Haines Borough Fish Passage Inventory and Assessment

Haines, Alaska

Prepared by the Takshanuk Watershed Council
November 2011

The mission of Takshanuk Watershed Council is to provide stewardship for the Chilkat, Chilkoot and Ferebee River systems. Through restoration, education, research, and community involvement we will benefit the natural ecology, economy and quality of life valued by all residents.

Introduction

Small streams in Southeast Alaska provide diverse and well-distributed habitat for anadromous fish, which support subsistence, commercial, and sport fisheries across the region. The ability of anadromous fish to migrate freely in small rivers and streams is critical for them to be able to complete their life cycle of migrating, spawning, and rearing. Primary impediments to fish passage on these small systems across federal, state, municipal, corporate, and private roads exist at crossings where culverts and other structure have been undersized, improperly installed, or damaged, negatively affecting channel morphology and fish passage.

The inability of a road crossing structure to pass juvenile or adult fish can have impacts on population and/or fish community structure over time. In 2008, the Takshanuk Watershed Council (TWC) completed a limited fish passage inventory and assessment in the Haines Borough with in-kind and funding support from the U.S. Fish and Wildlife Service Coastal Program and the Alaska Department of Environmental Conservation ACWA Program. The goal of this project was to initiate a Borough-wide inventory of road crossings of anadromous fish streams with existing protocols adapted from the USFS and ADFG. With this inventory, TWC can begin to realize its long-term goal to develop a prioritized database of all crossings in need of remediation based on fish passage needs and quality and quantity of upstream habitat. This report serves as the first part of the Haines Borough Fish Passage Inventory and Assessment and TWC expects it will be expanded in geographic scope and complexity as time and funds allow. Overall, this report provides an overview of the number, distribution, and condition of culvert crossings in the Haines Borough. It is TWC's intent that this information and associated maps will inform future culvert restoration, rehabilitation, and mitigation planning.

Methods

Road and anadromous stream intersections were identified by overlaying the Alaska Department of Fish and Game's (ADFG) Anadromous Waters Catalog (AWC) data with several road layers from the U.S. Census Bureau, and the Haines State Forest using TWC's Geographic Information System (GIS). A list of crossings was then developed based on where the AWC and road layers intersected. Crossings were grouped by general location and labeled according to road name and distance from the origination point of the road (e.g., Lutak 1.2, Mud Bay Road 7.7). Haines Borough roads, ADOT roads and Haines State Forest road crossings were considered the priority for this initial study.

Culverts under the ADOT Haines Highway were excluded from this survey due to relatively recent reconstruction of the highway and stream crossing improvements from Wells Bridge to the Border Station. Pre-project site evaluations by ADFG Habitat Division as well as contractual surveys and assessment has been recently completed by engineering firms in support of additional pending Haines Highway reconstruction from Haines Airport to Wells Bridge.

Using the list of crossings established from GIS, a two-person field crew then surveyed each crossing for their ability to pass fish using methods and criteria adapted from existing fish passage evaluation protocols. Stream channel, road, and crossing structure characteristics, were recorded on the TWC Fish Passage Inventory Data Sheet (Appendix A) in the field. Field methods for these data collections were adapted from those defined in the 2005 USFS National Inventory and Assessment Procedures For Identifying Barriers to Aquatic Organism Passage at Road-Stream Crossings (NIAP, 2005). Additional technical assistance with stream and culvert gradient survey procedures were provided as an in-kind service by engineering staff, Natural Channel Design, Inc.

Stream channel and culvert characteristics were then evaluated against the attributes defined in the ADFG /USFS 'Red-Gray-Green' Fish Passage Evaluation Matrix (Figure 1). The Matrix puts crossings into three categories: Red, Gray, and Green. Definitions in this categorization are as follows (using the 55mm juvenile coho as the design fish and the State of Alaska Q2-2-day duration flow standard.)

GREEN: Conditions are **assumed to be adequate for fish passage**
RED: Conditions are **assumed not to be adequate for fish passage**
GRAY: **Additional analysis is required** to determine if conditions are adequate for fish passage. Computer aided analysis of hydraulic conditions using the FishXing program is necessary for a definitive answer. (ADFG Tongass Road Condition Survey Report, 2000)

If the initial survey using the Matrix indicated 'Green' or 'Red' the crossing was not further evaluated. A second TWC-Natural Channel Design Inc. engineering-grade survey was completed on a subset of the culverts determined to be 'Red' in the initial survey and that data is available in a separate report upon request from TWC. Culverts determined to be 'Gray' have not been further evaluated using the Fish Xing program.

Figure 1. The Red-Gray-Green Matrix used by TWC as an initial categorization of stream crossings evaluated in this inventory (ADFG 2000).

Table 1. Fish passage evaluation criteria.

	Structure	*Green1*	*Grey2*	*Red3*
1	Bottomless pipe arch or countersunk pipe arch, substrate 100% coverage, invert depth greater than 20% of culvert rise.	Installed at channel grade (+/- 1%), culvert span to bankful width ratio of 0.9 to 1.0, no blockage.	Installed at channel grade (+/- 1%), culvert span to bankful width ratio of 0.5 to 0.9, less than 10% blockage.	Not installed at channel grade (+/- 1%), culvert span to bankful width ratio less than 0.5, greater than 10% blockage.
2	Countersunk pipe arches (1x3 corrugation and larger). Substrate less than 100% coverage, invert depth less than 20% of culvert rise.	Grade less than 0.5%, no perch, no blockage, culvert span to bedwidth ratio greater than 0.75.	Grade between 0.5 -2.0%, less than 4" perch, less than 10% blockage, culvert span to bedwidth ratio of 0.5 to 0.75.	Grade greater than 2.0%, greater than 4" perch, greater than 10% blockage, culvert span to bedwidth ratio less than 0.5.
3	Circular CMP 48 inch span and smaller, spiral corrugations, regardless of substrate coverage.	Culvert gradient less than 0.5%, no perch, no blockage, culvert span to bedwidth ratio greater than 0.75	Culvert gradient 0.5 to 1.0%, perch less than 4 inches, less than 10% blockage, culvert span to bedwidth ratio of 0.5 to 0.75.	Culvert gradient greater than 1.0%, perch greater than 4 inches, blockage greater than 10%, span to bedwidth ratio less than 0.5.
4	Circular CMPs with annular corrugations larger than 1x3 and 1x3 spiral corrugations (>48" span), substrate less than 100% coverage, invert depth less than 20% culvert rise.	Grade less than 0.5%, no perch, no blockage, culvert span to bedwidth ratio greater than 0.75.	Grade between 0.5 -2.0%, less than 4" perch, less than 10% blockage, culvert span to bedwidth ratio of 0.5 to 0.75.	Grade greater than 2.0%, greater than 4" perch, greater than 10% blockage, culvert span to bedwidth ratio less than 0.5.
5	Circular CMPs with 1x3 annular corrugations (all spans) and 1x3 spiral corrugations (>48" span), 100% substrate coverage, substrate depth greater than 20% of culvert rise.	Grade less than 1%, no perch, no blockage, culvert span to bedwidth ratio greater than 0.75	Grade 1.0 to 3.0%, perch less than 4 inches, less than 10% blockage, culvert span to bedwidth ratio of 0.5 to 0.75.	Culvert gradient greater than 3.0%, perch greater than 4 inches, blockage greater than 10%, culvert span to bedwidth ratio less than 0.5.
6	Circular CMPs with 2x6 annular corrugations (all spans), 100% substrate coverage, substrate depth greater than 20% of culvert span.	Grade less than 2.0%, no perch, no blockage, culvert span to bedwidth ratio greater than 0.75	Grade 2.0 to 4.0%, less than 4" perch, less than 10% blockage, culvert span to bedwidth ratio of 0.5 to 0.75.	Grade greater than 4.0%, greater than 4 inch perch, greater than 10% blockage, culvert span to bedwidth ratio less than 0.5.
7	Baffled or multiple structure installations		All	
8	Log stringer or modular bridge	No encroachment on bedwidth.	Encroachment on bedwidth (either streambank).	Structural collapse.

Results

Using GIS and field evaluations, TWC identified 37 crossings in the Haines Borough fish passage inventory. Surveys on these crossings resulted in 21 Red, 5 Gray, and 11 Green crossings as shown in the overall data summary Appendix B. Of the 37 crossings, eight were in the Haines Town site with two Green, one Gray, and five Red. The Red crossings are all on Comstock Rd (Table 1; Figures 2 & 3).

