WSP Indicator Analysis for the Section of the Bulkley TSA Situated Within the Babine Lake Watershed:

Road Density

Interior Watershed Assessment Protocol (IWAP) Watersheds

Prepared for:

SkeenaWild Conservation Trust
Unit 103 - 4622 Greig Avenue
Terrace BC V8G 1M9

Prepared by:

Eclipse Geomatics Ltd.
3423 Fulton Avenue Unit 102
Smithers BC V0J 2N0

May 2023

Note to reader:

These Wild Salmon Policy (WSP) habitat indicator assessment reports are intended as a coarse filter approach to identify watersheds that are potentially at risk of exceeding thresholds for the four WSP habitat indicators (Road Density, Stream Crossing Density, Total Land Cover Alteration, and Riparian Disturbance). These reports present the results of GIS-based (Tier 1) methods for assessing the status of a particular freshwater aquatic habitat pressure indicator and determining the watershed indicator "risk" status by comparing the measured values to indicator benchmarks. Pressure indicators are identified by Canada's WSP as proactive measures of identifying potential impacts to salmon habitat within a watershed. Additional information on the WSP is available at https://www.pac.dfo-mpo.gc.ca/fm-gp/salmon-saumon/wsp-pss/ip-pmo/ip-smm-pmo-eng.html#assessment.

The analysis presented in this report was carried out using standardized provincial datasets and did not integrate field-based (Tier 2) information or industry datasets. The results are presented for informational purposes and are not intended to replace operational watershed assessments.

Acknowledgements

We would like to thank Sarah Railton, Greg Knox, and Julia Hill Sorochan for their contributions and feedback, and to Mary Robinson, Glen Buhr, Craig Mount, and Simon Norris for providing input datasets and supporting information.

WSP Indicator Analysis for the Section of the Bulkley TSA Situated Within the Babine Lake Watershed

Pressure Indicator: Road Density

Assessment Units: IWAP Assessment Watersheds

Description of Pressure Indicator

Road density has been widely correlated to salmon habitat degradation and declines of salmon populations in the Pacific Northwest, and has been ranked as a high value indicator by the Wild Salmon Policy (WSP) Habitat Working Group (Stalberg et al., 2009). Road development can interfere with natural flow and increase peak flows within a watershed as well as cause increased erosion and sediment deposition and stream turbidity (Porter et al., 2019).

Road density is defined as the total length of roads in an area divided by the total area (km/km^2), and is closely associated with watershed land cover alterations, stream crossings and barriers, and riparian habitat disturbance (Porter et al., 2019).

Study Area

The Babine Lake Watershed is situated in the interior of northwest BC and covers an area of 6,555 km^2. Babine Lake is one of the largest natural lakes in BC and hosts important salmon spawning and rearing habitat. The Babine Lake Watershed falls within the Bulkley, Morice, Lakes, and Prince George Timber Supply Areas.

This report presents results for Bulkley Timber Supply Area (TSA) Interior Watershed Assessment Protocol (IWAP) watersheds situated within the Babine Lake Watershed by group name. The study area extent is shown in Figure 1. IWAP watersheds are primarily fourth order historical assessment watersheds delineated by the Bulkley TSA Watershed Assessment Panel in 1999 as reporting units for watershed assessment and monitoring projects (G. Buhr, personal communication, May 2023). Reporting watershed assessment results by IWAP watershed allows for continuity and comparison with historical results. Reference maps showing the study area and IWAP watersheds with the Bulkley TSA and Babine Lake Watershed boundaries are included as Appendix A.

Figure 1: The study area is indicated in red. The grey polygon indicates the outline of the Skeena River watershed and the brown polygon shows the Bulkley TSA extent.

