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FINAL REPORT

**HURLEY RIVER
LEVEL 1 INTERIOR WATERSHED
ASSESSMENT PROCEDURE (IWAP)**

Prepared for:

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Project #645





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Reference: 645

Mr. George Smith, A.Sc., T.
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Dear Mr. Smith:

Re: Hurley River Level 1 Interior Watershed Assessment Procedure

Summit Environmental Consultants Ltd. is pleased to provide you with four (4) copies of our final (Phase 3) report for the Hurley River Interior Watershed Assessment Procedure (IWAP). This report provides a description of the study area, presents the results of the IWAP analyses, and makes recommendations for follow-up work.

We trust that this completes our assignment to your satisfaction. Please call if you have any questions.

Yours truly,

Summit Environmental Consultants Ltd.

Hugh Hamilton, Ph.D., P.Ag.
Senior Environmental Scientist

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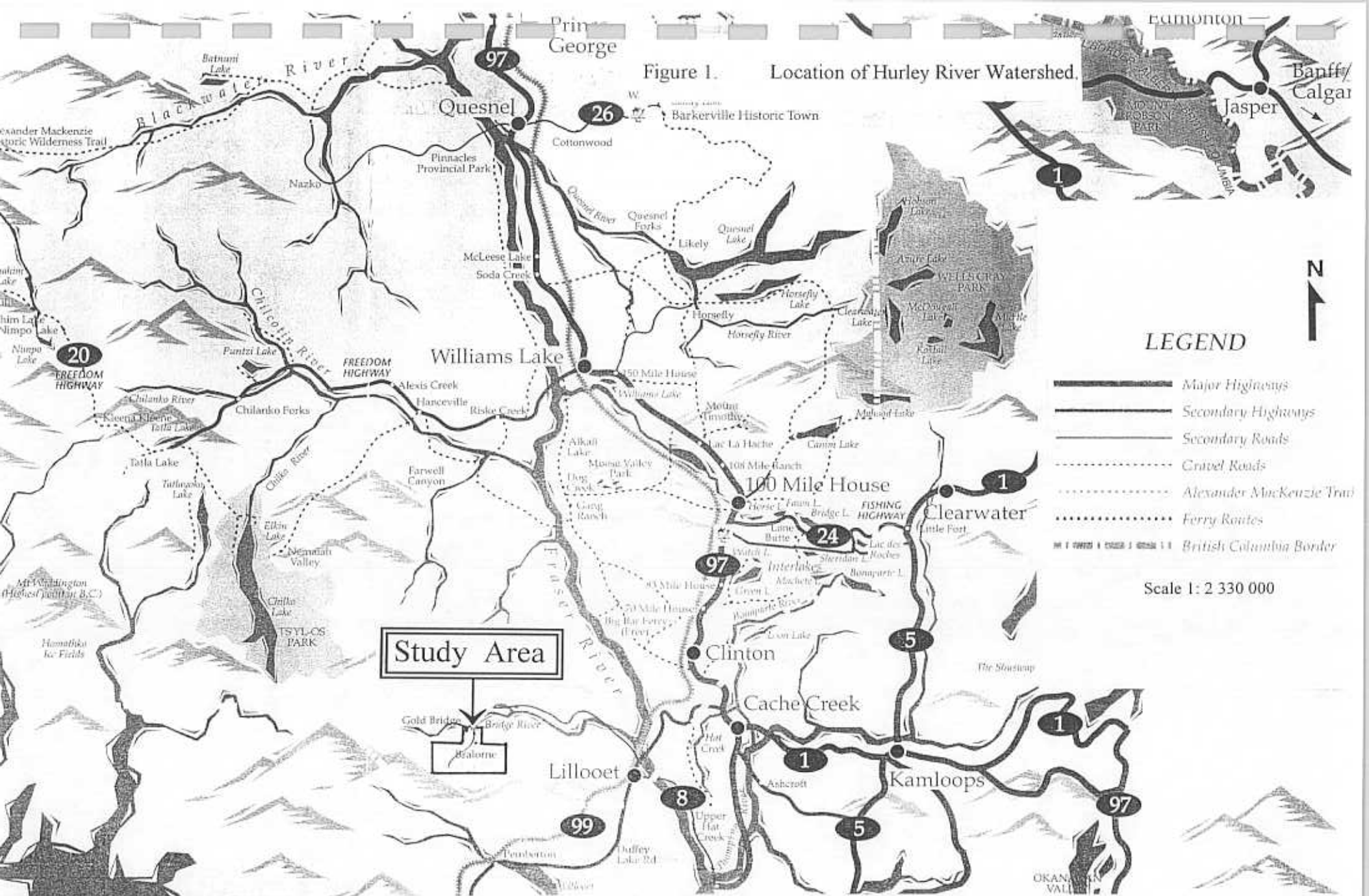
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1.0 INTRODUCTION

1.1 PROJECT BACKGROUND

The Hurley River watershed is located approximately 65 km west of Lillooet, B.C. Hurley River is a tributary of Bridge River, and is thus part of the Fraser River drainage basin (Figure 1). Forest harvest has taken place in the past within the Hurley watershed, and both the Small Business Forest Enterprise Program and Ainsworth Lumber Company are presently conducting forest harvest in the study area. In 1997, a Level 1 Interior Watershed Assessment Procedure (IWAP) was initiated by the B.C. Ministry of Environment, Lands and Parks (MELP). A Level 1 IWAP is intended to help forest planners assess the cumulative effects of past forest harvest, and to determine what additional watershed assessment steps are required to evaluate forest harvest effects on water resources. A Local Resource Use Plan (LRUP) has been completed for the Bralorne area of the Hurley River Watershed (lower portions of Cadwallader Creek, Noel Creek and Hurley River), but detailed resource inventory information is lacking for much of the remainder of the watershed.

In addition to forest harvest, a number of other activities have the potential to effect water resources. Gold mining took place in the watershed near Bralorne from 1863 to 1976 and further mineral exploration work has recently occurred in the same vicinity. Recreational pursuits such as snowmobiling, ski touring, all terrain vehicle use, guide outfitting, and camping also takes place in the watershed. A number of small tributaries of Cadwallader Creek (Cadwallader Creek flows into Hurley River) are used as domestic water sources and Blackbird Creek supplies water to the communities of Bralorne and Bradian (Ministry of Forests, 1993).



1.2 PROJECT OBJECTIVES

The Level 1 IWAP is an office-based reconnaissance level investigation with the objective of identifying potential impacts of road building and forest harvest on watershed resources. All information gathered for the level 1 analysis is taken from existing maps, aerial photographs and reports, supplemented with telephone interviews with persons familiar with the area. The procedure indicates which areas within a watershed are at risk from forest harvest, and helps guide recommendations on follow-up field work (i.e., Level 2 assessments), as required.

Specific objectives for the Hurley River IWAP are to:

1. Delineate sub-basins in the Hurley Creek watershed;
2. Compile 11 watershed indicators for each sub-basin from measurements made from maps and aerial photographs;
3. Calculate hazard indices;
4. Evaluate hazard sensitivity based on the hazard indices values and the quality of information used to generate the indices;
5. Make recommendations for further watershed assessment work.

2.0 METHODS

The Level 1 work completed for the Hurley River watershed followed the methods outlined in the Interior Watershed Assessment Procedure Guidebook (MOF/MELP, 1995). The methodology involves dividing the watersheds into sub-basins, and assessing the hydrologic sensitivity of the sub-basins based on a number of watershed descriptors. Using tables provided in the IWAP Guidebook, scores are assigned to each watershed descriptor, and a Hazard Index Score is calculated for four hazard groups. These hazard groups are:

- Peak Flow Hazard;
- Surface Erosion Hazard;
- Riparian Buffer Hazard; and
- Landslide Hazard.

According to the IWAP guidebook, a Hazard Index Score equal to or above 0.5 indicates an area of concern and the need for a more detailed investigation; that is, a Level 2 Channel Assessment. If all hazard indices are less than 0.5, the guidebook suggests that there may be limited cumulative impacts and no further analysis is required to assess impacts of past forestry activity. If the Surface Erosion Hazard Index is the only index equal to or greater than 0.5, the guidebook suggests that no further IWAP analysis is required.

Information for the Level 1 Watershed Assessment is derived from the sources outlined in Table 1. Results are presented in Section 3.0 of this report. The forms containing detailed measurements are presented in Appendix A. The IWAP spreadsheets on which the hazard indices are computed are presented in Appendix B.

Table 1. IWAP Information Sources for the Hurley River Watershed.

Information	Source	Map Sheet Number / Other Information
1:50 000 NTS topographic maps	Energy Mines and Resources (EMR)	92J/10 (1988), 92J/11 (1970), 92J/15 (1991)
1:250 000 NTS topographic maps	EMR (1989)	92J
1:20 000 TRIM maps	Ministry of Environment, Lands and Parks	92J.055, 92J.056, 92J.065, 92J.067, 92J.068, 92J.075, 92J.076, 92J.077, 92J.078, 92J.086, 92J.087
aerial photographs (1993) 1:15 000 (approximate scale)	Government of British Columbia	30BCC 93080 (152-127), 93086 (4-6,96-100,200-214), 93095 (209-220), 93096 (3-10,78-97,178-198), 93109 (106-117,151-183,1-8), 93110 (51-81), 93104 (189-213,161-176,7-17), 93103 (184-187)
1:50 000 FISS Maps	ECL Envirowest Consultants Limited	92J/10, 92J/11, 92J/15 (1994)
1:50 000 Forest Cover Maps	Ministry of Forests	see list of TRIM sheet above
1:15 000 Bralorne LRUP, Landscape-Viewsheds map, 1993	Ministry of Forests (1993)	
1:15 000 Bralorne LRUP, Landscape-Visual Quality Objectives map	Ministry of Forests (1993)	
1:15 000 Bralorne LRUP, Stability and Erosion Hazard map	Ministry of Forests (1993)	
1:250 000 Geology map	Geological Survey of Canada, EMR	92J Pemberton Area
1:100 000 Biogeoclimatic Units	Lloyd, et al. (1989), Ministry of Forests	92J/NE Bridge River, 92J/NW Lillooet River
1:500 000 Geology of the Southern Coast and Intermontane Belts	Journey, et. al. (1994), Geological Survey of Canada	one mapsheet including 92G, 92H, 92I, 92J

3.0 GENERAL WATERSHED DESCRIPTION

3.1 LOCATION, PHYSIOGRAPHY, AND BEDROCK GEOLOGY

The Hurley River watershed is located in the Pacific Ranges of the Coast Mountains north of Pemberton and west of Lillooet (EMR, 1989). The Hurley River drains into Bridge River between Downtown and Carpenter Lakes. Bridge River then flows east into the Fraser River (Figure 1). The community of Bralorne is within the Hurley River Watershed, and Gold Bridge, on Bridge River, is just downstream of the mouth of Hurley River. Additional descriptive information on the Hurley River watershed is summarized in Table 2.

Table 2. Characteristics of Hurley River Watershed.

