IWAP:
(Interior Watershed Assessment Procedure)
Fletcher, Bjerkness, & Kemp Creeks

Submitted to: BC Ministry of Environment , Lands and Parks
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TABLE of CONTENTS

APPENDIX 1, WATERSHED SCORE CARDS

1.0 SUMMARY

Kokanee Forests Consulting Ltd. conducted an Interior Watershed Assessment Procedure (IWAP), Level 1 for the Fletcher, Bjerkness, and Kemp Creek watersheds. This assessment work included collection and compilation of data and the assessment process described in the Interior Watershed Assessment Procedure Guidebook. No field checking was undertaken within the scope of this project.

It is important to appreciate that the results should be taken as an indicator of a potential for problems. The procedure may overestimate a potential hazard. On the basis of the Level 1 assessment, the following further works are recommended:

Fletcher Creek

All IWAP indicators and impact scores are Low. These scores include consideration of current status and developments proposed for the next five years. No further IWAP assessments are recommended for this watershed.

Kemp Creek

All IWAP indicators and impact scores are Low. These scores include consideration of current status and developments proposed for the next five years. No further IWAP assessments are recommended for this watershed.

Bjerkness Creek Sub-Basin

IWAP indicators include a Moderate potential impact in the Surface Erosion Category. All other impact scores are Low. These scores include consideration of current status and developments proposed for the next five years. Based on these scores and guidelines presented in the IWAP guidebook (September 1995), no further IWAP assessment work is recommended for this watershed.

Lofstead Creek Sub-Basin

IWAP indicators include a High potential impact score in the Surface Erosion category and a Moderate potential impact scores in the Riparian Buffers category. The following recommendations are made for further study and rehabilitation work:

?? Haul road density scores are high, and therefore a program of road deactivation is recommended, consistent with access management requirements. It is expected that the primary opportunities for this deactivation work are in the area north of the proposed blocks in the western portion of the sub-basin and roads within Woodlot 494.

?? An assessment of the timing and extent of surface flow in the lower reaches of Lofstead Creek is recommended. This will help to determine the potential impact of surface erosion concerns on water quality.

Bjerkness Creek, Total Basin

IWAP indicators include a Moderate potential impact score in the Surface Erosion category. Based on these scores and guidelines presented in the IWAP guidebook

(September 1995), no further IWAP assessment work is recommended for the Total Bjerkness Creek watershed. The focus of further IWAP assessment in the Bjerkness Creek watershed should be concentrated in the Lofstead Sub-basin.

2.0 TERMS OF REFERENCE

2.1 General

The IWAP is an important component for the planning and prioritization of works under the Watershed Restoration Program. The IWAP is also a requirement for forest development planning in a community watershed.

There has been no previous assessment work in the study drainages under the Watershed Restoration Program.

2.2 Study Area

The Fletcher, Bjerkness, and Kemp Creek Watersheds are in the Kootenay Lake Forest District and are located south and west of the Village of Kaslo. The study area extends westward from the west shore of Kootenay Lake and comprises a total of 5,216 hectares in all three watersheds. Fletcher Creek and Bjerkness Creek drain eastward into Kootenay Lake and are licenced sources of water for domestic, irrigation, and small scale hydroelectric use. Kemp Creek drains northward into the Kaslo River and is licenced for domestic and irrigation use. All three are designated community watersheds.

These drainages are within the Kokanee Range of the Selkirk Mountains. The upper elevations of the study area lie in Alpine Tundra and the ESSFwcp (Wet Cold Parkland Engelmann Spruce-Subalpine Fir Subzone) biogeoclimatic zones. Mid elevations are in the ESSFwc4 (Selkirk Wet Cold Engelmann Spruce-Subalpine Fir variant) biogeoclimatic zone. At lower elevations these drainages are in the ICHmw2 (Columbia-Shuswap Moist Warm Interior Cedar-Hemlock variant) and ICHdw (Dry Warm Interior Cedar Hemlock Subzone) biogeoclimatic zones.

The watersheds feature steep to very steep slopes at higher elevations. Exposed bedrock is frequent at the highest elevations. All three drainages have high elevation lakes.