Methodology

Data layers used to perform the spatial analysis include:

- Bulkley Strategic Road Inventory (BC Ministry of Forests, 2022)
- BC Timber Sales (BCTS) Aggregated Road Layer (BCTS, 2022)
- Digital Road Atlas (BC Ministry of Land, Water and Resource Stewardship [MLWRS], 2022)
- Forest Tenure Road Section Lines (BC Ministry of Forests, 2022)
- Freshwater Atlas (FWA) Lakes (BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development [BC MFLNRORD], 2019a)
- FWA Manmade Waterbodies (BC MFLNRORD, 2019b)
- FWA Rivers (BC MFLNRORD, 2019c)
- Bulkley TSA "Interior Watershed Assessment Procedure" (IWAP) Watersheds (Bulkley TSA Watershed Assessment Panel, 1999)
- FADM – Timber Supply Area (TSA) (BC MFLNRORD, 2021)

The input dataset versions are the same as those for the 2022 Babine Lake Watershed road density indicator analysis which used FWA assessment watersheds as assessment units (Eclipse Geomatics Ltd., 2022).

Road Input Layer Preparation

The Bulkley Strategic Road Inventory data layer was developed by BC MFLNRORD Skeena-Stikine District staff using information sourced from provincial TRIM base mapping, the Digital Road Atlas (DRA), Forest Tenure Road Section Lines (FTEN), and major licensee digital road files within the Bulkley TSA. The dataset was refined using best available orthophoto and satellite imagery and non-existent roads were removed (e.g. phantom duplicate or parallel road sections and planned roads that were never constructed) while deactivated roads were left in the data set (G. Buhr, personal communication, October 15, 2020).

The BCTS road layer is a combined road layer originally created in 2014 by combining the DRA and FTEN datasets with BCTS road information. It has been updated yearly by BCTS using ortho imagery to identify and remove overlapping features, creating a more accurate roads layer. The BCTS roads layer was partially updated in 2022, with the Bulkley TSA updated in 2021, the Morice TSA updated in 2022, and the Lakes TSA last updated in 2020 (M. Robinson, personal communication, Nov. 1, 2022). The Bulkley Strategic Road Inventory data layer was used for the Bulkley TSA due to its more recent update date.

An updated roads layer was developed for the purposes of this analysis by adding new (post-update) road segments from the DRA and FTEN data layers that do not appear in the Bulkley Strategic Road Inventory or BCTS layers as well as all DRA and FTEN roads within the study area but outside of the extents of the road inventory and BCTS datasets. These additional segments were extracted from the 2022 DRA and FTEN datasets by applying a 30 m buffer to the road inventory and BCTS datasets and selecting DRA and FTEN roads outside of this buffer added since the respective update dates of each TSA extent. Overlapping roads within the DRA and FTEN subsets were removed by applying a 30 m buffer to the DRA subset and selecting FTEN roads outside of the buffer. The extracted DRA and FTEN roads were then merged with the Bulkley Strategic Road Inventory and BCTS data layers to produce the input roads dataset. No Oil and Gas Commission road segments were present in the study area.

Land Base Calculation

In order to generate road density based on available land area within each assessment unit, the areas covered by freshwater were removed from the assessment unit prior to intersection with the disturbance layer. This approach was used to improve road density reporting for assessment units containing large water bodies (e.g. Babine Lake), where using the total watershed area in the calculation would under-report road density impacts on the land base. This approach is consistent with the BC Cumulative Effects Framework methodology (Provincial Aquatic Ecosystems Technical Working Group [PAETWG], 2020) but represents a change from previous analyses (Eclipse Geomatics Ltd., 2020). The FWA Lakes, Rivers, and Manmade Waterbody datasets were used to identify areas covered by freshwater.

Road Density Calculation

IWAP watersheds were used as assessment units for the road density analysis. Multi-part IWAP watersheds (i.e. West Babine face units and Fulton polygons) were assessed as a single unit in accordance with previous analyses (G. Buhr, personal communication, May 2023). Total road length (km) for each IWAP assessment watershed was calculated by summing all the road segments within each assessment unit. Road density (km/km^2) was calculated by dividing the total road length by the area of the land base for each assessment unit. An overview of road segments within the study area is provided as Figure 2.