On other road systems accessed via the Haines Highway, 15 crossings were surveyed (Table 2). On the east side of the highway, seven of the crossings are in the Kelsall drainage where five of the seven crossings are classified as Red with the remaining being Green (Figures 4 & 5). Twenty six miles out the Highway on the west side in the Porcupine area, seven crossings were identified with five being Green and two being Gray (Figure 6). Near the U.S./Canada Border two crossings were identified on 39 Mile Creek one Green and one Gray (Figure 7).

Out the Lutak Road, four crossings were surveyed with three Red and one Green (Table 3). The crossing at 4 mile Lutak Rd was not surveyed because it was replaced in 2009 (Figure 8). Towards Mud Bay, of the eleven culverts surveyed, eight are Red and three are Gray (Figures 9 & 10). In addition, two culverts were identified but not surveyed in this area.

Conclusion

Of the 37 crossings surveyed under this project, 21 of them were classified as 'Red' indicating that they need to be replaced or upgraded before fish can pass unimpeded. While identifying these crossings is a good starting point to prioritize restoration work, it does not identify the quality of upstream habitat that would be opened up to anadromous fish with improved passage. While the type of habitat upstream of some crossings is known such as those on Comstock Road this knowledge is not as clear on the crossings on the Kelsall Road. To complete the prioritization of restoration work for crossings in the Haines Borough, the quality of upstream habitat that would be opened up needs to be evaluated and linked with the crossing data.

It is important to note that this study did not inventory all of the crossings in the Haines Borough. In addition, crossings are in a constant state of flux due to weather events such as floods, roadwork, or structural deterioration and require periodic re-survey. With the foundation of this initial inventory, TWC has established a baseline defining the location, distribution, and condition of fish passage improvement opportunities across Haines Borough. Maintaining this inventory with frequent updates will ensure that when restoration funding becomes available it will be used to maximize fish habitat restoration through maintenance, grant funded activities, or mitigation.

Table 1. Results of crossings surveyed in the Haines Townsite.

Culvert ID	Steam	Tributary to	Latitude	Longitude	Road	Crossing	Final Culvert Assessment
Fair Dr. & HH	Sawmill	Chilkat River	59.23417	-135.45703	Fair Drive	Culvert	GREEN
Spruce Grove Dr. 0.0+	Sawmill	Chilkat River	59.23586	-135.46490	Spruce Grove Drive	Culvert	GREEN
Ed Shirley Dr & Mudbay	Unnamed	Sawmill Creek	59.23104	-135.44845	Ed Shirely Drive	Culvert	GRAY- Gradient
Comstock 0.0+	Unnamed	Sawmill Creek	59.24025	-135.46231	Comstock	Culvert	RED- Gradient
Comstock 0.1	Unnamed	Sawmill Creek	59.24069	-135.46305	Comstock	Culvert	RED- Gradient and Perch
Comstock 0.1+	Unnamed	Sawmill Creek	59.24034	-135.46418	Comstock	Culvert	RED- Gradient and Perch
Comstock 0.2	Unnamed	Sawmill Creek	59.24039	-135.46560	Comstock	Culvert	RED- Gradient and Perch
Comstock 0.3	Unnamed	Sawmill Creek	59.24025	-135.46803	Comstock	Culvert	RED- Gradient and Perch

Figure 2. Haines Townsite crossings. Results for HHY & Union, DOT Yard, and 6th & Union are from a previous study.

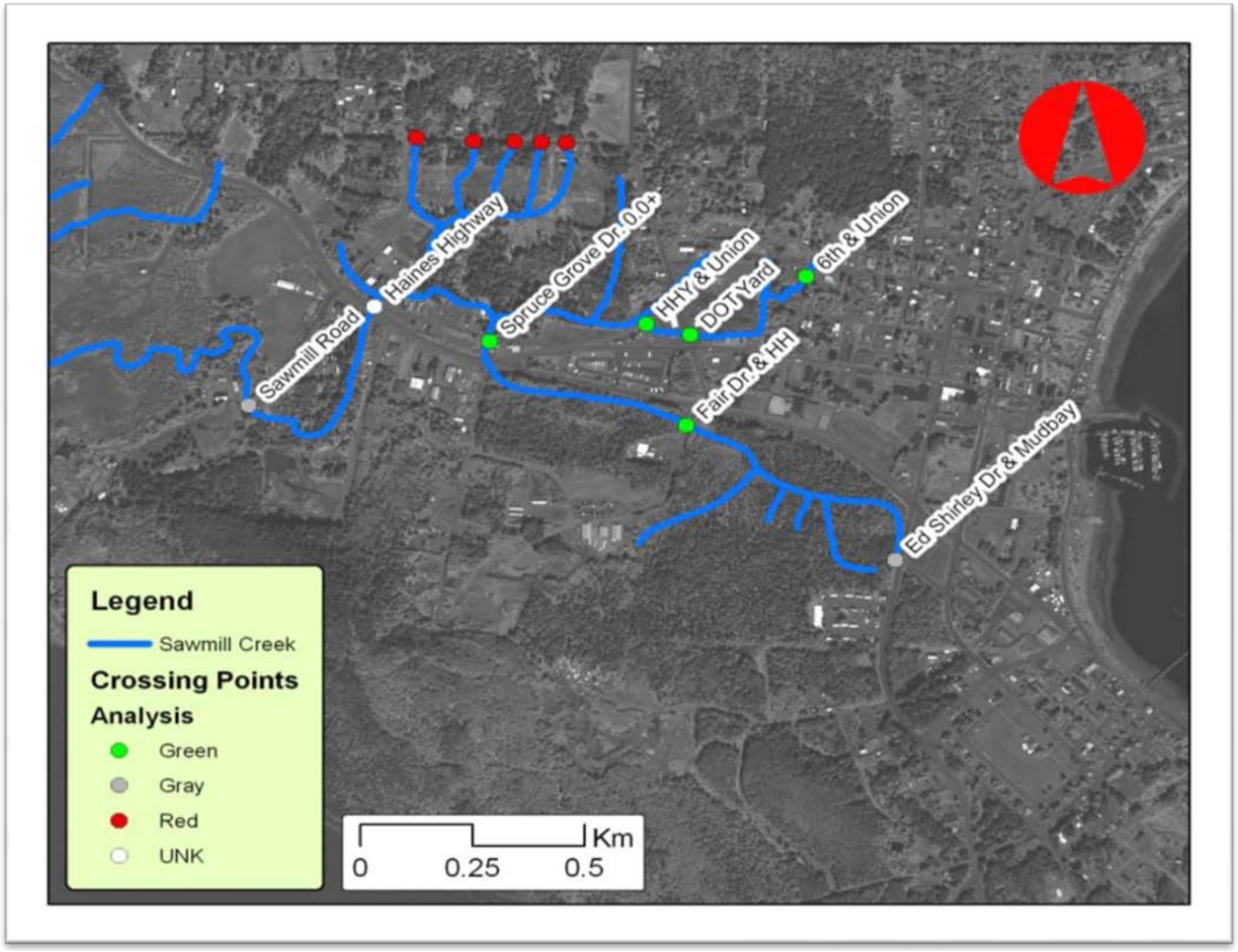


Figure 3. All of the crossings on Comstock Road in the Haines townsite are classified as deficient for fish passage.