Surface soils vary with elevation. Surficial soils in upper mid elevations of Kemp Creek and Fletcher Creek consist generally of deep moderately coarse and very coarse colluvium overlying bedrock. Upper sections of Bjerkness Creek show shallow, moderately coarse colluvium overlying bedrock. Mid-slope areas in all basins show shallow, medium and moderately fine textured colluvium overlying fine-grained bedrock. Lower mid-slope areas of Fletcher and Bjerkness Creek and lower sections of Kemp Creek show sections of coarse and medium textured basal till and colluvium. Coarse textured alluvial deposits are found at the bench areas near the Points of Interest (POI's) for Fletcher and Bjerkness Creeks and at the lower parts of Kemp Creek near the Kaslo River.

Bedrock includes granitic rock of the Nelson Pluton in the western portions of the study area. In the central and eastern parts of the drainages, bedrock consists of argillites, slates, phyllites, and carbonates of the Slocan Formation. The metasedimentary slates and

phyllites are relatively erodible due to the foliations (parallel planes of weakness) that cut through the rock. The argillites and granitic rocks are generally erosion resistant.

3.0 ASSESSMENT PROCEDURE

The IWAP for the Fletcher, Kemp, and Bjerkness Creek Watershed was carried out in accordance with procedures outline in the Interior Watershed Assessment Procedure Guidebook (September 1995). Pertinent geophysical and development information for this watershed was compiled in digital form on a Geographic Information System (GIS) using Arc\Info software.

Proposed watershed and sub-basin boundaries and the Point of Interest, (POI) for the watershed were reviewed by a meeting of stakeholders on January 28, 1997 attended by representatives of the Ministry of Forests, Ministry of Environment, Lands and Parks, Slocan Forest Products Ltd., and Kokanee. Those boundaries were used as the basis for the watershed analyses.

An office assessment of basin characteristics and initial interpretation of geographic and development features was conducted including review of available maps, reports, and air photographs.

For this analysis, all current development was combined with the developments proposed based on current (March 1997) 5-year development plans. These development plans include those prepared by Slocan Forest Products, Meadow Creek Cedar (for areas south of Fletcher Creek), and Woodlot 494 (for areas within the Lofstead Sub-basin).

Following the initial GIS analysis, basin characteristics for areas of concern were reviewed and checked against air photos for accuracy.

4.0 IWAP ANALYSIS

4.1 SUB-BASINS

For purposes of the IWAP assessment, the study area was divided into geographic sub-basins as follows:

Fletcher Creek

Fletcher Creek incorporates a single east-west oriented watershed which drains eastward to Kootenay Lake and has an area of 13.9 km^2 (1,387 hectares). The H60 elevation for Fletcher Creek is 1,680 metres. Fletcher Creek is treated as a distinct unit in this study.

Bjerkness Creek

Bjerkness Creek is composed of two distinct sub-basin units; Bjerkness and Lofstead. The total Bjerkness Creek basin has a combined area of 26.5 km^2 (2,648 hectares). Bjerkness Creek, including both the Bjerkness and Lofstead sub-basins is treated as a distinct unit in this study. The H60 elevation for Bjerkness Creek is 1,420 metres.

Bjerkness

The main channel of Bjerkness Creek runs eastward toward Kootenay Lake from the height of land at Keystone Mountain to the POI at the community water intake. The Bjerkness sub-basin has an area of 18.8 km^2 (1,884 hectares).

Lofstead

A second portion of the Bjerkness Creek drainage is the north-south trending Lofstead Creek which runs southward on a plateau area between a low ridge and the main basin slopes. between This sub-basin has a total area of 7.6 km^2 (764 hectares).

Kemp Creek

The Kemp Creek watershed contains a single unit comprising two main branches of Kemp Creek. The POI for this basin is the community intake. The Kemp basin has a total area of 11.8 km^2 (1,181 hectares). The H60 elevation for Kemp Creek is 1,860 metres. Kemp Creek is treated as a distinct unit in this study.

4.2 WATERSHED DATA

Watershed data are presented on Forms 1 to 9. These forms provide a summary of the basin measurements, and key basin indicators for each sub-basin and for the entire watershed. This information comprises the raw data for calculation of watershed indices which are presented on the Watershed Report Card (Form 10).