This analysis follows the methodology set out by the Pacific Salmon Foundation (2020) for Road Density with the following changes:

- Substitution of the updated Bulkley Strategic Road Inventory and BCTS layers for the DRA and FTEN datasets as they are considered to be more accurate road layers for the study area; and
- Use of the assessment unit land area not covered by freshwater features in order to improve reporting of road density for assessment units containing large waterbodies.

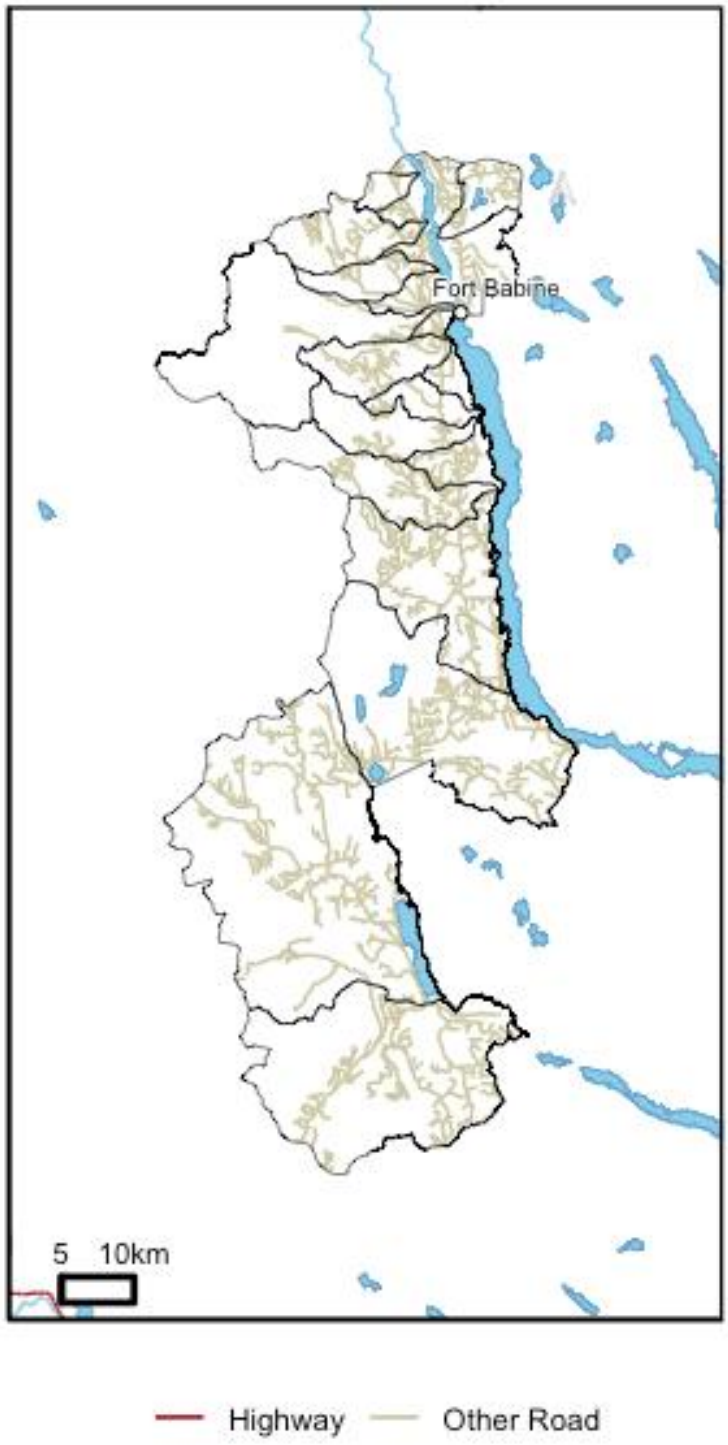


Figure 2: Roads located in the study area are shown with assessment units outlined in black.

