

An aerial photograph of a lake with a residential shoreline. The lake is dark blue and occupies the left and top portions of the frame. The shoreline is lined with numerous houses, many with large porches and decks, and several docks extending into the water. Several boats are docked at the piers. The background is a dense forest of evergreen trees. The text is overlaid on the left side of the image.

# FORESHORE INTEGRATED MANAGEMENT PLANNING FOR AQUATIC SPECIES AT RISK

IN THE UPPER  
COLUMBIA BASIN  
2019-2023





KOKANEE SALMON IN THE COLUMBIA VALLEY  
PHOTO © NICOLE TRIGG

## LAND ACKNOWLEDGEMENT

The Foreshore Integrated Management Planning Lake Surveys presented in this report took place on the traditional, ancestral, and unceded territories of the Ktunaxa, Lheidli T'enneh, Secwépemc, Sinixt, and Syilx Nations. This acknowledgement means that we recognize the role and responsibility that Indigenous Peoples in the Columbia Basin have to this land and the water that flows through it, and we respect that relationship by making space for Indigenous Knowledge alongside Western science in water stewardship.

## ACKNOWLEDGEMENTS

Living Lakes Canada would like to thank all of our advisors, partners, and funders who supported the Foreshore Integrated Management Planning for Aquatic Species at Risk in the Upper Columbia Basin project. A special thank you to the Foreshore Integrated Management Planning Technical Committee and to the many FIMP advisors including but not limited to: Bruce Mac Donald, B.Sc., B.Ed., FIMP Program Director, Terra Limnic Consulting; Heather Leschied, B.E.S. (Hons), Water Policy Advisor, Water Resources Stewardship, Ministry of Water, Land and Resource Stewardship; Jason Schleppe, M.Sc., R.P.Bio., Senior Biologist, Ecoscape Environmental Contractors; Sherri McPherson, B.Sc., R.P.Bio., Aquatic Biologist, Lotic Environmental; Louise Porto, M.Sc., R.P.Bio., WSP Canada; Crystal Lawrence B.Sc., R.P.Bio., WSP Canada. We hope this work will continue to positively impact the people and sensitive species living in the Upper Columbia Basin. We gratefully acknowledge the generous support from our funders and partners:

- Fisheries and Oceans Canada - Canada Nature Fund for Aquatic Species at Risk
- Real Estate Foundation of BC
- Fish and Wildlife Compensation Program
- Columbia Basin Trust
- Ministry of Forests - Province of British Columbia
- BC Hydro
- Foreshore Inventory and Mapping Technical Committee
- Regional District of East Kootenay
- Regional District of Central Kootenay
- Columbia Shuswap Regional District
- Ktunaxa Nation Council
- Okanagan Nation Alliance
- Shuswap Band
- Splatsin First Nation
- Syilx Natural Resources
- Community Mapping Network
- Lake Windermere Ambassadors
- Columbia Lake Stewardship Society
- Arrow Lakes Environment Stewardship Society
- Kootenay Lake Partnership
- Slocan Lake Stewardship Society
- St Mary Valley Rural Residents Association
- Ecoscape Environmental Contractors
- WSP Canada
- Masse Environmental Contractors
- Lotic Environmental
- Mountain Station Contractors



Fisheries and Oceans Canada / Pêches et Océans Canada



### SUGGESTED CITATION:

Mac Donald, B. and Peck, G. (2024). Foreshore Integrated Management Planning for Aquatic Species at Risk in the Upper Columbia Basin 2019-2023. Prepared by: Living Lakes Canada.



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CNFASAR - Canada Nature Fund for Aquatic Species at Risk
CSRD - Columbia Shuswap Regional District
CVR - Culturally Valuable Resource
DFO - Fisheries and Oceans Canada
DPA - Development Permit Area
EKILMP - East Kootenay Integrated Lake Management Partnership
FDG - Foreshore Development Guide
FHSI - Foreshore Habitat Sensitivity Index
FIM - Foreshore Inventory Mapping
FIMP - Foreshore Integrated Management Planning
FSR - Forest Service Road
KLP - Kootenay Lake Partnership
KNC - Ktunaxa Nation Council
LLC - Living Lakes Canada
MWLAP - BC Ministry of Water, Land and Air Protection
OCP - Official Community Plan
ONA - Okanagan Nation Alliance
QEP - Qualified Environmental Professional
RAPR - Riparian Areas Protection Regulation
RDCK - Regional District of Central Kootenay
RDEK - Regional District of East Kootenay
SARA - Species at Risk Act
SHIM - Sensitive Habitat Inventory Mapping
SMG - Shoreline Management Guidelines
TEK - Traditional Ecological Knowledge
UAV - Unmanned Aerial Vehicle
WLRS - BC Ministry of Water, Land and Resource Stewardship
ZOS - Zone of Sensitivity

# FIMP IN THE UPPER COLUMBIA BASIN

In 2019, Living Lakes Canada (LLC) entered into a contribution agreement with Fisheries and Oceans Canada (DFO) to survey and/or re-survey priority lakes in the Columbia Basin containing federally designated aquatic Species at Risk. The goal of the four-year project was to improve information about foreshore health and Species at Risk habitat requirements, to conserve and restore habitats of highest ecological value.

