Interior Watershed Assessment Procedure

for the

HYDRAULIC/KLO/POOLEY CREEK WATERSHEDS

UPDATE REPORT

Prepared for
WEYERHAEUSER CANADA LIMITED
Okanagan Falls Division

by
DOBSON ENGINEERING LTD.
#4 - 1960 Springfield Road
Kelowna, B.C.
V1Y 5v7

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WEYERHAEUSER CANADA LIMITED
Okanagan Falls Division

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UPDATE REPORT

1.0 INTRODUCTION

This updated Interior Watershed Assessment Procedure (IWAP) report for the Hydraulic/KLO/Pooley Creek community watersheds has been prepared for Weyerhaeuser Canada Ltd., Okangan Falls Division, in order to comply with the Bill 47 regulation requirements within the Penticton Forest District. The objective of this report is to provide information regarding both the current watershed condition and the risks associated with proposed forest development plans for the period of 1998 to 2003.

The initial IWAP was completed for the entire Mission Creek watershed including the Hydraulic, KLO and Pooley watersheds in 1996. The purpose of this updated watershed assessment is to:

- determine the current watershed condition and identify impacts that may be associated with past forest development (updated to 1998);
- provide landscape level recommendations regarding the hydrologic impact of proposed forest development plans for the watersheds for the period of 1998 to 2003;
- comply with the requirements of the Forest Practices Code Operational Regulation that watershed assessments must be completed and considered in the forest development plans for community watersheds.

2.0 KEY WATERSHED ASSESSMENT ISSUES

An initial Watershed Assessment Committee (WAC) meeting, that included BC Environment, Penticton Forest District, South East Kelowna Irrigation District (SEKID) and Dobson Engineering Ltd. was carried out in late October to discuss the current condition of the watershed and to identify concerns within SEKID's community watersheds ***[refer to Appendix D- WAC Meeting Minutes].*** At the initial WAC meeting the following issues and concerns were identified:

- the potential impact on channel stability and/or water quality from increased peak flows resulting from the proposed forest development;
- the potential for reduced channel stability and water quality impacts in the canyon portion of Hydraulic Creek that is situated directly above SEKID's water intake;

- compliance with water quality objectives set by BC Environment for the protection of drinking water, irrigation and aquatic life;

- the potential for reduced water quality as result of range and recreational use in the watershed;

For assessment purposes, the SEKID's community watersheds have been divided into two main watersheds: Hydraulic Creek and KLO Creek. The two points of interest for the assessment were located at the confluence of Hydraulic Creek with Mission Creek and the confluence of KLO Creek with Mission Creek ***[Appendix B].*** The KLO Creek watershed includes Pooley Creek, the upper drainage area of the KLO Creek watershed above SEKID's diversion ditch and the lower drainage area of the KLO Creek watershed. The Hydraulic Creek watershed includes only the drainage area below the McCulloch Reservoir since flows into Hydraulic Creek are controlled at the McCulloch Reservoir and the spillway for the reservoir drains into Wilkinson Creek.

One sub-basin was created above the outlet of the McCulloch Reservoir. The sub-basin area includes the upper portion of the KLO Creek watershed, the Affleck Creek community watershed, and the remaining area that drains into the reservoir ***[Appendix B].*** It should be noted that this is the entire drainage area that can be diverted or drains into the McCulloch reservoir when water is being diverted from Pooley Creek and the upper portion of KLO Creek. The reason for the overlap of the of the McCulloch Reservoir sub-basin and the KLO Creek watershed is due to the fact that the upper KLO Creek watershed area can be either diverted into the McCulloch reservoir or can be released directly down KLO Creek depending upon SEKID's water supply requirements.

TABLE 1
Sub-basin and Watershed Areas in the Hydraulic/KLO/Pooley Creek Watersheds

Sub-basin / Watershed	Area (km^2)
McCulloch Reservoir sub-basin	81.9
Hydraulic Creek at POI 1	55.3
KLO Creek at POI 2	71.7

3.0 WATERSHED CHARACTERISTICS

Hydraulic Creek and KLO Creek are located in the southern portion of the Mission Creek watershed and both creeks drain to the northwest into Mission Creek approximately 10 km from Okangan Lake, east of the City of Kelowna. The area of the Hydraulic Creek watershed below the McCulloch Reservoir is 55.3 km^2. The entire KLO Creek watershed encompasses an area of 71.7 km^2. Elevations in the watersheds range from 540 m above sea level at Mission Creek to over 2100 m at the summit of Little White Mountain. The lower portions of the creeks flow through narrow rock canyons with upland plateau areas situated on the Okanagan Highland area.

Soils within the watersheds are typically moderately coarse to coarse textured morainal material with minor components of colluvium on steeper slopes and organic and glacio-fluvial soils on gentler slopes. Bedrock consists of metamorphic rock of the Okanagan Plutonic and Metamorphic Complex: primarily gneiss with other rocks of granitic composition. Outcrops of extrusive bedrock (volcanic) are also present along the lower portions of the watershed. These rocks include basalts, andesites and volcaniclastics of the Karnloops Group. Both bedrock types have been subject to jointing and faulting.

The majority of the watersheds are located within the Montane Spruce biogeoclimatic zone with Interior Douglas Fir in the lower elevations, Englemann spruce and Sub-Alpine Fir in the upper elevations.

Normal precipitation within the watershed is 700 mm annually measured at the McCulloch Station (elev. 1250 m). Sixty percent of the watershed is above the 1 300 m contour (H60 line based on the entire Mission Creek watershed). Peak flows at the mouth of Hydraulic Creek are typically in the 1 to 4 m^3/s range. Peak flows up to 35 m^3/s have been recorded at the mouth of KLO Creek but are typically in the 1 to 4 m^3/s range.

Forest development in the watersheds has taken place since approximately the early-1960s with the majority of harvesting in the 1980s directed towards the control of Mountain Pine Beetle infestations. Weyerhaeuser Canada Limited is the only forest licensee that is currently operating in the watersheds.

3.1 Water Supply System

The South East Kelowna Irrigation District (SEKID) supplies water for both domestic and irrigation purposes. The principal source of water for SEKID is Hydraulic Creek with storage reservoirs that include the McCulloch Reservoir (Hydraulic Lake, Minnow Lake and Haynes Lake) and Fish Lake, Browne lake and Long Meadow Lake. In addition to the natural watersheds of the reservoirs, water is diverted into Hydraulic Creek above the McCulloch Reservoir from Canyon Creek, Pooley Creek, Stirling Creek and Affleck Creek.

The reservoirs start filling about the first of April with draw down commencing about the middle of June. During spring runoff when the McCulloch Reservoir is full water is spilled into Idabel Lake via the South Dam (Idabel Lake is located in the West Kettle River watershed). If required, diversion ditches from KLO Creek and Pooley Creek can be closed to reduce the flow into the McCulloch Reservoir. Therefore, in wet years the flow in KLO Creek can be unregulated without diversion. Treatment facilities at the intake on Hydraulic Creek consist of settling ponds, screens and chlorination.

In 1982 to 1983, to improve water quality, sections of Hydraulic Creek downstream from Hydraulic Lake were channelized where the creek flowed through a swampy meadow ***[Appendix*** B].

4.0 METHODS

This updated watershed assessment is based upon the original Interior Watershed Assessment procedure completed for the entire Mission Creek watershed in 1997. This updated watershed assessment includes a reconnaissance level channel assessment procedure (Re-CAP), identification of sediment source concerns and a risk assessment of Weyerhaeuser's forest development plans for 1998 to **2003.** The risk assessment included proposed ECA's for the Weyerhaeuser's current forest development. The reconnaissance level channel assessment procedure is based upon the *Channel Assessment Procedure Field Guidebook (December 1996)* and *Channel Assessment Procedure Guidebook (December 1996)*. The sediment source information was based upon road assessment work carried out in 1995 and was updated to include deactivation work carried out in 1997 along with information obtained from the reconnaissance level channel assessment procedure.

The following information was reviewed for this assessment:

- Integrated Watershed Restoration Plan completed by Dobson Engineering Ltd. Refer to report title: *Integrated Watershed Restoration Plan for the Mission Creek Watershed, Volume 1 (March 1997)*
- Road condition surveys (1994-1995) assessment completed by Dobson Engineering Ltd. Refer to report title: *Results of Watershed Field Assessments (March 1996)*
- Access Management Strategy completed by Dobson Engineering Ltd. Refer to report title: *Access Management Strategy Plan for the Mission Creek Watershed, (1996-1997)*
- Watershed assessment completed by Dobson Engineering Ltd. Refer to report titled: *Interior Watershed Assessment for the Mission Creek Watershed, (1996-1997)*
- *Mission Creek Restoration Deactivation/Restoration Earth Works and Revegetation Prescriptions Map* completed by D.R. Estey Engineering Ltd., August 1997
- Water quality assessment completed by BC Environment. Refer to report titled: **Okanagan Area, Hydraulic Creek and its Tributaries, Water Quality Assessment and Objectives (Undated)**
- *Assessment of Organic Matter Sources in Hydraulic Creek (November 1989)* completed by Madrone Consultants Ltd.
- *Hydraulic Creek Water Quality Study, 1987 Results)* completed by Larrett and Dobson, 1987.
- *Hydraulic Creek Erosion Study (October 1988)* completed by Madrone Consultants Ltd.
- Personnel communication with Stu Mould of Mould Engineering Ltd.
- Weyerhaeuser Canada Ltd.'s 1998 to **2003** Forest Development Plan

5.0 RESULTS OF THE OFFICE ANALYSIS

The current watershed report card for the Hydraulic Creek watershed, the KLO Creek watershed and the McCulloch Reservoir sub-basin is presented below in Table 2.

TABLE 2
Watershed Inventory Information

Watershed Inventory Category	McCulloch Reservoir Sub-basin	Hydraulic Creek Watershed	KLO Creek Watershed
Area of Unit (km^2)	81.9	55.3	71.7
ECA (%)	28.8	36.4	25.5
ECA Above the H60 Line (unweighted) (km^2)	20.1	8.7	16.6
ECA Above the H60 Line (unweighted) (km^2) (%)	25.1	15.7	24.8
Total Road Density (km/km2)	2.0	1.5	1.5
Length of Road as a High Sediment Source (km)	Refer to Sec. 5.2	Refer to Sec. 5.2	~~Refer to~~ Sec. 5.2 ?
Total Number of Landslides	0	~~0~~ 2	4
Length of Road on Unstable Slopes (km)	0	0	2.6
Number of Stream Crossings	223 Combined Total based on Original IWAP (March 1997)		
Length of Stream Logged to the Streambank (kmlkm)	0.2 to 0.4 Combined Total based on Original IWAP (March 1997)		
Length of Stream With Unstable Stream Channel (kmlkm)	0	0	0

Note: The watershed report card is based upon the original Interior Watershed Assessment report card completed in March 1997.

6.0 RESULTS OF FIELD ASSESSMENT

The current watershed condition was based on five primary impact categories: stream channels, peak flows, surface erosion, riparian buffers and landslides. These impact categories were assessed based upon potential impacts that the existing forest development may have on water quantity and water quality.

6.1 Peak Flows and Stream Channels

6.1.1 ECA's

ECA's within in the Hydraulic Creek watershed (POI 1), the KLO Creek watershed (POI 2) and the McCulloch Reservoir sub-basin is currently 36%, 26%, 29%, respectively. ECA's above the H60 line in the Hydraulic Creek watershed, KLO Creek watershed and the McCulloch Reservoir sub-basin are 16%, 24% and 25%, respectively.

6.1.2 Roads

Another indicator of potential impacts on peak flows is the density of roads within the watersheds and the sub-basin. The main impact roads may have on peak flows results from the interception of both surface and sub-surface flows by ditchlines and re-routing water directly into streams. The re-routing of the runoff can reduce the time required for water to reach a stream which, in turn, could increase peak flows.

Road densities within the watersheds and the sub-basin range from approximately 1.5 km/km^2 to 2.0 km/km^2. Road densities in this range are considered high but, based upon field observations of the condition of the roads and associated ditchlines, there is limited evidence to suggest roads are contributing to increased peak flows. The majority of roads are situated on relatively flat terrain. Road ditchlines do not appear to be conveying large amounts of water and are considered highly permeable given that the majority of roads are located on deep tills.

or just sediment?