Parameter	Value	Formula / Comment
Latitude/ Longitude of Mouth	122°50'50''W, 50°51'10''N	
Watershed area	683.6 km ²	
Basin length	35.75 km	distance from mouth to farthest point
Basin perimeter	151.5 km	
Mainstem channel length	39.0 km	
Sinuosity	1.12	channel length / valley length
Total stream channel length	2232.1 km	"blue line" on 1:50 000 scale map
Highest elevation point	2700 m	
Relief	2010 m	highest point - elevation at mouth
Relief ratio	0.90 m/km	max. relief / total stream channel length
Drainage density	3.27 km/km ²	total stream length / watershed area
Biogeoclimatic zones	IDF, MS, ESSF, AT	Interior Douglas Fir, Montane Spruce, Engelmann Spruce-Subalpine Fir, Alpine Tundra
Ecoregion	Interior Transition Ranges	
Estimated average daily January temperature at mouth	2.3 °C	From Shalath climate station, (elev. 244m) Atmospheric Environmental Service, 1993
Estimated average daily July temperature at mouth	20.9 °C	From Shalath climate station, (elev. 244m) Atmospheric Environmental Service, 1993
Estimated annual rainfall at mouth	1367.7 mm	From Garibaldi climate station, (elev. 381 m) Atmospheric Environmental Service, 1983
Estimated annual snowfall at mouth	478.0 mm	From Garibaldi climate station, (elev. 381 m) Atmospheric Environmental Service, 1983

For the IWAP analysis, the Hurley River watershed has been divided into eleven sub-basins (Figure 2). Table 3 lists the sub-basin names and their assigned sub-basin numbers which are used as identifiers in the forms and spreadsheets found in Appendices A and B.

Table 3. Sub-basin Names and Corresponding Numbers.

Sub-basin Number	Sub-basin Name
1	Upper Hurley River
2	Lone Goat Creek
3	Donnelly Creek
4	Lower Hurley River
5	Hope Creek
6	Lower Noel Creek
7	West Noel Creek
8	Lower Cadwallader Creek
9	East Noel Creek
10	Hawthorn Creek
11	Upper Cadwallader Creek

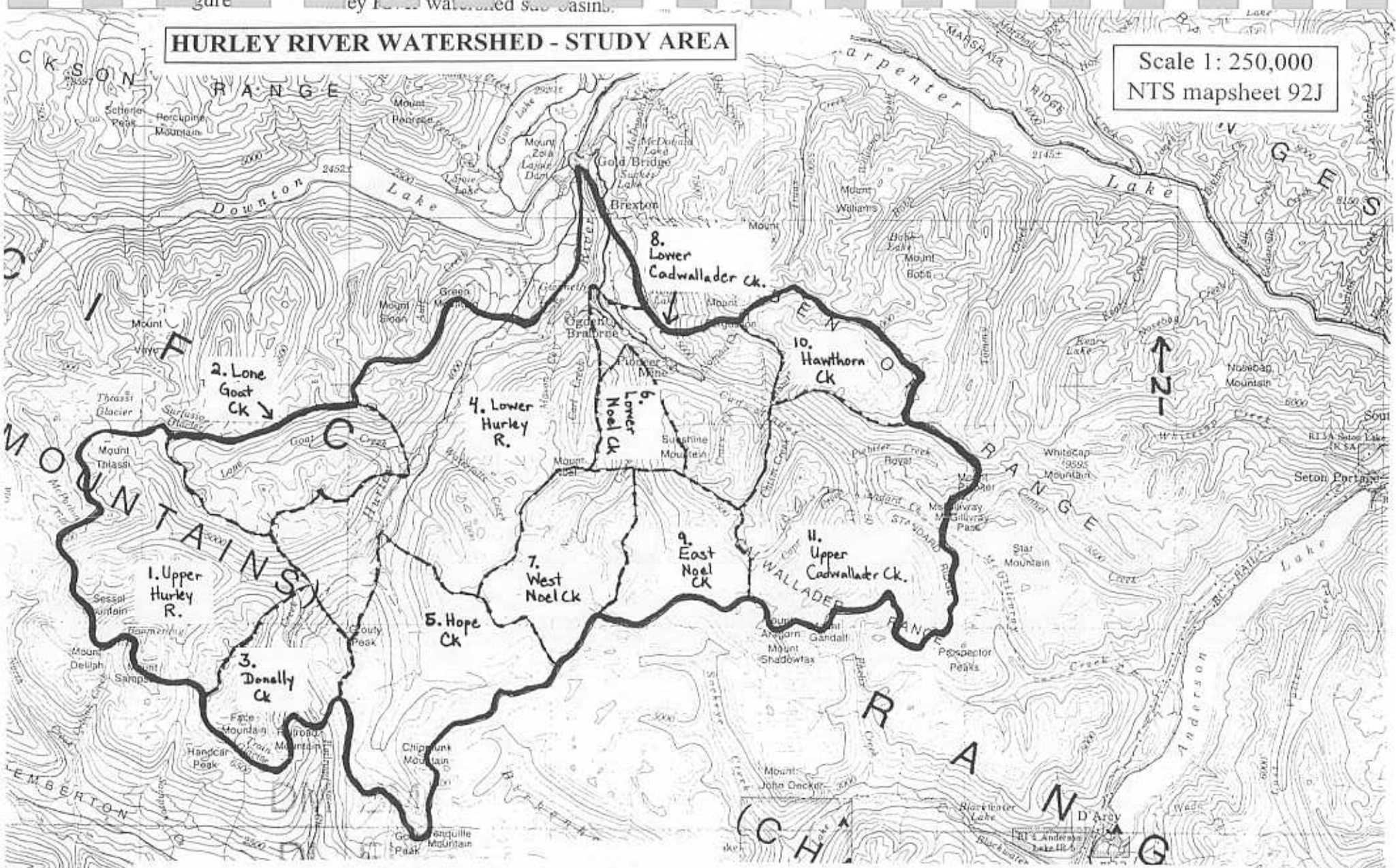
The Hurley River watershed is underlain by a variety of bedrock types with granodiorite and quartz diorite being the most dominant. Other bedrock types include greenstone, sandstone, chert, pelite and mafic volcanic rocks (Journey, et al., 1994). Granodiorite is generally resistant to erosion producing sandy and silty soils with abundant coarse fragments. Greenstone and basalt volcanic flows are resistant to physical erosion, but decompose through oxidation to form soils with a high clay content (MOF/MELP, 1995).

3.2 SURFICIAL GEOLOGY AND SOILS

Detailed soil mapping has not been completed for the majority of the Hurley River watershed. Soils can be inferred, however, from climate, topography and the vegetation growing there. In the alpine tundra, bedrock outcrops and shallow rocky soils would dominate. Podzols and Brunisols would form at lower elevations under coniferous forests in

HURLEY RIVER WATERSHED - STUDY AREA

Scale 1: 250,000
NTS mapsheet 92J



Scale
1: 250,000

areas of high rainfall. Podzolization and weak melanization are the dominant soil forming processes (Ministry of Forests, 1993).

Surficial geology has not been mapped for the Hurley River watershed area, but surficial materials likely consist of a mixture of glacial till, colluvium, and fluvio-glacial deposits. An ash veneer covers most of the soils in the LRUP study area indicating that the area was once influenced by volcanic activity.

3.3 CLIMATE AND BIOGEOCLIMATIC ZONES

Relief in the Hurley River watershed ranges from approximately 690 to 2700 metres above sea level on the eastern side of the Cascade Ranges (EMR, 1989). The topography and climate conditions within the Hurley River watershed are reflected by the vegetation. The lower parts of the watershed fall within the Cascade dry cool Interior Douglas-fir zone (IDF dk 2) (Lloyd et al., 1989a). This zone consists of stands of lodgepole pine and Douglas-fir, and has a warm, dry climatic regime resulting in moisture deficits. As the elevation increases in the Hurley River watershed the IDF dk 2 subzone blends into the dry cold montane Spruce subzone (MS dc), the dry very cold Engelmann spruce and Subalpine fir subzone (ESSF dv), the wet mild Engelmann spruce and Subalpine fir subzone (ESSF wm), and then two Alpine tundra Engelmann spruce complex subzones (AT-E wmp and AT-Edcp) (Lloyd, et al., 1989a & 1989b).

The closest climate station, Shalath, is east of the study area and is located at 50°44' N and 122°13' W at 244 m elevation, between Seton and Carpenter Lakes. The normal (1961-90) annual precipitation measured at Shalath is 520.2 mm with 97.1 mm falling as snow. The wettest month on average is January with a total monthly average precipitation value of 87.4 mm. The driest month was April with a total monthly average recorded at 22.7 mm. The annual average temperature is 9.6°C. The monthly average temperatures fall below zero for December and January (-1.0°C and -2.3°C). The warmest months are July and August with

the monthly average temperatures both reaching 20.9°C. It is important to note that the Shalath station is located in a valley bottom approximately 450 m lower than the mouth of Hurley River. Precipitation levels at greater elevations in the Hurley River watershed would be considerably higher while temperatures would be considerably cooler.

3.4 STREAMFLOW

A streamflow gauging station (Station No. 08ME011), located on Hurley River near Bralorne at latitude 50°46'05" N and longitude 122°51'25" W, recorded discharge between 1926 and 1936 (Water Survey of Canada, 1989). During 1926 and 1936, the highest monthly mean discharge rates were recorded between May and August with the greatest monthly mean discharge occurring in June (42.3 m³/s). This is typical for an interior watershed where high flows are generally experienced during spring snowmelt. The lowest monthly mean discharge rate was recorded in January (2.2 m³/s). The highest daily discharge for the period of record occurred on May 31, 1936 when a maximum daily discharge of 130 m³/s was measured.

3.5 FISHERIES

An electrofishing survey was completed by R.P. Griffith & Associates in September 1995 at 42 sites on Hurley River and Cadwallader Creek and the following tributaries: Noel, Hawthorn, Piebiter, Carl, Waterfalls, unnamed stream north of Waterfalls Creek, Lone Goat, Hope, and Donnelly Creeks (Figure 2). Incidental numbers of rainbow trout were found in Hurley River, and none upstream of Waterfalls Creek. The numbers were likely low due to the high turbidity in Hurley River, Donnelly and Lone Goat Creeks resulting from the addition of sediment transported by glacial meltwater. Sculpins were found in Hurley River downstream of the falls near the mouth of Cadwallader Creek. Of the smaller streams surveyed, Cadwallader, Hawthorn, Piebiter and Waterfalls were the only ones containing fish with the only captured species being rainbow trout. Fry numbers were low except for

adjacent to the abandoned Pioneer Mine on Cadwallader Creek. No bull trout were captured during this survey (R.P. Griffith & Associates, 1995). However, stream information summary maps (92J/10/11/15) revised by ECL Envirowest Consultants Limited (1994) indicate that bull trout have been found in Hurley River from the mouth to just past Hope Creek.

