Interior Watershed Assessment Update

McKuskey Creek Watershed

1.0 WATERSHED DESCRIPTIVE INFORMATION

Table 1.1 Summary information – Biophysical

Size (km^2)	BEC Zones	Elevation Range (m)	H_{60} Elevation (m)	Stream Density km/km^2	Distribution of slope gradients within the watershed (% of watershed)			
					<10% slope	10 to 30% slope	30 to 60% slope	>60%slope
309.20	ICHwk2 ESSFwk1 /wc3	915 - 2451	1445	1.81	23.08	45.16	28.21	3.55

Table 1.2. Characteristics of main stream reaches – (assessment is based on a combination of air-photo interpretations, TRIM maps, helicopter over-flight and various reports).

Reach ID	Minimum Elevation (m)	Maximum Elevation (m)	Reach Length (m)	Reach Gradient (%)	Stream Disturbance Assessment
Main-R1	917.073	920	2242	0.13%	Stable, irregular channel
Main-R2	920	922.818	1866	0.15%	Stable, irregular channel
Main-R3	922.818	923	7064	0.00%	Stable, irregular channel
Main-R4	923	939.995	4291	0.40%	Stable, irregular channel
Main-R5	939.995	940.4	2401	0.02%	Stable, irregular channel
Main-R6	940.4	940.006	10800	0.00%	Lake
Main-R7	940.006	980.726	2882	1.41%	stable
Main-R8	980.726	998.306	1386	1.27%	stable
Main-R9	998.306	1023.24	3045	0.82%	stable
Main-R10	1023.24	1099.61	3163	2.41%	stable
Main-R11	1099.61	1121.46	1086	2.01%	stable
Main-R12	1121.46	1282.97	2643	6.11%	stable
Main-R13	1282.97	1365.22	2270	3.62%	stable
Main-R14	1365.22	1727.51	3603	10.06%	stable

RPg = Riffle-Pool gravel morphology

2.0 WATERSHED HARVESTING, ROADS AND LAND-USE HISTORY

Table 2.1. McKuskey Creek Watershed

Private	Total harvest 2002 (%)	Current ECA (%)	Planned Harvest (%)	Current ECA below H60 (%)	Current ECA Above H60 (%)	Peak Flow Index		Road Density Active (km/km^2)		Stream Crossing density active (#/km^2)		Road Density De-active (km/km^2)	
						Current (2002) (%)	End of FDP (2007)(%)	Current (2002)	End of FDP (2007)	Current (2002)	End of FDP (2007)	Current (2002)	End of FDP (2007)
0	12.01	19.30	2.82	12.8	6.5	22.5	25.5	0.44	0.51	0.28	0.37	0.13	0.17

3.0 SUMMARY OF EXTENT OF RIPARIAN REMOVAL (agriculture and forestry)

Table 3.1. McKuskey Watershed

Watershed name	Length (km) of riparian removal on small tributaries (<5m in width)	Length (km) of riparian removal on large tributaries (>5m)	% Riparian removal of all tributaries	Length (km) of riparian removal on mainstem	% Riparian removal of mainstem	Total length of all tributaries (from Trim) (km)	Total length of mainstem (km)
McKuskey	44.90	0.60	**8.14**	0.00	**0.00**	559.20	30.37

4.0 SUMMARY OF LARGE SEDIMENT SOURCES

Table 4.1. McKuskey Watershed

Watershed Name	Large natural sediment sources		Large natural sediment sources directly connected to a stream		Large land-use related sediment sources		Large land-use related sediment sources directly connected to a stream		Large sediment sources	
	number	density (#/km^2)	number	density (#/km^2)	number	density (#/km^2)	number	density (#/km^2)	number	density (#/km^2)
McKuskey	28	0.091	14	0.046	4	0.013	4	0.013	34	0.110

