

Al Irvine  
New Graph Environment Ltd.  
[al@newgraphenvironment](mailto:al@newgraphenvironment)  
250-777-1518  
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Ministry of Environment

### **Re: Scientific Fish Collection Permit Application**

This permit application can also be viewed online [at this link](#). A summary of sites proposed for assessment, including historic fish presence records from FISS, is provided in Tables [2](#) to [3](#). Fish species known to occur within each watershed are summarized in Table [4](#). An overview map showing potential sample locations is presented in Figure [1](#). A KML file (google earth) and GPX file (for garmin gps devices) of all sites is attached to the application with latest versions downloadable [here](#) or [here](#). The KML includes detailed site-specific information accessible by clicking on each location in google earth, with brief summaries of background reports where available.

### **Brief description of project/activities**

This work is a multi-year collaboration of many groups and an initiative of the Society for Ecosystem Restoration Northern BC. Funding for the project is through the Fish and Wildlife Compensation Program, SERNbc and the Ministry of Transportation and Infrastructure. Fieldwork is being led by Al Irvine, R.P.Bio., of New Graph Environment Ltd., in collaboration with field and office teams from McLeod Lake Indian Band. Previous reports are linked below:

- [https://newgraphenvironment.github.io/Parsnip\\_Fish\\_Passage/](https://newgraphenvironment.github.io/Parsnip_Fish_Passage/)
- [https://newgraphenvironment.github.io/fish\\_passage\\_parsnip\\_2021\\_reporting/](https://newgraphenvironment.github.io/fish_passage_parsnip_2021_reporting/)
- [https://newgraphenvironment.github.io/fish\\_passage\\_peace\\_2022\\_reporting/](https://newgraphenvironment.github.io/fish_passage_peace_2022_reporting/)
- [https://newgraphenvironment.github.io/fish\\_passage\\_peace\\_2023\\_reporting/](https://newgraphenvironment.github.io/fish_passage_peace_2023_reporting/)
- [https://newgraphenvironment.github.io/fish\\_passage\\_peace\\_2024\\_reporting/](https://newgraphenvironment.github.io/fish_passage_peace_2024_reporting/)

## Rationale for sampling

Rationale for sampling is to inform fish presence/absence, species composition/density, abundance estimates, movement, growth, and survival as part of habitat confirmations and effectiveness monitoring related to fish passage restoration at barrier culverts. Habitat confirmation methodology information can be referenced in the above reports which builds on the [Fish Passage Technical Working Group Phase 2 protocol](#). Presence/absence of fish, species composition/abundance, distribution limits and fish movement can be useful for prioritizing which crossings are a best fit for fish passage restoration and inform baseline as well as follow up effectiveness monitoring.

## Methodologies

Sampling methodologies will be dependent on the site, fish species suspected, type of habitat encountered, risks to aquatic organisms potentially present (Table 1) and ongoing communications. Sampling methods may include minnowtrapping, electrofishing, and dip netting upstream and downstream of current and past barrier culvert locations.

Sampling is proposed at streams included in Tables 2 - 3 where we will be performing habitat confirmation assessments and follow up site visits related to past habitat confirmations/fish passage remediations.

## PIT Tagging

As part of this permit application we are proposing PIT tagging. When time allows and tagging is expected to improve knowledge of a system, our study plan is to electrofish small sites both upstream and downstream of priority culvert “barrier” sites and implant [Biomark APT12 PIT tags](#) in the abdominal cavity of select fish over 60mm in fork length. To anesthetize fish prior to PIT tagging, we use a clove oil solution at 0.1mL/L (1:10,000), which provides effective sedation with minimal residual effects (Fernandes et al. 2017). The solution is prepared by dissolving clove oil in ethyl alcohol at a 1:9 ratio before mixing into water (Fernandes et al. 2017). Site location (UTM), fish length and weight will also be collected. In addition to providing information on abundance upstream and downstream of potential culvert restoration sites, the study will also provide information for monitoring programs to document fish movement, growth and survival at sites over multi-year time frames. Main objectives are to:

1. Determine if fish are moving into restored areas
2. Determine if before any remediation is conducted - fish are moving through sites where stream crossing structures (culverts) likely cause connectivity issues

3. Evaluate if productivity of the systems are increasing following bridge installation and/or if fish are moving upstream/downstream of where replaced/removed structures are located

Dependent on how relevant tracking information would be to inform restoration actions, we may wish to tag select fish over 60mm in each site sampled. We would like to apply for a permit allowing a maximum of 600 fish tagged with a maximum of 150 fish/stream. Although we are requesting a maximum of 150 fish/stream, we have listed 150 fish of each species per stream because we will not know the species composition of the sites until the sampling occurs. In general, only salmonid and burbot species will be tagged with likely species present being rainbow trout, bull trout, and burbot. Based on past assessments in the same and similar systems in the region, the number of fish tagged per stream are very likely to be much less than 150, however we are requesting the maximum number of fish to be tagged to facilitate permit application procedures and allow for flexibility in the field based on actual sampling results.