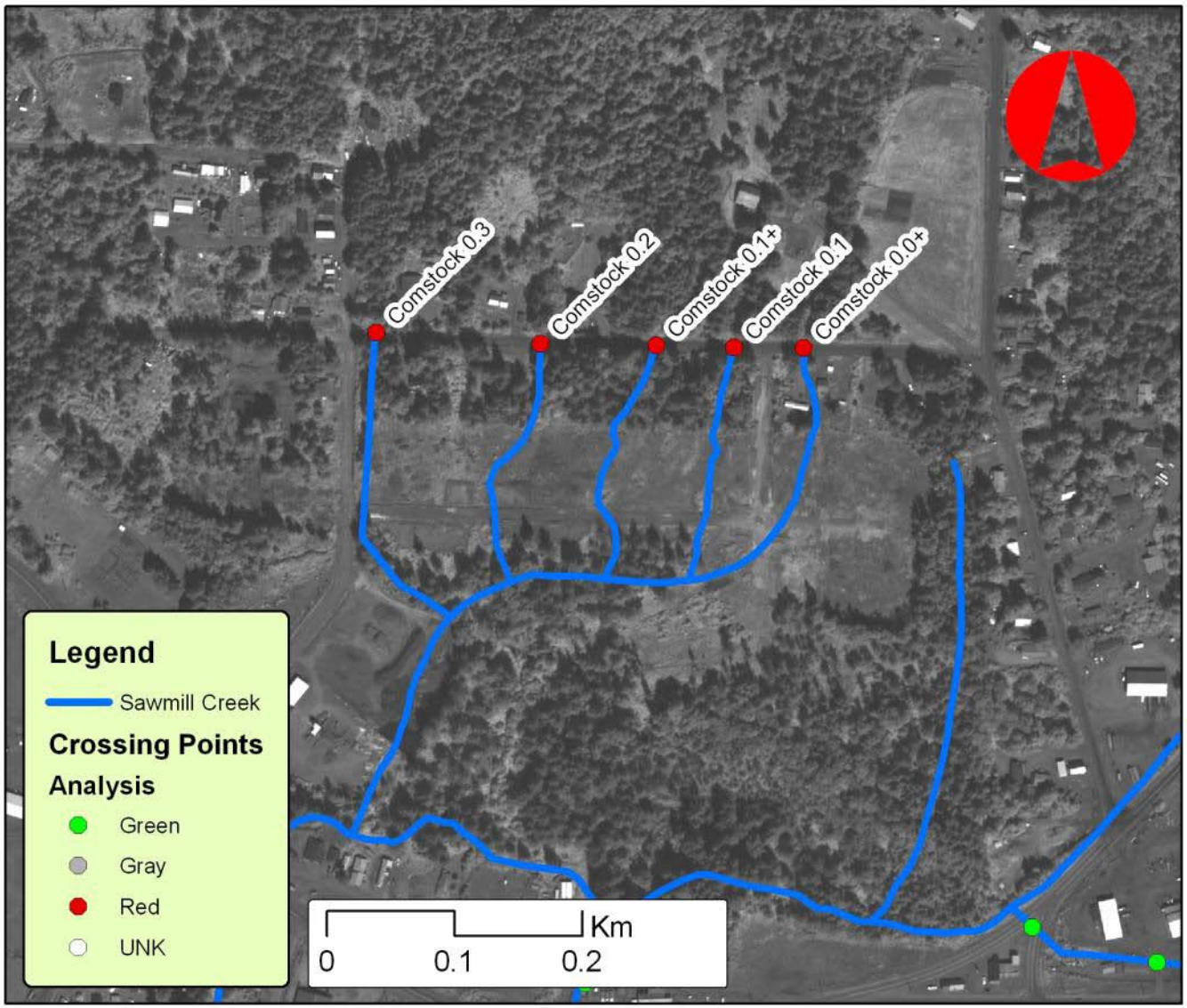


Table 2. Results of crossing surveys out the Haines Highway.

Culvert ID	Steam Name	Tributary to	Latitude	Longitude	Road	Crossing	Final Culvert Assessment
Kelsall_2.7	Unnamed	Kelsall River	59.46954	136.03684	Kelsall Rd	Culvert	RED- Perch and Ratio
Kelsall_3.0	Unnamed	Kelsall River	59.47253	136.04076	Kelsall Rd	Culvert	RED- Perch and Gradient
Kelsall_3.9	Unnamed	Kelsall River	59.48342	136.05371	Kelsall Rd	Culvert	RED- Ratio and block
Kelsall_4.3	Unnamed	Kelsall River	59.48749	136.06078	Kelsall Rd	Culvert	GREEN
Kelsall_9.6	Unnamed	Kelsall River	59.53788	136.09967	Kelsall Rd	Culvert	RED- Perch and Gradient
Kelsall_9.7	Unnamed	Kelsall River	59.53812	136.10088	Kelsall Rd	Culvert	RED- grade of one culvert
Kelsall_9.8	Nataga	Kelsall River			Kelsall Rd	Bridge	GREEN
Porcupine_2.2	Herman	Klehini River	59.41454	136.06434	Porcupine	Culvert	GRAY- ratio & grade
Porcupine_3.9	Cave	Klehini River	59.41693	136.11258	Porcupine	Culvert	GREEN
Porcupine_8.1	Porcupine	Klehini River	59.42049	136.22282	Porcupine	Bridge	GREEN
Porcupine_8.6	Bear	Klehini River	59.42258	136.23799	Porcupine	Bridge	GREEN
Porcupine_	Little Salmon	Tsirku River	59.38403	136.07486		Bridge	GREEN
Farm_4.0	Unnamed	Tsirku River	59.37545	135.93941	Farm	Culvert	GRAY- ratio & grade
Farm_4.0+	Unnamed	Tsirku River	59.37536	135.93963	Farm	Culvert	GREEN
Boarder Patrol Subdivision	39 Mile	Klehini River			Unnamed	Culvert	GRAY- Gradient & Ratio
Rock Quary	39 Mile	Klehini River			Highway	Bridge	GREEN

Figure 4. Crossings on the lower Kelsall Road out the Haines Highway.

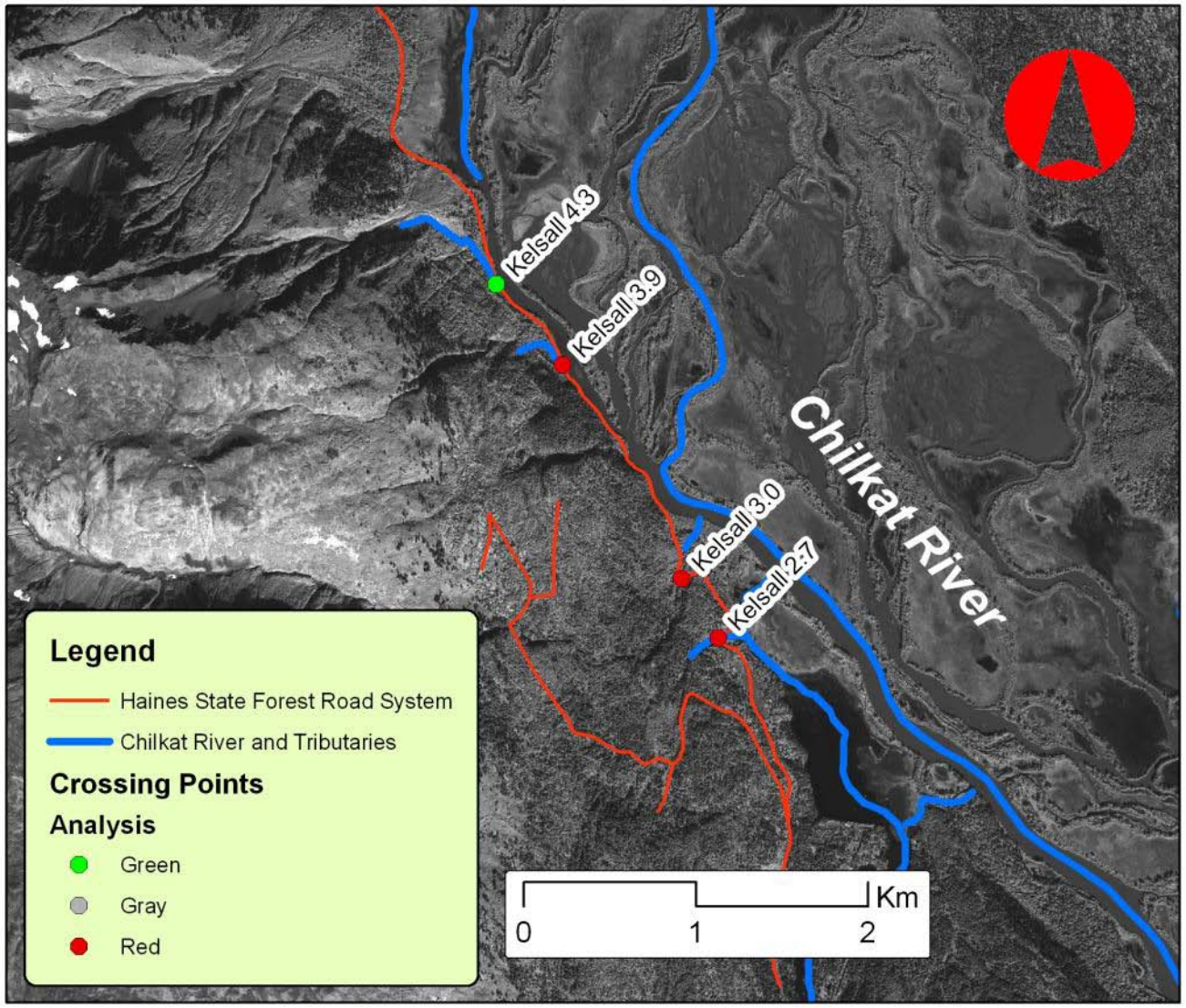


Figure 5. Crossings on the upper Kelsall Road out the Haines Highway.

