Upper Bulkley Fish and Aquatic Review
Summary of Data, Methodology, Results, and Thresholds
For Pressure Indicator Riparian Disturbance

Streamside riparian disturbance is rated of high value by the Wild Salmon Policy Habitat Working Group. Riparian disturbance is also rated high throughout the literature for its assessment in salmon habitat health.

1.0 GIS Data

- Fish Habitat Data (BC PSCIS 2012)
- Salmon presence and spawning data produced by SkeenaWild 2010-2014
- Salmon presence updated by Eclipse Geomatics 2016
- Digital Road Atlas (DRA)
- Forest Tenure Roads (FTEN roads)
- National Topographic System railway and existing pipeline
- FTEN Cut Blocks
- Consolidated Cutblock Data
- Freshwater Atlas Streams (1:20,000)
- Freshwater Atlas Lakes (1:20,000)
- Freshwater Atlas Assessment Watersheds (edited by K. Rabnett Jan. 2016)
- Wet'suwet'en House Territory boundaries

2.0 Methodology

The buffer tool in Manifold GIS was used to create a 30 m buffer[1] around all streams with fish presence (observed and inferred), as well as streams with no inferred fish presence. Disturbance factors buffered include roads[2], pipelines[3], and the CN railway.

Feature	Corridor width (m)
Stream	60
Road – main/mainline	30
Road – operational/in-block	18
Railway ROW	30
Pipeline – existing	75

The riparian corridors were intersected with the various linear development features as well as areal features such as cut blocks. The resultant tables were exported to excel where a pivot table was generated to summarize results.

[1] B.C. Ministry of Forests (MOF). 1995a. Interior watershed assessment procedure guidebook (IWAP0. http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/iwap/iwap-toc.htm

[2] Coombs, T., A. Bernard, and G. Nigh. 2010. Forest access road widths in the Lakes Timber Supply Area. BC Journal of Ecosystems
[2] Coombs, T., A. Bernard, and G. Nigh. 2010. Forest access road widths in the Lakes Timber Supply Area. BC Journal of Ecosystems and Management 11 (1&2):84-90. http://jem.forrex.org/index.php/jem/article/view/15/29

[3] The 75 m pipeline buffer is intended to include not only a 25 m right of way but also allows for a 50 m construction zone to accommodate the construction of facilities.

3.0 Thresholds

Report results use interim thresholds defined by the Wild Salmon Policy where <5% is considered a low level of disturbance, 5% to less than 15% a moderate level, and 15% or greater is considered a high level of disturbance.

4.0 Results

The results of the riparian disturbance indicator are reported out by a variety of boundaries including the Upper Bulkley Watershed, twenty-two sub-watersheds and face units within the Upper Bulkley, fifteen Wet'suwet'en house territories within the Upper Bulkley Watershed, the WSP Chinook Conservation Unit, and the Bulkley River Resource Management Zone as determined by the Morice LRMP.

4.1 Upper Bulkley Watershed

The Upper Bulkley watershed consists of 258.67 km^2 (11.1%) of streamside riparian zones. Currently 5.5 % of the riparian zones are situated along salmon bearing streams and 8.2 % alongside resident fish bearing streams. The remaining riparian zones are situated along streams with inferred fish presence (82.0 %) or streams with no (inferred) fish presence (4.3 %).

Table 4.1.1 Summary of Riparian Zones by Fish Presence (km^2)

Salmon Presence Observed	Fish Presence Observed	Fish Presence Inferred	No Fish Presence Inferred	Total Riparian
14.27	21.23	211.99	11.19	258.67

Across the Upper Bulkley watershed 14.8% (38.23 km^2) of the riparian zones have been altered by development. Harvesting contributes 91.2% (34.88 km^2) to the riparian disturbance, road development 4.1%, and the railroad and existing pipelines contribute the remaining 4.7%.