4.0 IWAP RESULTS AND DISCUSSION

4.1 PEAK FLOW HAZARD

The peak flow hazard index is a measure of how logging and road building in a watershed can affect maximum flow rates (MOF/MELP, 1995). The affects of logging are measured by determining the density of equivalent clearcut area (ECA) above and below the H_{60} line. Equivalent clearcut area of a cutblock is defined as the area logged multiplied by the reduction factor that takes into account forest regeneration since harvest.

The removal of forest canopy by clearcutting can impact peak flows (MOF/MELP, 1995). In forested areas, snow covering trees, shrubs and the ground sublimates into the air reducing the amount of snow accumulation. In clearcut areas less snow is exposed to the air and greater amounts of snow accumulate over the winter. In addition, exposure to solar radiation in clearcut areas will lead to quicker melting rates.

The greater accumulation of snow and the increase in melt rate above the H_{60} line can increase runoff. Peak flows in interior watersheds typically occur in spring when snow only remains in the top 60% of the watershed area. To take the effect of logging at higher elevations into account, the equivalent clearcut area above the H_{60} line is multiplied by 1.5. Since the majority of harvesting has taken place in the lower elevations of the Hurley River watershed (29.98 km² cut below the H_{60} line and 1.32 km² cut above the H_{60} line), the weighting of the ECA values has little effect on the peak flow hazard index.

The equivalent clearcut areas (ECAs) for the eleven sub-basins are listed in Table 4. They range between zero percent (Sub-basin 10) and 13% (Sub-basin 4). The ECA for the whole Hurley River watershed is 5%. All estimated ECAs are well within the threshold level of 20% of watershed area where changes in hydrologic regime are typically detectable (Reksten, 1991). The peak flow hazard indices (Form 11) range from zero (Sub-basin 10) to 0.22 (Sub-basin 4). All are less than 0.5 which indicates that the risk of peak flow impacts is "low" in all sub-basins.

Similar to harvested areas, the majority of road length for the Hurley River watershed has been built below the H_{60} line (Form 3). Therefore, cleared road length would have little effect on peak flows. Only Upper Cadwallader Creek (sub-basin 11) was recorded as having roads above the H_{60} line.

Digital forest cover information dated 1994 and 1995 was used to calculate the ECAs and road lengths. Some small business forest enterprise logging has taken place in Upper Hurley River, Lone Goat, Donnelly and Hope Creeks since 1994 and 1995, and has not been included in the ECA calculations. However, the amount of post-1995 harvest is insufficient to increase any of the peak flow scores to >0.5 .

Table 4. Equivalent Clearcut Areas (ECAs) for the Hurley River Sub-basins.

Sub-basin	Area (km ²)	ECA Above H ₆₀ (km ²)	ECA Below H ₆₀ (km ²)	Total ECA (km ²)	ECA% of basin area	Weighted ECA%
1	91.65	0.516	1.83	2.35	3%	3%
2	44.37	0	0.235	0.24	1%	1%
3	37.53	0.012	0.981	0.99	3%	3%
4	152.66	0.255	19.843	20.10	13%	13%
5	74.17	0.534	2.61	3.14	4%	5%
6	16.93	0	0.544	0.54	3%	3%
7	44.65	0.0002	0.069	0.07	<1%	<1%
8	51.73	0	1.22	1.22	2%	2%
9	37.26	0.007	1.66	1.67	4%	4%
10	31.38	0	0	0.00	0%	0%
11	101.31	0	0.979	0.98	1%	1%
Total	683.6	1.3	30.0	31.3	5%	5%

4.2 SURFACE EROSION HAZARD

The surface erosion hazard index assesses the potential for sediment to enter a stream and affect water quality and fish habitat (MOF/MELP, 1995). This index takes into account roads built on erodible soils, roads built within 100 metres of a stream and the number of stream crossings. Road cutslopes, fillslopes and surfaces, exposed to erosion by rainwater and snowmelt, are potential sediment sources, and crossings provide sites where sediment can be delivered to stream systems.

Soil mapping is unavailable for most of the Hurley River watershed, with the exception of the Bralorne Local Resource Use Plan area which was mapped by Dr. Terry Lewis from aerial

photographs in 1993 (Ministry of Forests, 1993). Very little ground truthing took place as part of that mapping exercise. Nevertheless, the Lewis map does classify the soils by erodibility (low, moderate, high, very high) which provides an opportunity to compare the mapped erodibility against other methods for assessing erodibility.

In the absence of soil mapping, the IWAP Guidebook suggests identifying erodible soils as either, i) soils developed on lacustrine, glaciolacustrine, or glaciofluvial terraces, or ii) soil on terrain with >60% slope, except rock (p. 59). For the Hurley River IWAP we have employed the latter definition. The sensitivity of the effect of using this definition on the resulting scores was evaluated by comparing the coverage of "erodible soils" mapped by Lewis to slopes >60%. The results indicate that the areal coverages for the two methods are very similar, and there would be no difference in the resulting surface erosion hazard rating (low, moderate, high). There are differences, however, in the specific areas identified as erodible. It is important to note that either of the methods used in the Bralorne area overestimate the extent of erodible soils compared to just mapping lacustrine, glaciolacustrine, or glaciofluvial terraces.

Four sub-basins in the study area, Donnelly, Lower Hurley, Lower Noel, Lower Cadwallader (Sub-basins 3, 4, 6 and 8), have erosion hazard index values greater than 0.5 (Form 11). Between 37% and 65% of their total road lengths are within 100 metres of a stream. Lower Hurley and Lower Noel sub-basins also have the highest densities of stream crossings in the study area with measurements of 1.11 and 1.18 stream crossings/km² (Form 10). The lower portion of Noel Creek consists of slow moving reaches which typically have higher sensitivity to damage from sedimentation. Parts of the lower reaches of Hurley River and Cadwallader Creeks have been mapped as having high soil erodibility within the Bralorne LRUP area (Ministry of Forests, 1993).

Upper Cadwallader and East Noel Creek sub-basins have approximately 71% of their total road lengths within 100 metres of a stream, but the erosion hazard indices were only 0.48 and 0.41 (Form 10). These lower hazard index scores reflect that the density of road length within

100 m of a stream, and the road density for the entire sub-basin is less than those measured for the four sub-basins with hazard indices greater than 0.5.

The key factors contributing to a surface erosion hazard index greater than 0.5 in the Hurley River watershed are the density of roads less than 100 metres from a stream (km/km^2), the density of stream crossings (number of crossings/ km^2), and the total road density in the sub-basin (km/km^2). Length of road on erodible soil does not appear to be a key factor; however, given the lack of ground-truthed information on soil erodibility, a field assessment is suggested to confirm the above surface erosion ratings.

4.3 RIPARIAN BUFFER HAZARD

The riparian buffer hazard index is a measure of how logging has affected riparian habitat and fish bearing streams (MOF/MELP, 1995). Fish bearing streams for the project area were determined from confirmed field observations by R.P. Griffith & Associates and Stream Information Summary maps (R.P. Griffith & Associates, 1995; ECL Envirowest Consultants Limited, 1994). In addition, for streams with no fish inventory data, stream lengths with less than 20% slope were inferred to be fish bearing. Length of fish bearing stream logged was estimated for this analysis by including all those fish bearing streams that flow through cutblocks.

The amount of harvesting in riparian zones is low throughout the Hurley River watershed with the highest riparian hazard index score reaching 0.29 in Lower Hurley River (sub-basin 4). Recent small business forest harvesting should have had negligible effect on the riparian hazard index, assuming the harvest followed Forest Practices Code guidelines for riparian area protection.

4.4 MASS MOVEMENT HAZARD

The landslide hazard index is a measure of potential sediment source stream impacts (MOF/MELP, 1995). This index takes into account natural and human-caused slides as well as length of road and presence of logging on unstable terrain.

As with erodible soils, the only terrain mapping for the study area is the Lewis map of the Bralorne LRUP area. Comparison of Lewis' Class 4 and Class 5 terrain with slopes $>60\%$ found close agreement in overall areal coverage, and only small differences in the specific location of potentially unstable/unstable terrain. Thus there is only a negligible difference in the effect of the two methods on the Landslide hazard index.

The Hurley River watershed contains considerable areas of mountainous terrain, and there are numerous natural mass movement features including avalanche tracks, talus slopes, and debris chutes. The Landslide Hazard Index is the only IWAP index that includes natural features in the index (i.e., landslides do not have to be caused by forest harvest to be counted). If all mass movement features identified on aerial photographs were counted (high estimate), all resulting landslide indices would be high (>0.7 , probably 1.0). To provide more spatial resolution, we used two approaches to landslide inventory; i) counting only those mass movement features which can be linked to roads or cutblocks (low estimate), and ii) adding other significant landslides (large size or near streams) (moderate estimate). Using the "low" method, only Lower Noel Creek (sub-basin 6) has a score >0.5 (Form 11). Using the "moderate" method, ten of the 11 basins have scores >0.5 (bracketed scores on Form 11), and seven of these have scores >0.7 suggesting a high landslide hazard. Lower Noel Creek sub-basin has both the highest density of landslides and roads on unstable terrain within the study area. No logging has occurred in any of the sub-basins on slopes $>60\%$.

Of the three possible approaches to landslide inventory, the “moderate” estimate provides the most appropriate indication of landslide risk by combining forest harvest-related slides with natural slides which reflect the potential for stream impacts. Like the case of erodible soils, some field evaluation of mass movement hazard is recommended.

4.5 SUMMARY OF HAZARD INDICES

Four hazard indices were calculated for each sub-basin as indicators of disturbance resulting from logging and natural landslides. Measurements made from maps and aerial photographs for each sub-basin were entered into the MOF IWAP Excel spreadsheet which generated the hazard scores (Form 10). These scores were then used to generate hazard indices as indicators for peak flow, surface erosion, riparian buffers and mass wasting (Table 5). Hazard indices less than 0.5 indicated low impact, greater than 0.5 and less than 0.7 indicated medium impact, and greater than 0.7 indicated high impact.

No sub-basins had index values greater than 0.5 for the peak flow and riparian buffer indices. Only four sub-basins have surface erosion indices greater than 0.5 (Lower Hurley River, Donnelly, Lower Noel, and Lower Cadwallader Creeks). When only counting human caused slides, Lower Noel Creek (Sub-basin 6) is the only sub-basin that has a mass wasting hazard index greater than 0.5. When counting human slides and the number of significant natural slides (slides large in size or connected to creeks), ten of the 11 sub-basins had mass wasting hazard indices greater than 0.5 with seven of these being greater than 0.7 (bracketed scores in Table 5). Hope Creek (Sub-basin 5) was the only sub-basin that had no hazard indices greater than 0.5.

Table 5. Hurley River Watershed Hazard Indices.