The watershed indices shown on Form 10 are numbers between 0.0 and 1.0 which reflect the relative magnitude of that index. Index scores of less than 0.5 are considered as having Low potential impacts. Medium potential impact ratings are given for scores of 0.5 to 0.7, and High potential impact ratings are assigned for scores greater than 0.7. These index scores form the basis for identification of potential watershed constraints and for development of management recommendations in the interpretation phase of the assessment.

The following parameters were used in the analysis:

?? The road inventory from forest cover and TRIM maps was used as the basis for roads and trails within the study area. Additional roads and logging trails not on the maps were added from review of available air photos. The logging trail classification is intended to include bladed trails and not just areas with repeated traffic.

?? Three levels of roads were assigned for use in the analysis. Lengths of roads were weighted according to the following scheme; active haul roads weighted at 1.0, inactive, partly revegetated haul roads weighted at 0.67, and logging trails weighted at 0.33.

?? Stream inventory was based on streams shown on the TRIM maps.

?? Terrain hazard mapping was available from several sources. These included:

TSIL “B” mapping for portions of Fletcher and Bjerkness Creeks, (Banting Engineering, 1996)

Reconnaissance Terrain Stability Mapping, (Peter Jordan, P.Geo., BC Ministry of Forests, 1994)

Some terrain hazard mapping and detailed terrain hazard assessments were done for the lower elevations of Kemp Creek and the area referred to as Kemp Face. These assessments by Integrated Hydropedology (1989), Dobson Engineering (1994), and the mapping by Dobson Engineering (1995) are for areas outside the Kemp Creek basin, and outside of the area influenced by Kemp Creek.

For areas where terrain hazard map coverage was incomplete or non-existent, terrain hazard classes used in the IWAP analysis were based on hillslope gradients such that slopes steeper than 60% were considered potentially unstable.

?? Classification of erodible soils was based on information provided in the Level "B" mapping in conjunction with slope gradients. Where hazard map coverage was incomplete, reference was made to soils classification provided in the "Soil Resources of the Nelson Map Area, RAB Bulletin 20", J.R. Jungen, 1980.

?? Classification of fish bearing streams was based on existing fisheries information. None of these streams are currently classified as fish-bearing, however there are records of stocking in some of the high elevation lakes.

?? Landslides were identified with the available air photos.

?? Private land within the study area was analysed "as is" with no weightings applied. For Fletcher Creek and Kemp Creek, only a minor portion of the study area is private land, and that land is located at low elevations near the Points of Interest. For Bjerkness Creek, a significant portion of the Lofstead sub-basin is private land (just under 18%). A breakdown of ECA calculations for Crown and Private land is provided on Form 8.

?? The IWAP analysis included all existing roads and disturbed areas as well as all roads and openings proposed under the current 5-Year development plan (March 1997). For Kemp Creek, Fletcher Creek, and the Bjerkness sub-basin, existing development was expected to be of low impact potential, therefore no analysis of current (1997) status was undertaken. IWAP scores for these areas which included proposed developments showed Low impact potentials in all categories which suggests that separate analysis of existing and post-development conditions is not warranted.

?? The Lofstead sub-basin showed High and Moderate impact potential scores in several categories, and therefore some discussion is presented of post 5-year plan development conditions comparing Crown land to private land.

The three large drawings; Hydrologic Recovery, Erodible Soils, and Unstable Terrain show the entire study area at a scale of 1:20,000. Features used in the IWAP analysis are shown on these two drawings, including roads, logging trails, streams, private land boundaries (where those boundaries form part of the larger scale digital Forest Cover and TRIM maps), forest tenure boundaries, harvested and burned areas, and their estimated hydrologic recoveries.

These drawings show mapped areas of potentially unstable slopes and erodible soils. A coloured buffer is shown extending 100 metres on each side of the streams to highlight

areas where road development and timber harvest may have a greater potential for impact on the streams. In the analysis of potential logging impacts adjacent to streams, a 20 metre buffer was applied to the logged area boundaries.

5.0 DATA INTERPRETATION

The IWAP produces numerical scores in four impact categories; Peak Flows, Surface Erosion, Riparian Buffers, and Mass Wasting. Each category score is determined from various combinations of two to five of the index scores. Hazard scores for each impact category were determined according to procedures presented in the IWAP Guidebook. These hazard scores are summarized on Form 11.

5.1 INTERPRETATION; FLETCHER CREEK

This drainage covers the southernmost portion of the study area. The basin includes two high elevation lakes; an un-named lake at elevation 1,967 metres and Fletcher Lake at elevation 1,615 metres. The H60 Elevation for Fletcher Creek is 1,680 m.