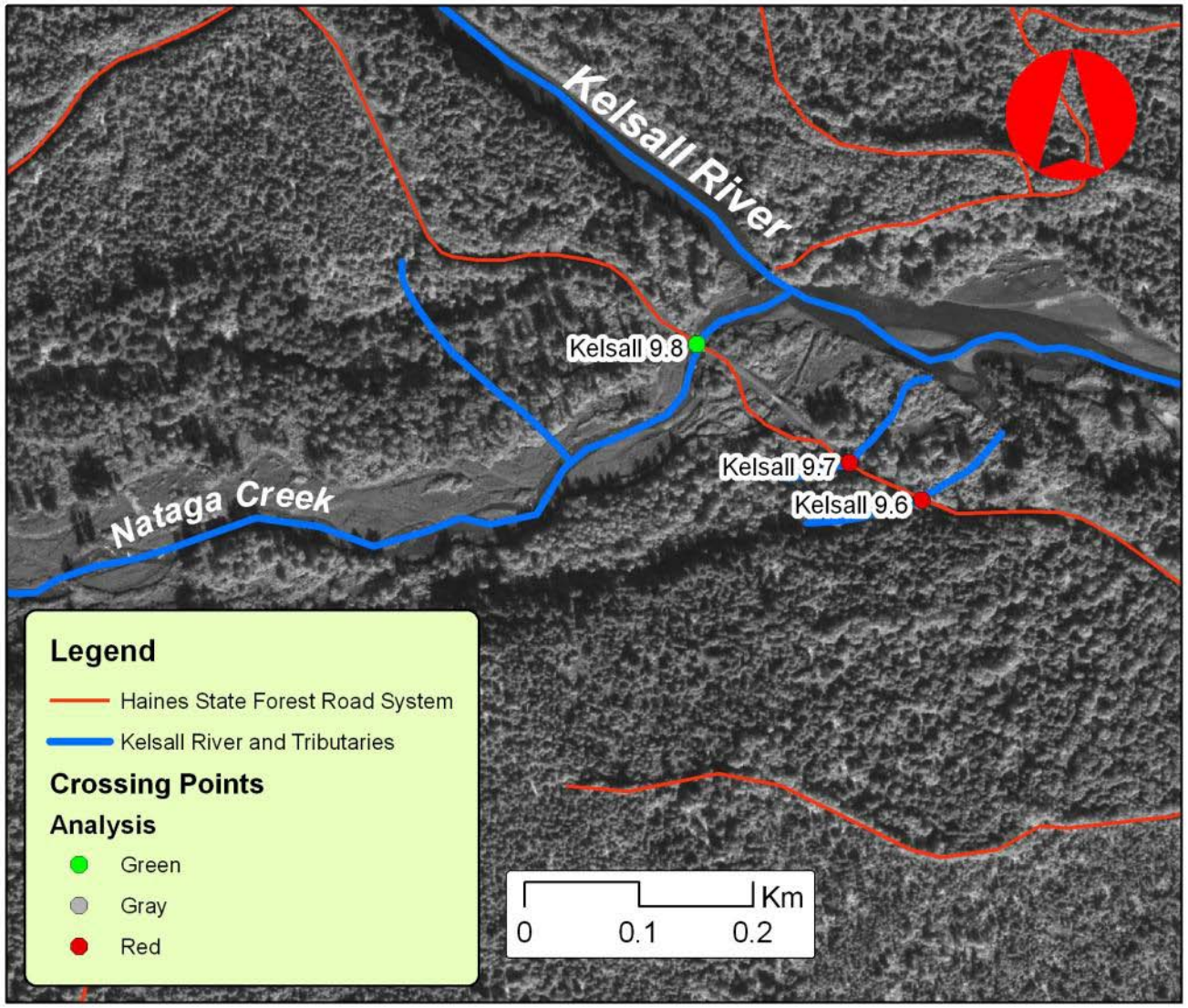


Figure 6. Porcupine area crossings south of the Haines Highway.

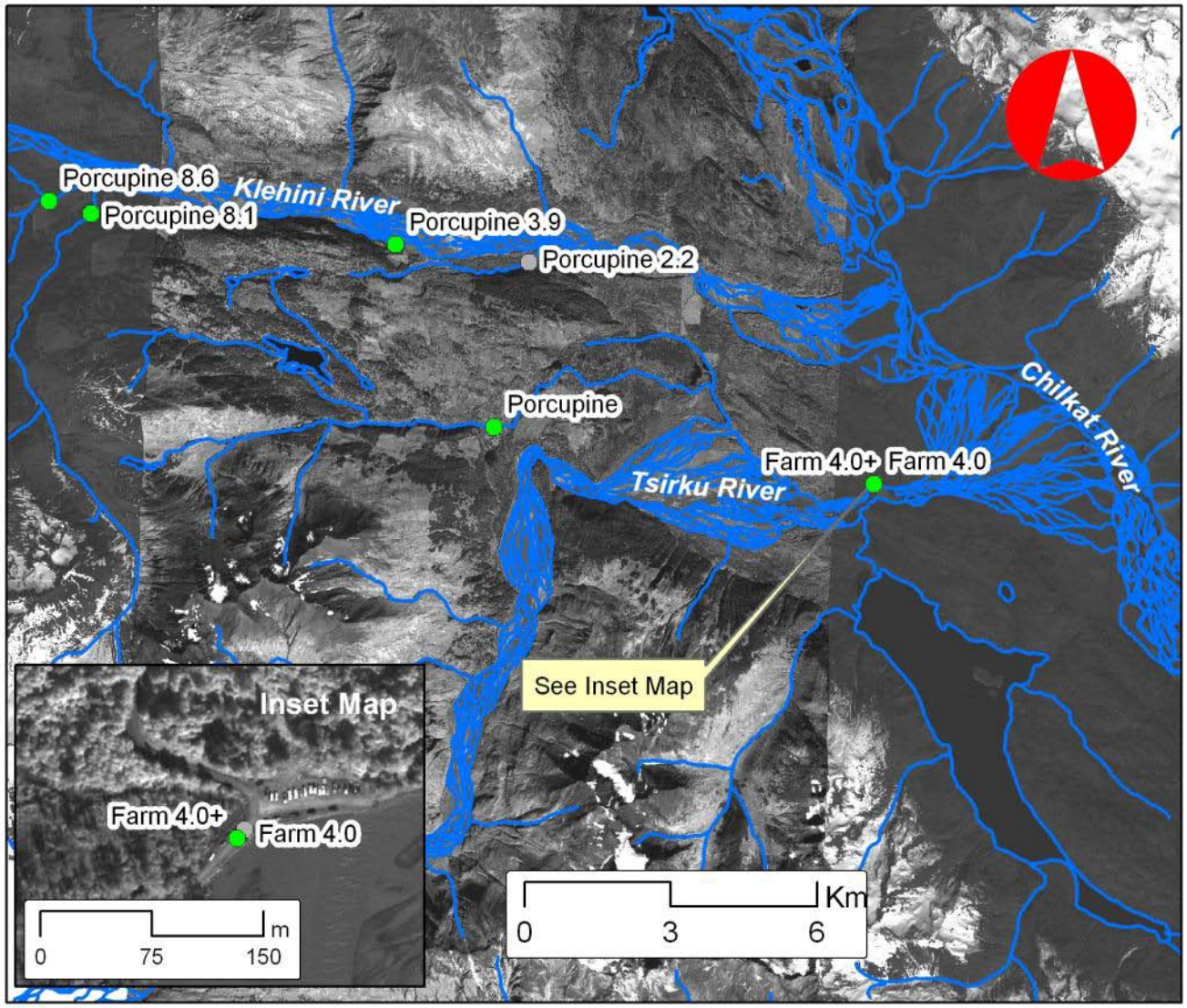


Figure 7. Crossings on 39 Mile Creek near the U.S./Canada Border.