6.1.3 Stream Channels

Mainstem channels in the Hydraulic Creek and KLO Creek watersheds were characterized as having stable to slightly disturbed, boulder/cobble step-pool and cascade pool morphologies *[refer to Re-CAP results – Appendix B]*. In the early 1980's portions of the mainstem of Hydraulic Creek were channelized to improve water quality, as a result the mainstem of Hydraulic Creek has lost some of its complexity but is still considered stable. Upper stream reaches situated within the McCulloch Creek sub-basin are characterized as stable riffle-pool and cascade-pool cobble/boulder channels. Limited channel disturbance were noted above the McCulloch Reservoir mainly due to the low stream gradients.

Throughout the watersheds, no evidence of extensive bank or channel instability was noted and impacts from possible increases in peak flows associated with past development were not discernible.

Stream channel concerns have been identified in the Idabel Lake area as result of water from the spillway flooding Idabel Lake and washing out the road into the lake. Channel conditions within the Idabel Lake area were not assessed as part of this watershed assessment since this area is located within the West Kettle River watershed and is not situated within a community watershed.

6.1.4 Peak Flow/Stream Channel Hazard

ECA and road density within the watersheds and the sub-basin are at a level that increased peak flows can occur but there was no evidence of moderately or severely disturbed channels. It is important to note that the McCulloch Reservoir has greatly altered historic streamflows in the Hydraulic Creek watershed. The drainage area within the Hydraulic Creek watershed that contributes to peak flows at POI 1 has been reduced by approximately 40% as result of outlet control at the reservoir and since there is no spillway on the McCulloch reservoir into Hydraulic Creek. As a result peak flows within the lower Hydraulic Creek watershed are much lower then historical peak flows since construction of the reservoir. Therefore, impacts to peak flowslchannel stability are a low hazard in the Hydraulic Creek watershed. Impacts to peak flows / channel stability are considered to be a moderate hazard within the KLO Creek watershed and the McCulloch Reservoir sub-basin based upon the current ECAs and channel conditions.

6.2 Road Assessment/Surface Erosion

In order to determine the surface erosion concerns within the watersheds and the sub-basin the road assessment work completed in 1995 was reviewed and was updated by including deactivation work carried out in 1997. A total of 13 moderate to high priority sites were identified in the road assessment *[Table 3 and 4].* The majority of surface erosion problems were caused by improper road drainage. Problems included collapsed or failed wooden culverts, plugged metal culverts, failing and eroded ditchlines, and/or lack of proper drainage (i.e. ditches). Remedial work was carried out on the majority of these sites in 1997 *[Table 3 and 4].* Deactivation of these road sections should have reduced the major point sources of surface erosion associated with forest development within the watersheds. Two moderate priority sites have not been addressed within the KLO Creek watershed. Summarized in the Table 3 is the total distance of roads that have been deactivated within in the watersheds and the McCulloch Reservoir sub-basin.

No forest development related surface erosion concerns were identified during the overview flight of the watershed in the summer of 1998. One area that may be a surface erosion hazard is the rock/gravel quarry situated within 100 m of KLO Creek. However this site was not inspected on the ground and the actual water quality hazard at this location is not known.

TABLE 3
High/Moderate Priority Sites in the KLO Creek Watershed

Site	Road #	Problem (1995)	Priority	Current Status/deactivation level
1	100	Road Surface erosion	M	not done
2	105	Stream running down road	M	not done
5	160	sediment transport	H	semi-permanent deactivation, culvert removed or backed up, crossditches and waterbars installed
6	160.3	standing water, surface erosion	M	semi-permanent deactivation, waterbars installed
7	160.4	road surface erosion	M	semi-permanent deactivation, crossditched and waterbars installed.

TABLE 4
High/Moderate Priority Sites in the Hydraulic Creek Watershed and McCulloch Reservoir Sub-basin

Site	Road #	Problem (1995)	Priority	Current **Status/deactivation** level
12	429	Road washout, ditch erosion	M	Semi-permanent, culverts removed, waterbars and crossditches installed
13	453	Surface erosion	M	Semi-permanent
14	460	Surface erosion	M	Semi-permanent
15	457.2	Surface erosion direct sediment transport to creek	H	Semi-permanent
17	571	slope failures	H	Semi-permanent
18	800	Crushed culvert	M	Semi-permanent
19	800	Direct sediment transport into Browne lake from road	H	Semi-permanent
27	1032	Surface erosion	M	Semi-permanent

TABLE 5
Total Kilometers of Road Deactivation within the **Hydraulic/KLO** Watersheds

Watershed Unit	**Semi-Permanent** Deactivation		Permanent Deactivation	
	Distance (km)	Density (km/km^2)	Distance (km)	Density (km/km^2)
Hydraulic Creek Watershed	23.3	0.42	5.2	0.09
Lower KLO Creek Watershed	14.2	0.37	2.7	0.07
McCulloch Reservoir Sub-basin	32.8	0.40	4.6	0.06

6.2.1 Surface Erosion hazard

Surface erosion hazard is moderate for the watersheds and the sub-basin based upon the amount of deactivation work carried out in 1997 and the results of the overview flight in 1998. No large point sources of sediment exist but the current road density is considered to be a large dispersed source of sediment throughout the watersheds and the sub-basin.

6.3 Riparian Buffers

Approximately 20% to 40% of area adjacent to streams has been logged in the Hydraulic Creek watershed, KLO Creek watershed and the McCulloch Reservoir sub-basin. Little evidence of channel instability associated with riparian harvesting was identified in the watersheds and the sub-basin but there is high amount of roads adjacent to streams that can be considered as dispersed sources of sediment.

6.3.1 Riparian Buffers Hazard

Based upon the amount of riparian harvesting that has occurred and the amount of roads adjacent to streams within the watersheds and the sub-basin, the riparian buffer hazard for the watershed is considered high.

6.4 Landslides

In the KLO Creek watershed six landslides were identified from the reconnaissance level channel assessment. All of these landslides were situated within the steep canyon of KLO Creek. Three of the landslides are related to the Kettle Valley Railroad with the remaining landslides considered as natural. All of these landslides have contributed a small amount of material into KLO Creek with limited impacts to stream channels.

In the Hydraulic Creek watershed two landslides were identified from the reconnaissance level channel assessment. Both of these slides were located within the steep canyon of Hydraulic Creek of Hydraulic Creek. One of these landslides was related to saturation of the slope as result of diverted water from an abandoned irrigation flume and the remaining landslide was considered natural. No landslides were identified in the McCulloch Reservoir sub-basin.

6.4.1 Landslide Hazard

The landslide hazard for the KLO Creek watershed, the Hydraulic Creek watershed and McCulloch sub-basin is considered low based upon the low number of landslides and limited impacts to stream channels.

7.0 RISKS OF FUTURE FOREST DEVELOPMENT

7.1 Peak Flow Hazards

Proposed ECA's for the watersheds and the sub-basin are shown below in Table 6.

TABLE 6
Current and Proposed ECA's in the Hydraulic Creek and KLO Creek Watersheds and the McCulloch Reservoir sub-basin

UNIT	EQUIVALENT CLEARCUT AREA (ECA)							
Watershed1 Sub-basin	Current	1998	1999	2000	2001	2002	2003	2004 plus (Info. Blocks)
Hydraulic Creek	36.4	36.2	35.8	35.6	34.9	33.7	32.3	36.6
KLO Creek	25.5	24.9	24.8	26.3	27.2	27.7	28.9	30.0
McCulloch Reservoir	28.8	27.9	27.6	28.3	29.7	30.9	31.0	32.4

*ECA projections for 2004+ do not include any projected growth on plantations beyond 2003.

No forest development is planned within the Hydraulic Creek watershed over the next five years, therefore, the current ECA of 36% will decrease to **32%.** Since there is no proposed forest development within the next five years increases in peak flows are not a concern in the Hydraulic Creek watershed. After 2003 Weyerhaeuser Canada Ltd. has two cutting permits (CP 174 and CP 175) proposed in the watershed with projected ECA's near 37%. Approximately 90% of the area to be harvested beyond the year 2003 is situated below the H60 line. This proposed development beyond the year 2003 is considered to be a low concern in regards to increased peak flows or reduced channel stability. This low concern is based upon the location of proposed blocks below the H60 line, reduced spring freshet flows as result of the controlled outlet at the McCulloch Reservoir and the relatively stable condition of stream channels within the watershed.

The proposed forest development within the KLO Creek watershed will increase the ECA from 26% to 29%. ECA's within the McCulloch Reservoir sub-basin will increase from 29% to 31%. ECA's above the H60 line are projected to increase from the 25% to 28% in both the KLO Creek watershed and the McCulloch Reservoir sub-basin. ECA increases within the 2% to 3% range are considered to be small and peak flow **1** stream channel stability impacts associated with the proposed forest development should not cause channel instabilities. Potential impacts from peak flows associated with the proposed forest development are unlikely based upon the current condition of channels and the fact that past ECA's within this area have exceeded the 25 to 30% range as a result of salvage logging to address Mountain Pine Beetle infestations.

Projected ECA's beyond the year 2003 are in the 30% to 32% range for the KLO Creek watershed and the McCulloch Reservoir sub-basin. Potential peak flow impacts associated with further development beyond 2003 are considered to be a moderate concern. Future decisions on whether ECA can exceed 30% should be based upon the condition of stream channels after the current forest development plan period.

7.2 Surface Erosion

The most significant concerns within the two watersheds and the sub-basin is the potential for increased delivery of sediment into the McCulloch Reservoir, SEKID's water intake and Mission Creek. In review of past water quality assessments there is an indication that forest development reduced water quality. Since the majority of surface erosion is associated with dispersed sediment sources throughout the watershed it is important that strong attention is given to minimizing sediment in areas with new road construction and on existing roads where active hauling will occur. Level C terrain mapping that includes surface erosion potential information has recently been completed for the watersheds and should assist in avoiding increased surface erosion.

Development of blocks beyond the year 2003 should be based upon water quality information associated with the development of the 1998 to 2003 forest development plan. Several of the proposed blocks scheduled beyond 2003 and their associated roads are situated upslope of the canyon area in the Hydraulic Creek watershed. This area is of particular concern since any sediment that is delivered to streams can be delivered directly into SEKID's water intake. Particular attention should be given to developing blocks and roads within this area to ensure that water quality at SEKID's water intake is not impacted.

7.3 Riparian Buffers

Potential impacts to riparian buffers associated with the proposed forest development are a low concern, given adherence to appropriate riparian management strategies for the purposes of maintaining streambank stability and water quality.

7.4 Landslides

Potential impacts from increased landslides associated with the proposed forest development are a low concern, since the majority of harvesting or road construction is proposed on low gradient terrain. Level C terrain mapping has recently been completed for the watersheds and should assist to minimize the risk of future landslides.

8.0 WATER QUALITY OBJECTIVES

Provisional water quality objectives have been set for the Hydraulic Creek system to minimize impacts to designated water uses (drinking water, irrigation water and recreational fisheries) associated with forest development activities. The water quality objectives include criteria levels for turbidity, suspended solids, microbiological indicators and water temperature. Criteria for monitoring locations and the frequency and timing of sampling have also been developed.

9.0 CONCLUSIONS

9.1 Existing Watershed Conditions

- Overall stream channels appeared stable with limited evidence of impacts from potential increases in peak flows that may be associated with past forest development.
- The majority of priority sites for surface erosion from roads appear to have been addressed with the deactivation of 82 km of road in the watersheds.
- An extensive amount of riparian buffers have been harvested throughout the watershed. But little channel instability associated with the riparian harvesting was observed. Fish habitat may have been impacted due to a loss of large woody debris and shade in some of the tributary channels.
- Six landslides were identified in the KLO Creek watershed and two in the Hydraulic Creek watershed. All of these landslides are located with the canyon portions of the watersheds and are related to the Kettle Valley Rail Road, diversion of water from an irrigation flume or natural causes. Some of the landslides contributed a small amount of material into the mainstem creeks with limited channel impacts.