A revision of the previous methods known as Sensitive Habitat Inventory and Mapping (SHIM) led to a revised protocol known as Foreshore Integrated Management Planning, or FIMP, which was subsequently applied to 10 lakes in the Columbia Basin from 2020 to 2023.

This report outlines the survey outcomes and resulting recommendations for each lake, and includes a discussion on the impact trends occurring with key takeaways highlighted. The FIMP work undertaken by Living Lakes Canada in the Columbia Basin is a testament to the value and effectiveness of FIMP as a powerful yet practical cumulative-impact assessment tool for freshwater conservation.



## SPECIES AT RISK IN THE UPPER COLUMBIA BASIN

This project targeted the following Species at Risk populations in the Upper Columbia Basin:

- Kootenay River White Sturgeon (*Acipenser transmontanus*)
- Shorthead and Columbia Sculpin (*Cottus confusus* and *Cottus hubbsi*)
- Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*)

Habitats specific to Species at Risk were documented using:

- literature reviews
- Section 16 Map Reserves
- SARA Public Registry
- ground-truthing during field assessments

For many Species at Risk, anthropogenic impacts such as land use development are strongly associated with ongoing cumulative habitat losses. Since the completed FIMP assessments were, in some cases, a continuation of previous assessments, the improved assessments have facilitated the:

- identification of key trends
- effectiveness of previous mitigation and habitat planning
- effectiveness of current land use planning implementation
- alignment of existing recovery measures and management plans for the identified Species at Risk

## FIMP TIMELINE

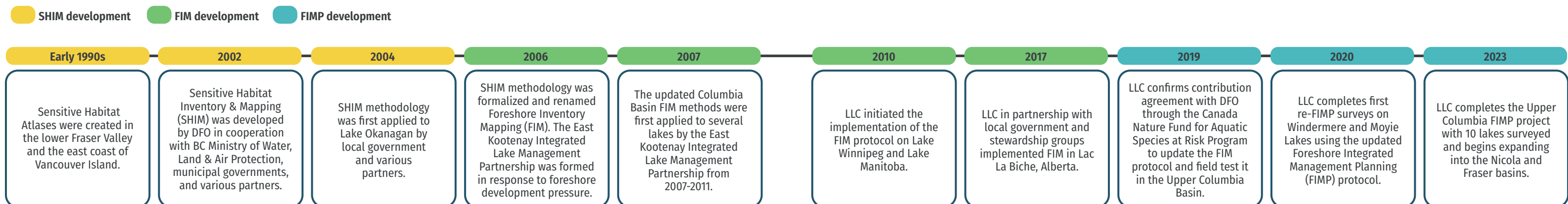


Figure 1: Historical timeline of SHIM/FIM/FIMP from 1990s to 2020s.



The Columbia Basin FIMP surveys can also be a tool in the effort to reintroduce anadromous Pacific salmon to the Columbia River system in Canada. By assessing and protecting existing natural habitats, particularly in lakes that historically supported salmon like Windermere and Columbia Lakes, these surveys support the overarching goal of restoring salmon populations and enhancing the ecological health of the Columbia River Basin, a key objective in the Columbia River Treaty renegotiations.



PHOTO © KAYLA HEINZE / INATURALIST

### Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*)

- **THREATS:** Key threats in the Columbia Basin include habitat alteration and fragmentation<sup>1</sup>, loss of riparian vegetation, impacts from residential, commercial, and industrial development including hardening of the foreshore, degradation of spawning gravels, beach grooming and water quality impacts.
- **OPPORTUNITIES:** FIMP can identify and monitor encroaching threats such as habitat alteration and fragmentation, support maintaining natural habitats<sup>2</sup> as well as identify potential areas for restoration.