<i>HURLEY RIVER</i>	Sub-basin Name										
	sb-1	sb-2	sb-3	sb-4	sb-5	sb-6	sb-7	sb-8	sb-9	sb-10	sb-11
Impact category											
Peak flow	0.05	0.01	0.06	0.22	0.08	0.09	0.01	0.12	0.07	0	0.04
Surface erosion	0.18	0.05	0.52	<u>0.99</u>	0.30	<u>0.96</u>	0.33	<u>0.89</u>	0.41	0.03	0.48
Riparian buffer	0	0.04	0.04	0.29	0.07	0.12	0.01	0.02	0.23	0	0.03
Mass wasting (1)	0	0	0.02	0.04	0.01	0.53	0.11	0.39	0	0.01	0.01
	<u>(0.75)</u>	<u>(0.71)</u>	<u>(0.56)</u>	<u>(1.0)</u>	<u>(0.01)</u>	<u>(0.92)</u>	<u>(0.71)</u>	<u>(1.0)</u>	<u>(0.60)</u>	<u>(0.86)</u>	<u>(0.58)</u>

Notes:

1. Mass wasting indices include only forest-harvest related landslides. Indices in brackets include other significant mass movement features (large size or near streams).
2. 'Medium' hazard indices >0.5 are shown in bold.
3. 'High' hazard indices >0.7 are shown in bold and underlined.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Cumulative impacts from logging and road building appear to be relatively small based on the results of the Level 1 Interior Watershed Assessment Procedure. The peak flow and riparian buffer hazard indices were less than 0.5 for all 11 sub-basins, indicating low risk of peak flow impacts. The surface erosion hazard index exceeded 0.5 for Lower Hurley River, Donelly, Lower Noel and Lower Cadwallader Creeks (Sub-basins 4, 3, 6, and 8). A high sub-basin density for roads built within 100 m of a stream, for the number of stream crossings and the

total road length were contributing factors to the medium and high hazard surface erosion ratings. Roads built on erodible soils did not appear to be a contributing factor, but the values for this measurement could change if detailed erodible soil mapping was completed for the Hurley River watershed. Risks of impacts from mass movement are primarily the result of natural slides. Only Lower Noel Creek (Sub-basin 6) had a mass movement hazard index score greater than 0.5 based on harvest-related slides alone.

The following recommendations are being made based on the IWAP results:

1. Overview stream channel assessments are recommended for Sub-basins 1 to 4 and 7 to 11. The IWAP criteria for follow-up Level 2 work is only met in these sub-basins due to the relatively high number of natural landslides;
2. A more detailed channel assessment procedure (CAP) is recommended for Sub-basin 6 (Lower Noel Creek) which had both surface erosion and harvest-related landslide hazard scores greater than 0.5;
3. Areas near road crossings should be looked at in detail in Sub-basin 6 (Lower Noel Creek) as these are areas where sediment can directly enter the creek; and
4. Reconnaissance mapping of erodible soils and unstable terrain in the Hurley River watershed is suggested to confirm the surface erosion hazard scores generated by the IWAP.

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Appendix A
IWAP Forms 1 - 11

FORM 1. Area measurements by elevation band and sub-basin.

Watershed Name: Hurley River

H60 of main watershed: 1730 metres.

Sub-basin name	Area below H60 line (km ²)	Area above H60 line (km ²)	Total area of sub-basin (km ²)	Mapsheets
Sub-basin 1	30.504	61.108	91.649	92J.075,065,064
Sub-basin 2	9.031	35.326	44.369	92J.075,076,065
Sub-basin 3	18.299	19.223	37.533	92J.065,066,055
Sub-basin 4	89.78	62.871	152.663	92J.086,087,076,077, 066,065
Sub-basin 5	33.541	40.606	74.175	92J.065,066,056
Sub-basin 6	10.795	6.133	16.929	92J.076,077
Sub-basin 7	9.699	34.948	44.653	92J.066,076
Sub-basin 8	25.289	26.441	51.734	92J.077,067,076
Sub-basin 9	10.905	26.349	37.264	92J.066,067,076,077
Sub-basin 10	4.028	27.333	31.379	92J.077
Sub-basin 11	30.756	70.536	101.311	92J.067,068,077,078
Total Watershed	272.628	410.875	683.358	

FORM 2. Peak flow index (indicator #1) calculations by sub-basin.

Watershed Name: Hurley River

Sub-basin name	Below H60 line			Above H60 line			Peak flow index Indicator #1 (C+F)
	A ECA (km ²)	B ECA/total sub-basin (km ² /km ²)	C Weighted ECA (B x 1)	D ECA (km ²)	E ECA/total sub-basin (km ² /km ²)	F Weighted ECA (E x 1.5)	
Sub-basin 1	1.83	0.02	0.02	0.52	0.01	0.01	0.03
Sub-basin 2	0.24	0.01	0.01	0.00	0.00	0.00	0.01
Sub-basin 3	0.98	0.03	0.03	0.01	0.00	0.00	0.03
Sub-basin 4	19.84	0.13	0.13	0.26	0.00	0.00	0.13
Sub-basin 5	2.61	0.04	0.04	0.53	0.01	0.01	0.05
Sub-basin 6	0.54	0.03	0.03	0.00	0.00	0.00	0.03
Sub-basin 7	0.07	0.00	0.00	0.00	0.00	0.00	0.00
Sub-basin 8	1.22	0.02	0.02	0.00	0.00	0.00	0.02
Sub-basin 9	1.66	0.04	0.04	0.01	0.00	0.00	0.04
Sub-basin 10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub-basin 11	0.98	0.01	0.01	0.00	0.00	0.00	0.01
Total Watershed	29.98	0.04	0.04	1.32	0.00	0.00	0.05

FORM 3. Road inventory and density (indicators #2, #3 and #8) (see Appendix 9)

Watershed Name: Hurley River

Sub-basin name	Sub-basin area (km ²)	Road above H60 line		Road for entire sub-basin	
		Length (km)	Indicator #2 Density (km/km ²)	Length (km)	Indicator #3 and #8 - Density (km/km ²)
Sub-basin 1	91.65	0.00	0.00	9.98	0.11
Sub-basin 2	44.37	0.00	0.00	2.48	0.06
Sub-basin 3	37.53	0.00	0.00	13.91	0.37
Sub-basin 4	152.66	0.00	0.00	149.43	0.98
Sub-basin 5	74.18	0.00	0.00	14.39	0.19
Sub-basin 6	16.93	0.00	0.00	11.07	0.65
Sub-basin 7	44.65	0.00	0.00	5.08	0.11
Sub-basin 8	51.73	0.00	0.00	49.37	0.95
Sub-basin 9	37.26	0.00	0.00	7.97	0.21
Sub-basin 10	31.38	0.00	0.00	0.71	0.02
Sub-basin 11	101.31	4.19	0.04	21.54	0.21
Total Watershed	683.66	4.19	0.01	285.93	0.42

FORM 4. Roads adjacent to streams (indicators #4, #5, #6 and #7)

Watershed Name: Hurley River

Sub-basin name	Sub-basin area (km ²)	Road on erodible soils		Road within 100 m of a stream		Road within 100 m of a stream on erodible soils		Density of stream crossings	
		Length (km)	Indicator #4 Density (km\km ²)	Length (km)	Indicator #5 Density (km\km ²)	Length (km)	Indicator #6 Density (km\km ²)	Number (no.)	Indicator #7 Density (no.\km ²)
Sub-basin 1	91.65	0.04	0.00	4.47	0.05	0.00	0.00	17.00	0.19
Sub-basin 2	44.37	0.00	0.00	1.33	0.03	0.00	0.00	1.00	0.02
Sub-basin 3	37.53	0.27	0.01	8.99	0.24	0.22	0.01	14.00	0.37
Sub-basin 4	152.66	2.55	0.02	67.90	0.45	1.65	0.01	169.00	1.11
Sub-basin 5	74.18	0.25	0.00	6.75	0.09	0.00	0.00	22.00	0.30
Sub-basin 6	16.93	1.79	0.11	6.99	0.41	0.95	0.06	20.00	1.18
Sub-basin 7	44.65	0.24	0.01	4.31	0.10	0.16	0.00	15.00	0.34
Sub-basin 8	51.73	1.50	0.03	18.61	0.36	0.95	0.02	44.00	0.85
Sub-basin 9	37.26	0.03	0.00	5.67	0.15	0.03	0.00	13.00	0.35
Sub-basin 10	31.38	0.10	0.00	0.21	0.01	0.00	0.00	1.00	0.03
Sub-basin 11	101.31	0.72	0.01	15.46	0.15	0.45	0.00	48.00	0.47
Total Watershed	683.66	7.47	0.01	140.70	0.21	4.41	0.01	364.00	0.53

FORM 5. Riparian buffer impacts (indicators #9 and #10).

Watershed Name: Hurley River

Sub-basin name	Length of stream logged (km)	Total stream length (km)	Indicator #9 Portion of stream logged (km/km)	Length of fish-bearing stream logged (km)	Total length of fish-bearing stream (km)	Indicator #10 Portion of fish-bearing stream logged (km/km)
Sub-basin 1	0.00	287.23	0.00	0.00	46.64	0.00
Sub-basin 2	0.92	89.50	0.01	0.68	31.89	0.02
Sub-basin 3	0.42	94.39	0.00	0.42	19.93	0.02
Sub-basin 4	34.95	411.70	0.09	14.23	98.43	0.15
Sub-basin 5	3.72	230.27	0.02	1.89	52.42	0.04
Sub-basin 6	1.53	41.30	0.04	0.26	7.08	0.04
Sub-basin 7	0.28	164.69	0.00	0.03	20.41	0.00
Sub-basin 8	0.59	120.10	0.01	0.02	25.03	0.00
Sub-basin 9	6.84	246.69	0.03	2.13	18.66	0.11
Sub-basin 10	0.00	86.95	0.00	0.00	15.65	0.00
Sub-basin 11	3.83	459.34	0.01	0.96	59.15	0.02

Total watershed	53.08	2232.16	0.02	20.62	395.31	0.05
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FORM 6. Landslide hazard (indicators #11, #12 and #13).

Watershed Name: Hurley River

Sub-basin name	Sub-basin area (km ²)	Landslides in sub-basin (use air photos)			Road on unstable terrain			Streams whose banks have been logged on slopes >60%	
		Number of forestry induced	Number of natural and forestry induced	Indicator #11 Density (no./km ²) for forestry induced	Density (no./km ²) for natural and forestry induced	Length (km)	Indicator #12 Density (km/km ²)	Length (km)	Indicator #13 Density (km/km ²)
Sub-basin 1	91.65	0	23	0.00	0.25	0.04	0.00	0.00	0.00
Sub-basin 2	44.37	0	10	0.00	0.23	0.00	0.00	0.00	0.00
Sub-basin 3	37.53	0	5	0.00	0.13	0.42	0.01	0.00	0.00
Sub-basin 4	152.66	1	62	0.01	0.41	3.44	0.02	0.05	0.00
Sub-basin 5	74.18	0	0	0.00	0.00	0.25	0.00	0.00	0.00
Sub-basin 6	16.93	2	6	0.12	0.35	1.79	0.11	0.00	0.00
Sub-basin 7	44.65	1	10	0.02	0.22	0.24	0.01	0.00	0.00
Sub-basin 8	51.73	4	21	0.08	0.41	1.49	0.03	0.01	0.00
Sub-basin 9	37.26	0	6	0.00	0.16	0.03	0.00	0.00	0.00
Sub-basin 10	31.38	0	10	0.00	0.32	0.10	0.00	0.00	0.00
Sub-basin 11	101.31	0	15	0.00	0.15	0.72	0.01	0.00	0.00

Total watershed	683.66	8	168	0.01	0.25	8.53	0.01	0.06	0.00
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FORM 7. Other land uses.