9.2 Proposed Forest Development

- The proposed forest development plan for the period of 1998 to 2003 for Weyerhaeuser Canada Ltd., Okanagan Falls Division, is considered to be a low concern for impacts to stream channel stability or increased peak flows in the Hydraulic Creek watershed, KLO Creek watershed or the McCulloch Creek Reservoir.
- Surface erosion is a concern within these watersheds and the sub-basin. It is important that close attention is given to minimizing sediment in areas with new road construction and on existing roads where active hauling will occur.
- The proposed forest development should have minimal impacts on riparian conditions, provided that appropriate riparian management strategies are carried out for the purposes of maintaining streambank stability and water quality.
- Increased landslides associated with the proposed forest development are a low concern since the majority harvesting or road construction is not proposed on unstable terrain. Level C terrain mapping has recently been completed for these watersheds and should assist in developing appropriate development strategies to avoid future landslides and surface erosion problems.

10.0 RECOMMENDATIONS

To minimize potential cumulative impacts from forest development the following recommendations are provided:

- Appropriate road construction and block development measures should be developed to ensure that the proposed forest development will not exceed water quality objectives.

- Following the completion of the proposed development, roads associated with the cutting permits should be deactivated or maintained to a level appropriate with anticipated future use. Natural drainage should be maintained or restored within all blocks and on access roads.

- Conduct post-harvesting inspections of the blocks to ensure natural drainage patterns have been maintained. Any disturbances identified should be mitigated as required.

- Establish a monitoring program on the mainstem channels to assess potential changes to stream channel stability and sediment movement in order to develop long-term ECA levels in the sub-basin and the watersheds.

To minimize potential cumulative impacts from issues that are not related to the forest development plan the following recommendations are provided:

- Periodic monitoring of inactive roads (i.e. non-status) and recently deactivated roads should be carried out to ensure that sediment issues are addressed.

- Consideration should be given to developing a long-term forest development plan for the watersheds.

- The long-term sustainable level of harvest and associated ECAs for the watersheds should be based on information collected from the channel monitoring sites, streamflow information, the long-term forest development plan to ensure that stream channel stability and water quality are protected.

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APPENDICES

APPENDIX A

Re-CAP Procedure Details

APPENDIX A

Re-CAP Procedure Details

The reconnaissance level channel assessment procedure (Re-CAP) involved both office and field work. The mainstem channel is examined in its entirety at a reconnaissance level and specific reaches are identified for more detailed assessment. The procedures used are based on the **Channel Assessment Procedure Guidebook** (dated December 1996) and the **Channel Assessment Procedure Field Guidebook** (dated December 1996).

The purpose of the Re-CAP is to:

- Determine the present channel conditions and the extent of disturbed reaches along the mainstem channel.
- Identify any areas for potential rehabilitation work.
- Identify any potential impacts to the channel stability as a result of the proposed forest development.

Office Work

The first step is to break the mainstem channel into reaches. Air photos, TRIM topographical maps and other resource information are used to identify reach breaks. Reach breaks are usually located at significant changes in channel gradient, changes in discharge (tributary confluences), changes in hillslope coupling and changes in channel morphology ***[Figure 1 Appendix B].***

A comparison of pre- and post-forest development air photos is used to identify any channel disturbances which can be attributable to forest development. A longitudinal profile of the mainstem channel for each sub-basin is also plotted to assist in identifying changes in slope ***[Appendix B].***

The factors used to determine reach breaks, as well as the length and level of disturbance for each reach is provided ***[Tables 1 & 2 Appendix B].***

Upon completion of the field work (outlined under "Field Work") a summary of the channel characteristics and disturbances for each reach is completed ***[Appendix B].***

Field Work

The objective of the field assessment is to determine the length and severity of channel impacts from past forest development and other land uses and potential future impacts.

The amount and type of information collected at the field locations was based on the level of existing or proposed forest development, aerial observations, accessibility and professional judgment.

Information collected at each field assessment site includes:

- Channel characteristics - channel gradient, bankfull channel width and depth, bed materials (including size of the largest stone on the bed that is moved by flowing water), bank materials, amount and orientation of LWD and riparian vegetation
- Channel morphology
- Representative photos of the reach
- Channel disturbances - evidence of channel degradation or aggradation

Field forms and photos are completed for each reach ***[Appendix*** B]

APPENDIX B

Re-CAP Procedure Results

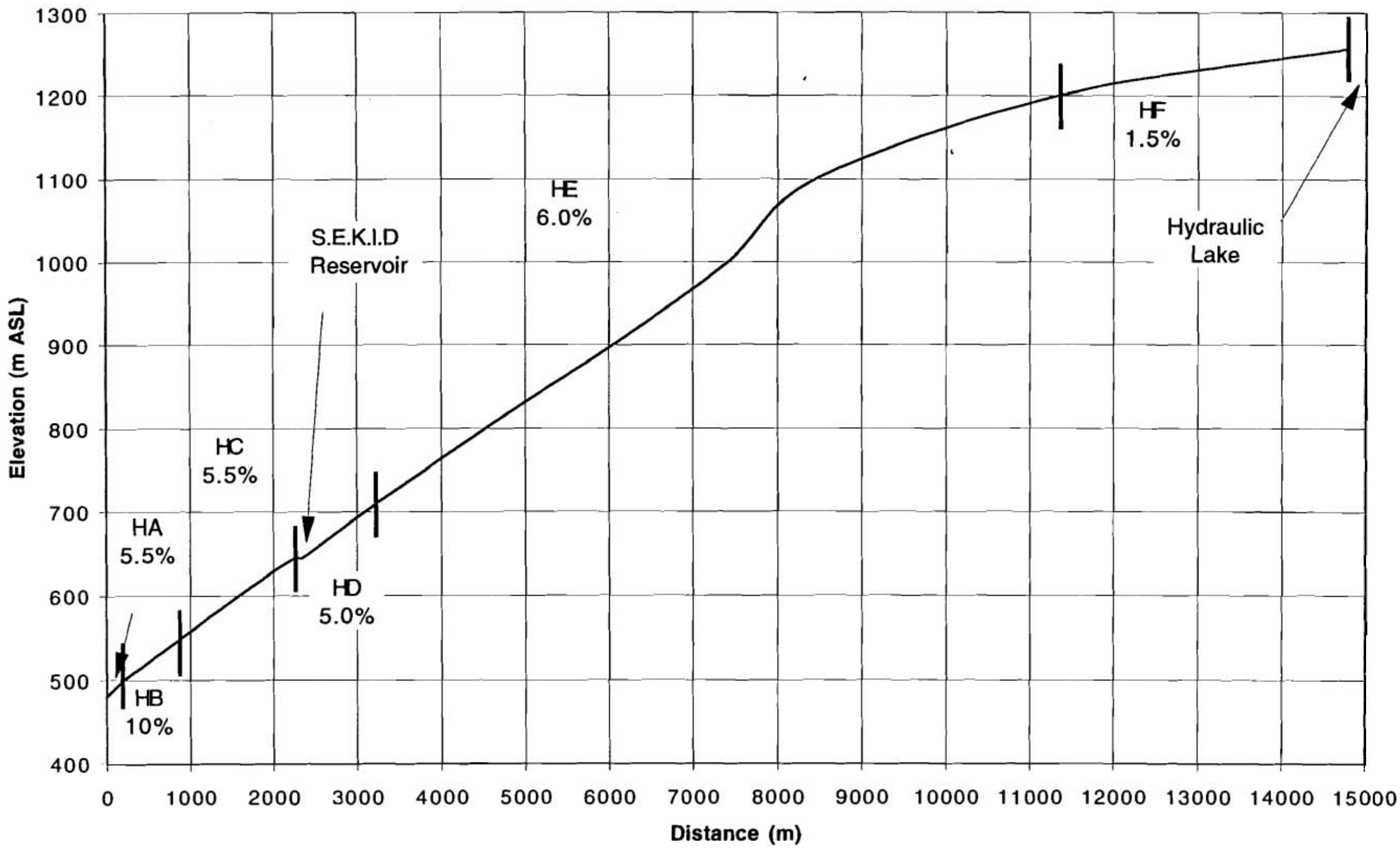
-Reach Break and Location Map

-Longitudinal Profiles

-Reach Break and Disturbance Summary (Tables 1 and 2)

-CAP forms (office and field) and Photographs

Longitudinal Profile - Hydraulic Creek



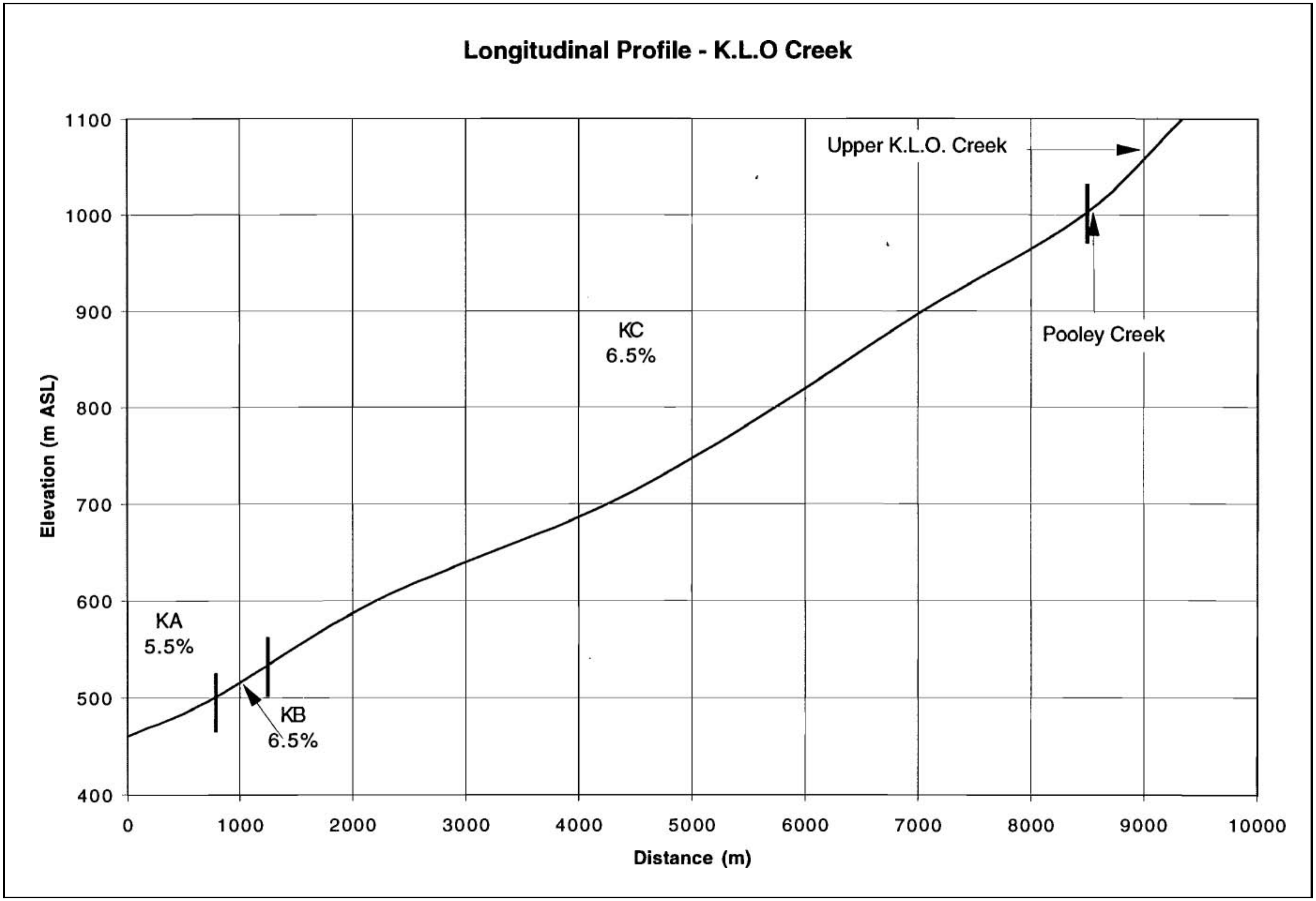

Longitudinal Profile - K.L.O Creek
Elevation (m ASL)
1100
1000
900
800
700
600
500
400
Distance (m)
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
KA
5.5%
KB
6.5%
KC
6.5%
Upper K.L.O. Creek
Pooley Creek

TABLE 1
Reach Break and Disturbance Summary - Hydraulic Creek

			Stream length in each disturbance class (km)			
Reach and length (km)	Features	Channel type	None (Sorother)	Low (A1, D1)	Moderate (A2, D2)	High (A3, D3)
HA - 0.22	---	CP-c:D1	---	0.22	---	---
HB - 0.50	ΔS,F	SP-b:S	0.50	---	---	---
HC - 1.50	ΔS,F	CP-c:S	1.50	---	---	---
HD - 1.00	AF	CP-c:Channelized	1.00	---	---	---
HE - 8.30	AF	CP-c:S	8.30	---	---	---
HF - 3.30	ΔS,F,H	RP-g/s:S	3.30	---	---	---
Σ=14.82 km	---	---	Σ=14.60 km	Σ=0.22 km	Σ=0 km	Σ=0 km

ΔS=Change in gradient   ΔF=Change in channel form/type
ΔQ=Change in volume (tributary input)   ΔH=Changes in hillslope coupling

Each progressive reach is different than the preceding one for at least one of the codes in the features column. For example Reach HB is different than Reach HA because of a change in channel form and gradient - (ΔF,S).