### White Sturgeon (*Acipenser transmontanus*)

- **THREATS:** Urbanization and land use threats have been identified as factors influencing many fish populations that White Sturgeon may depend on for food<sup>3</sup>. These forage fish, especially during their early life history, depend on nearshore habitats to feed, grow and spawn, making their populations vulnerable to degraded conditions.
- **OPPORTUNITIES:** Specific management recovery measures for White Sturgeon populations in the Columbia Basin have been identified to maintain healthy and abundant food resources and protect critical habitat<sup>4</sup>. FIMP can protect nearshore habitats for sturgeon to



PHOTO © ALLAN ALLRED / INATURALIST

feed, grow and spawn. Links to urbanization/land use impacts for forage fish populations will help identify cumulative impacts that also may be limiting White Sturgeon recovery.

### Shorthead Sculpin (*Cottus confusus*) & Columbia Sculpin (*Cottus hubbsi*)

- **THREATS:** For these sculpin species, climate change, urbanization, and industrial development are key threats<sup>5</sup>, specifically shoreline or stream alterations. Sculpins are a shallow-water species that require rocky substrates in nearshore areas to complete their life cycle. Therefore, beach grooming, removal of rocky substrates for the creation of sandy beaches and water level changes (extraction and regulation) are some key factors that impact these species.
- **OPPORTUNITIES:** FIMP captures and monitors these types of encroaching threats, maps habitat<sup>6</sup>, and also identifies potential areas for restoration.

Furthermore, the FIMP data collected can help facilitate recovery planning and become part of long-term monitoring programs for these species, where ongoing assessment can continue to add to our understanding of land uses and their associated impacts along lake and river shorelines.



TOP PHOTO © PRICKLY\_SCULPIN / INATURALIST  
BOTTOM PHOTO © TIVINJD / INATURALIST



## DEVELOPMENT OF METHODS

Sensitive Habitat Atlases were first created in the early 1990s in the lower Fraser Valley and on the east coast of Vancouver Island to identify streams and water bodies that were sensitive to the extensive land developments occurring at that time.

In 2002, Fisheries and Oceans Canada (DFO) in cooperation with the British Columbia Ministry of Water, Land and Air Protection (MWLAP), municipal governments, and other non-government partners further developed the planning tool, which acquired the name Sensitive Habitat Inventory Mapping (SHIM).

The SHIM protocol was then adapted to use on lakes and was first applied to Lake Okanagan, BC by local government in 2004. Following this, the lake shoreline version of the SHIM methodology (Schleppe and Mason, 2006)<sup>7</sup> was formalized and the protocol was renamed Foreshore Inventory Mapping (or FIM).

In 2006, the East Kootenay Integrated Lake Management Partnership (EKILMP) was formed to address development concerns on East Kootenay lakes with federal, provincial, and local governments, Indigenous communities, and stewardship groups participating. One goal of EKILMP was to adapt the SHIM/FIM protocol to lakes in the Upper Columbia Basin lakes with a lake foreshore fish and wildlife habitat classification system and Shoreline Management Guidelines (SMG). These efforts resulted in the updated Columbia Basin FIM methods (FIM survey and SMG) were first applied on Lake Windermere in 2007.

Subsequently, the SHIM/FIM protocol was applied to 14 additional lakes across the region with project outcomes (maps, guidelines, shoreline footage, etc.) widely adopted by government, First Nations, stewardship groups, developers, and their contractors.

Efforts to revise the FIM methodology began in September 2019 with the formation of a diverse Technical Review Committee to advise on potential methodological revisions. The committee included practitioners with extensive FIM shoreline mapping experience, as well as representatives from the DFO Fish and Fish Habitat Protection Program Integrated Planning Unit, the B.C. Ministry of Water, Land, and Resource Stewardship (WLRS), the Ktunaxa Nation Council (KNC), and Okanagan Nation Alliance (ONA).

The information and advice informed the revised methods, which were released in 2021 as: Foreshore Integrated Management Planning Methods, Schleppe, J., McPherson, S., Porto, L. and Mason, B. 2020.<sup>8</sup>

## LAKE PRIORITIZATION, PROJECT PROCESS AND DATA STORAGE

LLC drafted a Lake Prioritization Process for the Upper Columbia Basin<sup>9</sup> to prioritize lakes in the Upper Columbia Basin for assessment, resulting in a Candidate Lake List. The process to prioritize lakes for FIMP surveys, though partially subjective (e.g., desktop review including Species at Risk information, field reconnaissance, stakeholder interest, and professional judgement), was effective — based on solid working knowledge of the geographical area and relevant issues, and supported by government agency project approval data. This analytical framework led to 10 high-priority lakes being surveyed or re-surveyed by the LLC FIMP program team.