5.0 SUMMARY OF LAND-USE ACTIVITIES ON UNSTABLE TERRAIN

Table 5.1. McKuskey Watershed

Watershed	Length of road on unstable terrain (km)		Area of cut blocks on unstable terrain (km^2)		Road density on unstable terrain (km/km^2)	Source of information for stability assessment
	Active	Proposed	Harvested	Proposed		
McKuskey	0	0	0	0	0.0000	slope>60%

6.0 SUMMARY OF ROAD RELATED SOURCES OF SURFACE EROSION

Table 6.1 McKuskey Watershed - summary of stream crossing sediment source survey –			
Number of crossings surveyed	Estimated total # of crossings (TRIM maps)	Percentage surveyed	Watershed Size (km^2)
48	100	48.00%	309.2

Table 6.2 Summary of Water Quality Concern Ratings (WQCR) – McKuskey Watershed							
No Concern		**Low**		**Medium**		**High**	
Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
16	33.33	14	29.17	6	12.50	12	25.00

Stream Width Class	Table 6.3 Summary of Water Quality Concern Ratings by Stream Size - McKuskey Watershed								# of streams surveyed per class
	None		Low		Medium		High		
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	
1	2	100.00%	0	0.00%		0.00%	0	0.00%	2
2	3	60.00%	1	20.00%	1	20.00%	0	0.00%	5
3	5	62.50%	2	25.00%	0	0.00%	1	12.50%	8
4	6	21.43%	9	32.14%	4	14.29%	9	32.14%	28
5	0	0.00%	2	40.00%	1	20.00%	2	40.00%	5

Table 6.4 ESC Summary - McKuskey	
WQCR	"Equivalent" number of stream crossings
No Concern	0.0
Low	8.8
Moderate	8.8
High	25.0
Total	42.5

Table 6.5 Surface erosion hazard – McKuskey Watershed	
Equivalent stream crossing density (xings/km^2)	Surface Erosion Hazard
0.14	LOW

7.0 SUMMARY OF MAINSTEM CHANNEL CONDITIONS

Table 7.1. Extent of channel disturbance

Reach ID	Reach Length (m)	Reach Gradient (%)	Length disturbed (m)	% of channel disturbed	Level of channel disturbance	Probable cause of disturbance
Main-R1	2242	0.1%	0	0	Low	N/a
Main-R2	1866	0.2%	0	0	Low	N/a
Main-R3	7064	0.0%	0	0	Low	N/a
Main-R4	4291	0.4%	0	0	Low	N/a
Main-R5	2401	0.0%	0	0	Low	N/a
Main-R6	10800	0.0%	0	0	Low	N/a
Main-R7	2882	1.4%	0	0	Low	N/a
Main-R8	1386	1.3%	0	0	Low	N/a
Main-R9	3045	0.8%	0	0	Low	N/a
Main-R10	3163	2.4%	0	0	Low	N/a
Main-R11	1086	2.0%	0	0	Low	N/a
Main-R12	2643	6.1%	0	0	Low	N/a
Main-R13	2270	3.6%	0	0	Low	N/a
Main-R14	3603	10.1%	0	0	Low	N/a

8.0 SUMMARY OF FISHERIES RESOURCES IN THE WATERSHED

Table 8.1. Documented fish species presence

Category	Common Name	Latin Name	Species Code	Reference
Freshwater game species	Rainbow Trout	*Oncorhynchus mykiss*	RB	Fish Wizard[1]
N/A	Unidentified Species	N/A	N/A	Fish Wizard[1]

[1]Fish Wizard available at http://pisces.env.gov.bc.ca

9.0 SUMMARY OF HAZARDS FOR THE McKuskey WATERSHED

Table 9.1. Watershed assessment hazards

Watershed	Sub-basin	Hazard Ratings[2]						Generalized Channel Disturbance[1]
		Increases in peak-flows (Current/ Proposed)	Reduction in riparian functions	Large logging related sediment sources	Road related sediment sources (field work)	Accelerated surface erosion from GIS (Current/ proposed)	Accelerated mass wasting	
McKuskey		VL/L	L	H	L	M/M	VL	1