## Risks associated with project/activities and associated mitigation

Table 1: Risks and mitigation

Impact	Mitigation
High Voltage Injuries	Use the minimum effective voltage. Avoid contacting fish with the anode. Avoid electrofishing directly adjacent to metal culverts.
Disruption of Spawning	Avoid electrofishing during highest risk periods in likely spawning habitat.
Physical Stress on Fish	Quick/gentle handling and release of captured fish. Use of clove oil to anesthetize fish.
Injury from PIT Tagging Surgeries	Shallow insertion of tags and use of fresh sterile syringes every approximately 10 surgeries.
Mortality in traps due to predation and starvation	Ensure all traps set are retrieved within 24 hours.

Please note that the sampling will be completed before October 31 (end of August till early October) however the end-date of the sampling period is listed as Dec 31 on the application to allow time outside of the busy field season for the data to be processed, QA'd and organized so that required reporting can be as informative as possible when submitted. An example of how we have been presenting results and methodologies from past assessments can be referenced in reports above.

Please do not hesitate to contact me if you need more information or have any questions or concerns.



Al Irvine, R.P.Bio

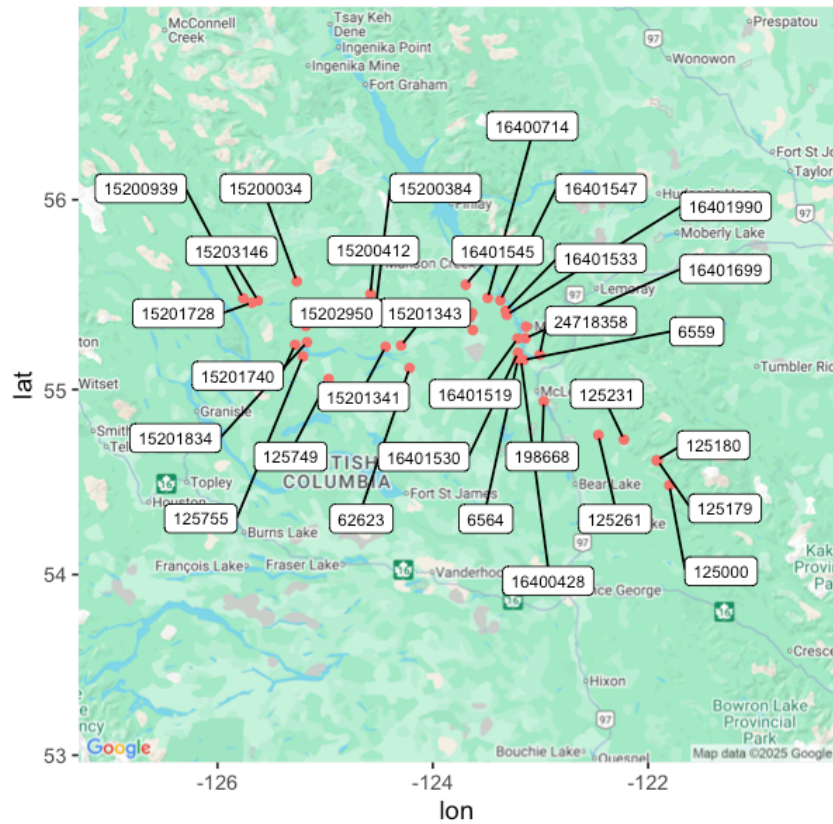


Figure 1: Location of potential sample sites.

Table 2: Potential sampling locations.