Sum of moderate and high disturbance channels = 0 km
Sum % of moderate and high disturbance channels = 0%

TABLE 2
Reach Break and Disturbance Summary - K.L.O. Creek

			Stream length in each disturbance class (km)			
Reach and length (km)	Features	Channel type	None (S or other)	Low (A1, D1)	Moderate (A2, D2)	High (A3, D3)
KA - 0.70	---	CP-c:A1	---	0.70	---	---
KB - 0.62	ΔF,H	CP-b:A1	---	0.62	---	---
KC - 7.18	ΔS,F	CP-b:A1	---	7.18	---	---
Σ=8.50 km			Σ=0 km	Σ=8.50 km	Σ=0 km	Σ=0 km

ΔS=Change in gradient   ΔF=Change in channel form/type
ΔQ=Change in volume (tributary input)   ΔH=Changes in hillslope coupling

Each progressive reach is different than the preceding one for at least one of the codes in the features column. For example Reach KB is different than Reach KA because of a change in channel form and hillslope coupling - (ΔF,H).

Sum of moderate and high disturbance channels = 0 km
Sum % of moderate and high disturbance channels = 0%

APPENDIX B

Channel Assessment Forms

Form 1 - Classifying channel reaches

Form 2 - General assessment of channel morphology

Form 3 - General assessment of channel impact values

Form 4 - Identifying changes in large channel morphologies

Form 5 - Detailed assessment of large channel morphology

Form 6 - Detailed assessment of large channel impact values

Form 7 - **Mainstem** channel impact values

Form 8 - Summary of assessments performed

Field form 1 - Field data

Field form 2 - Disturbance summary

Form 1 - Classifying channel reaches

Sub-basin	Reach letter	Reach length (km)	Drainage network class	CAP applies (Y/N)
HYDRAULIC CREEK				
HYDRAULIC	HA	0.22	CA1aii	Y
HYDRAULIC	HB	0.50	CB2aii	N
HYDRAULIC	HC	1.50	CA1bii	Y
HYDRAULIC	HD	1.00	CC1bii	N
HYDRAULIC	HE	8.30	CA1bii	Y
HYDRAULIC	HF	3.30	CA1aii	Y
K.L.O. CREEK				
K.L.O.	KA	0.70	CA1bii	Y
K.L.O.	KB	0.62	CB1aii	N
K.L.O.	KC	7.18	CA1aii	Y

Form 2 - General assessment of channel morphology - N/A

The General Assessment was not completed for K.L.O. and Hydraulic Creeks as these small channels are not clearly visible on the air photographs.

Sub-basin name	Length of mainstem channel (rn)				
	(a) Total	(b) Downstream of logging	(c) Total (b) with non-erodible channels	(d) Length of (b) with erodible and visible channels	(e) Length of (d) with altered channel morphology
---	---	---	---	---	---

Form 3 - General assessment of channel impact values - N/A

Sub-basin name	Channel impact			
	Observed		Potential	
	Observed changes=(e/a)	Observed CIV	Potential changes= [(b-c)-(d-e)]/a	Potential CIV
---	---	---	---	--

Form 4 - Identifying changes in large channel morphologies - N/A

Sub-basin			
Reach			
Large channel sediment supply phase			
Aerial photograph indicators	**Channel condition after logging**		
	Aggrading	**Stable**	**Degrading**
Channel pattern	---	---	---
Channel islands	---	---	---
Channel bars	---	---	---
Lateral stability	---	---	---
Channel width	---	---	---
Sinuosity	---	---	---
Meander wavelength	---	---	---
Pre-logging stability class	---	---	---
Post logging stability class	---	---	---
Disturbance level	---	---	---

Form 5 - Detailed assessment of large channel morphology - N/A

Sub-basin name	Length of mainstem channel (km)					
	(a) Total	(b) Downstream of logging	(c) Total (b) with non-erodible channels	(d) Length of (b) with large channel morphology	(e) Length of (d) with erodible large channel morphology	(f) Length of (d) with altered channel morphology
---	---	---	---	---	---	---

Form 6 - Detailed assessment of large channel impact values - N/A

Sub-basin name	**Channel impact**					
	Observed		**Potential**		**Large channels**	
	Observed changes= (f/a)	CIV	changes = [(b-c)-(e-f)]/a	CIV	Observed changes= (f/d)	Large Channel CIV
---	---	---	---	---	---	---

Form 7 - Mainstem channel impact values

Sub-basin name	(a) Total mainstem channel length (km)	(b) Total length of moderate and high disturbed channel (km)	(c) Impact ratio =(b/a)	Mainstem channel CIV	Channel Impact/Instability Rating
Hydraulic	14.82	0	0	0	0
K.L.O.	8.50	0	0	0	0

Form 8 - Summary of assessments performed

Sub-basin name	General assessment	Detailed assessment		CIV
		Air photograph	Field	
K.L.O.	**NA**	N/A	x	0.0
Hydraulic	**NA**	**N/A**	x	0.0

General Assessment
Analysis completed by: **N/A** Date of analysis: **N/A**
Detailed Assessment - Aerial Photograph
Analysis completed by: **N/A**
Detailed Assessment - Field (August/September, 1998)
Analysis completed by: Rob Scherer, Gary VanEmmerik

K.L.0.-Hydraulic Channel Assessment - Field Form 1

Sub-basin: **Hydraulic Creek**
Reach: **HA**

Date: **09/01/98**
Crew: **Scherer/VanEmmerik**
Weather: **Sunny**

Station	Wb (m)	d (cm)	s (%)	D (cm)	Channel Type
0+000	3.1	30	6	20	CPc:D1
0+020	2.9	40	5.5	20	CPc:D1
0+040	4.1	30	6	25	CPc:D1
0+060	3.7	35	5	20	CPc:D1
0+080	3.2	40	5	20	CPc:D1

Distance	Bank Type	Channel Type	Disturbance Indicators	Photo Roll and Frame
0+000	A2/3	CPc:D1	B2,C5	---
0+020	A2/3	CPc:D1	D2	---
0+040	A2/3	CPc:D1	B2,C5	RG1/P21,22
0+060	A2/3	CPc:D1	D2	---
0+080	A2/3	CPc:D1	C5	RG1/P23,24

S1 Homogenous bed texture	C1 Extensive riffles or cascades	B1 Abandoned channels
S2 Sediment fingers	C2 Minimal pool area	B2 Eroding banks
S3 Sediment wedges	C3 Elevated mid-channel bars	B3 Avulsions
S4 Extensive bars	C4 Multiple channels or braids	D1 Small woody debris
S5 Extensive scoured zones	C5 Disturbed stone lines	D2 LWD function
		D3 Recently formed LWD jams

A (Erodible): 1=Silt, 2=Sand, 3=Gravel, 4=Cobble, 5=Boulder
N (Non-erodible): 1=Till, 2=Colluvium, 3=Bedrock

Comments: Bed materials are cobble and gravel and channel is partially degraded. The banks are eroded in places, but not significantly (the 97 flood likely played a role). The riparian vegetation is dominated by mature alder and the hills are decoupled.

PHOTO **HA-1.** Reach HA - Upstream **(R1, P23)**

PHOTO **HA-2.** Reach HA - Downstream (R2, P22)

K.L.0.-Hydraulic Channel Assessment - Field Form 1

Sub-basin: **Hydraulic Creek**
Reach: HB

Date: **09/01/98**
Crew: **Scherer/VanEmmerik**
Weather: **Sunny**

Station	Wb (m)	d (cm)	s (%)	D (cm)	Channel Type
---	---	---	---	---	SPb:S
---	---	---	---	---	SPb:S
---	---	---	---	---	SPb:S
---	---	---	---	---	SPb:S
---	---	---	---	---	SPb:S

Distance	Bank Type	Channel Type	Disturbance Indicators	Photo Roll and Frame
---	---	SPb:S	---	---
---	---	SPb:S	---	---
---	---	SPb:S	---	---
---	---	SPb:S	---	---
---	---	SPb:S	---	---

S1 Homogenous bed texture	C1 Extensive riffles or cascades	B1 Abandoned channels
S2 Sediment fingers	C2 Minimal pool area	B2 Eroding banks
S3 Sediment wedges	C3 Elevated mid-channel bars	B3 Avulsions
S4 Extensive bars	C4 Multiple channels or braids	D1 Small woody debris
S5 Extensive scoured zones	C5 Disturbed stone lines	D2 LWD function
		D3 Recently formed LWD jams

A (Erodible): 1=Silt, 2=Sand, 3=Gravel, 4=Cobble, 5=Boulder
N (Non-erodible): 1=Till, 2=Colluvium, 3=Bedrock

Comments: This is **a** bedrock canyon reach and field measurements were not recorded. The channel is stable.

K.L.0.-Hydraulic Channel Assessment - Field Form 1

Sub-basin: **Hydraulic Creek**
Reach: **HC**

Date: **09/01/98**
Crew: **Scherer/VanEmmerik**
Weather: **Sunny**

Station	Wb (m)	d (cm)	s (%)	D (cm)	Channel Type
0+000	4.2	25	5	20	CPc:S
0+020	3.7	28	5.5	25	CPc:S
0+040	4.1	27	4.5	20	CPc:S
0+060	4.0	20	5	18	CPc:S
0+080	3.9	28	5	20	CPc:S

Distance	Bank Type	Channel Type	Disturbance Indicators	Photo Roll and Frame
0+000	A3/4	CPc:S	---	---
0+020	A3/4	CPc:S	---	---
0+040	A3/4	CPc:S	---	RG2/P5,6
0+060	A3/4	CPc:S	---	---
0+080	A3/4	CPc:S	---	---

S1 Homogenous bed texture	C1 Extensive riffles or cascades	B1 Abandoned channels
S2 Sediment fingers	C2 Minimal pool area	B2 Eroding banks
S3 Sediment wedges	C3 Elevated mid-channel bars	B3 Avulsions
S4 Extensive bars	C4 Multiple channels or braids	D1 Small woody debris
S5 Extensive scoured zones	C5 Disturbed stone lines	D2 LWD function
		D3 Recently formed LWD jams

A (Erodible): 1=Silt, 2=Sand, 3=Gravel, 4=Cobble, 5=Boulder
N (Non-erodible): 1=Till, 2=Colluvium, 3=Bedrock

Comments: Bed materials are cobble and boulder with intact stone lines. Banks are cobble and gravel and no erosion is evident. Riparian vegetation consists of pole sapling alder and mature cedar. The reservoir access road parallels the left bank and the hills on the right bank are coupled. The channel is stable.