[1] Note: Generalized channel disturbance codes: 1 = no disturbance identified, 2 = localized channel disturbance, 3 = minor localized land-use related disturbance, 4 = moderate land-use related channel disturbance, 5 = extensive land-use related channel disturbance.
[2] Note: Hazard ratings: VL=very low, L=low, M=moderate, H=high, VH=very high

10.0 INTERPRETATIONS

10.1 Peak flow Hazards

The peak flow hazard in McKuskey watershed is currently **Very Low** (PFI=22.5%) and will increase to a hazard rating of **Low** (PFI=25.5%) by the end of the current forest development plan. This includes the large areas that were burnt by wildfires and salvaged several decades ago. All reaches of the mainstem below the lake (where most of the logging has occurred) are stable and do not show any signs of accelerated erosion. Crooked Lake provides a very effective buffer for increased peak flows that may occur from forest harvesting in the upper watershed. There are no significant concerns for increased peak flows in the McKuskey watershed.

10.2 Hazards Associated with a loss in Riparian Functions

There has been no riparian harvesting along the mainstem of McKuskey Creek, however several of it's tributaries have experienced extensive riparian harvesting. This may have caused localized negative impacts on fish habitat. The overall hazard assessment for McKuskey Creek watershed is **Low.** Localized channel instability, caused mostly by riparian harvest and large sediment sources , was identified in Cosmoskey and Skyes-Fire Creek (photos #1417 and #1430).

10.3 Hazards Associated with Large Sediment Sources

There are several large forestry related sediment sources that are directly connected to a stream channel in this watershed (Table 4.1 and Appendix 2). This has resulted in a **High** hazard assessment for this IWAP indicator. Many of these sediment sources have been addressed by the Watershed Restoration Program and are now stabilizing and producing less sediment to the stream system. However Smith (2002) reports that restoration work in the McKuskey watershed (mostly Skyes Fire and Cosmosky) has had mixed results in improving slope stability and reducing sediment input to adjacent streams. Some of the landslides may be causing localized negative impacts on fish habitat in the tributary watersheds where they have occurred, but I believe that the impacts to the lower reaches of McKuskey Creek are probably insignificant, although localized impacts may not.

10.4 Hazards Associated with Road Related Surface Erosion

Almost 50% of all stream crossings identified on TRIM maps were surveyed for sources of surface erosion. We believe that there were less crossings in the field than indicated on TRIM maps and consequently our survey intensity is probably significantly higher than 50%. Also, many stream crossings identified on non-status roads are now inaccessible because of the dense re-growth on the road right of way. It is likely that most (if not all) of these crossings are no longer sediment sources. We believe that we surveyed more than 85% of all accessible (and potential sediment producing) stream crossings.

Our survey identified that 37% of the crossings surveyed had medium or high water quality concern ratings (WQCR) relative to the production of fine sediments to the stream system. (Table 6.2). The location of these is identified on the accompanying maps and the details are provided in the database (Appendix 3). Although this percentage is relatively high, the total equivalent stream crossing density remains low, simply because of the large size of the watershed. The surface erosion hazard for this watershed is consequently **Low.**

10.5 Hazards Associated with Accelerated Mass Wasting (from logging on steep slopes).

The assessed hazard for this IWAP indicator is **Very Low** for the McKuskey Creek watershed. This is simply because the mapping indicates that there is no forest harvesting or road building of slopes greater than 60%. The 60% slope indicator was used because there is no significant amount of slope stability mapping available for this watershed. Although the 60% mapping indicates no hazard, there are obviously some localized slope stability problems in this watershed as evidenced by the failure that occurred in the spring of 2002 (photograph # 1375). The "crude" mapping of slope stability by using the 60% method does not identify these localized problems.