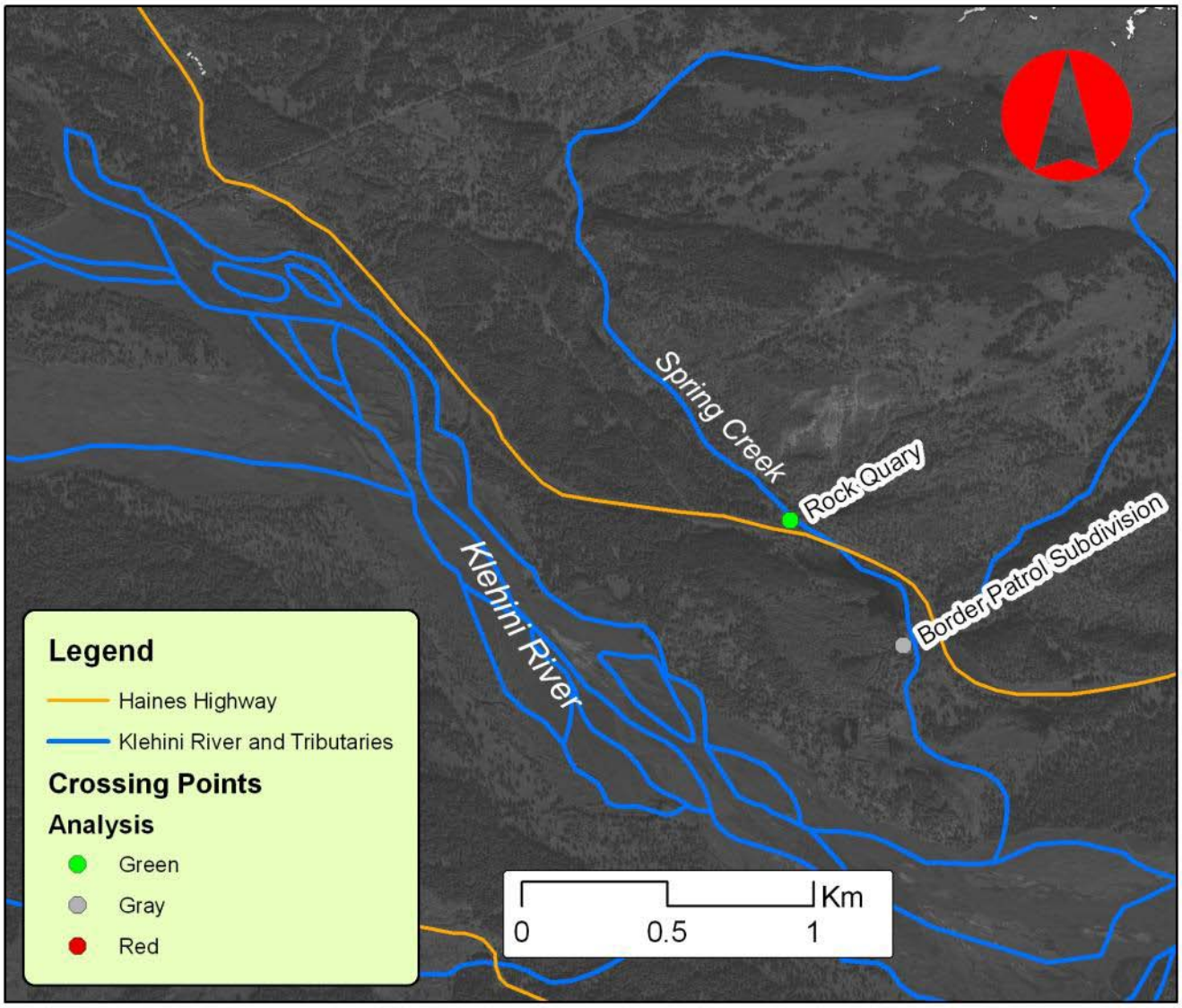


Table 3. Survey results from Lutak Road and the Mudbay area.							
Culvert ID	**Steam Name**	**Tributary to**	**Latitude**	**Longitude**	**Road**	**Crossing**	**Final Culvert Assessment**
Lutak_1.6	Johnson's	Lutak Inlet	59.26045	135.44220	Lutak Rd	Culvert	RED- Perch
Lutak_2.1	Mink Creek	Lutak Inlet	59.26747	35.44516	Lutak Rd	Culvert	No Survey Schedule to be replaced in 2009
Lutak_5.9	Unnamed	Lutak Inlet	59.29952	135.51647	Lutak Rd	Culvert	RED- Perch, Gradient
Lutak_7.5	Unnamed	Lutak Inlet	59.31410	135.54673	Lutak Rd	Culvert	RED- Perch, Gradient, Ratio
Lutak_9.0	Chilkoot River	Lutak Inlet	59.32436	135.55814	Lutak Rd	Bridge	GREEN
Mud Bay Area							
SmallTracts_1.7	Holgate	Chilkat Inlet			Mudbay	Culvert	GRAY- RATIO
Mudbay_2.4	Unnamed	Car's Cove	59.20267	135.43103	Mudbay	Culvert	RED-Perched and Gradient
Mudbay_2.4+	Unnamed	Car's Cove	59.20136	135.43115	Mudbay	Culvert	GRAY- Ratio, Gradient, block
Mudbay_5.3	Letnikof	Letnikof Cove	59.17085	135.38702	Mudbay	Culvert	RED- Perch, Grade
Mudbay_5.4	Letnikof	Letnikof Cove	59.17012	135.38566	Mudbay	Culvert	RED- Gradient and Ratio
Mudbay_5.6	Unnamed	Letnikof Creek	59.16793	135.38271	Mudbay	Culvert	RED- Perch and Gradient
Mudbay_6.3	Jurgeleit	Paradise Cove	59.15921	135.37687	Mudbay	Culvert	RED- Perch, Gradient, Ratio
Mudbay_7.1	Flat Bay	Flat Bay	59.15653	135.35972	Mudbay	Culvert	RED-Perch
Mudbay_7.9	Kip's	Flat Bay	59.14863	135.34874	Mudbay	Culvert	RED- Gradient
ChilkatPark_0.3	Tom's	Flat Bay Creek	59.15006	135.36720	Chilkat State Park	Culvert	RED- Gradient

Figure 8. Crossings on the Lutak Road. The Lutak 2.1 crossing was not surveyed.

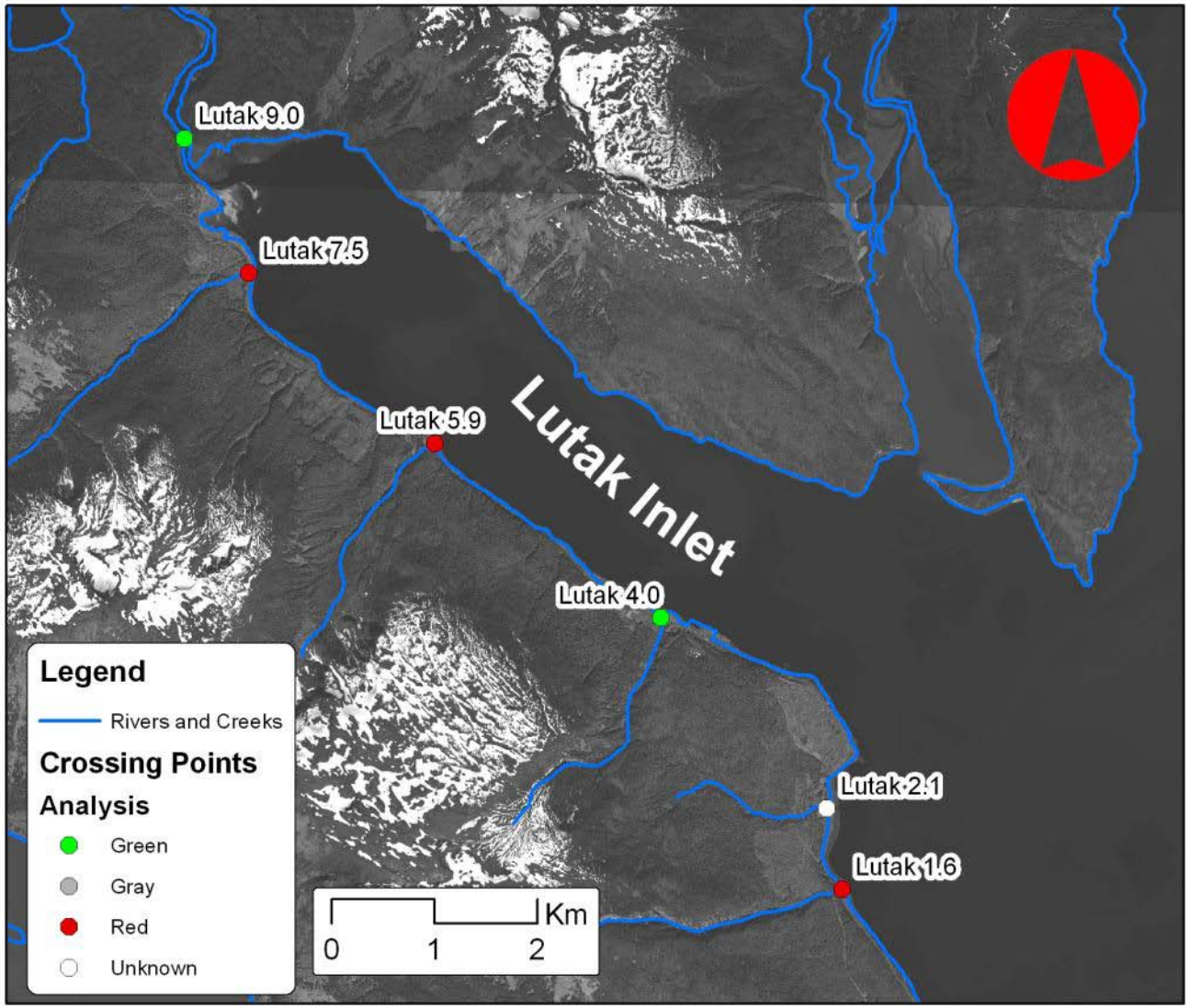


Figure 9. Crossings in the Mudbay area including Holgate (Onemile) Creek.