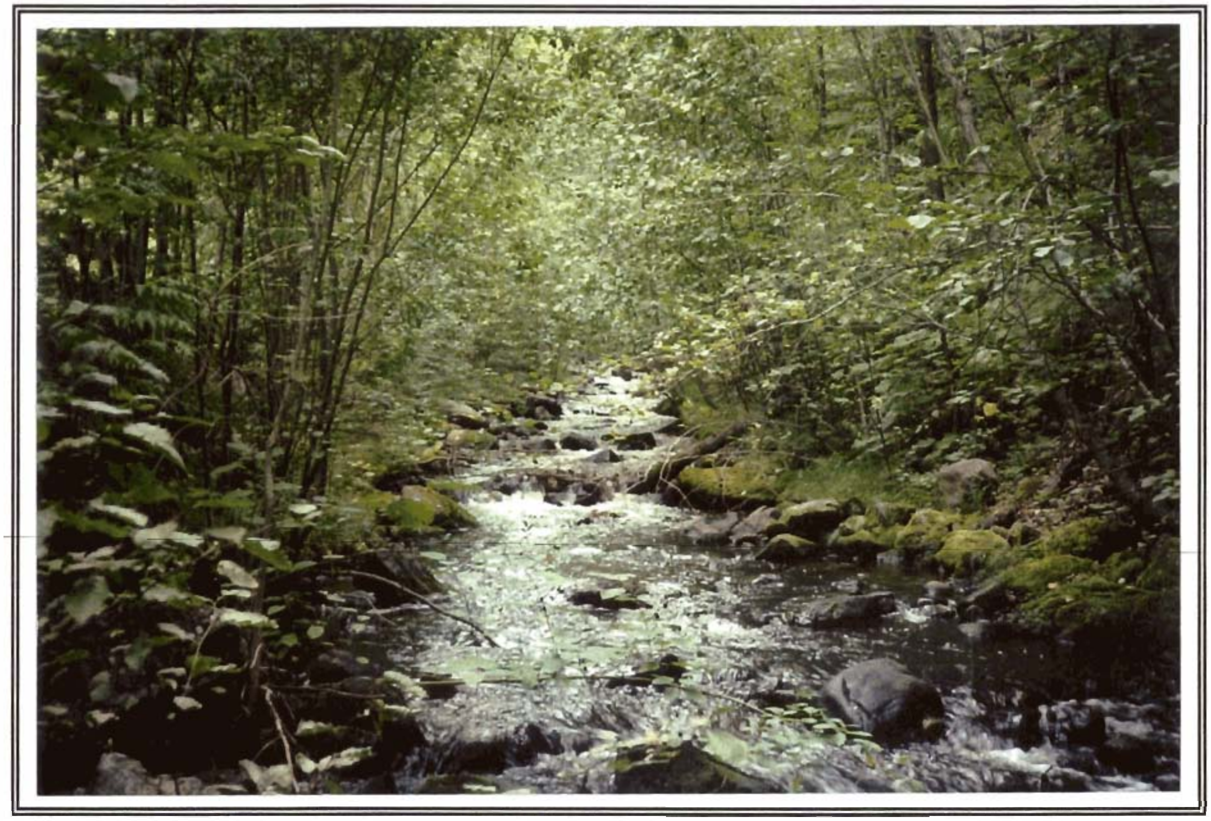


PHOTO HC-1. Reach **HC** - Upstream (R2, P5)

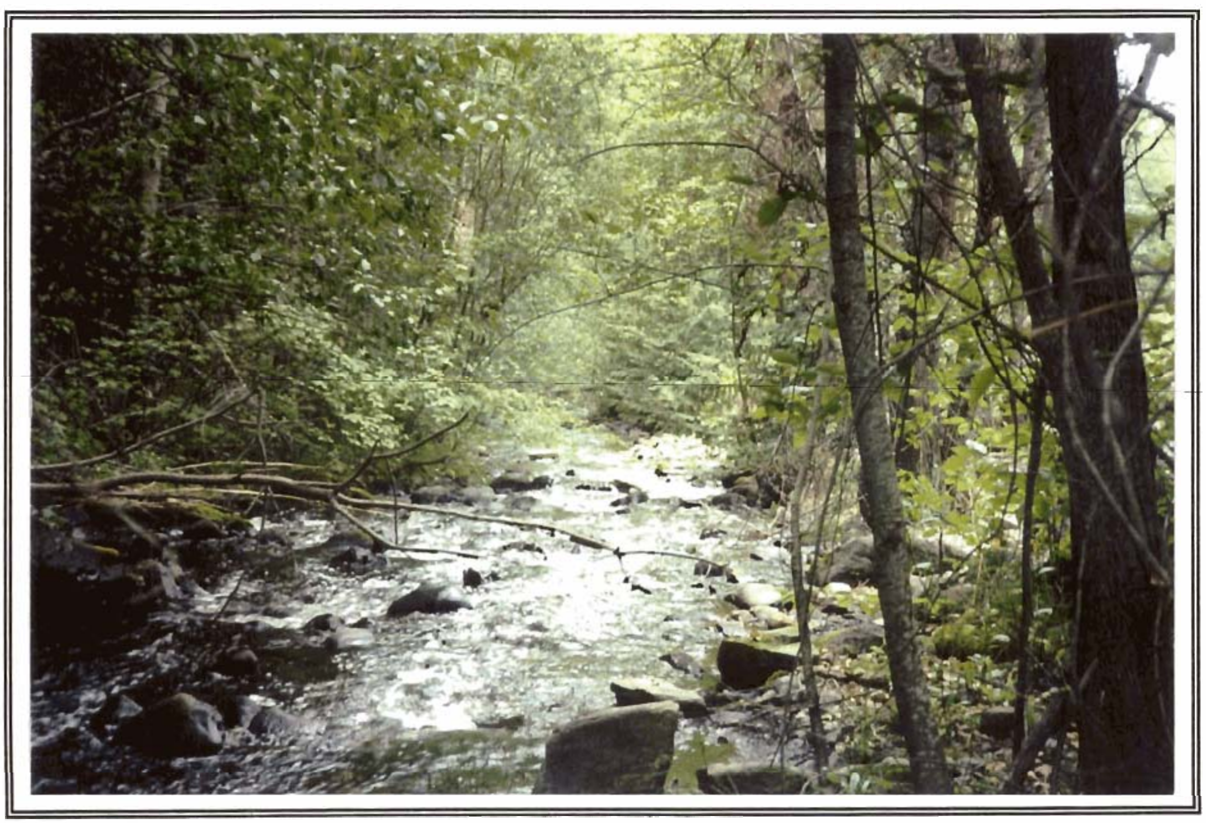


PHOTO HC-2. Reach **HC** - Downstream (R2, P6)

K.L.O.-Hydraulic Channel Assessment - Field Form 1

Sub-basin: **Hydraulic Creek**
Reach: **HD**

Date: **09/01/98**
Crew: **Scherer/VanEmmerik**
Weather: **Sunny**

Station	Wb (m)	d (cm)	s (%)	D (cm)	Channel Type
---	---	---	---	---	CPc:S-Channelized
---	---	---	---	---	CPc:S-Channelized
---	---	---	---	---	CPc:S-Channelized
---	---	---	---	---	CPc:S-Channelized
---	---	---	---	---	CPc:S-Channelized

Distance	Bank Type	Channel Type	Disturbance Indicators	Photo Roll and Frame
---	---	CPc:S-Channelized	---	RA4/P4,6
---	---	CPc:S-Channelized	---	---
---	---	CPc:S-Channelized	---	---
---	---	CPc:S-Channelized	---	---
---	---	CPc:S-Channelized	---	---

S1 Homogenous bed texture	C1 Extensive riffles or cascades	B1 Abandoned channels
S2 Sediment fingers	C2 Minimal pool area	B2 Eroding banks
S3 Sediment wedges	C3 Elevated mid-channel bars	B3 Avulsions
S4 Extensive bars	C4 Multiple channels or braids	D1 Small woody debris
S5 Extensive scoured zones	C5 Disturbed stone lines	D2 LWD function
		D3 Recently formed LWD jams

A (Erodible): 1=Silt, 2=Sand, 3=Gravel, 4=Cobble, 5=Boulder
N (Non-erodible): 1=Till, 2=Colluvium, 3=Bedrock

Comments: This is a channelized reach upstream from the intake and detailed field measurements were not recorded. The channel is stable.

PHOTO HD-1. Reach HD - Overview (RA4, P4)

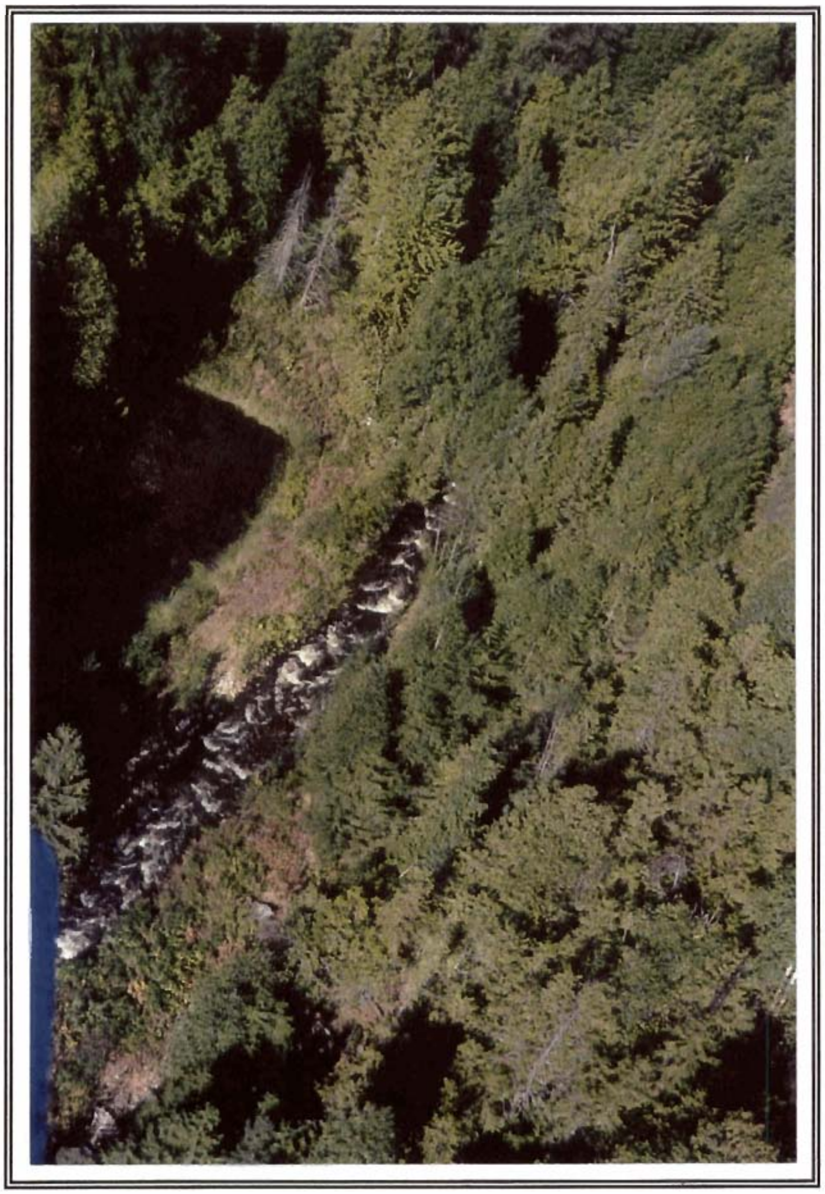


PHOTO HD-2. Reach HD - Overview (RA4, P6)

K.L.0.-Hydraulic Channel Assessment - Field Form 1

Sub-basin: **Hydraulic Creek**
Reach: HE

Date: **09/01/98**
Crew: **Scherer/VanEmmerik**
Weather: **Sunny**

Station	Wb (m)	d (cm)	s (%)	D (cm)	Channel Type
---	---	---	---	---	CPc:S
---	---	---	---	---	CPc:S
---	---	---	---	---	CPc:S
---	---	---	---	---	CPc:S
---	---	---	---	---	CPc:S

Distance	Bank Type	Channel Type	Disturbance Indicators	Photo Roll and Frame
---	---	CPc:S	---	RA4/P8
---	---	CPc:S	---	---
---	---	CPc:S	---	---
---	---	CPc:S	---	---
---	---	CPc:S	---	---

S1 Homogenous bed texture	C1 Extensive riffles or cascades	B1 Abandoned channels
S2 Sediment fingers	C2 Minimal pool area	B2 Eroding banks
S3 Sediment wedges	C3 Elevated mid-channel bars	B3 Avulsions
S4 Extensive bars	C4 Multiple channels or braids	D1 Small woody debris
S5 Extensive scoured zones	C5 Disturbed stone lines	D2 LWD function
		D3 Recently formed LWD jams
A (Erodible): 1=Silt, 2=Sand, 3=Gravel, 4=Cobble, 5=Boulder N (Non-erodible): 1=Till, 2=Colluvium, 3=Bedrock		

Comments: This reach has the same characteristics as reach HD, except it is not channelized. The channel is stable.