Risk Thresholds

Categorical risk thresholds applied were generated for the Skeena Region by the Pacific Salmon Foundation based on recommendations from the Wild Salmon Policy Habitat Working Group (Porter et al., 2014; Stalberg et al., 2009) and are tabulated below:

Threshold Rating	Road Density (km/km^2)
Low	< 0.40
Moderate	≥ 0.40 and < 1.2
High	≥ 1.2

Results of Analysis

A summary of the results of the road density analysis with categorical risk thresholds for each assessment unit are shown as Figure 3. Detailed results for each assessment unit are tabulated in Appendix B, and the distribution of the assessment results are shown as a series of figures in Appendix C.

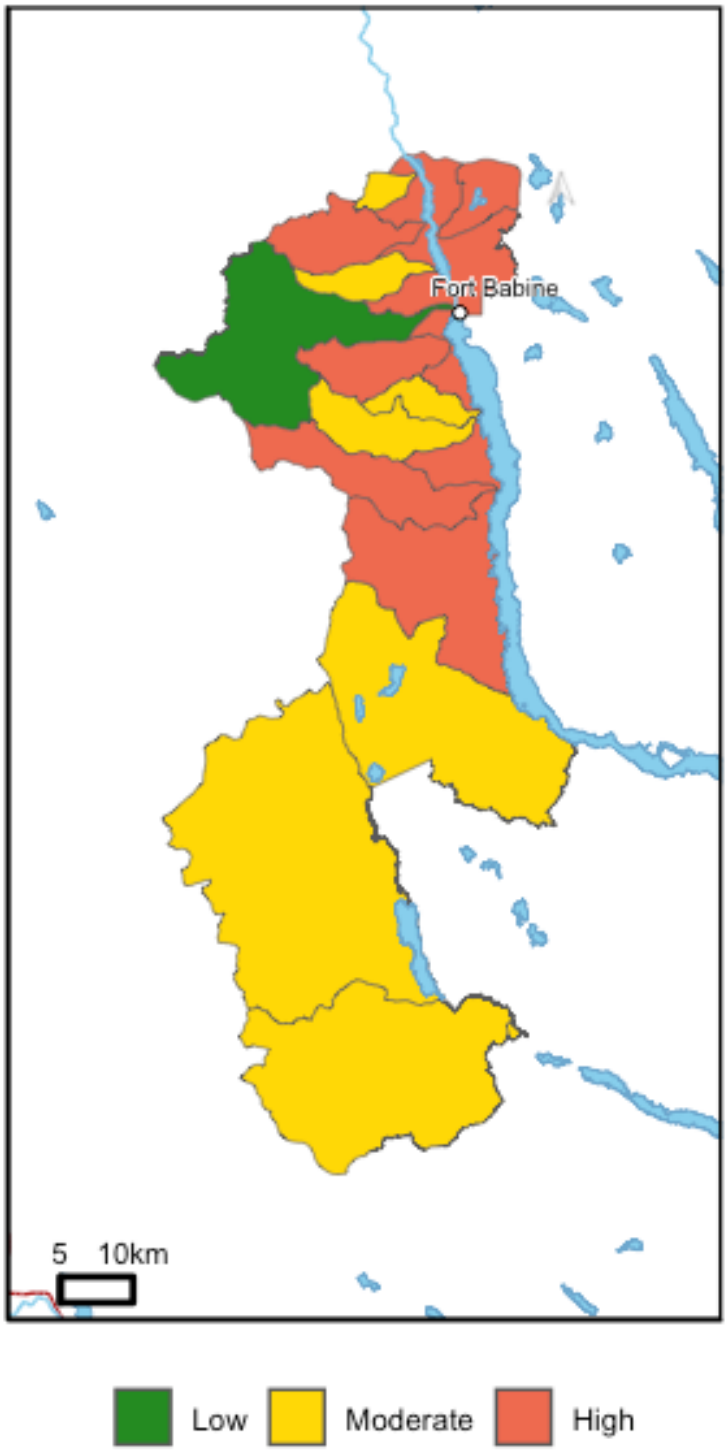


Figure 3: Road density (km/km^2) for each boundary in the study area is shown on a study area map. The results are colorized by risk threshold (low risk < 0.40 km/km^2, moderate risk ≥ 0.40 and < 1.2 km/km^2, high risk ≥ 1.2 km/km^2).