Watershed Name: Hurley River

Sub-basin name	Range use close to streams? (yes/no)	Mining close to streams? (yes/no)	All-terrain vehicles close to streams? (yes/no)
Sub-basin 1	No	No	Yes
Sub-basin 2	No	No	Yes
Sub-basin 3	No	No	Yes
Sub-basin 4	No	No	Yes
Sub-basin 5	No	Yes	Yes
Sub-basin 6	No	No	Yes
Sub-basin 7	No	No	Yes
Sub-basin 8	No	Yes	Yes
Sub-basin 9	No	No	Yes
Sub-basin 10	No	No	Yes
Sub-basin 11	No	Yes	Yes

Total watershed	No	Yes	Yes
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FORM 8. Watershed characteristics by sub-basin.

Watershed Name: Hurley River

Sub-basin name	Sub-basin area (km ²)	Crown land		Private land		Operable land	
		area (km ²)	%	area (km ²)	%	area (km ²)	%
Sub-basin 1	91.65	91.65	100.00	0.00	0.00		
Sub-basin 2	44.37	44.37	100.00	0.00	0.00		
Sub-basin 3	37.53	37.53	100.00	0.00	0.00		
Sub-basin 4	152.66	152.14	99.65	0.53	0.35		
Sub-basin 5	74.17	74.17	100.00	0.00	0.00		
Sub-basin 6	16.93	16.93	99.98	0.00	0.02		
Sub-basin 7	44.65	44.65	100.00	0.00	0.00		
Sub-basin 8	51.73	46.55	89.99	5.18	10.01		
Sub-basin 9	37.26	37.26	100.00	0.00	0.00		
Sub-basin 10	31.38	31.38	100.00	0.00	0.00		
Sub-basin 11	101.31	101.31	100.00	0.00	0.00		

Total watershed	683.66	677.95	99.16	5.71	0.84	683.66	100.00
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FORM 9. Watershed characteristics by sub-basin.

Watershed Name: Hurley River

Sub-basin name	Area with unstable slopes App. 5 (km ²)	Area with erodible soils App. 6 (km ²)	Do DFO and/or BC Environ. have temp. concerns? App. 7 (km ²)	Hydrological zone App. 12	Dominant bedrock geology App. 13	Are there glaciers in the sub-basin? (Yes/No)
Sub-basin 1	37.41	37.41		Chilcotin Ranges	quartz diorite	Yes
Sub-basin 2	13.31	13.30		Chilcotin Ranges	quartz diorite	Yes
Sub-basin 3	12.73	12.59		Chilcotin Ranges	greenstone, felsic	Yes
Sub-basin 4	46.27	45.21		Chilcotin Ranges	quartz diorite, chert	Yes
Sub-basin 5	14.50	14.34		Chilcotin Ranges	quartz diorite, greenstone	Yes
Sub-basin 6	6.71	6.67		Chilcotin Ranges	chert, pelite, mafic	No
Sub-basin 7	17.03	17.03		Chilcotin Ranges	quartz diorite, sandstone	Yes
Sub-basin 8	17.43	17.37		Chilcotin Ranges	chert, pelite, gabbro	No
Sub-basin 9	14.21	14.21		Chilcotin Ranges	schist, sandstone,	Yes
Sub-basin 10	13.44	13.42		Chilcotin Ranges	granodiorite, chert	Yes
Sub-basin 11	38.91	38.79		Chilcotin Ranges	granodiorite, quartz diorite,	Yes
Total	231.96	230.33		Chilcotin Ranges	quartz diorite, granodiorite	Yes

Form 10: Watershed Report Card

Watershed name: Hurley River

Impact category	Indicators	Sub-basin name										
		sb-1	sb-2	sb-3	sb-4	sb-5	sb-6	sb-7	sb-8	sb-9	sb-10	sb-11
Peak flow	1. peak flow index	0.03	0.01	0.03	0.13	0.05	0.03	0	0.02	0.04	0	0.01
	2. road density above H ₆₀ line (km/km ²)	0	0	0	0	0	0	0	0	0	0	0.04
	3. road density for entire sub-basin (km/km ²)	0.11	0.06	0.37	0.98	0.19	0.65	0.11	0.95	0.21	0.02	0.21
Surface erosion	4. roads on erodible soil (km/km ²)	0	0	0.01	0.02	0	0.11	0.01	0.03	0	0	0.01
	5. roads < 100m from a stream (km/km ²)	0.05	0.03	0.24	0.44	0.09	0.41	0.1	0.36	0.15	0.01	0.15
	6. roads on erodible soils <100 m from a stream (km/km ²)	0	0	0.01	0.01	0	0.06	0	0.02	0	0	0
	7. no. of stream crossings (no./km ²)	0.19	0.02	0.37	1.11	0.30	1.18	0.34	0.85	0.35	0.03	0.47
	8. road density for entire sub-basin (km/km ²)	0.11	0.06	0.37	0.98	0.19	0.65	0.11	0.95	0.21	0.02	0.21
Riparian buffer	9. portion of stream logged (km/km)	0	0.01	0	0.08	0.02	0.04	0	0	0.03	0	0.01
	10. portion of fish-bearing stream logged (km/km)	0	0.02	0.02	0.14	0.04	0.04	0	0	0.11	0	0.02
Mass wasting	11. no. of landslides (no./km ²)	0	0	0	0.01	0	0.12	0.02	0.08	0	0	0
	12. roads on unstable slopes (km/km ²)	0	0	0.01	0.02	0	0.11	0.01	0.03	0	0	0.01
	13. streambanks logged on slopes >60% (km/km ²)	0	0	0	0	0	0	0	0	0	0	0
Other land uses	Crown range use (Y/N)	N	N	N	N	N	N	N	N	N	N	N
	All-terrain vehicles (Y/N)*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Mining (Y/N)	N	N	N	N	Y	N	N	Y	N	N	Y

* Snowmobile use

Form 11. Hazard Index

<i>HURLEY RIVER</i>	Sub-basin Name										
Impact category	sb-1	sb-2	sb-3	sb-4	sb-5	sb-6	sb-7	sb-8	sb-9	sb-10	sb-11
Peak flow	0.05	0.01	0.06	0.22	0.08	0.09	0.01	0.12	0.07	0	0.04
Surface erosion	0.18	0.05	0.52	0.99	0.30	0.96	0.33	0.89	0.41	0.03	0.48
Riparian buffer	0	0.04	0.04	0.29	0.07	0.12	0.01	0.02	0.23	0	0.03
Mass wasting (1)	0 (0.75)	0 (0.71)	0.02 (0.56)	0.04 (1.0)	0.01 (0.01)	0.53 (0.92)	0.11 (0.71)	0.39 (1.0)	0 (0.60)	0.01 (0.86)	0.01 (0.58)

Shaded values are >0.5 indicating moderate to high risk.

Note 1. Mass wasting indices include only forest-harvest related landslides. Indices in brackets include other significant slides (large size or near streams).

Appendix B
IWAP Calculation Spreadsheets

Data Entry Sheet - IWAP Version 1.03 - November 1995

Enter watershed data in column 1.

Read scores and hazard indices in columns 5 and 6 on next page.

	(1)	(2)	(3)	(4)
Watershed Name?	Subbasin 1 (Upper Hurley)			
Map units are in: (1 = km. and sq.km.; 2 = m. and ha.)	1			
Watershed area?	91,649	sq. km.	*	
Peak Flow and Surface Erosion				
Elevation of H60?	1730	m.		
ECA above H60?	0.5157	sq. km.	*	
ECA below H60?	1.834	sq. km.	*	
Road length above H60?	0	km.	*	
Road length below H60?	9.98	km.	*	
Surface Erosion				
Length of road on erodable soils?	0.037	km.	*	
Length of road within 100 m. of stream?	4.467	km.	*	
Length of road on erodable soils within 100 m. of stream?	0	km.	*	
Number of active stream crossings?	17		*	
Riparian Buffer				
Total stream length?	287,232	km.	*	
Length of stream logged?	0	km.	*	
Total length of fish bearing streams?	46,644	km.	*	
Length of fish bearing streams logged?	0	km.	*	
Landslides				
Number of landslides?	0		*	
Length of road on unstable slopes?	0.037	km.	*	
Length of stream with logged banks and on slopes > 60%	0	km.	*	
Other Land Use and Watershed Characteristics				
Is there range use next to streams?	no			
Is there mining close to streams?	no			
Is there ATV use close to streams?	yes			
Hydrologic zone?	Chicotin Ranges			
Percent area of crown land?	100			
Percent area of private land?	0			
Percent area with unstable slopes?	40.82			
Percent area with erodable soils?	40.82			
Dominant bedrock geology?	quartz diorite			
Is there a fisheries (DFO or MoE) thermal concern?				

Notes:

(2) Enter data in units shown in this column.

(3) An asterisk in this column indicates essential data for calculations.

(4) "err" message in this column indicates an inconsistency in the data.

All cells except B6..B44 are protected.

Calculation Sheet

Subbasin 1 (Upper Hurley)

Map units were identified as:

km. and sq.km.

(5)

(6)

Hazard
Index

Peak Flow

	Indicator	Score	
	Index above H60	0.01	
	Index below H60	0.02	
1	Total Peak Flow Index	0.03	0.05
2	Road density above H60	0.00 km/sq.km.	0.00
3	Total road density (See note below)	0.11 km/sq.km.	0.04
			0.05

Surface Erosion

4	Roads on erodable soils	0.00 km/sq.km.	0.00
5	Roads within 100 m of a stream	0.05 km/sq.km.	0.12
6	Roads that are both of the above	0.00 km/sq.km.	0.00
7	Active stream crossings	0.19 no./sq.km.	0.23
8	Total road density (See note below)	0.11 km/sq.km.	0.04
			0.18

Riparian Buffer

9	Portion of stream logged?	0.00 km/km.	0.00
10	Portion of fish bearing streams logged?	0.00 km/km.	0.00
			0.00

Landslides

11	Landslide density	0.00 no./sq.km.	0.00
12	Roads on unstable slopes	0.00 km/sq.km.	0.00
13	Streams >60% and banks logged	0.00 km/sq.km.	0.00
			0.00

Notes:

The calculations of scores for #3 and #8 above are slightly different.

This spreadsheet is based on the IWAP Guidebook dated September 1995.

However, the spreadsheet is subject to change. Please contact a Forest Service regional hydrologist to ensure that you are using the latest version.

Data Entry Sheet - IWAP Version 1.03 - November 1995

Enter watershed data in column 1.

Read scores and hazard indices in columns 5 and 6 on next page.