PHOTO **HE-1.** Reach HD/HE - Overview (RA4, P8)

K.L.0.-Hydraulic Channel Assessment - Field Form 1

Sub-basin: **Hydraulic Creek**
Reach: **HF**

Date: **09/01/98**
Crew: **Scherer/VanEmmerik**
Weather: **Sunny**

Station	Wb (m)	d (cm)	s (%)	D (cm)	Channel Type
---	---	---	---	---	RPg/s:S
---	---	---	---	---	RPg/s:S
---	---	---	---	---	RPg/s:S
---	---	---	---	---	RPg/s:S
---	---	---	---	---	RPg/s:S

Distance	Bank Type	Channel Type	Disturbance Indicators	Photo Roll and Frame
---	---	RPg/s:S	---	RA4, P9
---	---	RPg/s:S	---	---
---	---	RPg/s:S	---	---
---	---	RPg/s:S	---	---
---	---	RPg/s:S	---	---

S1 Homogenous bed texture	C1 Extensive riffles or cascades	B1 Abandoned channels
S2 Sediment fingers	C2 Minimal pool area	B2 Eroding banks
S3 Sediment wedges	C3 Elevated mid-channel bars	B3 Avulsions
S4 Extensive bars	C4 Multiple channels or braids	D1 Small woody debris
S5 Extensive scoured zones	C5 Disturbed stone lines	D2 LWD function
		D3 Recently formed LWD jams

A (Erodible): 1=Silt, 2=Sand, 3=Gravel, 4=Cobble, 5=Boulder
N (Non-erodible): 1=Till, 2=Colluvium, 3=Bedrock

Comments: This reach is channelized through what used to be a wetland near the outlet of Hydraulic Lake. The channel is stable.

PHOTO HF-1. Reach HF - Overview (RA4, P9)

K.L.0.-Hydraulic Channel Assessment - Field Form 1

Sub-basin: **K.L.O. Creek**
Reach: **KA**

Date: **09/01/98**
Crew: **Scherer/VanEmmerik**
Weather: **Sunny**

Station	Wb (m)	d (cm)	s (%)	D (cm)	Channel Type
---	---	---	---	---	CPc:A1
---	---	---	---	---	CPc:A1
---	---	---	---	---	CPc:A1
---	---	---	---	---	CPc:A1
---	---	---	---	---	CPc:A1

Distance	Bank Type	Channel Type	Disturbance Indicators	Photo Roll and Frame
---	---	CPc:A1	---	RA4/P13,15
---	---	CPc:A1	---	---
---	---	CPc:A1	---	---
---	---	CPc:A1	---	---
---	---	CPc:A1	---	RG2/P9

S1 Homogenous bed texture	C1 Extensive riffles or cascades	B1 Abandoned channels
S2 Sediment fingers	C2 Minimal pool area	B2 Eroding banks
S3 Sediment wedges	C3 Elevated mid-channel bars	B3 Avulsions
S4 Extensive bars	C4 Multiple channels or braids	D1 Small woody debris
S5 Extensive scoured zones	C5 Disturbed stone lines	D2 LWD function
		D3 Recently formed LWD jams

A (Erodible): 1=Silt, 2=Sand, 3=Gravel, 4=Cobble, 5=Boulder
N (Non-erodible): 1=Till, 2=Colluvium, 3=Bedrock

Comments: This fan reach is slightly aggraded as evidenced by cobble deposits at the mouth of K.L.O. Creek. Material is transported through the canyon reach KB, and although some material is held up in reach KA, there are deposits reaching Mission Creek.

PHOTO KA-1. Reach **KA** mouth - Overview (RA4, P13)

PHOTO KA-2. Reach **KA** - Overview (RA4, P15)

PHOTO **KA-3.** Reach KA/KB - Downstream (R2, P9)

K.L.0.-Hydraulic Channel Assessment - Field Form 1

Sub-basin: **K.L.O. Creek**
Reach: **KB**

Date: **09/01/98**
Crew: **Scherer/VanEmmerik**
Weather: **Sunny**

Station	Wb (m)	d (cm)	s (%)	D (cm)	Channel Type
---	---	---	---	---	CPb:A1
---	---	---	---	---	CPb:A1
---	---	---	---	---	CPb:A1
---	---	---	---	---	CPb:A1
---	---	---	---	---	CPb:A1

Distance	Bank Type	Channel Type	Disturbance Indicators	Photo Roll and Frame
---	---	CPb:A1	---	RA4/P18
---	---	CPb:A1	---	---
---	---	CPb:A1	---	RG2/P7
---	---	CPb:A1	---	---
---	---	CPb:A1	---	---

S1 Homogenous bed texture	C1 Extensive riffles or cascades	B1 Abandoned channels
S2 Sediment fingers	C2 Minimal pool area	B2 Eroding banks
S3 Sediment wedges	C3 Elevated mid-channel bars	B3 Avulsions
S4 Extensive bars	C4 Multiple channels or braids	D1 Small woody debris
S5 Extensive scoured zones	C5 Disturbed stone lines	D2 LWD function
		D3 Recently formed LWD jams

A (Erodible): 1=Silt, 2=Sand, 3=Gravel, 4=Cobble, 5=Boulder
N (Non-erodible): 1=Till, 2=Colluvium, 3=Bedrock

Comments: This is a bedrock canyon reach and detailed field measurements were not recorded. Any sediment input to this reach is transported to the lower channel. Cobble and gravel deposits are located near the bottom of the canyon reach (Photo KA3).

PHOTO KB-1. Reach KB - Overview (RA4, P18)

PHOTO KB-2. Reach KB - Upstream (R2, P7)

K.L.O.-Hydraulic Channel Assessment - Field Form 1

Sub-basin: **K.L.O. Creek**
Reach: **KC**

Date: **09/01/98**
Crew: **Scherer/VanEmmerik**
Weather: **Sunny**

Station	Wb (m)	d (cm)	s (%)	D (cm)	Channel Type
---	---	---	---	---	CPb:A1
---	---	---	---	---	CPb:A1
---	---	---	---	---	CPb:A1
---	---	---	---	---	CPb:A1
---	---	---	---	---	CPb:A1

Distance	Bank Type	Channel Type	Disturbance Indicators	Photo Roll and Frame
---	---	CPb:A1	---	RA4/P19,22
---	---	CPb:A1	---	---
---	---	CPb:A1	---	---
---	---	CPb:A1	---	---
---	---	CPb:A1	---	---

S1 Homogenous bed texture	C1 Extensive riffles or cascades	B1 Abandoned channels
S2 Sediment fingers	C2 Minimal pool area	B2 Eroding banks
S3 Sediment wedges	C3 Elevated mid-channel bars	B3 Avulsions
S4 Extensive bars	C4 Multiple channels or braids	D1 Small woody debris
S5 Extensive scoured zones	C5 Disturbed stone lines	D2 LWD function
		D3 Recently formed LWD jams

A (Erodible): 1=Silt, 2=Sand, 3=Gravel, 4=Cobble, 5=Boulder
N (Non-erodible): 1=Till, 2=Colluvium, 3=Bedrock

Comments: This is a canyon reach with poor access. This reach was primarily assessed via helicopter. There are several small sediment wedges (cobble sized material) throughout this reach. LWD is present in the channel, but not abundant. One large landslide off the east bank has impacted the channel. Upstream of the slide, there is limited channel disturbance.

PHOTO KC-1. Reach KC - Overview (RA4, P19)

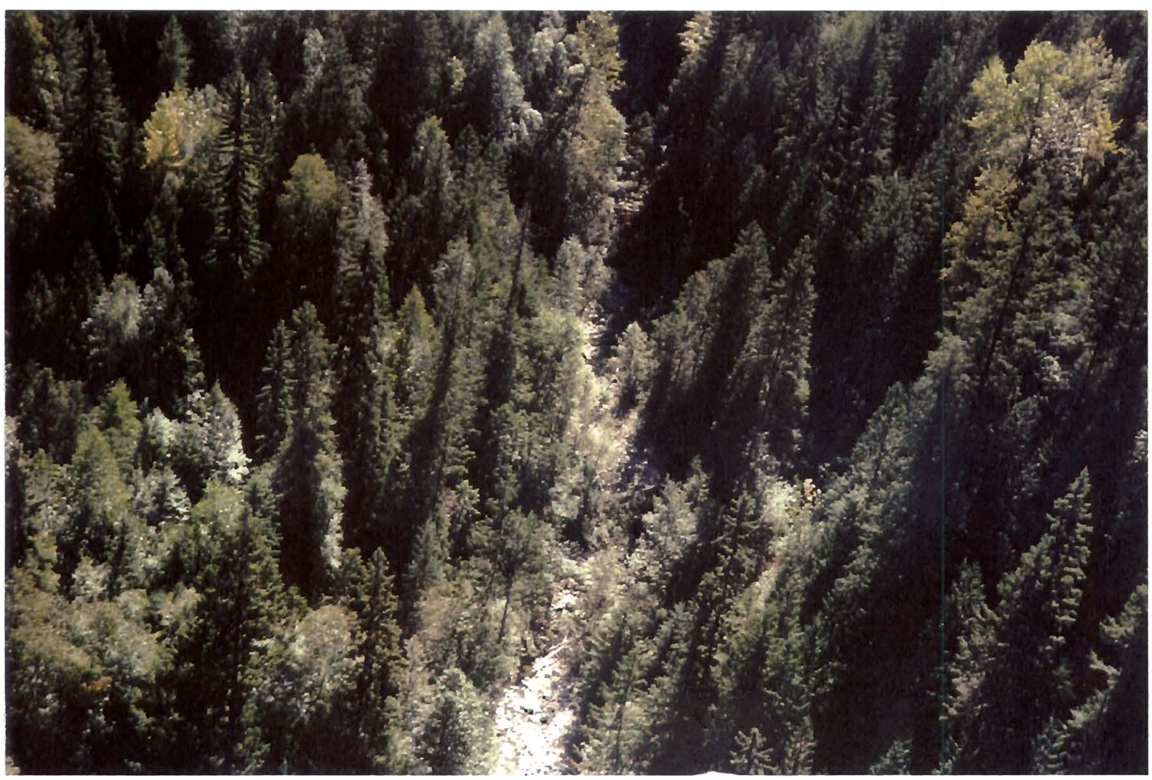


PHOTO KC-2. Reach KC - Overview (RA4, P22)

K.L.O.-Hydraulic Channel Assessment - Field Form 1

Sub-basin: **Upper K.L.O. Creek**
Reach: **Upper K.L.O. Creek**

Date: **09/01/98**
Crew: **Scherer/VanEmmerik**
Weather: **Sunny**

Station	Wb (m)	d (cm)	s (%)	D (cm)	Channel Type
---	---	---	---	---	SPb:S
---	---	---	---	---	SPb:S
---	---	---	---	---	SPb:S
---	---	---	---	---	SPb:S
---	---	---	---	---	SPb:S

Distance	Bank Type	Channel Type	Disturbance Indicators	Photo Roll and Frame
---	---	SPb:S	---	RG1/P19
---	---	SPb:S	---	---
---	---	SPb:S	---	---
---	---	SPb:S	---	---
---	---	SPb:S	---	---

S1 Homogenous bed texture	C1 Extensive riffles or cascades	B1 Abandoned channels
S2 Sediment fingers	C2 Minimal pool area	B2 Eroding banks
S3 Sediment wedges	C3 Elevated mid-channel bars	B3 Avulsions
S4 Extensive bars	C4 Multiple channels or braids	D1 Small woody debris
S5 Extensive scoured zones	C5 Disturbed stone lines	D2 LWD function
		D3 Recently formed LWD jams

A (Erodible): 1=Silt, 2=Sand, 3=Gravel, 4=Cobble, 5=Boulder
N (Non-erodible): 1=Till, 2=Colluvium, 3=Bedrock

Comments: This is a stable bedrock canyon reach not requiring detailed measurements. There are no major sediment sources to this reach.