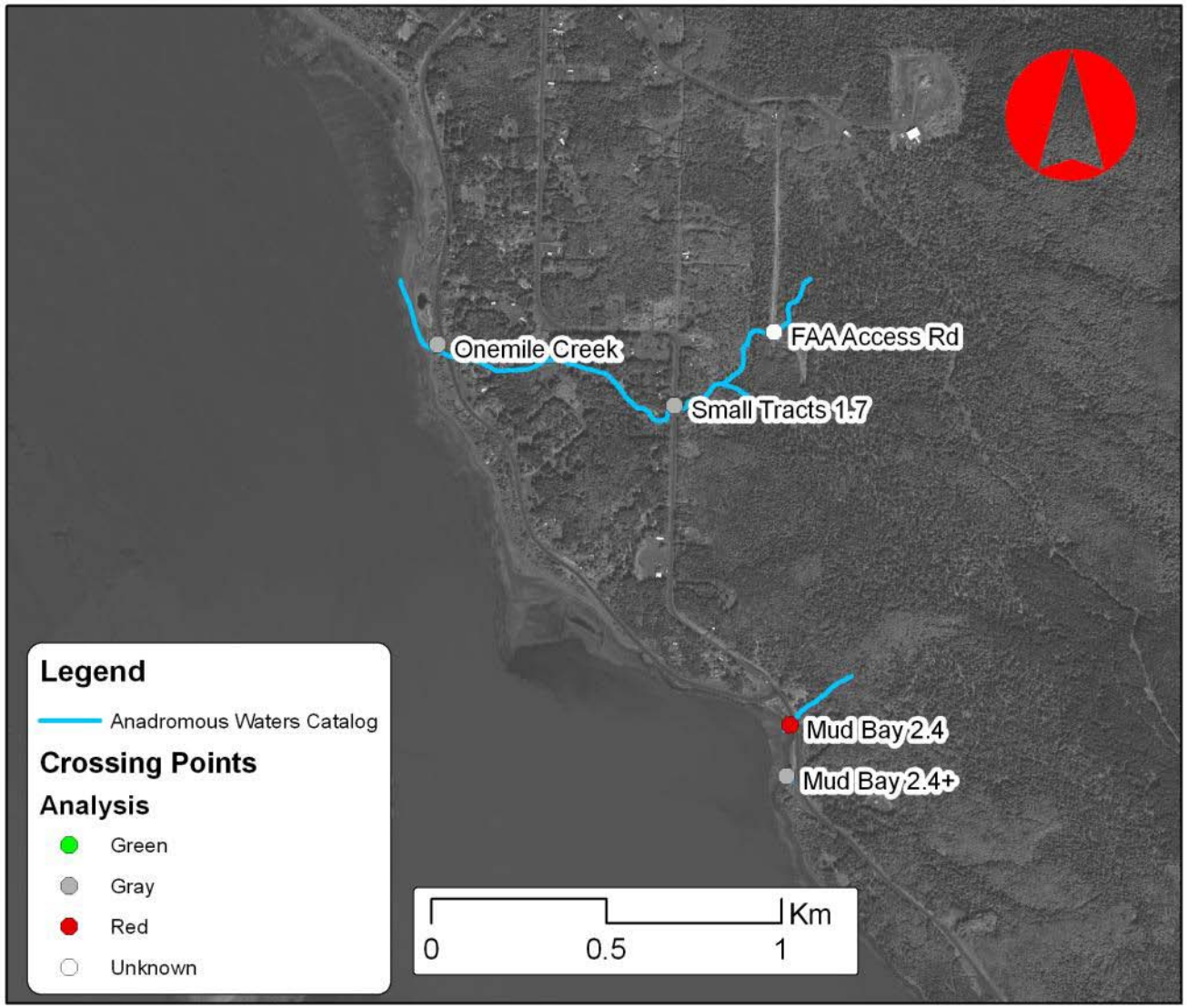
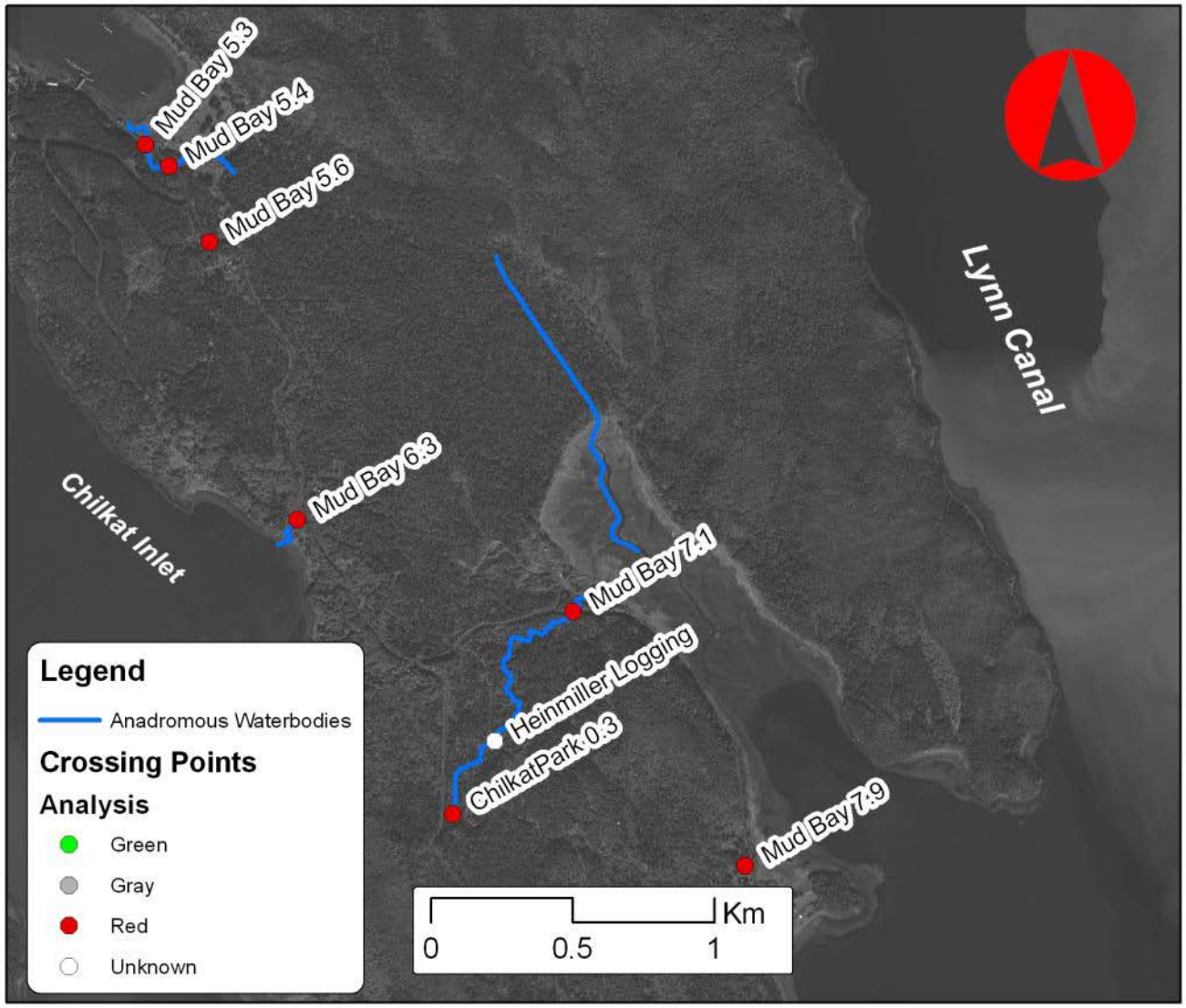


Figure 10. Crossings in southern Mudbay area.



REFERENCES

Flanders S. L. and J. Cariello 2000. Tongass Road Condition Survey Report. Technical Report No. 00-7 Available from the Southeast Regional Office of the Habitat and Restoration Division, Alaska Department of Fish and Game, 802 3rd Street, Douglas, AK, 9982400020.

Appendix A. Example inventory fish passage data sheet.