	(1)	(2)	(3)	(4)
Watershed Name?	Subbasin 2 (Lone Goat)			
Map units are in: (1 = km. and sq.km.; 2 = m. and ha.)	1			
Watershed area?	44.369	sq.km.	*	
Peak Flow and Surface Erosion				
Elevation of H60?	1730	m.		
ECA above H60?	0	sq.km.	*	
ECA below H60?	0.23523	sq.km.	*	
Road length above H60?	0	km.	*	
Road length below H60?	2.48	km.	*	
Surface Erosion				
Length of road on erodable soils?	0	km.	*	
Length of road within 100 m. of stream?	1.33	km.	*	
Length of road on erodable soils within 100 m. of stream?	0	km.	*	
Number of active stream crossings?	1		*	
Riparian Buffer				
Total stream length?	89.499	km.	*	
Length of stream logged?	0.924	km.	*	
Total length of fish bearing streams?	31.889	km.	*	
Length of fish bearing streams logged?	0.68	km.	*	
Landslides				
Number of landslides?	0		*	
Length of road on unstable slopes?	0	km.	*	
Length of stream with logged banks and on slopes > 60%	0	km.	*	
Other Land Use and Watershed Characteristics				
Is there range use next to streams?	no			
Is there mining close to streams?	no			
Is there ATV use close to streams?	yes			
Hydrologic zone?	Chilcotin Ranges			
Percent area of crown land?	100			
Percent area of private land?	0			
Percent area with unstable slopes?	29.99			
Percent area with erodable soils?	29.98			
Dominant bedrock geology?	quartz diorite			
Is there a fisheries (DFO or MoE) thermal concern?				

Notes:

- (2) Enter data in units shown in this column.
 (3) An asterisk in this column indicates essential data for calculations.
 (4) "err" message in this column indicates an inconsistency in the data.

All cells except B6..B44 are protected.

Calculation Sheet

Subbasin 2 (Lone Goat)

Map units were identified as:

km. and sq.km.

(5)

(6)

	Indicator	Score	Hazard Index
Peak Flow			
	Index above H60	0.00	
	Index below H60	0.01	
	1 Total Peak Flow Index	0.01	0.01
	2 Road density above H60	0.00 km/sq.km.	0.00
	3 Total road density (See note below)	0.06 km/sq.km.	0.02
			0.01
Surface Erosion			
	4 Roads on erodable soils	0.00 km/sq.km.	0.00
	5 Roads within 100 m of a stream	0.03 km/sq.km.	0.07
	6 Roads that are both of the above	0.00 km/sq.km.	0.00
	7 Active stream crossings	0.02 no./sq.km.	0.03
	8 Total road density (See note below)	0.06 km/sq.km.	0.02
			0.05
Riparian Buffer			
	9 Portion of stream logged?	0.01 km/km.	0.03
	10 Portion of fish bearing streams logged?	0.02 km/km.	0.04
			0.04
Landslides			
	11 Landslide density	0.00 no./sq.km.	0.00
	12 Roads on unstable slopes	0.00 km/sq.km.	0.00
	13 Streams >60% and banks logged	0.00 km/sq.km.	0.00
			0.00

Notes:

The calculations of scores for #3 and #8 above are slightly different.

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Data Entry Sheet - IWAP Version 1.03 - November 1995

Enter watershed data in column 1.

Read scores and hazard indices in columns 5 and 6 on next page.

	(1)	(2)	(3)	(4)
Watershed Name?	Subbasin 3 (Donelly)			
Map units are in: (1 = km. and sq.km.; 2 = m. and ha.)	1			
Watershed area?	37.533	sq.km.	*	
Peak Flow and Surface Erosion				
Elevation of H60?	1730	m.		
ECA above H60?	0.0121	sq.km.	*	
ECA below H60?	0.98083	sq.km.	*	
Road length above H60?	0	km.	*	
Road length below H60?	13.91	km.	*	
Surface Erosion				
Length of road on erodable soils?	0.266	km.	*	
Length of road within 100 m. of stream?	8.99	km.	*	
Length of road on erodable soils within 100 m. of stream?	0.221	km.	*	
Number of active stream crossings?	14		*	
Riparian Buffer				
Total stream length?	94.392	km.	*	
Length of stream logged?	0.424	km.	*	
Total length of fish bearing streams?	19.93	km.	*	
Length of fish bearing streams logged?	0.424	km.	*	
Landslides				
Number of landslides?	0		*	
Length of road on unstable slopes?	0.423	km.	*	
Length of stream with logged banks and on slopes > 60%	0	km.	*	
Other Land Use and Watershed Characteristics				
Is there range use next to streams?	no			
Is there mining close to streams?	no			
Is there ATV use close to streams?	yes			
Hydrologic zone?	Chilcotin Ranges			
Percent area of crown land?	100			
Percent area of private land?	0			
Percent area with unstable slopes?	33.92			
Percent area with erodable soils?	33.54			
Dominant bedrock geology?	greenstone, felsic volcanics			
Is there a fisheries (DFO or MoE) thermal concern?				

Notes:

(2) Enter data in units shown in this column.

(3) An asterisk in this column indicates essential data for calculations.

(4) "err" message in this column indicates an inconsistency in the data.

All cells except B6..B44 are protected.

Calculation Sheet

Subbasin 3 (Donelly)

Map units were identified as:

km. and sq.km.

(5)

(6)

	Indicator	Score	Hazard Index
Peak Flow			
Index above H60	0.00		
Index below H60	0.03		
1 Total Peak Flow Index	0.03	0.04	
2 Road density above H60	0.00 km/sq.km.	0.00	
3 Total road density (See note below)	0.37 km/sq.km.	0.12	0.06
Surface Erosion			
4 Roads on erodable soils	0.01 km/sq.km.	0.01	
5 Roads within 100 m of a stream	0.24 km/sq.km.	0.58	
6 Roads that are both of the above	0.01 km/sq.km.	0.03	
7 Active stream crossings	0.37 no./sq.km.	0.47	
8 Total road density (See note below)	0.37 km/sq.km.	0.12	0.52
Riparian Buffer			
9 Portion of stream logged?	0.00 km/km.	0.01	
10 Portion of fish bearing streams logged?	0.02 km/km.	0.04	0.04
Landslides			
11 Landslide density	0.00 no./sq.km.	0.00	
12 Roads on unstable slopes	0.01 km/sq.km.	0.04	
13 Streams >60% and banks logged	0.00 km/sq.km.	0.00	0.02

Notes:

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Data Entry Sheet - IWAP Version 1.03 - November 1995

Enter watershed data in column 1.

Read scores and hazard indices in columns 5 and 6 on next page.

	(1)	(2)	(3)	(4)
Watershed Name?	Subbasin 4 (Lower Hurley)			
Map units are in: (1 = km. and sq.km.; 2 = m. and ha.)	1			
Watershed area?	152.663	sq.km.	*	
Peak Flow and Surface Erosion				
Elevation of H60?	1730	m.		
ECA above H60?	0.2553	sq.km.	*	
ECA below H60?	19.84267	sq.km.	*	
Road length above H60?	0	km.	*	
Road length below H60?	149.43	km.	*	
Surface Erosion				
Length of road on erodable soils?	2.547	km.	*	
Length of road within 100 m. of stream?	67.902	km.	*	
Length of road on erodable soils within 100 m. of stream?	1.649	km.	*	
Number of active stream crossings?	169		*	
Riparian Buffer				
Total stream length?	411.699	km.	*	
Length of stream logged?	34.947	km.	*	
Total length of fish bearing streams?	98.429	km.	*	
Length of fish bearing streams logged?	14.225	km.	*	
Landslides				
Number of landslides?	1		*	
Length of road on unstable slopes?	3.444	km.	*	
Length of stream with logged banks and on slopes > 60%	0.05	km.	*	
Other Land Use and Watershed Characteristics				
Is there range use next to streams?	no			
Is there mining close to streams?	no			
Is there ATV use close to streams?	yes			
Hydrologic zone?	Chilcotin Ranges			
Percent area of crown land?	99.65			
Percent area of private land?	0.35			
Percent area with unstable slopes?	30.31			
Percent area with erodable soils?	29.61			
Dominant bedrock geology?	quartz diorite, chert			
Is there a fisheries (DFO or MoE) thermal concern?				

Notes:

(2) Enter data in units shown in this column.

(3) An asterisk in this column indicates essential data for calculations.

(4) "err" message in this column indicates an inconsistency in the data.

All cells except B6..B44 are protected.

Calculation Sheet

Subbasin 4 (Lower Hurley)

Map units were identified as:

km. and sq km.

(5)

(6)

Hazard
Index

Peak Flow

	Indicator	Score	
	Index above H60	0.00	
	Index below H60	0.13	
	1 Total Peak Flow Index	0.13	0.22
	2 Road density above H60	0.00 km/sq km.	0.00
	3 Total road density (See note below)	0.98 km/sq km.	0.33
			0.22

Surface Erosion

	4 Roads on erodable soils	0.02 km/sq.km.	0.03	
	5 Roads within 100 m of a stream	0.44 km/sq.km.	0.99	
	6 Roads that are both of the above	0.01 km/sq.km.	0.05	
	7 Active stream crossings	1.11 no./sq.km.	1.00	
	8 Total road density (See note below)	0.98 km/sq.km.	0.33	0.99

Riparian Buffer

	9 Portion of stream logged?	0.08 km/km.	0.28	
	10 Portion of fish bearing streams logged?	0.14 km/km.	0.29	0.29

Landslides

	11 Landslide density	0.01 no./sq.km.	0.03	
	12 Roads on unstable slopes	0.02 km/sq.km.	0.08	
	13 Streams >60% and banks logged	0.00 km/sq.km.	0.00	0.04

Notes:

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Data Entry Sheet - IWAP Version 1.03 - November 1995

Enter watershed data in column 1.

Read scores and hazard indices in columns 5 and 6 on next page.

	(1)	(2)	(3)	(4)
Watershed Name?	Subbasin 5 (Hope)			
Map units are in: (1 = km. and sq.km.; 2 = m. and ha.)	1			
Watershed area?	74.175	sq.km.	*	
Peak Flow and Surface Erosion				
Elevation of H60?	1730	m.		
ECA above H60?	0.5337	sq.km.	*	
ECA below H60?	2.61276	sq.km.	*	
Road length above H60?	0	km.	*	
Road length below H60?	14.39	km.	*	
Surface Erosion				
Length of road on erodible soils?	0.249	km.	*	
Length of road within 100 m. of stream?	6.751	km.	*	
Length of road on erodible soils within 100 m. of stream?	0	km.	*	
Number of active stream crossings?	22		*	
Riparian Buffer				
Total stream length?	230.27	km.	*	
Length of stream logged?	3.717	km.	*	
Total length of fish bearing streams?	52.423	km.	*	
Length of fish bearing streams logged?	1.891	km.	*	
Landslides				
Number of landslides?	0		*	
Length of road on unstable slopes?	0.249	km.	*	
Length of stream with logged banks and on slopes > 60%	0	km.	*	
Other Land Use and Watershed Characteristics				
Is there range use next to streams?	no			
Is there mining close to streams?	yes			
Is there ATV use close to streams?	yes			
Hydrologic zone?	Chilcotin Ranges			
Percent area of crown land?	100			
Percent area of private land?	0			
Percent area with unstable slopes?	19.55			
Percent area with erodible soils?	19.33			
Dominant bedrock geology?	quartz diorite, greenstone			
Is there a fisheries (DFO or MoE) thermal concern?				