APPENDIX C

ECA Calculations for the Hydraulic Creek/KLO Creek and McCulloch Reservoir Sub-basin

Individual Drainage Area ECA Calculations - Hydraulic / KLO

Basin	Total Area	Private/Clearing Area	Private %	Area For ECA Calculations	Current		End of 1998		End of 1999		End of 2000		End of 2001		End of 2002		End of 2003		2004+	
					ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%
Affleck CWS	384.1	12.5	3.25	371.6	123.5	33.25	114.5	30.82	136.1	36.63	131.9	35.50	122.9	33.08	121.6	32.71	121.6	32.71	121.6	32.71
Hydraulic Watershed	5530.9	965.5	17.46	5530.9	2012.8	36.39	1999.5	36.15	1979.7	35.79	1967.7	35.58	1929.7	34.89	1864.0	33.70	1787.9	32.33	2024.8	36.61
Lower KLO watershed	3893.6	417.8	10.73	3475.9	989.5	28.47	975.4	28.06	972.0	27.96	972.0	27.96	902.2	25.96	879.4	25.30	902.9	25.98	976.0	28.08
Upper KLO Watershed	3277.5	54.5	1.66	3223.0	717.8	22.27	693.2	21.51	687.5	21.33	789.8	24.51	919.6	28.53	973.7	30.21	1032.7	32.04	1032.7	32.04
McCulloch	7810.0	192.5	2.46	7617.5	2177.4	28.58	2114.4	27.76	2066.9	27.13	2131.9	27.99	2251.2	29.55	2348.6	30.83	2357.9	30.95	2774.6	36.42
Adjacent McCulloch	4532.5	138.0	3.04	4394.5	1459.6	33.21	1421.2	32.34	1379.4	31.39	1342.1	30.54	1331.6	30.30	1374.9	31.29	1325.3	30.16	1432.2	32.59

Note: H60 Calculations use same private land inclusions as individual sub-basins
Note 2: ECA projections for 2004+ do not include any projected growth on plantations beyond 2003.

ECA Calculations - Hydraulic Creek Watershed below McCulloch Reservoir

Basin	Total Area	Private/Clearing Area	Private %	Area For ECA Calculations	Current		End of 1998		End of 1999		End of 2000		End of 2001		End of 2002		End of 2003		2004+	
					ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%
Hydraulic Watershed	5530.9	965.5	17.46	5530.9	2012.8	36.39	1999.5	36.15	1979.7	35.79	1967.7	35.58	1929.7	34.89	1864.0	33.70	1787.9	32.33	1787.9	32.33

ECA Calculations for the entire KLO Creek Watershed (includes drainage area above and below diversion ditch)

Basin	Total Area	Private/Clearing Area	Private %	Area For ECA Calculations	Current		End of 1998		End of 1999		End of 2000		End of 2001		End of 2002		End of 2003		2004+	
					ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%
Upper Klo	3277.5	54.5	1.66	3223.0	717.8	22.27	693.2	21.51	687.5	21.33	789.8	24.51	919.6	28.53	973.7	30.21	1032.7	32.04	1032.7	32.04
Lower KLO watershed	3893.6	417.8	10.73	3475.9	989.5	28.47	975.4	28.06	972.0	27.96	972.0	27.96	902.2	25.96	879.4	25.30	902.9	25.98	902.9	25.98
Total KLO Watershed	7171.1	472.3	6.59	6698.9	1707.4	25.49	1668.5	24.91	1659.5	24.77	1761.8	26.30	1821.7	27.19	1853.1	27.66	1935.6	28.89	1935.6	28.89

Note 2: ECA projections for 2004+ do not include any projected growth on plantations beyond 2003.

ECA Calculations for the McCulloch Reservoir (includes drainage area of upper KLO, Affleck Creek and Area adjacent to McCulloch Reservoir)

Basin	Total Area	Private/Clearing Area	Private %	Area For ECA Calculations	Current		End of 1998		End of 1999		End of 2000		End of 2001		End of 2002		End of 2003		2004+	
					ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%
Adjacent McCulloch	4532.5	138.0	3.04	4394.5	1459.6	33.21	1421.2	32.34	1379.4	31.39	1342.1	30.54	1331.6	30.30	1374.9	31.29	1325.3	30.16	1432.2	32.59
Affleck CWS	384.1	12.5	3.25	371.6	123.5	33.25	114.5	30.82	136.1	36.63	131.9	35.50	122.9	33.08	121.6	32.71	121.6	32.71	121.6	32.71
Upper KLO Watershed	3277.5	54.5	1.66	3223.0	717.8	22.27	693.2	21.51	687.5	21.33	789.8	24.51	919.6	28.53	973.7	30.21	1032.7	32.04	1032.7	32.04
McCulloch Res. Sub-basin	8194.1	205.0	2.50	7989.1	2301.0	28.80	2228.9	27.90	2203.0	27.57	2263.9	28.34	2374.1	29.72	2470.2	30.92	2479.5	31.04	2586.4	32.37

Note 2: ECA projections for 2004+ do not include any projected growth on plantations beyond 2003.

Individual Drainage Area ECA Calculations Above H60 - Hydraulic

Basin	Total Area	Private/Clearing Area	Private %	Area For ECA Calculations	Current		End of 1998		End of 1999		End of 2000		End of 2001		End of 2002		End of 2003		2004+	
					ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%
Affleck	384.1	12.5	3.25	371.6	123.5	33.25	114.5	30.82	136.1	36.63	131.9	35.50	122.9	33.08	121.6	32.71	121.6	32.71	121.6	32.71
Hydraulic Watershed	5530.9	965.5	17.46	5530.9	869.6	15.72	865.4	15.65	862.4	15.59	862.0	15.59	849.0	15.35	824.9	14.91	803.2	14.52	826.7	14.95
Lower KLO	3893.6	417.8	10.73	3475.9	946.1	27.22	939.0	27.01	935.6	26.92	935.6	26.92	866.0	24.91	843.5	24.27	868.7	24.99	909.3	26.16
Upper KLO	3277.5	54.5	1.66	3223.0	717.8	22.27	693.2	21.51	687.5	21.33	789.8	24.51	919.6	28.53	973.7	30.21	1032.7	32.04	1032.7	32.04
McCulloch	7810.0	192.5	2.46	7617.5	1884.9	24.74	1829.7	24.02	1804.8	23.69	1880.8	24.69	2000.0	26.26	2099.2	27.56	2116.9	27.79	2223.8	29.19
Adjacent McCulloch	4532.5	138.0	3.04	4394.5	1167.1	26.56	1136.6	25.86	1117.3	25.42	1091.0	24.83	1080.5	24.59	1125.5	25.61	1084.2	24.67	1191.1	27.10

Note 2: ECA projections for 2004+ do not include any projected growth on plantations beyond 2003.

ECA Calculations above H60 - Hydraulic Creek Watershed below McCulloch Reservoir

Basin	Total Area	Private/Clearing Area	Private %	Area For ECA Calculations	Current		End of 1998		End of 1999		End of 2000		End of 2001		End of 2002		End of 2003		2004+	
					ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%
Hydraulic Watershed	5530.9	965.5	17.46	5530.9	869.6	15.72	865.4	15.65	862.4	15.59	862.0	15.59	849.0	15.35	824.9	14.91	803.2	14.52	826.7	14.95

ECA Calculations above H60 for the entire KLO Creek Watershed (includes drainage area above and below diversion ditch)

Basin	Total Area	Private/Clearing Area	Private %	Area For ECA Calculations	Current		End of 1998		End of 1999		End of 2000		End of 2001		End of 2002		End of 2003		2004+	
					ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%
Upper KLO	3277.5	54.5	1.66	3223.0	717.8	22.27	693.2	21.51	687.5	21.33	789.8	24.51	919.6	28.53	973.7	30.21	1032.7	32.04	1032.7	32.04
Lower KLO	3893.6	417.8	10.73	3475.9	946.1	27.22	939.0	27.01	935.6	26.92	935.6	26.92	866.0	24.91	843.5	24.27	868.7	24.99	909.3	26.16
Total KLO Watershed	7171.1	472.3	6.59	6698.9	1663.9	24.84	1632.1	24.36	1623.1	24.23	1725.4	25.76	1785.5	26.65	1817.2	27.13	1901.4	28.38	1942.0	28.99

Note 2: ECA projections for 2004+ do not include any projected growth on plantations beyond 2003.

ECA Calculations above the H60 for the McCulloch Reservoir (includes drainage area of upper KLO, Affleck Creek and Area adjacent to McCulloch Reservoir)

Basin	Total Area	Private/Clearing Area	Private %	Area For ECA Calculations	Current		End of 1998		End of 1999		End of 2000		End of 2001		End of 2002		End of 2003		2004+	
					ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%
Adjacent McCulloch	4532.5	138.0	3.04	4394.5	1167.1	26.56	1136.6	25.86	1117.3	25.42	1091.0	24.83	1080.5	24.59	1125.5	25.61	1084.2	24.67	1191.1	27.10
Affleck	384.1	12.5	3.25	371.6	123.5	33.25	114.5	30.82	136.1	36.63	131.9	35.50	122.9	33.08	121.6	32.71	121.6	32.71	121.6	32.71
Upper KLO	3277.5	54.5	1.66	3223.0	717.8	22.27	693.2	21.51	687.5	21.33	789.8	24.51	919.6	28.53	973.7	30.21	1032.7	32.04	1032.7	32.04
McCulloch Res. Sub-basin	8194.1	205.0	2.50	7989.1	2008.4	25.14	1944.2	24.34	1940.9	24.29	2012.7	25.19	2122.9	26.57	2220.8	27.80	2238.5	28.02	2345.3	29.36

Note 2: ECA projections for 2004+ do not include any projected growth on plantations beyond 2003.

Individual Drainage Area ECA Calculations Below H60 - Hydraulic/KLO

Basin	Total Area	Private/Clearing Area	Private %	Area For ECA Calculations	Current		End of 1998		End of 1999		End of 2000		End of 2001		End of 2002		End of 2003		2004+	
					ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%
Affleck	384.1	12.5	3.25	371.6	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Hydraulic Watershed	5530.9	965.5	17.46	5530.9	1143.2	20.67	1134.2	20.51	1117.3	20.20	1105.7	19.99	1080.7	19.54	1039.1	18.79	984.7	17.80	1197.9	21.66
Lower KLO	3893.6	417.8	10.73	3475.9	43.4	1.25	36.4	1.05	36.4	1.05	36.4	1.05	36.2	1.04	36.0	1.04	34.2	0.99	66.6	1.92
Upper KLO	3277.5	54.5	1.66	3223.0	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
McCulloch	7810.0	192.5	2.46	7617.5	292.5	3.84	284.6	3.74	262.1	3.44	251.2	3.30	251.2	3.30	249.4	3.27	241.1	3.16	241.1	3.16
Adjacent McCulloch	4532.5	138.0	3.04	4394.5	292.5	6.66	284.6	6.48	262.1	5.96	251.2	5.72	251.2	5.72	249.4	5.68	241.1	5.49	241.1	5.49

Note 2: ECA projections for 2004+ do not include any projected growth on plantations beyond 2003.