Road density was calculated for a total of 14 IWAP watersheds within the study area. Road density values ranged from 0.19 to 1.73 km/km^2, with road density values of six assessment units above the upper threshold of 1.2 km/km^2 and seven assessment units with road densities above the moderate risk threshold (Figure 3; Appendix B and Appendix C). Assessment units with high and moderate road densities are associated with road development throughout the study area (Figures 2 and 3).

Summary

Road density estimations were calculated for 14 IWAP watersheds within the Bulkley TSA and the Babine Lake Watershed using datasets sourced from the Province of BC. Risk categories derived by the Pacific Salmon Foundation were used to assess risk to freshwater habitat from road development.

Results of the analysis indicated road density values ranged from 0.19 to 1.73 km/km^2, with high and moderate risk of impacts from road development throughout the study area.

References

BC Ministry of Forests. 2022. Forest Tenure Road Section Lines [Electronic dataset]. Retrieved from https://catalogue.data.gov.bc.ca/dataset/forest-tenure-road-section-lines on November 1, 2022.

BC Ministry of Land, Water and Resource Stewardship [MLWRS]. 2022. Digital Road Atlas (DRA) - Master Partially-Attributed Roads [Electronic dataset]. Retrieved from https://catalogue.data.gov.bc.ca/dataset/digital-road-atlas-dra-master-partially-attributed-roads on November 1, 2022.

BC Ministry of Forests. 2022. Bulkley Strategic Road Inventory [Electronic dataset]. Provided by G. Buhr on November 29, 2022.

BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development [BC MFLNRORD]. 2021. FADM – Timber Supply Area (TSA) [Electronic dataset]. Retrieved from https://catalogue.data.gov.bc.ca/dataset/fadm-timber-supply-area-tsa on Apr. 21, 2021.

BC MFLNRORD. 2019a. Freshwater Atlas Lakes [Electronic dataset]. Retrieved from https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-lakes on Oct. 16, 2019.

BC MFLNRORD. 2019b. Freshwater Atlas Manmade Waterbodies [Electronic dataset]. Retrieved from https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-manmade-waterbodies on Oct. 16, 2019.

BC MFLNRORD. 2019c. Freshwater Atlas Rivers [Electronic dataset]. Retrieved from https://catalogue.data.gov.bc.ca/dataset/freshwater-atlas-rivers on Oct. 16, 2019.

BC Timber Sales [BCTS]. 2022. Bulkley, Lakes, and Morice TSA Roads [Electronic dataset]. Provided by M. Robinson on November 1, 2022.

Bulkley TSA Watershed Assessment Panel. 1999. Bulkley TSA "Interior Watershed Assessment Procedure" (IWAP) Watersheds [Electronic dataset]. The Panel included representatives from the BC Ministry of Forests, Fisheries and Oceans Canada, and the BC Ministry of the Environment. Provided by G. Buhr on April 28, 2023.

Eclipse Geomatics Ltd. 2022. WSP Indicator Analysis for Babine Lake: Road Density Freshwater Atlas (FWA) Assessment Units. Prepared for SkeenaWild Conservation Trust.

Eclipse Geomatics Ltd. 2020. WSP Indicator Analysis for the Kispiox TSA: Road Density Freshwater Atlas (FWA) Assessment Units. Prepared for SkeenaWild Conservation Trust.

Pacific Salmon Foundation. 2020. Methods for Assessing Status and Trends in Pacific Salmon Conservation Units and their Freshwater Habitats. The Pacific Salmon Foundation, Vancouver BC, Canada. Version 1.0.