10.6 Watershed Cumulative Effects and Channel Stability

It is my opinion that there are no significant cumulative effects and problems associated with channel stability near the mouth of McKuskey Creek (Point of Interest). However, I do believe that there are a few tributary watersheds the have been significantly impacted by past forest harvesting practices. These would certainly include Skyes-Fire creek and the lower reaches of Cosmoskey Creek. There are also a few small tributaries that were heavily harvested in the past decades and may have experienced localized negative impacts to fish habitat. These are located on the west side of the watershed and flow into reach R#3 of the mainstem of McKuskey Creek. Continued watershed restoration activities should continue in these small watersheds and further harvesting should be delayed in these tributary watersheds until the stream channels recover. Smith (2002) reports that the recontouring of the road and trail prisms in the Skyes Fire drainage did not reduce the occurrence of new slope failures. He also reports that rehabilitation and further assessment work is currently being undertaken at these sites.

11.0 RECOMMENDATIONS

11.1) Recommendations for the Forest Development Plan (landscape level)

It is my opinion that there are no significant rate-of-cut issues when considering the McKuskey Creek watershed as a whole (landscape unit). The current ECA is very low and the amount of planned harvest is not very large. The mainstem of the channel is very stable and there has been no riparian harvest along it. However, there are certainly some site specific issues that must continue to be addressed to manage water quality in this watershed. These are discussed in the next section.

11.2) Recommendations for Site Specific Activities (site level)

1. Stream crossings that were rated with a Medium or High WQCR should be visited in the field and site specific prescriptions made to further control erosion and sediment delivery. It is important to note that most of the crossings that had concerns were for small streams (class 4 and 5 stream width – Table 6.5). Crossings over large streams were generally well built and erosion and sediment control was generally adequate.

2. There are some localized slope stability problems in this watershed as evidenced by the number of large sediment sources and recent failures. Thus it is important that site level slope stability assessments continue to be done on moderate and steep slope areas (slopes greater than 50% in the fine textured soils). The use of qualified terrain specialist and geoscientists is important for the management of steep terrain.

3. Uncompleted (and ineffective) watershed restoration activities in Skyes-Fire Creek watershed should be given a high priority for completion.

4. Erosion control around crossings of small streams should be given more attention as forest harvesting proceeds in this watershed. It would be a good idea to develop a series of specific erosion control procedures that should be implemented for crossings of small streams (i.e. Erosion and Sediment Control Plan). These procedures could be provided to the road contractor and the performance of the contractor and the procedure itself could be evaluated in the coming years.

5. Maintain effective Erosion and Sediment Control plans for the McKuskey watershed. This would include: a) Development of a plan with precise objectives and standards and clear operating procedures, b) clearly define the types of erosion and sediment control practices that need to be implemented, c) regular maintenance of any ESC structure that has been installed, d) regular field monitoring to evaluate the effectiveness of the plan.

APPENDIX 1 – Database of disturbed riparian areas

ID	Channel Width	Stream Type	One or 2 sided	Length of RL (km)	Landuse
McKusRL-001	1	2	1	0.5991	1
McKusRL-002	4	2	2	0.3841	1
McKusRL-003	4	2	2	0.2355	1
McKusRL-005	3	2	2	3.0538	1
McKusRL_004	4	3	2	0.8434	1
McKusRL-006	4	3	2	0.2947	1
McKusRL-007	4	3	2	1.0566	1
McKusRL-008	4	2	2	0.9015	1
McKusRL-009	4	2	2	1.2793	1
McKusRL-010	4	2	2	1.1296	1
McKusRL-011	4	2	2	1.1656	1
McKusRL-012	4	2	2	1.6048	1
McKusRL-013	4	2	2	1.8747	1
McKusRL-016	4	2	2	0.6532	1
McKusRL-017	4	3	2	0.1995	1
McKusRL-015	4	3	2	0.8406	1
McKusRL-018	4	3	2	0.7866	1
MckusRL-019	4	2	2	0.7821	1
McKusRL-020	4	2	2	1.4426	1
McKusRL-021	4	3	2	0.6708	1
McKusRL-022	4	2	2	0.7893	1
McKusRL-023	4	2	2	1.1811	1
McKusRL-024	4	2	2	1.0936	1
McKusRL-025	4	3	2	0.9024	1
McKusRL-026	4	2	2	0.9063	1
McKusRL-027	4	3	2	0.2497	1
McKusRL-028	4	3	2	0.6137	1
McKusRL-029	4	2	2	1.4959	1
McKusRL-030	4	2	2	0.3476	1
McKusRL-031	4	2	2	0.361	1
McKusRL-032	4	2	2	0.2628	1
McKusRL-033	4	2	2	0.8167	1
McKusRL-034	4	2	2	0.472	1
McKusRL-035	4	3	2	0.8334	1
McKusRL-036	4	3	2	0.4604	1
McKusRL-037	4	3	2	0.7699	1