Table 4.1.2 Summary of Riparian Disturbance within Riparian Zones (km^2)

Total Riparian	Roads	Harvesting		Pipelines	Railway	Total Riparian Disturbed	% Riparian Disturbed
		Prior June 1995	Post June 1995				
258.67	1.56	18.53	16.38	0.97	0.81	38.25	14.79%

4.2 Wet'suwet'en House Territories within the Upper Bulkley Watershed

The results of the spatial analysis calculated 526.8 km^2 (11.2%) of streamside riparian within the fifteen Wet'suwet'en house territories situated within the Upper Bulkley watershed. Currently 4.6% of the riparian areas are situated along salmon bearing streams and 10.4% along resident fish bearing streams. 72.0% of the riparian areas are situated along streams with inferred fish presence, and 13.0% of the riparian is situated along streams with no (inferred) fish presence.

Table 4.2.1 Summary of Riparian Zones within Wet'suwet'en House Territories by Fish Presence (km^2)

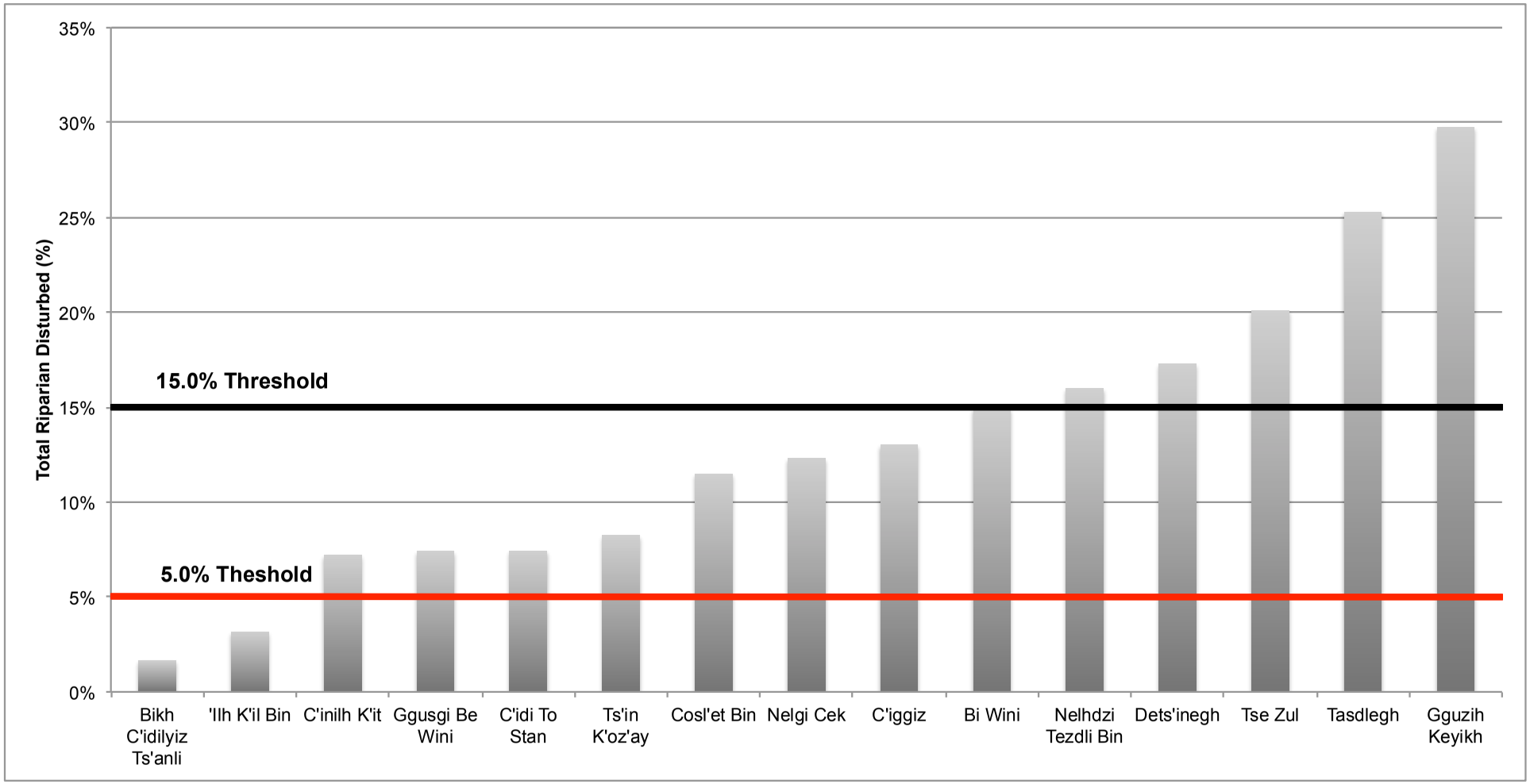
House Territories	Area of House Territory (km^2)	Salmon Presence-Observed	Fish Presence - Observed	Fish Presence - Inferred	No Fish Presence	Total Riparian (km^2)	Riparian as % of Total Watershed Area
'Ilh K'il Bin	305.26	2.68	1.78	34.17	0.49	39.12	12.81%
Bi Wini	883.29	3.36	9.76	53.96	22.46	89.54	10.14%
Bikh C'idilyiz Ts'anli	142.48	0.20	2.82	11.59	5.73	20.34	14.28%
C'idi To Stan	505.42	2.22	7.42	33.54	16.55	59.73	11.82%
C'iggiz	177.29	0.84	2.40	13.61	2.86	19.71	11.12%
C'inilh K'it	396.40	1.00	6.75	29.76	8.60	46.12	11.63%
Cosl'et Bin	361.06	1.82	6.29	32.02	2.42	42.54	11.78%
Dets'inegh	70.79	0.99	0.06	5.90	0.01	6.96	9.83%
Ggusgi Be Wini	288.66	1.03	2.83	31.86	0.45	36.16	12.53%
Gguzih Keyikh	54.13	0.07	0.43	5.23	0.00	5.73	10.59%
Nelgi Cek	214.98	2.13	2.50	16.02	3.08	23.73	11.04%
Nelhdzi Tezdli Bin	417.79	1.22	5.69	33.64	2.04	42.59	10.19%
Tasdlegh	477.18	2.63	3.29	46.59	0.99	53.49	11.21%
Ts'in K'oz'ay	280.41	3.14	1.30	17.78	2.29	24.51	8.74%
Tse Zul	131.12	0.94	1.37	13.79	0.41	16.51	12.59%
Total	**4,706.26**	**24.27**	**54.70**	**379.43**	**68.38**	**526.78**	**11.19%**