Provincial Aquatic Ecosystems Technical Working Group (PAETWG) – Ministry of Environment and Climate Change Strategy and Ministry of Forests, Lands and Natural Resource Operations and Rural Development. 2020. Interim Assessment Protocol for Aquatic Ecosystems in British Columbia – Standards for Assessing the Condition of Aquatic Ecosystems under British Columbia's Cumulative Effects Framework. Version 1.3. 51 pp. URL: https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/cumulative-effects/protocols/cef-aquatic-ecosystems-protocol-dec2020.pdf

Porter, M., Pickard, D., Casley, S., Ochoski, N., Bryan, K. and S. Huang. 2014. Sockeye Habitat Report Cards: Spawning Conservation Unit (CU). Pacific Salmon Foundation Skeena Salmon Program. https://www.psf.ca/document-library/sockeye-habitat-report-cards-spawning-cu. Accessed Dec. 16, 2019.

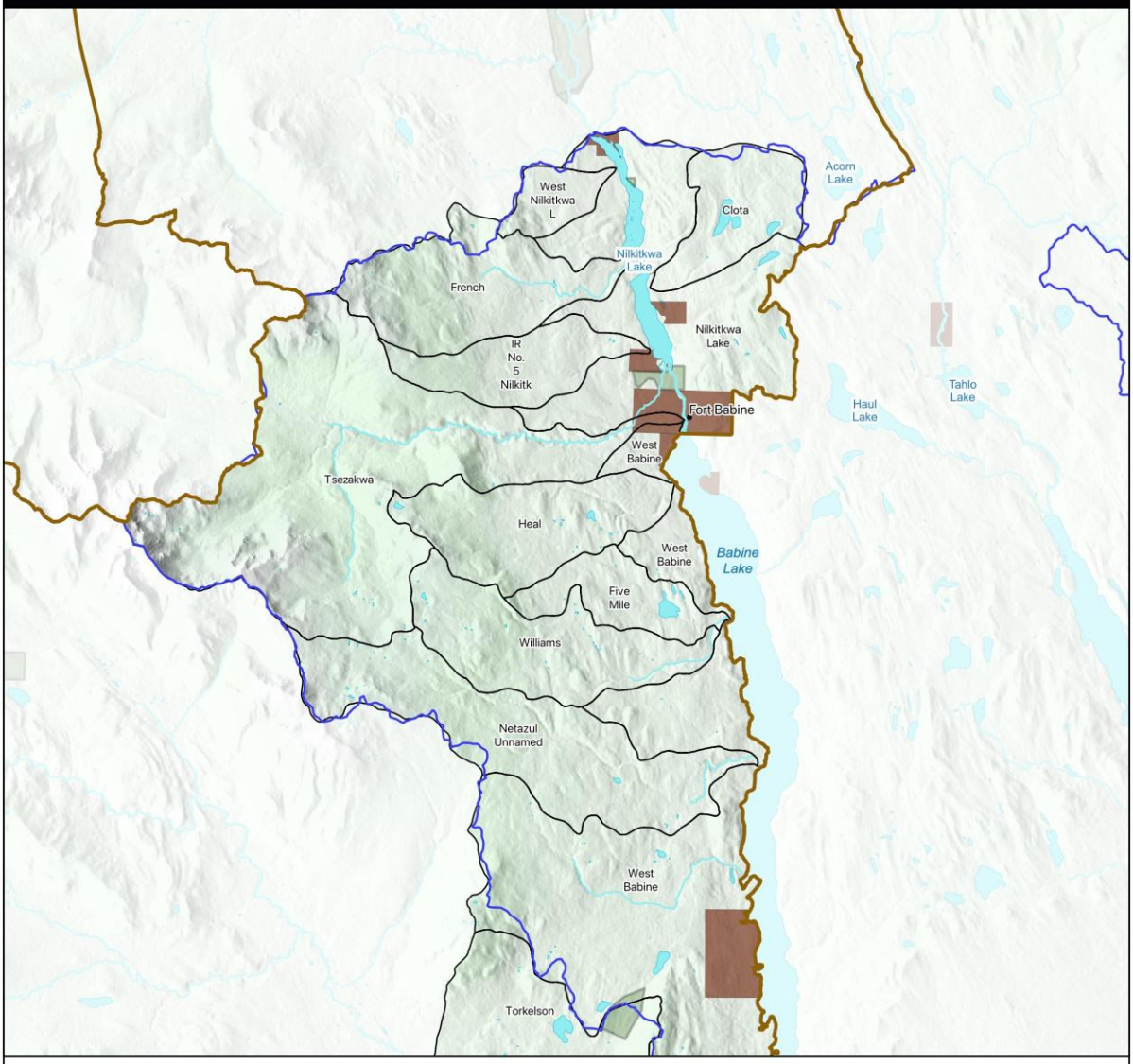
Porter, M., Casley, S., Pickard, D., Snead, E., Smith, R., and K. Wieckowski. 2017. Version 3.4, March 2019. Watershed Status Evaluation Protocol (WSEP): Tier 1 – watershed-level fish values monitoring. Report prepared by ESSA Technologies Ltd. for BC British Columbia Ministry of Forests, Lands and Natural Resource Operations and BC Ministry of the Environment (MOE), Victoria, BC. 27 p.