FISH PASSAGE INVENTORY DATA SHEET

Road: Mud Bay Road	Mile Post:	Crossroad:	Elev:
Stream Name: Holgate Creek	Tributary to: Drains into the Chilkat Inlet	Basin: sub-basin of Battery Point Watershed	
Quad:	Section-Township-Range: Sec 3, T31S, R59E	Lat/Long	

Flow Conditions During Survey: [X] continuous [ ] isolat. pools [ ] dry
Describe:

Fisheries Information

Fish Presence Observed During Survey: [ ] upstream [ ] downstream [ ] none
Age Classes: [ ] adults [ ] juveniles [ ] none
Species: cutthroat trout (*Salmo clarkii*)
Juvenile Size Classes: [ ] <3" [ ] 3"-6" [ ] >6"
Number of Fish Observed:

Stream Crossing Information

Inlet Type: [X] projecting [ ] headwall [ ] wingwall [ ] mitered [X] flared
Alignment (deg): [X] <30° [ ] 30°-45° [ ] >45°
Inlet Apron: [ ] yes [X] no
Describe: Inlet flared end section with pipe slightly projected

Outlet Configuration: [ ] at stream grade [X] free-fall into pool [ ] cascade over riprap
Outlet Apron: [X] yes [ ] no
Tailwater Control: [ ] pool tailout [ ] full-spanning log or debris jam [ ] other
[ ] concrete weir [ ] boulder weir [ ] log weir [X] no control point
Describe: outlet flared end section, apron extending 6.5 ft beyond culvert

Channel Width(s):	upstream:	downstream:	OHW:
	~10 (ft)	30+ (ft)	8 (ft)

Depth(s):	inlet invert	outlet invert	bankfull:	pool	tail crest
	(ft)	(ft)	(ft)	(ft)	

Culvert Information

Culvert Type: [X] circular [ ] pipe arch [ ] box [ ] open-bottom [ ] other

Dimensions:	Diameter:	Height/Rise:	Width/Span:	Length:
	66 (in.)	(ft)	(ft)	80 (ft)

Material: [ ] SSP [ ] CSP [X] aluminum [ ] plastic
[ ] concrete [ ] log/wood [ ] other

Corrugations (width x depth): [ ] 2-2/3" x 1/2" [X] 3" x 1" [ ] 5" x 1"
[ ] 6" x 2" [ ] spiral [ ] other

Slope(s):	Upstream:	Downstream:	Culvert:	Bankfull/OHW:
	3.02%	**1.07%**	**6.50%**	**3.00%**

Embedded: [ ] yes [X] no culvert not retaining material
Substrate Depth (ft) 1 Substrate Coverage 5%
Describe Substrate: Most material has washed away; some substrate still in frame #s 7,10,13

Pipe Condition: [ ] good [X] fair [ ] poor [ ] extremely poor
Describe: algae mark ~6" above frame
Rustline Height (ft): [ ] NP (new CSP or SSP) [ ] NA (concrete,alum,plastic)

Barrel Retrofit (weirs/baffles): [X] yes [ ] no retention grid not holding material
Type: [X] steel ramp baf [ ] Washington [X] other culvert bedload collector
Describe (size, number, placement, materials): 6.6' long x 3.5' wide x 1.1' high; 13 frames

Appendix A. Example inventory fish passage data sheet.

Most substrate has been removed from baffle device; baffle sections are ~6.6 ft with 13 sections through culvert; nos. 13, 10, 7 still have some substrate ~200mm size; no. 13 is downstream of culvert and might be obstructing passage within the apron end section. Debris has accumulated just outside the outlet and may impede passage.

Outlet Beam:
Breaks-in-Slope:
Fill Volume:

Appendix A. Example inventory fish passage data sheet.

SITE PHOTOS

Culvert ID	Waypoint	Steam Name	Tributary to	Latitude	Longitude	Road	Mile Post	Crossing	Flow	Fish Present	Inlet	Outlet	Culv. Type	Culv. Width (in)	Culv. Height (in)	Culv Material
Kelsall_2.7	44	Unnamed	Kelsall River	59.46954	-136.03684	Kelsall Rd	2.7	Culvert	Continuous	AWC	Projecting	fall over riprap	Circular	48	48	CMP
Kelsall_3.0	43	Unnamed	Kelsall River	59.47253	-136.04076	Kelsall Rd	3.0	Culvert	Continuous	TRAP	Projecting	free-fall into pool	Circular	48	48	CMP
Kelsall_3.9	41	Unnamed	Kelsall River	59.48342	-136.05371	Kelsall Rd	3.9	Culvert	Continuous	TRAP	Projecting	at stream grade	Circular	72	72	CMP
Kelsall_4.3	42	Unnamed	Kelsall River	59.48749	-136.06078	Kelsall Rd	4.3	Culvert	Continuous	TRAP	Projecting	at stream grade	Circular	72	72	CMP
Kelsall_9.6	34	Unnamed	Nataga Creek	59.53788	-136.09967	Kelsall Rd	9.6	Culvert	Continuous	TRAP	Projecting	free-fall into pool	Circular	48	48	CMP
Kelsall_9.7	33	Unnamed	Nataga Creek	59.53812	-136.10088	Kelsall Rd	9.7	Culvert	Continuous	TRAP	Projecting	at stream grade	Circular	48	48	CMP
Kelsall_9.8	n/a	Nataga Creek	Kelsall River			Kelsall Rd	9.8	Bridge	Continuous	AWC	/	/	/	/	/	/
Lutak_1.6	246	Johnson's Creek	Lutak Inlet	59.26045	-135.44220	Lutak Rd	1.6	Culvert	Continuous	TRAP	Projecting	free-fall into pool	3 pipe arch	72	57	CMP
Lutak_2.1	247	Mink Creek	Lutak Inlet	59.26747	-135.44516	Lutak Rd	2.1	Culvert	Continuous	TRAP	X	X	X	X	X	X
Lutak_5.9	256	Unnamed	Lutak Inlet	59.29952	-135.51647	Lutak Rd	5.9	Culvert	Continuous	TRAP	Projecting	fall over riprap	2 Circular	84, 48	84, 48	CMP
Lutak_7.5	262	Unnamed	Lutak Inlet	59.31410	-135.54673	Lutak Rd	7.5	Culvert	Continuous	CHECK	Projecting	f-f into pool, at grade	3 Circular	36, 90, 90	36, 90, 90	CMP
Lutak_9.0	264	Chilkoot River	Lutak Inlet	59.32436	-135.55814	Lutak Rd	9.0	Bridge	Continuous	AWC	/	/	/	/	/	/
SmallTracts_1.7	n/a	Holgate Creek	Chilkat Inlet			Mudbay	1.7	Culvert	Continuous	AWC	Projecting	at stream grade	Circular	60	60	CMP
Mudbay_2.4	242	Unnamed	Car's Cove	59.20267	-135.43103	Mudbay	2.4	Culvert	Continuous	TRAP	Projecting	fall over riprap	Circular	54	54	CMP
Mudbay_2.4+	241	Unnamed	Car's Cove	59.20136	-135.43115	Mudbay	2.4+	Culvert	Continuous	TRAP	Projecting	at stream grade	Circular	48	48	CMP
Mudbay_5.3	235	Letnikof Creek	Letnikof Cove	59.17085	-135.38702	Mudbay	5.3	Culvert	Continuous	Sighting	Projecting	fall over riprap	Circular	48	48	CMP
Mudbay_5.4	239	Letnikof Creek	Letnikof Cove	59.17012	-135.38566	Mudbay	5.4	Culvert	Continuous	Sighting	Projecting	at stream grade	Circular	32	32	CMP
Mudbay_5.6	104	Unnamed	Letnikof Creek	59.16793	-135.38271	Mudbay	5.6	Culvert	Continuous	AWC	Projecting	fall over riprap	Circular	24	24	CMP
Mudbay_6.3	1304	Jurgeleit Creek*	Paradise Cove	59.15921	-135.37687	Mudbay	6.3	Culvert	Continuous	AWC	Projecting	free-fall into pool	Circular	24	24	CMP
Mudbay_7.1	106	Flat Bay Creek	Flat Bay	59.15653	-135.35972	Mudbay	7.1	Culvert	Continuous	AWC	Projecting	free-fall into pool	Circular	48	48	CMP
Mudbay_7.9	105	Kip's Creek	Flat Bay	59.14863	-135.34874	Mudbay	7.9	Culvert	Continuous	TRAP	Projecting	at stream grade	Circular	24	24	CMP
ChilkatPark_0.3	237	Tom's Creek	Flat Bay Creek	59.15006	-135.36720	Chilkat State Park	0.3	Culvert	Continuous	TRAP	Projecting	at stream grade	Circular	24	24	CMP
Comstock 0.0+	1	Unnamed	Sawmill Creek	59.24025	-135.46231	Comstock	0.0+	Culvert	Continuous	AWC	Projecting	at stream grade	Circular	24	24	CMP
Comstock 0.1	2	Unnamed	Sawmill Creek	59.24069	-135.46305	Comstock	0.1	Culvert	Continuous	AWC	Projecting	fall over riprap	Circular	24	24	CMP
Comstock 0.1+	3	Unnamed	Sawmill Creek	59.24034	-135.46418	Comstock	0.1+	Culvert	Continuous	AWC	Projecting	free-fall into pool	Circular	24	24	CMP
Comstock 0.2	5	Unnamed	Sawmill Creek	59.24039	-135.46560	Comstock	0.2	Culvert	Continuous	AWC	Projecting	free-fall into pool	Circular	24	24	CMP
Comstock 0.3	6	Unnamed	Sawmill Creek	59.24025	-135.46803	Comstock	0.3	Culvert	Continuous	AWC	Projecting	fall over riprap	Circular	20	20	CMP
Fair Dr. & HH	10	Sawmill Creek	Chilkat River	59.23417	-135.45703	Fair Drive	Intersection	Culvert	Continuous	AWC	Projecting	at stream grade	pipe arch	40	30	CMP
Spruce Grove Dr. 0.0+	11	Sawmill Creek	Chilkat River	59.23586	-135.46490	Spruce Grove Dr	Intersection	Culvert	Continuous	AWC	Projecting	at stream grade	pipe arch	78	53	CMP
Ed Shirley Dr & Mudbay	14	Unnamed	Sawmill Creek	59.23104	-135.44845	Ed Shirely Drive	Intersection	Culvert	Isolated pools	TRAP	Projecting	at stream grade	Circular	20	20	CMP
Porcupine_2.2	72	Herman Creek	Klehini River	59.41454	-136.06434	Porcupine	2.2	Culvert	Continuous	AWC	Projecting	at stream grade	3 Circular	72	72	CMP
Porcupine_3.9	94	Cave Creek	Klehini River	59.41693	-136.11258	Porcupine	3.9	Culvert	Continuous	AWC	Projecting	at stream grade	pipe arch	100	75	CMP
Porcupine_8.1	97	Porcupine Creek	Klehini River	59.42049	-136.22282	Porcupine	8.1	Bridge	Continuous	AWC	/	/	/	/	/	/
Porcupine_8.6	96	Bear Creek	Klehini River	59.42258	-136.23799	Porcupine	8.6	Bridge	Continuous	AWC	/	/	/	/	/	/
Porcupine_	98	Little Salmon	Tsirku River	59.38403	-136.07486			Bridge	Continuous	AWC	/	/	/	/	/	/
Farm_4.0	99	Unnamed	Tsirku River	59.37545	-135.93941	Farm	4.0	Culvert	Continuous		Projecting	at stream grade	Circular	60	60	CMP
Farm_4.0+	100	Unnamed	Tsirku River	59.37536	-135.93963	Farm	4.0+	Culvert	Continuous		Projecting	at stream grade	Circular	60	60	CMP
Border Patrol Subdivision	n/a	37 Mile Creek	Klehini River			Unnamed	0.0+	Culvert	Continuous	AWC	Projecting	at stream grade	Circular	96	96	CMP
Rock quary 38_Haines hwy	n/a	39 Mile creek	Klehini River			Haines Highway	38.0	Bridge	Continuous	AWC	/	/	/	/	/	/