Site ID	Stream Name	Watershed Code	UTM Zone	UTM Easting	UTM Northing	Watershed Group Code
125000	Tributary To Parsnip River	236-738000-00000-00000-0000-000-000-000-000-000-000	10	577541	6038215	PARS
125179	Unnamed Tributary To Missinka River	236-614900-20900-03300-0000-0000-000-000-000-000-000	10	570307	6052836	PARS
125180	Tributary To Missinka River	236-614900-20900-00000-0000-0000-000-000-000-000-000	10	569665	6053046	PARS
125231	Tributary To Table River	236-450800-15400-00000-0000-0000-000-000-000-000-000	10	549962	6065137	PARS
125261	Fern Creek	236-358400-00000-00000-0000-0000-000-000-000-000-000	10	534601	6067771	PARS
125749	Unnamed Tributary To Airline Creek	237-625800-53700-00000-0000-0000-000-000-000-000-000	10	374238	6102796	NATR
125755	Glaucers Creek	237-671800-00000-00000-0000-0000-000-000-000-000-000	10	359563	6116606	NATR
15200034	—	237-792500-61000-00000-0000-0000-000-000-000-000-000	10	357257	6160917	NATR
15200384	—	237-528900-57600-16500-2290-0000-000-000-000-000-000	10	403312	6145393	NATR
15200412	Gillis Creek	237-528900-57600-00000-0000-0000-000-000-000-000-000	10	400259	6152248	NATR
15200939	Nation River	237-000000-00000-00000-0000-0000-000-000-000-000-000	10	325553	6152065	NATR
15200985	—	237-077300-00000-00000-0000-0000-000-000-000-000-000	10	458491	6137652	NATR
15201007	—	237-062300-00000-00000-0000-0000-000-000-000-000-000	10	459777	6140085	NATR
15201341	—	237-449000-00000-00000-0000-0000-000-000-000-000-000	10	408422	6121011	NATR
15201343	—	237-393200-00000-00000-0000-0000-000-000-000-000-000	10	417680	6121619	NATR
15201728	—	237-897400-00000-00000-0000-0000-000-000-000-000-000	10	330395	6149308	NATR
15201740	Fish Creek	237-673600-00000-00000-0000-0000-000-000-000-000-000	10	355086	6123605	NATR

Site ID	Stream Name	Watershed Code	UTM Zone	UTM Easting	UTM Northing	Watershed Group Code
15201834	—	237-688000-00000-00000-0000-0000-000-000-000-000-000-000	10	362065	6124875	NATR
15202084	—	237-124500-19300-00000-0000-0000-000-000-000-000-000-000	10	460163	6130113	NATR
15202950	—	237-713900-19200-08800-0000-0000-000-000-000-000-000-000	10	361739	6134520	NATR
15203146	—	237-877600-00000-00000-0000-0000-000-000-000-000-000-000	10	334061	6150367	NATR
16400428	—	230-906900-15800-00000-0000-0000-000-000-000-000-000-000	10	488458	6112359	PARA
16400714	—	230-910500-00000-00000-0000-0000-000-000-000-000-000-000	10	469038	6148922	PARA
16400738	—	230-905500-00000-00000-0000-0000-000-000-000-000-000-000	10	491471	6131967	PARA
16401519	—	230-907800-00000-00000-0000-0000-000-000-000-000-000-000	10	486512	6124976	PARA
16401530	—	230-907400-00000-00000-0000-0000-000-000-000-000-000-000	10	486724	6116602	PARA
16401533	Dastaiga Creek	230-909100-00000-00000-0000-0000-000-000-000-000-000-000	10	479617	6141422	PARA
16401545	Blackwater Creek	230-913400-00000-00000-0000-0000-000-000-000-000-000-000	10	456256	6156862	PARA
16401547	—	230-910000-00000-00000-0000-0000-000-000-000-000-000-000	10	476480	6147560	PARA
16401699	Gagnon Creek	230-905800-00000-00000-0000-0000-000-000-000-000-000-000	10	491234	6125187	PARA
16401990	—	230-908900-00000-00000-0000-0000-000-000-000-000-000-000	10	480206	6138995	PARA
198668	Tributary To Mcleod Lake	230-906800-71800-00000-0000-0000-000-000-000-000-000-000	10	501971	6087814	CARP
24718358	Buth Creek	230-906600-00000-00000-0000-0000-000-000-000-000-000-000	10	499574	6115412	PARA
62623	Suschona Creek	237-372000-61800-00000-0000-0000-000-000-000-000-000-000	10	422422	6108185	NATR

Site ID	Stream Name	Watershed Code	UTM Zone	UTM Easting	UTM Northing	Watershed Group Code
6559	–	230-906900-02100-00000-0000-0000-000-000-000-000-000-000	10	489968	6112333	PARA
6564	–	230-906900-19500-00000-0000-0000-000-000-000-000-000-000	10	486579	6112299	PARA