ECA Calculations below H60 - Hydraulic Creek Watershed below McCulloch Reservoir

Basin	Total Area	Private/Clearing Area	Private %	Area For ECA Calculations	Current		End of 1998		End of 1999		End of 2000		End of 2001		End of 2002		End of 2003		2004+	
					ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%
Hydraulic Watershed	5530.9	965.5	17.46	5530.9	1143.2	20.67	1134.2	20.51	1117.3	20.20	1105.7	19.99	1080.7	19.54	1039.1	18.79	984.7	17.80	1197.9	21.66

ECA Calculations below H60 for the entire KLO Creek Watershed (includes drainage area above and below diversion ditch)

Basin	Total Area	Private/Clearing Area	Private %	Area For ECA Calculations	Current		End of 1998		End of 1999		End of 2000		End of 2001		End of 2002		End of 2003		2004+	
					ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%
Lower KLO	3893.6	417.8	10.73	3475.9	43.4	1.25	36.4	1.05	36.4	1.05	36.4	1.05	36.2	1.04	36.0	1.04	34.2	0.99	66.6	1.92
Upper KLO	3277.5	54.5	1.66	3223.0	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Total KLO Watershed	7171.1	472.3	6.59	6698.9	43.4	0.65	36.4	0.54	36.4	0.54	36.4	0.54	36.2	0.54	36.0	0.54	34.2	0.51	66.6	0.99

Note 2: ECA projections for 2004+ do not include any projected growth on plantations beyond 2003.

ECA Calculations below H60 for the McCulloch Reservoir (includes drainage area of upper KLO, Affleck Creek and Area adjacent to McCulloch Reservoir)

Basin	Total Area	Private/Clearing Area	Private %	Area For ECA Calculations	Current		End of 1998		End of 1999		End of 2000		End of 2001		End of 2002		End of 2003		2004+	
					ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%	ECA	ECA%
Adjacent McCulloch	4532.5	138.0	3.04	4394.5	292.5	6.66	284.6	6.48	262.1	5.96	251.2	5.72	251.2	5.72	249.4	5.68	241.1	5.49	241.1	5.49
Affleck	384.1	12.5	3.25	371.6	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
Upper KLO	3277.5	54.5	1.66	3223.0	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
McCulloch Res. Sub-basin	8194.1	205.0	2.50	7989.1	292.5	3.66	284.6	3.56	262.1	3.28	251.2	3.14	251.2	3.14	249.4	3.12	241.1	3.02	241.1	3.02

Note 2: ECA projections for 2004+ do not include any projected growth on plantations beyond 2003.

APPENDIX D

Minutes from the Initial Watershed Assessment Committee Meeting

Interior Watershed Assessment Procedure
for the
Hydraulic/KLO/Pooley Community Watersheds

Summary of the Initial Watershed Assessment Committee Meeting

October 28, 1998

Location: Dobson Engineering Ltd.

1:00 PM

1. Introduction of Attendees

Don Dobson	Dobson Engineering Ltd.
Dave Gooding	BC Environment
Brian Harris	BC Environment
Jerome Jang	Penticton Forest District
Cam Leadbeater	Weyerhaeuser Canada Ltd., Okanagan Falls Division
Rob Scherer	Dobson Engineering Ltd.
Toby Pike	South East Kelowna Irrigation District
Barb Pryce	Penticton Forest District

2. Purpose of Updating the Hydraulic/KLO/Pooley Creek Watersheds Assessment Procedure (WAP) and the Role of Watershed Assessment Committee (WAC)

- The main objective of the updating the Hydraulic/KLO/Pooley Creek WAP will be to assess all proposed forest development plans (1998 to 2003) in the watershed above the South East Kelowna Irrigation District's (SEKID) intake to determine potential impacts on the water resources (i.e. water quality and water quantity). The procedure will include initial and final WAC meetings, calculation of equivalent clearcut areas (ECA) for proposed forest development plans (1998 to 2003) in the Hydraulic/KLO/Pooley Creek watersheds, a reconnaissance level channel assessment procedure, review and update of sediment source information and risk assessment of the proposed forest development plans. The Penticton Forest District and BC Environment has requested the updated watershed assessment in order to meet Bill 47 regulation requirements that states a watershed assessment that is acceptable to the DM/DEO must be completed for any forest development plans submitted after December 15, 1998 within community watersheds.

- The role of the WAC is to develop and provide recommendations (in consultation with the contracted hydrologist) to the prescribing foresters regarding proposed forest development plans for 1999 to 2004. The prescribing forester will then include the WAC recommendations within their forest development plan or inform the District Manager why their forest development plan is not consistent with the WAC recommendations.

- Issues such as range and recreation are considered to be outside of the scope of this assessment. These issues may be identified and should be dealt with outside of the forest development plan.

Expected completion date for the draft WAP update report is November 18, 1998. The final WAC meeting is tentatively set for 9:00 am, December 2, 1998 at the Penticton Forest District Office.

Action: Dobson Engineering Ltd. will provide the Watershed Assessment Committee a copy of the draft report along with recommendations to consider for review approximately two weeks before the final WAC meeting.

3. Overview of Previous Assessment Work:

a) History

Several assessments have already been completed in 1996 within the watershed which include a Level 1 Interior Watershed Assessment Procedure (IWAP), Level 1 Road Assessment, Channel Assessment Procedure, Access Management Strategy, and Integrated Watershed Assessment Procedure.

Several kilometers of road have also been deactivated in 1997.

SEKID was initially satisfied with the access management strategy for their community watersheds but deactivation of a water diversion ditch caused some erosion problems and a main access road used by SEKID was deactivated. Both of these problems had to be corrected by SEKID using their own funding. Other than these two problems SEKID was pleased with the deactivation.

Action: Dobson Engineering Ltd. will review the access management strategy, road assessments, channel assessment and past deactivation of roads to identify if there are any outstanding priority sites that require further deactivation.

b) Water Delivery Systems

SEKID's main storage reservoir is located on Hydraulic Lake. Two diversion ditches, one from the upper KLO Creek watershed and one from Pooley Creek, supply water to these lakes.

Hydraulic Lake is usually full sometime in May. Once Hydraulic Lake is full water can spill out towards Idabel Lake. The Idabel Lake road has been washed out as result of the overflows. Water can also be released down Hydraulic Creek, KLO Creek, and Pooley Creek to minimize flows at the south spillway on Hydraulic Lake.

Action: Don Dobson will talk to Stu Mould (Mould Engineering Ltd.) regarding peak flows and how the reservoirs might impact peak flows.

SEKID plans on constructing a storage reservoir on Turtle lake and divert Sterling Creek into the lake in 2002/2003. Approval for diversion has been in place since 1904 and has recently been re-approved.

SEKID expressed concern that recreation activity in the watershed has been a problem especially with vandalism of gates.

Impacts from cattle are also an ongoing concern.

c) Forest Development

The amount of past forest development was described by Rob Scherer based upon preliminary equivalent clearcut area information for the various watersheds. ECA information will be included within the WAP report.

4. Proposed Forest Development

Cam L. described Weyerhaeuser's current forest development plans for 1998 to 2003. Three cutting permits are proposed over the next five years (CP 117, CP 118 and CP 119). The majority of this development is green logging with limited mountain pine beetle attack. Four cutting permits CP 173, CP 174, CP 175 and CP 176 are planned for after 2004.

Action: Dobson Engineering Ltd. is to check to see if CP 173 to CP 176 were included in the ECA calculations

5. Point of Interest/Sub-basin Delineation

Two points of interest (POIs) were agreed upon for the watershed assessment. The first POI is located at the confluence of KLO Creek with Mission Creek and the second POI is located at the confluence of Hydraulic Creek with Mission Creek.

The main sub-basin for the watershed includes the entire area above Hydraulic Lake which includes the Affleck Creek community watershed and Upper KLO Creek watershed. Residual areas include the Hydraulic Creek canyon and the lower portion of KLO Creek below the diversion.

Action: Dobson Engineering Ltd. will also calculate ECAs for the entire KLO Creek watershed since some years the diversion ditch located in the upper KLO Creek watershed is not used allowing flows from the upper KLO Creek watershed to go directly down KLO Creek.

6. Other Items

BC Environment has set water quality objectives for this watershed. As result, Weyerhaeuser can not prescribe forest development that can impact water quality objectives. Monitoring protocol to determine if water quality objectives are being met was not known.

Action: Brian Harris will send copies of the Hydraulic Creek water quality objectives to the WAC members.

Action: Brian Harris will talk to BC Environment to determine what the monitoring protocol is for assessing if water quality objectives are being met. Clarification is required to determine what these objectives mean to the WAP, where are they assessed, and have they been monitored consistently over time.

RS/bp

WQI

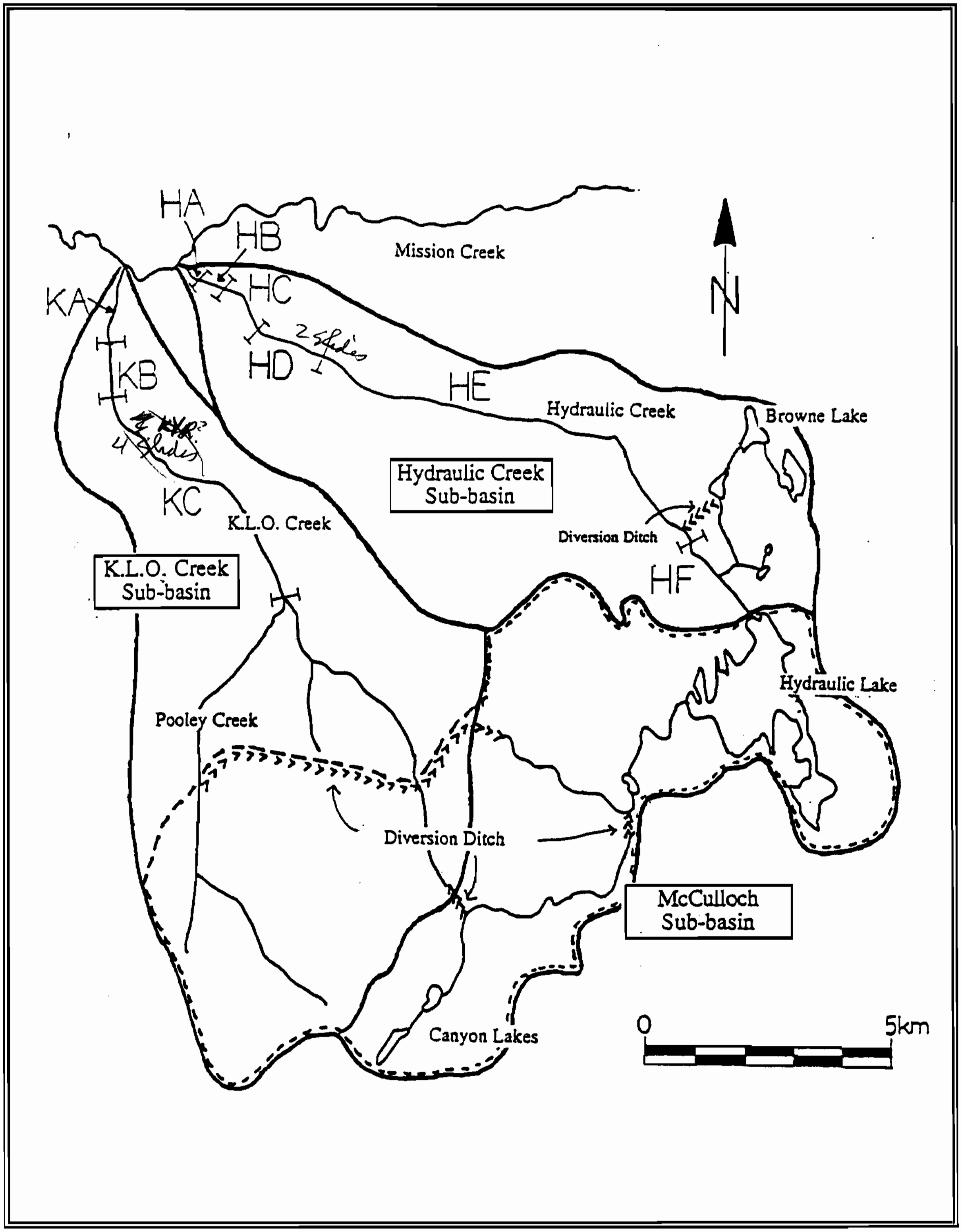


FIGURE 1
Hydraulic and K.L.O. Creeks Reach Break Location Map