McKusRL-038	4	3	2	0.3639	1
McKusRL-039	4	3	2	0.6674	1
McKusRL-040	4	3	2	0.6472	1
McKusRL-041	3	3	2	2.3245	1
McKusRL-042	4	3	2	0.3833	1
McKusRL-043	3	3	2	2.2491	1
McKusRL-044	4	3	2	1.1173	1
McKusRL-045	4	3	2	0.4062	1
McKusRL-046	4	3	2	0.7609	1
McKusRL-047	4	3	2	0.3741	1
McKusRL-048	3	3	2	0.3504	1
McKusRL-049	4	3	2	0.2177	1
McKusRL-050	4	3	2	0.2831	1
McKusRL-051	4	3	2	0.9645	1
McKusRL-052	3	3	2	0.36	1
McKusRL-053	4	3	2	0.2002	1
McKusRL-054	4	3	2	0.7896	1
McKusRL-055	4	3	2	0.2844	1
McKusRL-056	4	3	2	0.2585	1
McKusRL-057	4	3	2	0.3415	1
McKusRL-058	4	3	2	0.5836	1
McKusRL-059	4	3	2	0.1354	1
McKusRL-060	4	3	2	0.0764	1

APPENDIX 2 – Database of large sediment sources

ID	Type	Cause	Deliverability	Degree of Revegetation	Activity Level
McKusLS-001	5	3	1	2	2
McKusLS-003	4	3	2	1	1
McKusLS-002	4	3	2	1	1
McKusLS-008	5	3	1	2	2
McKusLS-004	4	3	3	1	1
McKusLS-009	4	3	1	2	2
McKusRL-006	5	8	3	2	2
McKusLS-005	4	3	3	1	1
McKusLS-007	4	5	3	1	1
McKusLS-010	4	3	1	2	2
McKusLS-015	4	3	3	2	2
McKusLS-016	4	3	2	2	2
McKusLS-013	4	3	2	2	2
McKusLS-011	4	3	3	2	2
McKusLS-012	4	3	2	3	2
McKusLS-017	4	3	3	1	1
McKusLS-018	4	3	2	2	2
McKusLS-019	4	3	2	2	2
McKusLS-021	4	2	3	1	3
McKusLS-024	4	4	3	2	2

McKusLS-025	5	2	2	2	2
McKusLS-022	5	8	2	2	2
McKusLS-014	4	5	3	1	3
McKusLS-026	7	4	3	2	3
McKusLS-027	4	3	1	2	1
McKusLS-028	7	4	1	1	3
McKusLS-029	3	6	3	2	1
McKusLS-030	5	6	3	2	3
McKusLS-031	5	5	3	1	3
McKusLS-032	3	3	3	2	2
McKusLS-033	5	1	2	1	3
McKusLS-034	4	2	3	1	3
McKusLS-035	3	2	3	1	3
McKusLS-036	3	2	3	1	3

APPENDIX 3 – Database of stream crossing survey (surface erosion)