Access and development in this watershed is confined to the south side of Fletcher Creek (Meadow Creek Cedar) and mostly below the H60 elevation. One block and a portion of a second block were logged in 1976 and planted in 1991. These areas are expected to be at the 25% hydrologic recovery level at the end of the current 5-year period (2002). A portion of a third block is proposed for harvest within the 5-year development plan, and is expected to have 0% hydrologic recovery by the end of the current 5-year period.

The Fletcher Creek sub-basin shows Low impact scores for all indicators.

Based on the impact scores, the Fletcher Creek Sub-basin received a Low hazard index ranking for all categories.

The following recommendations are made for further study and rehabilitation work:

?? No further IWAP study is recommended for this watershed.

5.2 INTERPRETATION; BJERKNESS SUB-BASIN

The Bjerkness sub-basin covers 1,183 hectares at the eastern portion of the watershed. There are a series of high elevation lakes at the western portion of the watershed surrounding Trafalgar Mountain. These lakes are within the boundaries of Kokanee Glacier Provincial Park. The H60 elevation is 1,420 m. The Bjerkness Creek watershed is composed of two quite distinct units; the Bjerkness Sub-basin and the Lofstead Sub-basin.

The Bjerkness sub-basin encompasses the main channel of Bjerkness Creek from the headwaters to the lower elevation benches above Kootenay Lake. There are two main roads through this sub-basin. A secondary road runs through private land along the lower bench area and provides access to properties west of Mirror Lake. A second road provides logging access to higher elevation areas west of Mirror Lake and runs for approximately 2.5 kilometres on the north side of the creek before turning northward. A portion of this logging road is proposed for reconstruction in 1997.

Existing development in the Bjerkness sub-basin includes an area of old logging on private land areas in lower elevations, and an area of cultivated land nearby. Proposed timber

development includes a tiny portion of a proposed clearcut block. A large portion of the upper elevations on the north side of Bjerkness Creek are burned areas rated as having 0% hydrologic recovery.

The Bjerkness sub-basin shows a Moderate impact potential score for Indicator #4 (roads on erodible soils) and Indicator #6 (roads less than 100 m from a stream and on erodible soils). All other scores were rated as Low.

Based on the IWAP scores, this sub-basin shows a Moderate impact score for the Surface Erosion Category. All indicators were rated as Low.

The weighted ECA (Equivalent Clearcut Area) for this sub-basin is estimated to be 22%. This value is judged to be conservative based on the low recovery values applied to the extensive burned areas (dated at 1940) on the north side of the creek. This ECA score will have little effect on the present 5-year development plan because there is no significant harvest currently proposed within this sub-basin. However, if future development is constrained by that conservative rating, then field assessments to evaluate the hydrologic recovery of the burned areas may be warranted.

The following recommendations are made for further study and rehabilitation work:

?? No further IWAP study is recommended for this watershed.

?? Surface erosion scores are based on the density of roads on erodible soils and less than 100m from a steam. Consideration should be given to permanent deactivation of these roads where possible, in accordance with access needs.

5.3 INTERPRETATION; LOFSTEAD SUB-BASIN

The Lofstead sub-basin covers approximately 7.6 km^2 (764 hectares) and consists of two main branches of Lofstead Creek; a gently sloping southward trending main branch and a relatively steep eastward trending tributary which meets the main creek at a plateau area between Mirror Lake and True Blue Mountain.

This sub-basin includes cultivated land near the confluence of the two branches of the creek, and cleared land in the valley bottom. Lofstead Creek runs beside a secondary road and for some distance, functions as the road ditch. Flows in the creek are reportedly seasonal, and surface flow disappears for some distance in the portion of the creek south of the confluence of the tributary with the main branch.

Proposed development in this sub-basin includes 12.6 hectares of clearcuts (two blocks) on Crown land in the western portion of this sub-basin (Slocan Forest Products). Approximately 1.4 kilometres of upgrade and new road construction is proposed to provide access to these blocks. A series of blocks is proposed using a number of harvest systems in the northern part of the sub-basin (Woodlot 494). This sub-basin also includes cultivated and residential land.