Corrugations	Embedded (in)	Pipe Condition	Rustline (in)	Baffles	% Blocked	Perch (in)	Gradient %	Bed Width(in)	culvert width to bedwidth ratio	Final Culvert Assessment
2-2/3"x1/2" spiral	no	good	11	no	0	48	NA	120	48:120=***0.4***	RED- Perch and Ratio
2-2/3"x1/2" spiral	no	fair		no	0	60	4.4, 3.4, 5.2	198	144:198=***0.73***	RED- Perch and Gradient
1x3 spiral into circular	yes- 36	fair		no	10	0	0.025	151.2	72:151.2=***0.48***	RED- Ratio and block
1x3 spiral	yes-48	poor	entire culvert	no	0	0	0.4	50	72:50=***1.44***	GREEN
2-2/3"x1/2" spiral	no	good		no	0	17	3	78	48:78=***0.62***	RED- Perch and Gradient
2-2/3"x1/2" spiral	no	good	6	no	0	0	3.0, 2.0	60	96:60=***1.6***	RED- grade of one culvert
/	/	/	/	/	/	/	/	/	/	GREEN
3x1circular	no	poor, poor, v. poor	4,3,n/a	no	0, 0, 95%	28, 20, n/a	3.5, 4.07, n/a	96	144:96= ***1.5***	Red- Perch
X	X	X	X	X	X	X	X	X	X	Scheduled to be replaced
6x2 circ., 2-2/3x1/2 spir.	no	good, fair	new pipe, 7	no	0	12, 19	2.67, 3.04	240	132:240= ***0.55***	Red- Perch, Gradient
2-2/3"x1/2" sp., 3x1 spir	0, 8, 0	fair, fair, poor	0, 12, 12-24	no	30, 0, 0	19, 0, 0	4.32, 4.89, 1.05	288	90:288=***0.31***	Red- Perch, Gradient, Ratio
/	/	/	/	/	/	/	/	/	/	GREEN
1x3 circular	no	good	new pipe	Yes- #5 @ 4"	0	0	4.3	97	60:97= ***0.62***	GREY- RATIO
1x3 circular	no	good	0	no	10	6-12	4.1	55	54:55=***0.98***	RED-Perched and Gradient
2-2/3"x1/2" spiral	no	good	6	no	10	0	1.03	96	48:96=***0.50***	GREY- Ratio, Gradient, block
2-2/3"x1/2" spiral	no	poor	20	no	0	108	5.77 (break)	48	48:48= ***1.0***	RED- Perch, Grade
2-2/3"x1/2" spiral	no	fair	0	no	0	0	2.38, 2.63	68	64:68= ***0.94***	RED- Gradient and Ratio
2-2/3"x1/2" spiral	no	fair	4	no	0	9	5.62	swamp	swamp	RED- Prech and Gradient
2-2/3"x1/2" spiral	no	fair	8	no	0	9	6.66	62	24:62= ***0.39***	RED- Prech, Gradient, Ratio
	no	fair		no	0	7				RED-Perch
2-2/3"x1/2" spiral	no	fair	0	no	0	0	2.74	40	24:40= ***0.60***	RED- Gradient
2-2/3"x1/2" spiral	yes- 4	good	4	no	0	0	4.35, 1.3	65	48:65= ***0.74***	RED- Gradient
2-2/3"x1/2" spiral	no	poor	2	no	5	0	3.92	21	24:21= ***1.14***	RED- Gradient
2-2/3"x1/2" spiral	no	fair	6	no	5	31	8.0	22	24:22=***1.09***	RED- Gradient and Perch
2-2/3"x1/2" spiral	no	poor	6	no	0	42	4.25	39	24:39= ***0.62***	RED- Gradient and Perch
2-2/3"x1/2" spiral	no	poor	2.75	no	10	21	2.72	45	24:45= ***0.53***	RED- Gradient and Perch
2-2/3"x1/2" spiral	no	extremely poor	entire culvert	no	10	11	3.51	24	20:24=***0.85***	RED- Gradient and Perch
2-2/3"x1/2" spiral	no	good	15.5	no	0	0	0.78	swamp	swamp	GREEN
2-2/3"x1/2" circular	yes- 5	good	17	no	0	0	0.13	58	78:58= ***1.34***	GREEN
2-2/3"x1/2" spiral	no	poor	8	no	10	0	1.74	swamp	swamp	GREY- Gradient
2-2/3"x1/2" spiral	yes	good		no	0	0	1.39, 0.7,0.02	379.2	216:379.2=***0.54***	GREY- ratio & grade
6x2 circular	no	good	11	no	0	0	0.12	43.2	100:43.2=***2.31***	GREEN
/	/	/	/	/	/	/	/	/	/	GREEN
/	/	/	/	/	/	/	/	/	/	GREEN
/	/	/	/	/	/	/	/	/	/	GREEN
2-2/3"x1/2" spiral	yes- 2-10	good		no	0	0	1.47	120	60:120=***0.5***	GREY- ratio & grade
3x1 spiral	yes- 17	good		no	0	0	0.22	72	60:72=***0.83***	Green
9x2.5 circular	no	good	18	no	0	0	1.81	156	96:156=0.62	GREY- Gradient & Ratio
/	/	/	/	/	/	/	/	/	/	GREEN