Stalberg, H.C., Lauzier, R.B., MacIsaac, E.A., Porter, M., and C. Murray. 2009. Canada's policy for conservation of wild pacific salmon: Stream, lake, and estuarine habitat indicators. Can. Manuscr. Fish. Aquat. Sci. 2859: xiii + 135p.

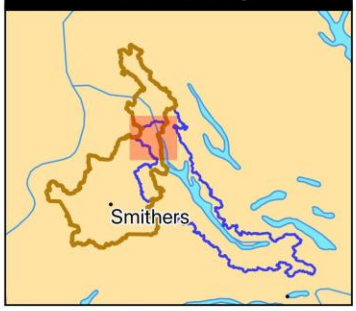
Appendix A: Reference Maps

eclipse GEOMATICS

Babine Lake Watershed Reference Map - North



Location Map



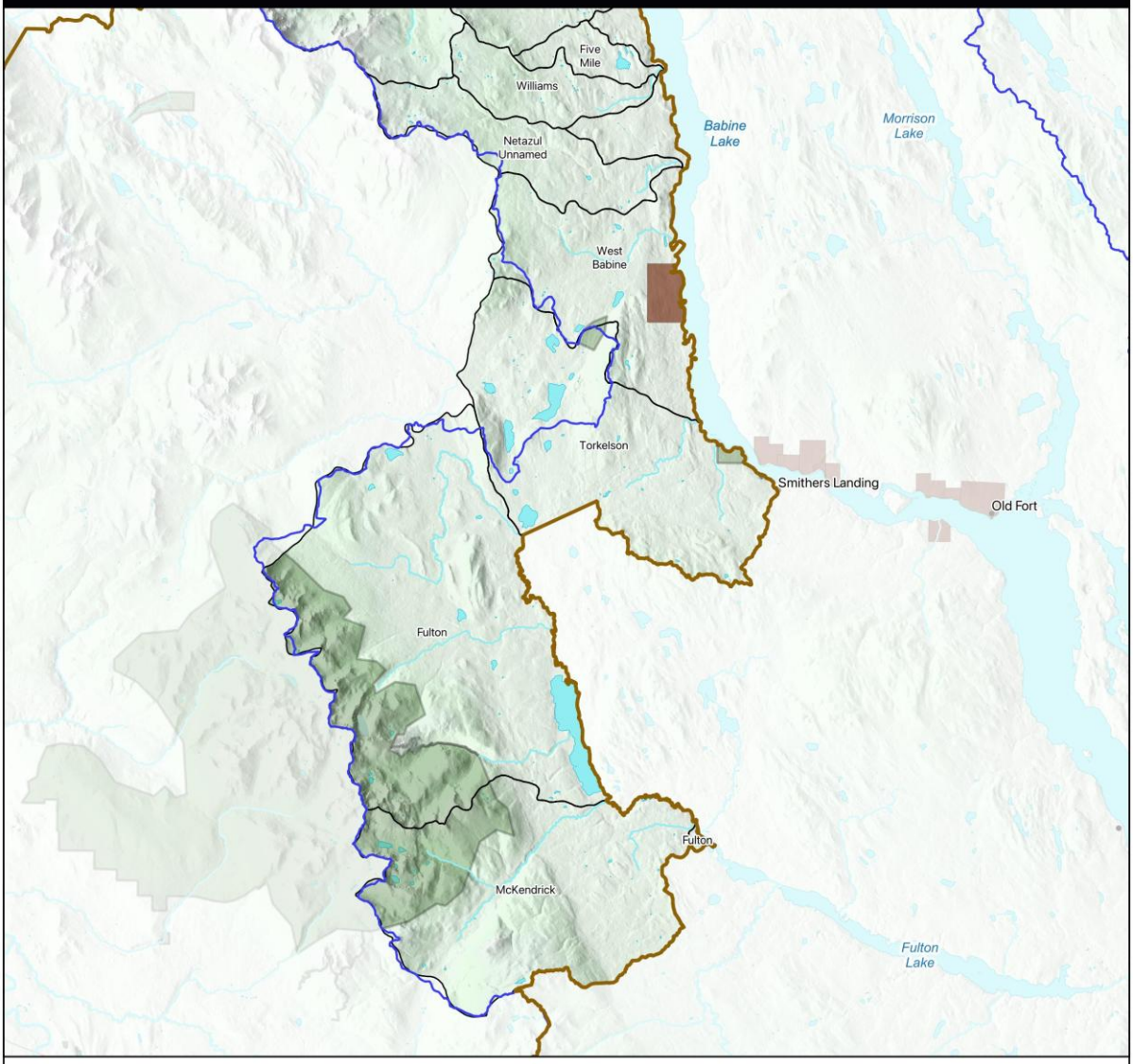
Legend

- Babine Lake IWAP Watershed
- Bulkley Timber Supply Area
- Babine Lake Watershed
- Reserve
- Park

0 1 2 3 4 5 km

Prepared for SkeenaWild by Eclipse Geomatics Ltd., May 2023.

Babine Lake Watershed Reference Map - South



Location Map

Legend

- Babine Lake IWAP Watershed
- Bulkley Timber Supply Area
- Babine Lake Watershed
- Reserve
- Park

0 5 10 km

Prepared for SkeenaWild by Eclipse Geomatics Ltd., May 2023.

Appendix B: Results Table

Assessment Unit	Net Area (km^2)	Road Length (km)	Road Density (km/km^2)	Risk
Clota	16.81	26.80	1.59	High
Five Mile	13.36	13.77	1.03	Moderate
French	31.70	41.12	1.30	High
Fulton	244.55	230.22	0.94	Moderate
Heal	27.87	39.48	1.42	High
IR No. 5 Nilkitk	16.87	19.90	1.18	Moderate
McKendrick	159.61	153.48	0.96	Moderate
Netazul Unnamed	47.75	59.62	1.25	High
Nilkitkwa Lake	55.08	95.47	1.73	High
Torkelson	145.21	154.61	1.06	Moderate
Tsezakwa	98.50	18.52	0.19	Low
West Babine	110.20	186.07	1.69	High
West Nilkitkwa L	6.82	5.60	0.82	Moderate
Williams	30.37	23.92	0.79	Moderate

Note: Values were rounded to two decimal places following risk characterization.

Appendix C: Results Distribution

Results are colourized by risk threshold (low risk < 0.40 km/km^2, moderate risk ≥ 0.40 and < 1.2 km/km^2, high risk ≥ 1.2 km/km^2).