**Table 3: Potential sample site details**

Site ID	Stream Name	Species Upstream	# Fish Tags
125000	Tributary To Parsnip River	–	150
125179	Unnamed Tributary To Missinka River	BT;RB	150
125180	Tributary To Missinka River	RB	150
125231	Tributary To Table River	RB	150
125261	Fern Creek	BB;C;CBC;DC;DV;LSU;RB;RSC;SU	150
125749	Unnamed Tributary To Airline Creek	–	150
125755	Glaucers Creek	BB;CC;CSU;LSU;NSC;RB;RB/CT;RSC;SP;SU	150
15200034	–	–	150
15200384	–	–	150
15200412	Gillis Creek	–	150
15200939	Nation River	RB	150
15200985	–	–	150
15201007	–	RB	150
15201341	–	–	150
15201343	–	CCG;LKC;RB;SP	150
15201728	–	–	150
15201740	Fish Creek	BT;RB	150
15201834	–	–	150
15202084	–	RB	150
15202950	–	–	150
15203146	–	–	150
16400428	–	PCC;RB	150
16400714	–	–	150
16400738	–	–	150
16401519	–	LKC;RB	150
16401530	–	RB	150
16401533	Dastaiga Creek	SP	150
16401545	Blackwater Creek	BB;BT;CC;CSU;DV;GR;LKC;LSU;MW;RB	150
16401547	–	RB;SP	150
16401699	Gagnon Creek	BB;BMC;BT;C;CAS;CC;CCG;CSU;LKC;LSU;LW;NSC;PCC;RB;RSC;SP;SU;WSU	150
16401990	–	RB	150
198668	Tributary To Mcleod Lake	–	150

Site ID	Stream Name	Species Upstream	# Fish Tags
24718358	Buth Creek	–	150
62623	Suschona Creek	CSU;LKC;LSU;RB	150
6559	–	–	150
6564	–	–	150

Table 4: Fish species recorded in the Fisheries Information Summary System within the freshwater atlas watershed group areas where the potential sample sites are located.

Scientific Name	Species Name	BC List	COSEWIC	Carp Lake	Crooked	Nation	Parsnip Arm	Parsnip
<i>Catostomus catostomus</i>	Longnose Sucker	Yellow	–	Yes	Yes	Yes	Yes	Yes
<i>Catostomus columbianus</i>	Bridgelip Sucker	Yellow	–	–	Yes	–	–	–
<i>Catostomus commersonii</i>	White Sucker	Yellow	–	Yes	Yes	Yes	Yes	Yes
<i>Catostomus macrocheilus</i>	Largescale Sucker	Yellow	–	Yes	Yes	Yes	Yes	Yes
<i>Chrosomus eos</i>	Northern Redbelly Dace	Yellow	–	–	–	–	–	–
<i>Chrosomus neogaeus</i>	Finescale Dace	Yellow	–	–	–	–	–	–
<i>Coregonus clupeaformis</i>	Lake Whitefish	Yellow	–	Yes	Yes	Yes	Yes	Yes
<i>Cottus aleuticus</i>	Coastrange Sculpin (formerly Aleutian Sculpin)	Yellow	–	–	–	–	–	Yes
<i>Cottus asper</i>	Prickly Sculpin	Yellow	–	Yes	Yes	Yes	Yes	Yes
<i>Cottus cognatus</i>	Slimy Sculpin	Yellow	–	Yes	–	Yes	Yes	Yes
<i>Cottus hubbsi</i>	Mottled Sculpin	Blue	SC (Nov 2010)	–	–	Yes	–	Yes
<i>Cottus rhotheus</i>	Torrent Sculpin	Yellow	–	–	–	–	–	–
<i>Cottus ricei</i>	Spoonhead Sculpin	Yellow	NAR (May 1989)	–	–	–	Yes	–
<i>Couesius plumbeus</i>	Lake Chub	Yellow	DD	Yes	Yes	Yes	Yes	Yes
<i>Culaea inconstans</i>	Brook Stickleback	Yellow	–	–	–	–	–	–
<i>Esox lucius</i>	Northern Pike	Yellow	–	–	Yes	–	–	–
<i>Hiodon alosoides</i>	Goldeye	Blue	–	–	–	–	–	–
<i>Hybognathus hankinsoni</i>	Brassy Minnow	No Status	–	Yes	Yes	Yes	Yes	–
<i>Lota lota</i>	Burbot	Yellow	–	Yes	Yes	Yes	Yes	Yes
<i>Mylocheilus caurinus</i>	Peamouth Chub	Yellow	–	Yes	Yes	Yes	Yes	Yes
<i>Notropis atherinoides</i>	Emerald Shiner	Unknown	–	–	–	–	–	–
<i>Notropis hudsonius</i>	Spottail Shiner	Red	–	–	–	–	–	–
<i>Oncorhynchus clarkii</i>	Cutthroat Trout	No Status	–	–	–	–	–	–