East Kootenay Region	Original Survey (FIMP)	Re-Survey (FIMP)
Windermere	2006	2020
Columbia	2009	2021
Moyie	2008	2020
St. Mary	2010	2022
Whitetail	2020	N/A
Whiteswan	2020	N/A
West Kootenay Region	Original Survey (FIMP)	Re-Survey (FIMP)
Slocan	2010	2021
Kootenay	2012	2021
Arrow	2022	N/A
Trout (no CNFASAR)	2022	N/A

Table 1: Columbia Basin FIMP survey lakes completed by Living Lakes Canada.

A comprehensive process for writing, posting, reviewing, and awarding FIMP projects to contractors was developed. Additionally, the LLC Program Team implemented a comprehensive data management, storage, and access strategy within the FIMP Dataset<sup>10</sup>, hosted by the Columbia Basin Water Hub<sup>11</sup>, which will function effectively into the future.

All previously collected FIMP data can now be accessed through the Columbia Basin Water Hub, a central place for open water data, scientific research, and collaboration. FIMP project reports and maps were also posted to the BC Community Mapping Network<sup>12</sup> website.



# INDIGENOUS KNOWLEDGE AND FIMP

Until 2012, lake surveys did not include information on Indigenous Knowledge nor were cultural or archaeological values of the foreshore recognized. However, when Kootenay Lake was surveyed in 2012, the Kootenay Lake Partnership (KLP), a multi-agency initiative to support management approaches for a productive and healthy Kootenay Lake ecosystem, decided to include the collection of Ktunaxa archaeological and cultural knowledge and data into an updated version of the Kootenay Lake Shoreline Guidance Document.

This was a comprehensive Sensitive Habitat Inventory Mapping project that involved an inventory and assessment of ecological, archaeological and Ktunaxa cultural values along the shoreline of Kootenay Lake. The resulting Shoreline Guidance Document<sup>13</sup> directs shoreline development such as docks, retaining walls, or dredging activities in an effort to protect high value shoreline habitats. This was the first time Indigenous Knowledge was aligned with the SHIM/FIM/SMG protocol.

The process that started in 2019 to update, improve, and standardize the FIMP methodology involved the inclusion of Indigenous Knowledge in tandem with Western science. Our intent with this four-year project was to better identify opportunities to interweave Indigenous Knowledge with Western Science and promote inclusivity within the FIMP project process. This intent was discussed at length in the first year of the project when the technical committee collaboratively conceived two new pathways to include Indigenous Knowledge in the form of Traditional Ecological Knowledge (TEK) in FIMP:

- **Pathway 1**—FHSI Analysis Quantitative TEK data can be included in the FHSI analysis. In this way, the data would influence the FHSI Ecological Rankings and be subject to the same recommendations outlined in the FDG report.
- **Pathway 2**—Mapped Polygons if the TEK data are qualitative (or should remain masked due to their sensitive nature). The FHSI cannot incorporate qualitative data. However, they can be geospatially mapped and used to identify areas that warrant further consideration.

There were many challenges around these fairly limiting pathways, the primary being that opportunities to also interweave cultural and archaeological data (not related to ecological values) were not identified. Until 2023, inclusion of Indigenous Knowledge into FIMP has

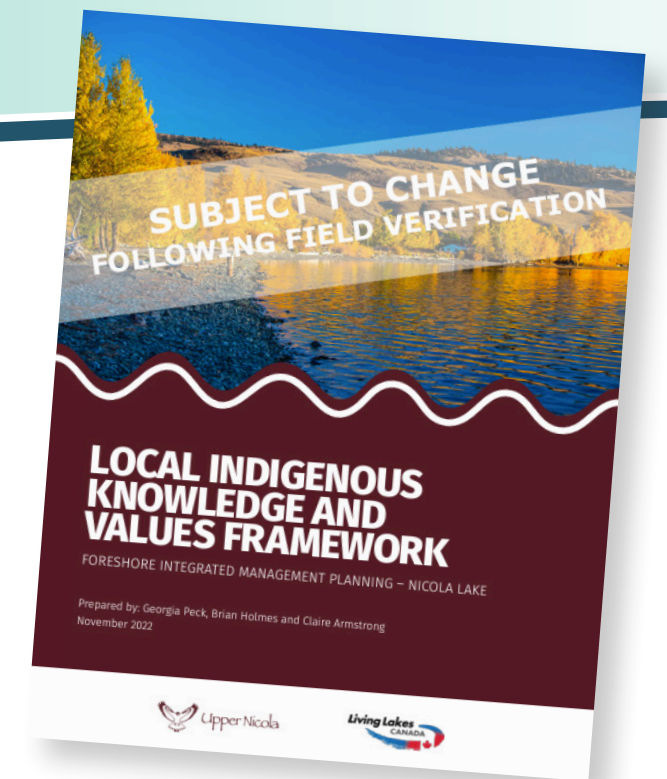
been fairly limited to knowledge directly related to fish and wildlife habitat and other ecological parameters.