Private land constitutes nearly 18% of the total Lofstead Sub-basin. Analysis shows that the ECA on the private land portion of this sub-basin is approximately 5%. This compares to a Crown land ECA of nearly 12%. The total ECA for the sub-basin is 17%. There is

potential for the ECA to increase above the levels determined in this analysis in the event of significant private land logging.

The Lofstead Sub-Basin shows Moderate impact potential scores for Indicators #7 (density of stream crossing) and Indicator #9 (portion of stream logged). **High** impact potential scores were recorded for Indicator #3 and #8 (road density, entire sub-basin), Indicator #4 (roads on erodible soils), Indicator #5 (roads less than 100 m from a stream), and Indicator #12 (roads on unstable slopes).

Based on the impact scores, the Lofstead Sub-Basin received a Moderate hazard impact potential rating for the Riparian Buffers category, and a **High** hazard impact potential rating for the Surface Erosion category.

The Riparian Buffers score appears to be derived from high scores in the portion of stream that is logged, and this in turn has a component of agricultural use of Private land in the lower portion of the sub-basin.

The Surface Erosion rating is derived from roads on erodible soils and roads less than 100 metres from a stream, and to a lesser extent from road density. While it is clear that these indicators identify areas of concern, the potential impact of these parameters on water quality downstream is less certain.

Lofstead Creek reportedly runs underground (i.e. no surface flow) for much or all of the year. Under those conditions, it is expected that surface erosion will have little or no impact on water quality at the Point of Interest (POI) at Bjerkness Creek.

The following recommendations are made for further study and rehabilitation work:

?? Road density scores are high, and therefore a program of road deactivation is recommended, consistent with access management requirements. It is suggested that potential opportunities for deactivation work are in the area north of the proposed blocks in the western portion of the sub-basin and roads within Woodlot 494.

5.4 BJERKNESS CREEK (Combined Bjerkness and Lofstead Sub-Basins)

The Bjerkness Basin (Combined Area) shows Moderate impact scores for Indicator #6 (roads less than 100 metres from a stream and on erodible soils) and Indicator #12 (road on unstable slopes). **High** scores were obtained for Indicator #4 (roads on erodible soils) and Indicator #5 (roads less than 100 m from a stream). All other indicator scores were rated as Low.

Based on the impact scores, the Bjerkness Basin (Combined Area) received a hazard impact rating of Moderate for the Surface Erosion Category. Hazard impact ratings were Low for all other categories.

The following recommendations are made for further study and rehabilitation work:

?? Based on these scores and guidelines presented in the IWAP guidebook (September 1995), no further IWAP assessment work is recommended for the Total Bjerkness Creek watershed. The focus of IWAP assessment work in the Bjerkness Creek

watershed should be concentrated in the Lofstead Sub-basin and based on the factors which create the High and Moderate scores within that sub-basin.

5.5 KEMP CREEK

The Kemp Creek basin covers a total of 11.8 km^2. (1,181 hectares). The extreme southwest corner of the basin borders on KokaneeGlacier Provincial Park. Kemp Creek runs north to northeast and drains into the Kaslo River. The H60 Elevation for Kemp Creek is 1,860m.

Development is restricted to the northeast corner of the sub-basin, near the community water intake (POI). There is no new development proposed in this watershed. Proposed development on the north-facing slopes are concentrated on first order streams which drain northward to the Kaslo River. These areas are outside the study area and will have no impact on the community water intake. A portion of a harvest block proposed for 1998 development, and outside the study area is the only proposed development which may potentially have an impact on Kemp Creek. There is an old burned area in the southeast portion of the basin above the H60 elevation for which zero recovery has been assigned.

The Kemp Creek Basin shows Low impact scores for all indicators. All hazard impact ratings are Low.

The following recommendations are made for further study and rehabilitation work:

?? No further IWAP assessments are recommended for this watershed.

6.0 CLOSURE

This watershed assessment was prepared in accordance with procedures presented in the Interior Watershed Assessment Procedure Guidebook. Recommendations presented in the final edition of this report will have been prepared in consultation with stakeholder groups.

The assessment of terrain features and development structures are based on interpretation of the available information. Professional judgement has been exercised to consider a range of options or interpretations of impact indicators and index scores.

Respectfully submitted,

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APPENDIX 1

WATERSHED SCORE CARDS

FORMS 1 TO 11