Scientific Name	Species Name	BC List	COSEWIC	Carp Lake	Crooked	Nation	Parsnip Arm	Parsnip
<i>Oncorhynchus clarkii lewisi</i>	Westslope (Yellowstone) Cutthroat Trout	Blue	SC (Nov 2016)	–	–	–	–	–
<i>Oncorhynchus mykiss</i>	Rainbow Trout	Yellow	–	Yes	Yes	Yes	Yes	Yes
<i>Oncorhynchus nerka</i>	Kokanee	Yellow	–	–	–	Yes	Yes	Yes
<i>Osmerus dentex</i>	Rainbow Smelt	Unknown	–	–	–	Yes	–	Yes
<i>Perca flavescens</i>	Yellow Perch	Unknown	–	–	–	–	–	–
<i>Percopsis omiscomaycus</i>	Trout-perch	Yellow	–	–	–	–	–	–
<i>Platygobio gracilis</i>	Flathead Chub	Yellow	–	–	–	–	–	–
<i>Prosopium coulterii</i>	Pygmy Whitefish	Yellow	NAR (Nov 2016)	–	–	Yes	Yes	Yes
<i>Prosopium cylindraceum</i>	Round Whitefish	Yellow	–	–	–	–	–	Yes
<i>Prosopium williamsoni</i>	Mountain Whitefish	Yellow	–	Yes	Yes	Yes	Yes	Yes
<i>Ptychocheilus oregonensis</i>	Northern Pikeminnow	Yellow	–	Yes	Yes	Yes	Yes	Yes
<i>Rhinichthys cataractae</i>	Longnose Dace	Yellow	–	–	Yes	Yes	Yes	Yes
<i>Rhinichthys falcatus</i>	Leopard Dace	Yellow	NAR (May 1990)	–	–	–	–	–
<i>Richardsonius balteatus</i>	Redside Shiner	Yellow	–	Yes	Yes	Yes	Yes	Yes
<i>Salvelinus confluentus</i>	Bull Trout	Blue	SC (Nov 2012)	Yes	Yes	Yes	Yes	Yes
<i>Salvelinus fontinalis</i>	Brook Trout	Exotic	–	–	Yes	–	Yes	Yes
<i>Salvelinus malma</i>	Dolly Varden	Yellow	–	Yes	Yes	Yes	Yes	Yes
<i>Salvelinus namaycush</i>	Lake Trout	Yellow	–	Yes	Yes	Yes	Yes	Yes
<i>Sander vitreus</i>	Walleye	Yellow	–	–	–	–	–	–
<i>Thymallus arcticus</i>	Arctic Grayling	Yellow	–	–	–	Yes	Yes	Yes
–	Chub (General)	–	–	Yes	Yes	–	Yes	Yes
–	Dace (General)	–	–	–	–	–	Yes	Yes
–	Lamprey (General)	–	–	–	–	Yes	–	–
–	Minnow (General)	–	–	Yes	Yes	–	Yes	Yes
–	Northern Pearl Dace	–	–	–	–	–	–	–
–	Salmon (General)	–	–	–	–	Yes	–	–
–	Sculpin (General)	–	–	Yes	Yes	Yes	Yes	Yes
–	Smelt (General)	–	–	–	–	–	Yes	–
–	Squanga	–	–	–	Yes	–	–	–
–	Sucker (General)	–	–	Yes	Yes	Yes	Yes	Yes
–	Whitefish (General)	–	–	Yes	Yes	Yes	Yes	Yes

## References

Fernandes, I. M., Y. F. Bastos, D. S. Barreto, L. S. Lourenço, and J. M. Penha. 2017. "The Efficacy of Clove Oil as an Anaesthetic and in Euthanasia Procedure for Small-Sized Tropical Fishes." *Brazilian Journal of Biology = Revista Brasileira De Biologia* 77 (3): 444–50. <https://doi.org/10.1590/1519-6984.15015>.