Sub Basin	Cros-sing ID	UTM Easting	UTM Northing	Structure type	Size of Culvert	Crossing Erosion Score	WQCR	Stream width Class	Stream gradient Class
McKuskey	J100	655841	5790242	5	6	0.0208	None	1	1
McKuskey	J101	663430	5788986	s.pt.		0	s.pt		0
McKuskey	J102	662216	5789366	5	400	0.4835	Med	5	4
McKuskey	J103	661329	5789405	5	600	0.375	Low	4	3
McKuskey	J104	660591	5789321	1		0.125	Low	2	6
McKuskey	J105	660498	5789333	5	600	0.0208	None	4	3
McKuskey	J106	660482	5789299	5	600	0.882	High	4	3
McKuskey	J107	660153	5789431	1		0.0208	None	3	3
McKuskey	J108	659666	5789489	5	400	0.2343	Low	5	3
McKuskey	J109	658872	5789801	5	450	0.3675	Low	5	3
McKuskey	J110	658710	5789858	5	800	0.3675	Low	4	3
McKuskey	J111	657298	5790655	5	800	0.2037	Low	4	2
McKuskey	J112	656568	5790974	5	1000	0.0208	None	3	2
McKuskey	J113	654446	5794325	5	800	0.0208	None	4	1
McKuskey	J114	654394	5794877	1		0.0208	None	2	1
McKuskey	J115	655215	5794446	5	400	0.125	Low	3	1
McKuskey	J116	654394	5795116	1		0.0208	None	2	2
McKuskey	J117	653757	5795731	1		0.0208	None	3	2
McKuskey	J118	651735	5796605	1		0.0208	None	2	2
McKuskey	J119	650685	5797738	s.pt.		0	s.pt		0
McKuskey	J120	651900	5798266	s.pt.		0	s.pt		0
McKuskey	J121	652116	5798833	1		0.5	Med	2	3
McKuskey	J122	649737	5797992	s.pt.		0	s.pt		0
McKuskey	J123	649184	5798442	5	600	0.4057	Med	4	1
McKuskey	J124	648114	5800164	5	800	0.1838	Low	3	2
McKuskey	J125	647204	5801760	5	300	0.0208	None	3	1
McKuskey	J126	646776	5801937	1		0.0208	None	1	1
McKuskey	J127	646864	5799789	5	600	0.0208	None	3	6
McKuskey	J01	651171	5795336	5	400	0.0208	None	4	2
McKuskey	J02	650845	5795292	5	400	0.0208	None	4	2
McKuskey	J03	650223	5796043	5	600	0.0208	None	4	4
McKuskey	J04	650072	5796203	5	600	0.855	High	4	3
McKuskey	J05	650026	5796265	8		0.887	High	4	2
McKuskey	J06	649941	5796314	5	450	0.8893	High	4	2
McKuskey	J07	649546	5796548	5	600	0.8452	High	4	2

McKuskey	J08	648128	5797178	4		0.3563	Low	4	4
McKuskey	J09	648344	5797049	6		0.3785	Low	4	3
McKuskey	J10	648907	5796779	5	600	0.0208	None	4	1
McKuskey	J11	648551	5797518	5	500	0.3934	Low	4	2
McKuskey	J12	648244	5798019	5	900	0.8575	High	4	2
McKuskey	J13	647764	5798361	5	500	0.95	High	4	3
McKuskey	J14	647592	5798662	5	800	0.9025	High	4	5
McKuskey	J15	647569	5799079	5	500	0.2078	Low	4	3
McKuskey	J16	647573	5799303	5	600	0.5953	Med	4	3
McKuskey	J17	647534	5799375	5	500	0.2227	Low	4	3
McKuskey	J18	647467	5799562	5	500	0.3638	Low	4	3
McKuskey	J19	647433	5799911	5	600	0.4747	Med	4	4
McKuskey	J20	647194	5800861	5	500	0.6662	Med	4	2
McKuskey	J21	647199	5798045	s.pt.		0	s.pt		0
McKuskey	J22	647098	5798204	5	600	0.9	High	5	6
McKuskey	J23	647136	5798381	5	600	0.95	High	4	6
McKuskey	J24	647128	5798385	5	500	0.9	High	6	6
McKuskey	J25	646920	5799172	5	600	0.8623	High	3	6