The disturbance to streamside riparian varies from 1.6 % in the Bikh C'idilyiz Ts'anli house territory, to the maximum disturbance value of 29.7% in Gguzih Keyikh house territory. Two of the Wet'suwet'en house territories have a riparian disturbance value below the 5.0% threshold, eight of the house territories have moderate riparian disturbance values, and the remaining five house territories have a riparian disturbance above the 15.0% threshold. The average disturbance value within the fifteen Wet'suwet'en house territories is 12.2%, just below the high risk threshold.

Table 4.2.2 Summary of Riparian Disturbance by Type of Development (km^2)

House Territories	Total Riparian	Roads	Pipelines	Harvesting		Railway	Total Riparian Altered	% Disturbed
				Prior June 1995	Post June 1995			
'Ilh K'il Bin	39.12	0.14	0.00	0.62	0.37	0.11	1.24	3.17%
Bi Wini	89.54	0.12	0.55	4.82	7.88	0.00	13.37	14.93%
Bikh C'idilyiz Ts'anli	20.34	0.00	0.00	0.19	0.14	0.00	0.33	1.64%
C'idi To Stan	59.73	0.14	0.06	3.46	0.69	0.09	4.44	7.43%
C'iggiz	19.71	0.14	0.00	0.70	1.66	0.07	2.57	13.03%
C'inilh K'it	46.12	0.25	0.01	1.96	1.09	0.01	3.32	7.21%
Cosl'et Bin	42.54	0.32	0.08	2.92	1.44	0.12	4.89	11.48%
Dets'inegh	6.96	0.05	0.04	0.58	0.53	0.01	1.20	17.28%
Ggusgi Be Wini	36.16	0.26	0.03	0.96	1.27	0.15	2.68	7.40%
Gguzih Keyikh	5.73	0.02	0.03	1.26	0.39	0.00	1.71	29.76%
Nelgi Cek	23.73	0.30	0.04	1.80	0.71	0.06	2.92	12.31%
Nelhdzi Tezdli Bin	42.59	0.19	0.40	2.17	4.06	0.00	6.82	16.01%
Tasdlegh	53.49	0.30	0.28	6.86	6.05	0.03	13.53	25.29%
Ts'in K'oz'ay	24.51	0.13	0.06	1.27	0.50	0.07	2.02	8.24%
Tse Zul	16.51	0.09	0.10	2.33	0.79	0.00	3.32	20.11%
Total	**526.78**	**2.47**	**1.68**	**31.91**	**27.56**	**0.72**	**64.35**	**12.22%**