Notes:

- (2) Enter data in units shown in this column.
 (3) An asterisk in this column indicates essential data for calculations.
 (4) "err" message in this column indicates an inconsistency in the data.

All cells except B6..B44 are protected.

Calculation Sheet

Subbasin 5 (Hope)

Map units were identified as:

km. and sq.km.

(5)

(6)

Hazard
Index**Peak Flow**

Indicator

Score

Index above H60

0.01

Index below H60

0.04

1 Total Peak Flow Index

0.05

0.08

2 Road density above H60

0.00 km/sq.km.

0.00

3 Total road density (See note below)

0.19 km/sq.km.

0.06

0.08**Surface Erosion**

4 Roads on erodable soils

0.00 km/sq.km.

0.01

5 Roads within 100 m of a stream

0.09 km/sq.km.

0.23

6 Roads that are both of the above

0.00 km/sq.km.

0.00

7 Active stream crossings

0.30 no./sq.km.

0.37

8 Total road density (See note below)

0.19 km/sq.km.

0.06

0.30**Riparian Buffer**

9 Portion of stream logged?

0.02 km/km.

0.05

10 Portion of fish bearing streams logged?

0.04 km/km.

0.07

0.07**Landslides**

11 Landslide density

0.00 no./sq.km.

0.00

12 Roads on unstable slopes

0.00 km/sq.km.

0.01

13 Streams >60% and banks logged

0.00 km/sq.km.

0.00

0.01**Notes:**

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Data Entry Sheet - IWAP Version 1.03 - November 1995

Enter watershed data in column 1.

Read scores and hazard indices in columns 5 and 6 on next page.

	(1)	(2)	(3)	(4)
Watershed Name?	Subbasin 6 (Lower Noel)			
Map units are in: (1 = km. and sq.km.; 2 = m. and ha.)	1			
Watershed area?	16.929	sq. km.	*	
Peak Flow and Surface Erosion				
Elevation of H60?	1730	m.		
ECA above H60?	0	sq. km.	*	
ECA below H60?	0.54448	sq. km.	*	
Road length above H60?	0	km.	*	
Road length below H60?	11.07	km.	*	
Surface Erosion				
Length of road on erodable soils?	1.792	km.	*	
Length of road within 100 m. of stream?	6.991	km.	*	
Length of road on erodable soils within 100 m. of stream?	0.951	km.	*	
Number of active stream crossings?	20		*	
Riparian Buffer				
Total stream length?	41.298	km.	*	
Length of stream logged?	1.532	km.	*	
Total length of fish bearing streams?	7.083	km.	*	
Length of fish bearing streams logged?	0.26	km.	*	
Landslides				
Number of landslides?	2		*	
Length of road on unstable slopes?	1.792	km.	*	
Length of stream with logged banks and on slopes > 60%	0	km.	*	
Other Land Use and Watershed Characteristics				
Is there range use next to streams?	no			
Is there mining close to streams?	no			
Is there ATV use close to streams?	yes			
Hydrologic zone?	Chilcotin Ranges			
Percent area of crown land?	99.98			
Percent area of private land?	0.02			
Percent area with unstable slopes?	39.64			
Percent area with erodable soils?	39.42			
Dominant bedrock geology?	chert, pelite, mafic volcanics			
Is there a fisheries (DFO or MoE) thermal concern?				

Notes:

(2) Enter data in units shown in this column.

(3) An asterisk in this column indicates essential data for calculations.

(4) "err" message in this column indicates an inconsistency in the data.

All cells except B6..B44 are protected.

Calculation Sheet

Subbasin 6 (Lower Noel)

Map units were identified as:

km. and sq.km.

(5)

(6)

	Indicator	Score	Hazard Index
Peak Flow			
	Index above H60	0.00	
	Index below H60	0.03	
	1 Total Peak Flow Index	0.03	0.05
	2 Road density above H60	0.00 km/sq.km.	0.00
	3 Total road density (See note below)	0.65 km/sq.km.	0.22
			0.09

Surface Erosion

	4 Roads on erodable soils	0.11 km/sq.km.	0.21	
	5 Roads within 100 m of a stream	0.41 km/sq.km.	0.93	
	6 Roads that are both of the above	0.06 km/sq.km.	0.28	
	7 Active stream crossings	1.18 no./sq.km.	1.00	
	8 Total road density (See note below)	0.65 km/sq.km.	0.22	0.96

Riparian Buffer

	9 Portion of stream logged?	0.04 km/km.	0.12	
	10 Portion of fish bearing streams logged?	0.04 km/km.	0.07	0.12

Landslides

	11 Landslide density	0.12 no./sq.km.	0.53	
	12 Roads on unstable slopes	0.11 km/sq.km.	0.35	
	13 Streams >60% and banks logged	0.00 km/sq.km.	0.00	0.53

Notes:

The calculations of scores for #3 and #8 above are slightly different.

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Data Entry Sheet - IWAP Version 1.03 - November 1995

Enter watershed data in column 1.

Read scores and hazard indices in columns 5 and 6 on next page.

	(1)	(2)	(3)	(4)
Watershed Name?	Subbasin 7 (West Noel)			
Map units are in: (1 = km. and sq.km.; 2 = m. and ha.)	1			
Watershed area?	44.653	sq.km.	*	
Peak Flow and Surface Erosion				
Elevation of H60?	1730	m.		
ECA above H60?	0.0002	sq.km.	*	
ECA below H60?	0.06899	sq.km.	*	
Road length above H60?	0	km.	*	
Road length below H60?	5.08	km.	*	
Surface Erosion				
Length of road on erodable soils?	0.237	km.	*	
Length of road within 100 m. of stream?	4.31	km.	*	
Length of road on erodable soils within 100 m. of stream?	0.158	km.	*	
Number of active stream crossings?	15		*	
Riparian Buffer				
Total stream length?	164.687	km.	*	
Length of stream logged?	0.278	km.	*	
Total length of fish bearing streams?	20.411	km.	*	
Length of fish bearing streams logged?	0.026	km.	*	
Landslides				
Number of landslides?	1		*	
Length of road on unstable slopes?	0.237	km.	*	
Length of stream with logged banks and on slopes > 60%?	0	km.	*	
Other Land Use and Watershed Characteristics				
Is there range use next to streams?	no			
Is there mining close to streams?	no			
Is there ATV use close to streams?	yes			
Hydrologic zone?	Chilcotin Ranges			
Percent area of crown land?	100			
Percent area of private land?	0			
Percent area with unstable slopes?	38.14			
Percent area with erodable soils?	38.14			
Dominant bedrock geology?	quartz diorite, sandstone			
Is there a fisheries (DFO or MoE) thermal concern?				

Notes:

(2) Enter data in units shown in this column.

(3) An asterisk in this column indicates essential data for calculations.

(4) "err" message in this column indicates an inconsistency in the data.

All cells except B6..B44 are protected.

Calculation Sheet

Subbasin 7 (West Noel)

Map units were identified as:

km. and sq.km.

(5)

(6)

	Indicator	Score	Hazard Index
Peak Flow			
Index above H60	0.00		
Index below H60	0.00		
1 Total Peak Flow Index	0.00	0.00	
2 Road density above H60	0.00 km/sq.km.	0.00	
3 Total road density (See note below)	0.11 km/sq.km.	0.04	0.01

Surface Erosion

4 Roads on erodable soils	0.01 km/sq.km.	0.01	
5 Roads within 100 m of a stream	0.10 km/sq.km.	0.24	
6 Roads that are both of the above	0.00 km/sq.km.	0.02	
7 Active stream crossings	0.34 no./sq.km.	0.42	
8 Total road density (See note below)	0.11 km/sq.km.	0.04	0.33

Riparian Buffer

9 Portion of stream logged?	0.00 km/km.	0.01	
10 Portion of fish bearing streams logged?	0.00 km/km.	0.00	0.01

Landslides

11 Landslide density	0.02 no./sq.km.	0.11	
12 Roads on unstable slopes	0.01 km/sq.km.	0.02	
13 Streams >60% and banks logged	0.00 km/sq.km.	0.00	0.11

Notes:

The calculations of scores for #3 and #8 above are slightly different.

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Data Entry Sheet - IWAP Version 1.03 - November 1995

Enter watershed data in column 1.

Read scores and hazard indices in columns 5 and 6 on next page.

	(1)	(2)	(3)	(4)
Watershed Name?	asin 8 (Lower Cadwallader)			
Map units are in: (1 = km. and sq.km.; 2 = m. and ha.)	1			
Watershed area?	51.734	sq.km.	*	
Peak Flow and Surface Erosion				
Elevation of H60?	1730	m.		
ECA above H60?	0	sq.km.	*	
ECA below H60?	1.22494	sq.km.	*	
Road length above H60?	0	km.	*	
Road length below H60?	49.37	km.	*	
Surface Erosion				
Length of road on erodable soils?	1.495	km.	*	
Length of road within 100 m. of stream?	18.614	km.	*	
Length of road on erodable soils within 100 m. of stream?	0.95	km.	*	
Number of active stream crossings?	44		*	
Riparian Buffer				
Total stream length?	120.1	km.	*	
Length of stream logged?	0.591	km.	*	
Total length of fish bearing streams?	25.033	km.	*	
Length of fish bearing streams logged?	0.022	km.	*	
Landslides				
Number of landslides?	4		*	
Length of road on unstable slopes?	1.494	km.	*	
Length of stream with logged banks and on slopes > 60%	0.011	km.	*	
Other Land Use and Watershed Characteristics				
Is there range use next to streams?	no			
Is there mining close to streams?	yes			
Is there ATV use close to streams?	yes			
Hydrologic zone?	Chilcotin Ranges			
Percent area of crown land?	89.99			
Percent area of private land?	10.01			
Percent area with unstable slopes?	33.7			
Percent area with erodable soils?	33.58			
Dominant bedrock geology?	chert, pelite, gabbro			
Is there a fisheries (DFO or MoE) thermal concern?				

Notes:

(2) Enter data in units shown in this column.

(3) An asterisk in this column indicates essential data for calculations.

(4) "err" message in this column indicates an inconsistency in the data.

All cells except B6..B44 are protected.

Calculation Sheet

Subbasin 8 (Lower Cadwallader)

Map units were identified as:

km. and sq.km.