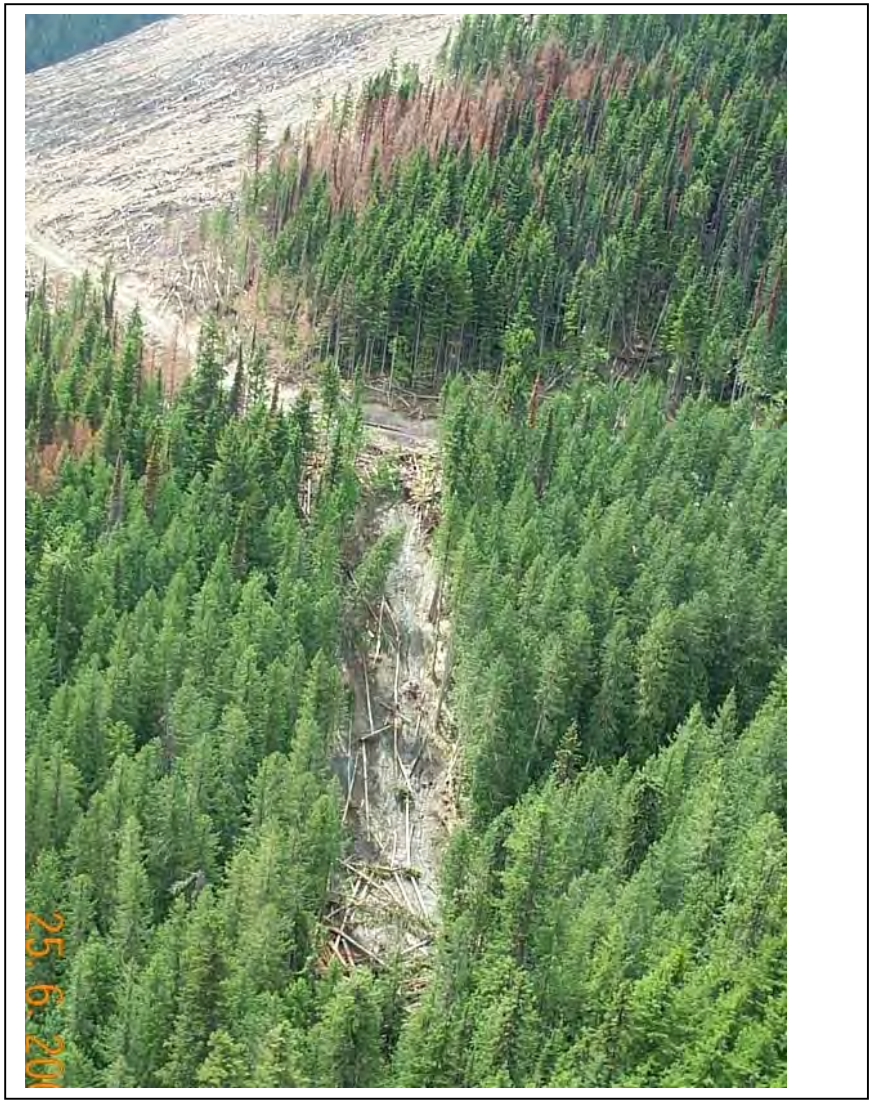
APPENDIX 4- Inventory of disturbed channel reaches

No disturbed (i.e. unstable) reaches identified along the mainstem of McKuskey Creek .

APPENDIX 5 – Selected photographs

Photograph 1371# Lower McKuskey River

Photograph # 1417 Skyes-fire sub-drainage looking downstream



Photograph #1375. Recent slope failure in Lower McKuskey

APPENDIX 5 – Selected photographs

Photograph #1430. Channel avulsion at mouth of Cosmoskey.

Photograph #1629. SCQI site J121, score = 0.5 (Medium)

Photograph # 1639. Site J126, score = 0.0 (Low)

Photograph #Site J13, score=0.95 (High), ineffective ESC.