Figure 4.2.1 Riparian Disturbance Thresholds Applied within the Wet'suwet'en House Territories



4.3 Sub-watersheds

The twenty-two sub-watersheds within the Upper Bulkley watershed contain 259.34 km^2 (11.1%) of streamside riparian zones. Currently 5.5% of the riparian buffers are situated along salmon bearing streams, and 8.4% along resident fish bearing streams. The remaining 81.7% of the riparian buffers are situated along streams with inferred fish presence, with only 4.3% of the remaining riparian zones along streams with no (inferred) fish presence.

Table 4.3.1 Summary of Riparian Zones by Fish Presence (km^2)

Sub-Watershed	Sub-watershed Area (km^2)	Salmon Presence Observed	Fish Presence Observed	Fish Observed Inferred	No Fish Presence Inferred	Total Riparian (km^2)	Riparian as % of Total Watershed Area
Ailport	97.13	0.75	0.96	6.24	2.86	10.81	11.13%
Aitken	148.66	0.00	1.38	15.11	0.74	17.23	11.59%
Barren	25.81	0.11	0.00	2.72	0.07	2.90	11.25%
Buck	566.77	4.09	6.08	39.91	4.55	54.62	9.64%
Byman	94.04	0.13	1.35	10.19	0.11	11.78	12.53%
Cesford	36.70	0.01	0.00	5.15	0.02	5.17	14.10%
Crow	73.96	0.06	0.76	8.63	0.04	9.50	12.84%
Johnny David	43.73	0.11	0.00	5.75	0.00	5.86	13.41%
Maxan	370.73	1.62	3.78	35.22	0.80	41.42	11.17%
Mckilligan	38.20	0.00	0.00	4.15	0.01	4.17	10.91%
Mcquarrie	114.62	0.08	1.58	11.32	0.81	13.79	12.03%
Perow	20.63	0.00	0.02	2.46	0.00	2.48	12.03%
Richfield	161.81	0.27	0.98	20.43	0.40	22.08	13.65%
Sub-total	**1,792.79**	**7.23**	**16.89**	**167.28**	**10.41**	**201.82**	**11.26%**

Continued ..