(5)

(6)

	Indicator	Score	Hazard Index
Peak Flow			
	Index above H60	0.00	
	Index below H60	0.02	
	1 Total Peak Flow Index	0.02	0.04
	2 Road density above H60	0.00 km/sq.km.	0.00
	3 Total road density (See note below)	0.95 km/sq.km.	0.32
			0.12

Surface Erosion

	4 Roads on erodable soils	0.03 km/sq.km.	0.06	
	5 Roads within 100 m of a stream	0.36 km/sq.km.	0.82	
	6 Roads that are both of the above	0.02 km/sq.km.	0.09	
	7 Active stream crossings	0.85 no./sq.km.	0.95	
	8 Total road density (See note below)	0.95 km/sq.km.	0.32	0.89

Riparian Buffer

	9 Portion of stream logged?	0.00 km/km.	0.02	
	10 Portion of fish bearing streams logged?	0.00 km/km.	0.00	0.02

Landslides

	11 Landslide density	0.08 no./sq.km.	0.39	
	12 Roads on unstable slopes	0.03 km/sq.km.	0.10	
	13 Streams >60% and banks logged	0.00 km/sq.km.	0.00	0.39

Notes:

The calculations of scores for #3 and #8 above are slightly different.

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However, the spreadsheet is subject to change. Please contact a Forest Service regional hydrologist to ensure that you are using the latest version.

Data Entry Sheet - IWAP Version 1.03 - November 1995

Enter watershed data in column 1.

Read scores and hazard indices in columns 5 and 6 on next page.

	(1)	(2)	(3)	(4)
Watershed Name?	Subbasin 9 (East Noel)			
Map units are in: (1 = km. and sq.km.; 2 = m. and ha.)	1			
Watershed area?	37.264	sq.km.	*	
Peak Flow and Surface Erosion				
Elevation of H60?	1730	m.		
ECA above H60?	0.0073	sq.km.	*	
ECA below H60?	1.66109	sq.km.	*	
Road length above H60?	0	km.	*	
Road length below H60?	7.97	km.	*	
Surface Erosion				
Length of road on erodable soils?	0.028	km.	*	
Length of road within 100 m. of stream?	5.667	km.	*	
Length of road on erodable soils within 100 m. of stream?	0.028	km.	*	
Number of active stream crossings?	13		*	
Riparian Buffer				
Total stream length?	246.694	km.	*	
Length of stream logged?	6.836	km.	*	
Total length of fish bearing streams?	18.664	km.	*	
Length of fish bearing streams logged?	2.133	km.	*	
Landslides				
Number of landslides?	0		*	
Length of road on unstable slopes?	0.028	km.	*	
Length of stream with logged banks and on slopes > 60%	0	km.	*	
Other Land Use and Watershed Characteristics				
Is there range use next to streams?	no			
Is there mining close to streams?	no			
Is there ATV use close to streams?	yes			
Hydrologic zone?	Chilcotin Ranges			
Percent area of crown land?	100			
Percent area of private land?	0			
Percent area with unstable slopes?	38.12			
Percent area with erodable soils?	38.12			
Dominant bedrock geology?	schist, sandstone, qrtz diorite			
Is there a fisheries (DFO or MoE) thermal concern?				

Notes:

(2) Enter data in units shown in this column.

(3) An asterisk in this column indicates essential data for calculations.

(4) "err" message in this column indicates an inconsistency in the data.

All cells except B6..B44 are protected.

Calculation Sheet

Subbasin 9 (East Noel)

Map units were identified as:

km. and sq.km.

(5)

(6)

	Indicator	Score	Hazard Index
Peak Flow			
	Index above H60	0.00	
	Index below H60	0.04	
	1 Total Peak Flow Index	0.04	0.07
	2 Road density above H60	0.00 km/sq.km.	0.00
	3 Total road density (See note below)	0.21 km/sq.km.	0.07

Surface Erosion

	4 Roads on erodable soils	0.00 km/sq.km.	0.00	
	5 Roads within 100 m of a stream	0.15 km/sq.km.	0.38	
	6 Roads that are both of the above	0.00 km/sq.km.	0.00	
	7 Active stream crossings	0.35 no./sq.km.	0.44	
	8 Total road density (See note below)	0.21 km/sq.km.	0.07	0.41

Riparian Buffer

	9 Portion of stream logged?	0.03 km/km.	0.09	
	10 Portion of fish bearing streams logged?	0.11 km/km.	0.23	0.23

Landslides

	11 Landslide density	0.00 no./sq.km.	0.00	
	12 Roads on unstable slopes	0.00 km/sq.km.	0.00	
	13 Streams >60% and banks logged	0.00 km/sq.km.	0.00	0.00

Notes:

The calculations of scores for #3 and #8 above are slightly different.

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Data Entry Sheet - IWAP Version 1.03 - November 1995

Enter watershed data in column 1.

Read scores and hazard indices in columns 5 and 6 on next page.

	(1)	(2)	(3)	(4)
Watershed Name?	Subbasin 10 (Hawthorn)			
Map units are in: (1 = km. and sq.km.; 2 = m. and ha.)	1			
Watershed area?	31.379	sq.km.	*	
Peak Flow and Surface Erosion				
Elevation of H60?	1730	m.		
ECA above H60?	0	sq.km.	*	
ECA below H60?	0	sq.km.	*	
Road length above H60?	0	km.	*	
Road length below H60?	0.71	km.	*	
Surface Erosion				
Length of road on erodable soils?	0.102	km.	*	
Length of road within 100 m. of stream?	0.213	km.	*	
Length of road on erodable soils within 100 m. of stream?	0	km.	*	
Number of active stream crossings?	1		*	
Riparian Buffer				
Total stream length?	86.947	km.	*	
Length of stream logged?	0	km.	*	
Total length of fish bearing streams?	15.652	km.	*	
Length of fish bearing streams logged?	0	km.	*	
Landslides				
Number of landslides?	0		*	
Length of road on unstable slopes?	0.102	km.	*	
Length of stream with logged banks and on slopes > 60%	0	km.	*	
Other Land Use and Watershed Characteristics				
Is there range use next to streams?	no			
Is there mining close to streams?	no			
Is there ATV use close to streams?	yes			
Hydrologic zone?	Chilcotin Ranges			
Percent area of crown land?	100			
Percent area of private land?	0			
Percent area with unstable slopes?	42.84			
Percent area with erodable soils?	42.77			
Dominant bedrock geology?	granodiorite, chert			
Is there a fisheries (DFO or MoE) thermal concern?				

Notes:

(2) Enter data in units shown in this column.

(3) An asterisk in this column indicates essential data for calculations.

(4) "err" message in this column indicates an inconsistency in the data.

All cells except B6..B44 are protected.

Calculation Sheet

Subbasin 10 (Hawthorn)
Map units were identified as:

km. and sq.km.

(5)

(6)

	Indicator	Score	Hazard Index
Peak Flow			
Index above H60	0.00		
Index below H60	0.00		
1 Total Peak Flow Index	0.00	0.00	
2 Road density above H60	0.00 km/sq.km.	0.00	
3 Total road density (See note below)	0.02 km/sq.km.	0.01	0.00

Surface Erosion

4 Roads on erodable soils	0.00 km/sq.km.	0.01	
5 Roads within 100 m of a stream	0.01 km/sq.km.	0.02	
6 Roads that are both of the above	0.00 km/sq.km.	0.00	
7 Active stream crossings	0.03 no./sq.km.	0.04	
8 Total road density (See note below)	0.02 km/sq.km.	0.01	0.03

Riparian Buffer

9 Portion of stream logged?	0.00 km/km.	0.00	
10 Portion of fish bearing streams logged?	0.00 km/km.	0.00	0.00

Landslides

11 Landslide density	0.00 no./sq.km.	0.00	
12 Roads on unstable slopes	0.00 km/sq.km.	0.01	
13 Streams >60% and banks logged	0.00 km/sq.km.	0.00	0.01

Notes:

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Data Entry Sheet - IWAP Version 1.03 - November 1995

Enter watershed data in column 1.

Read scores and hazard indices in columns 5 and 6 on next page.

	(1)	(2)	(3)	(4)
Watershed Name?	basin 11 (Up.Cadwallader)			
Map units are in: (1 = km. and sq.km.; 2 = m. and ha.)	1			
Watershed area?	101.311	sq.km.	*	
Peak Flow and Surface Erosion				
Elevation of H60?	1730	m.		
ECA above H60?	0	sq.km.	*	
ECA below H60?	0.97883	sq.km.	*	
Road length above H60?	4.19	km.	*	
Road length below H60?	17.35	km.	*	
Surface Erosion				
Length of road on erodible soils?	0.722	km.	*	
Length of road within 100 m. of stream?	15.464	km.	*	
Length of road on erodible soils within 100 m. of stream?	0.453	km.	*	
Number of active stream crossings?	48		*	
Riparian Buffer				
Total stream length?	459.34	km.	*	
Length of stream logged?	3.83	km.	*	
Total length of fish bearing streams?	59.149	km.	*	
Length of fish bearing streams logged?	0.96	km.	*	
Landslides				
Number of landslides?	0		*	
Length of road on unstable slopes?	0.722	km.	*	
Length of stream with logged banks and on slopes > 60%	0	km.	*	
Other Land Use and Watershed Characteristics				
Is there range use next to streams?	no			
Is there mining close to streams?	yes			
Is there ATV use close to streams?	yes			
Hydrologic zone?	Chilcatin Ranges			
Percent area of crown land?	100			
Percent area of private land?	0			
Percent area with unstable slopes?	38.41			
Percent area with erodible soils?	38.28			
Dominant bedrock geology?	granodiorite, qrtz diorite, schist			
Is there a fisheries (DFO or MoE) thermal concern?				

Notes:

- (2) Enter data in units shown in this column.
 (3) An asterisk in this column indicates essential data for calculations.
 (4) "err" message in this column indicates an inconsistency in the data.

All cells except B6..B44 are protected.

Calculation Sheet

Subbasin 11 (Up.Cadwallader)

Map units were identified as:

km. and sq.km.

(5)

(6)

Indicator	Score	Hazard Index
Peak Flow		
Index above H60	0.00	
Index below H60	0.01	
1 Total Peak Flow Index	0.01	0.02
2 Road density above H60	0.04 km/sq.km.	0.04
3 Total road density (See note below)	0.21 km/sq.km.	0.07
		0.04

Surface Erosion

4 Roads on erodable soils	0.01 km/sq.km.	0.01	
5 Roads within 100 m of a stream	0.15 km/sq.km.	0.38	
6 Roads that are both of the above	0.00 km/sq.km.	0.02	
7 Active stream crossings	0.47 no./sq.km.	0.57	
8 Total road density (See note below)	0.21 km/sq.km.	0.07	0.48

Riparian Buffer

9 Portion of stream logged?	0.01 km/km.	0.03	
10 Portion of fish bearing streams logged?	0.02 km/km.	0.03	0.03

Landslides

11 Landslide density	0.00 no./sq.km.	0.00	
12 Roads on unstable slopes	0.01 km/sq.km.	0.02	
13 Streams >60% and banks logged	0.00 km/sq.km.	0.00	0.01

Notes:

The calculations of scores for #3 and #8 above are slightly different.

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