BCB 97094, Photos 200 – 202
30BCB 97094, Photos 217 – 218

Deverney, N., **IWAP: (Interior Watershed Assessment Procedure) Fletcher, Bjerkness, & Kemp Creeks**, Prepared for Slocan Forest Products Ltd., Slocan Division by Kokanee Forests Consulting Ltd., June 24, 1997

Wells, W.H., and C. Wallace, **Terrain Interpretation of Operating Areas for Kaslo Community Forest License, Woodlot 494, and Goose Creek Timber Ltd.**, Prepared for Kaslo and District Community Forest Society, 1999.

Anonymous, **Coastal Watershed Assessment Procedure Guidebook (CWAP) and Interior Watershed Assessment Procedure Guidebook (IWAP), 2nd Edition**, April 1999.

Carver, M., **Reconnaissance Channel Assessment, Kemp Creek, Final Draft**, Prepared for Kaslo and District Community Forest Society, September 30, 2001.

Jordan, P., **Kemp Creek Fire N70171, Post-Wildfire Risk Analysis**, Prepared for B.C. Ministry of Forests and Range: Kootenay Lake Forest District, Southern Interior Forest Region, and Southeast Fire Centre, October 3, 2007.