Table 4.3.1 Summary of Riparian Zones by Fish Presence (km^2) - Continued

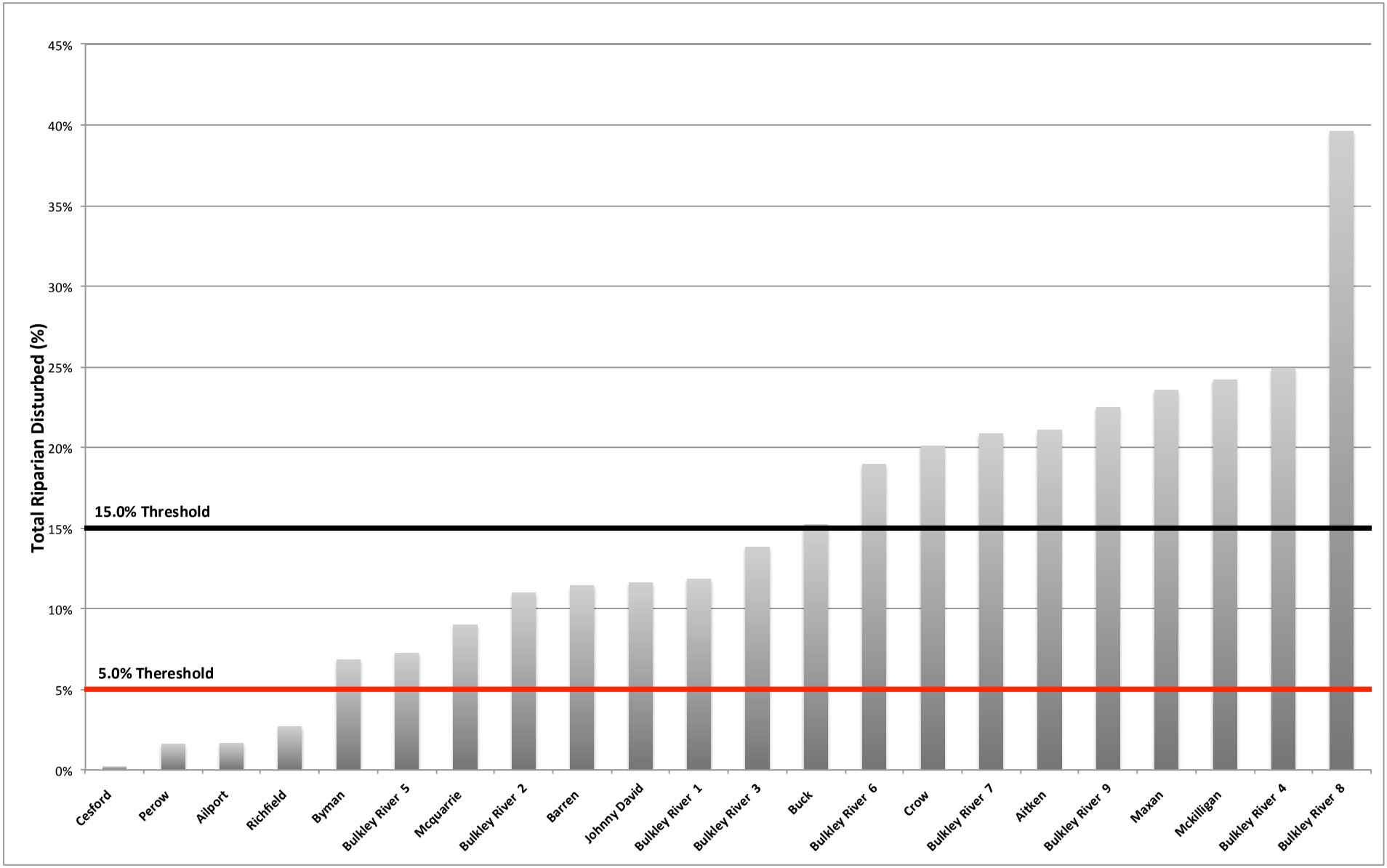
Face Units	Sub-watershed Area (km^2)	Salmon Presence Observed	Fish Presence Observed	Fish Observed Inferred	No Fish Presence Inferred	Total Riparian (km^2)	Riparian as % of Total Watershed Area
Bulkley River 1	78.47	0.95	0.87	5.86	0.32	8.00	10.20%
Bulkley River 2	51.21	0.76	0.91	4.93	0.32	6.92	13.51%
Bulkley River 3	75.84	1.33	0.56	7.82	0.07	9.78	12.89%
Bulkley River 4	30.07	0.00	0.25	3.09	0.05	3.39	11.27%
Bulkley River 5	36.87	1.48	0.01	2.91	0.00	4.41	11.95%
Bulkley River 6	59.21	0.00	0.83	4.35	0.00	5.18	8.75%
Bulkley River 7	64.63	2.18	0.00	5.37	0.01	7.56	11.70%
Bulkley River 8	32.23	0.35	0.00	1.61	0.00	1.96	6.09%
Bulkley River 9	93.77	0.00	1.57	8.76	0.00	10.33	11.01%
Sub-total	**522.29**	**7.05**	**5.00**	**44.71**	**0.77**	**57.53**	**11.01%**
Total	**2,315.07**	**14.28**	**21.89**	**211.99**	**11.19**	**259.34**	**11.20%**

Within the Upper Bulkley watershed, 14.78% of the streamside riparian zones have been altered by harvesting, roads, railway and the existing pipeline. The majority of the disturbance to riparian zones, 91.2%, is due to harvesting. Roads, the CN railway, and the PNG pipeline contribute the remaining 8.8% of the riparian disturbance.

Table 4.3.2 Summary of Riparian Disturbance (km^2) by Type of Development

Sub-watershed	Total Riparian	Roads	Pipeline	Harvesting		Railways	Total Riparian Disturbed	% Disturbed
				Prior June 1995	Post June 1995			
Ailport	10.81	0.02	0.00	0.00	0.15	0.01	0.18	1.66%
Aitken	17.23	0.06	0.11	2.51	0.95	0.00	3.63	21.09%
Barren	2.90	0.02	0.00	0.11	0.21	0.00	0.33	11.45%
Buck	54.62	0.31	0.39	3.49	4.10	0.00	8.31	15.21%
Byman	11.78	0.03	0.00	0.49	0.28	0.01	0.81	6.85%
Cesford	5.17	0.01	0.00	0.00	0.00	0.00	0.01	0.19%
Crow	9.50	0.14	0.02	1.26	0.48	0.00	1.91	20.09%
Johnny David	5.76	0.02	0.00	0.27	0.38	0.00	0.67	11.62%
Maxan	41.42	0.15	0.29	4.92	4.39	0.00	9.76	23.56%
Mckilligan	4.17	0.02	0.01	0.69	0.30	0.00	1.01	24.19%
Mcquarrie	13.79	0.04	0.00	0.70	0.50	0.00	1.24	8.99%
Perow	2.48	0.03	0.00	0.01	0.00	0.01	0.04	1.60%
Richfield	22.08	0.06	0.00	0.47	0.06	0.00	0.59	2.69%
Subtotals	**201.70**	**0.91**	**0.83**	**14.91**	**11.81**	**0.04**	**28.49**	**14%**
Bulkley River Face Units								
BR 1	8.00	0.18	0.01	0.48	0.19	0.09	0.95	11.85%
BR 2	6.92	0.09	0.09	0.06	0.43	0.09	0.76	10.99%
BR 3	9.78	0.10	0.00	0.79	0.26	0.20	1.35	13.83%
BR 4	3.39	0.04	0.00	0.53	0.28	0.00	0.84	24.90%
BR 5	4.41	0.04	0.00	0.00	0.11	0.17	0.32	7.26%
BR 6	5.18	0.02	0.04	0.47	0.45	0.00	0.98	18.94%
BR 7	7.14	0.13	0.00	0.42	0.76	0.18	1.49	20.86%
BR 8	1.83	0.02	0.01	0.25	0.39	0.04	0.72	39.61%
BR 9	10.33	0.03	0.00	0.62	1.67	0.00	2.32	22.50%
Subtotals	**56.97**	**0.65**	**0.15**	**3.61**	**4.56**	**0.78**	**9.74**	**17.10%**
Totals	**258.67**	**1.56**	**0.97**	**18.52**	**16.36**	**0.81**	**38.23**	**14.78%**

Figure 4.3.1 Riparian Disturbance Thresholds Applied in the Bulkley Sub-watersheds.



4.4 Additional Management and Resource Zones

This report includes two additional management and resource zones related to aquatic objectives situated within the Upper Bulkley Watershed. These areas include the Wild Salmon Policy Chinook Conservation Unit and the Bulkley River Resource Management Zone as determined by the Morice LRMP. Both management units fall in the moderate risk category with respect to disturbance to riparian areas.

Table 4.4.1 Summary of Riparian Zones by Fish Presence

Sub-Watershed	Area (km^2)	Salmon Presence Observed	Fish Habitat Observed	Fish Habitat Inferred	No Fish Habitat Inferred	Total Riparian Area (km^2)	Riparian as % of Total Area
Bulkley River RMZ	53.20	0.00	8.09	5.90	0.02	14.01	26.33%
Chinook Conservation Unit	117.88	0.00	13.87	9.06	0.02	22.95	19.47%

Table 4.4.2 Summary of Riparian Disturbance (km^2) by Type of Development

Management Area	Total Riparian	Roads	Pipeline	Harvesting		Railways	Total Riparian Disturbed	% Disturbed
				Prior June 1995	Post June 1995			
Bulkley River RMZ	14.01	0.19	0.03	0.03	0.11	0.57	0.93	6.64%
Chinook Conservation Unit	22.95	0.40	0.06	0.04	0.26	0.45	1.21	5.27%
Total	**36.96**	**0.59**	**0.09**	**0.07**	**0.37**	**1.02**	**2.14**	**5.79%**

Figure 4.4.1 Riparian Disturbance Thresholds Applied in the Additional Management and Resource Zones.