Over the course of the 2019-2023 Columbia Basin FIMP project, it became clear the agreed upon approach to incorporating Indigenous Knowledge was restrictive.

Additional challenges such as funding project timelines, lack of capacity, constricting ways to measure success, and confined budget parameters gave limited opportunities to consistently evaluate and redefine the project process to prioritize inclusivity. Consequently, the inclusion of TEK in the Columbia Basin FIMP projects was not satisfactory to either LLC or Indigenous communities in and around the Columbia Basin.

These issues prompted Living Lakes Canada to co-develop the Local Indigenous Knowledge and Values Framework<sup>14</sup> alongside the Upper Nicola Band ahead of plans to expand the updated FIMP methodology onto Nicola Lake in 2023. Our intent with this project was to explore opportunities outside of the confined deliverables and co-create a framework instructing ways of harmonizing Indigenous Knowledge and Western science while also creating opportunities for both worldviews to work in tandem throughout the FIMP project process. This framework has since been published and applied to the 2023 Nicola Lake re-survey.

It is our hope that these efforts will set a precedent and will encourage an inclusive process for foreshore planning that places cultural and ecological integrity at the forefront of decision making with a holistic approach supported by relationships.





# 2020-2021 FIMP LAKE SURVEYS



WHITETAIL LAKE. PHOTO © WSP CANADA

## WHITETAIL LAKE // WHITESWAN LAKE MOYIE LAKE // LAKE WINDERMERE

FIMP field assessments of two high priority, small lakes (Whitetail and Whiteswan) were completed in 2020 in addition to two re-FIMP field assessments that took place on two high priority, small-medium lakes (Windermere and Moyie).

This initial assessment involved further field testing of the revised FIMP methodology to ensure modifications were appropriate and effective for addressing Species at Risk and their habitats, and communicated accurately via the standards and methods document. Additionally, a contractor new to FIMP methods was introduced and trained to conduct FIMP.

*Please note: The following lake-specific recommendations below have been summarized for the purpose of this report. Exhaustive lists can be found in respective lake reports. We encourage readers to visit the links below to learn more about lake-specific recommendations.*

## WHITETAIL LAKE

**SURVEY:** September 2020

**FISHERIES VALUES:** Rainbow Trout and Brook Trout

**RESULTS:** Most of the entire Whitetail Lake shoreline, comprising 9.9 km of shoreline, was found to be in natural condition (8.2 km; 83%), while the remainder was disturbed (1.7 km; 17%). Consequently, most of the lake shoreline was classified as having a low level of impact with the remaining areas having either medium (3 km; 30%) or no (2.2 km; 23%) level of impact.

### RECOMMENDATIONS:

- Designate conservation areas in wetland habitats.
- Complete a fish and fish habitat inventory of the lake's tributaries at various seasons.
- Update the ZOS to include additional sensitive habitat features as polygons, points or lines in the FIMP process if additional data becomes available in the future.
- Incorporate Indigenous Knowledge into FIMP maps and reports, if it becomes available in the future.
- Conduct a UAV (drone) survey along the shoreline of Whitetail Lake during low water to visually document the shoreline. The UAV survey could not be conducted in 2020 due to wildfires within the vicinity of Whitetail Lake that restricted drone use.

[VIEW WHITETAIL LAKE REPORTS](#)



## WHITESWAN LAKE

**SURVEY:** September 2020

**FISHERIES VALUES:** Westslope Cutthroat Trout

**RESULTS:** Contractors who were new to the methodology conducted the survey. More than half (7.6 km; 59%) of the 12.9 km total shoreline was found to be in a natural condition, while the remainder was disturbed (5.3 km; 41%). The most significant alteration was the Whiteswan Lake Forest Service Road along the entire south side of the lake over 5.1 km (39% of the foreshore). Other impacts observed included disturbance to the lakebed by motorboats disrupting submergent vegetation within the shallow littoral zones at both ends of the lake, and an ATV track on the foreshore at the east end of the lake.

### RECOMMENDATIONS:

- Designation of various conservation zones, including wetlands, stream mouths, shore spawning habitat, shallow littoral zones at the east and west ends of the lake, and riparian cottonwood within the floodplain at the east end of the lake.
- Limit use of power boats within the shallow littoral zones at the east and west ends of the lake to reduce disturbance to shallow littoral areas.
- Ensure road maintenance practices on the Whiteswan FSR minimize disturbance to the foreshore. Where possible, grading and/or snow removal should be directed towards the upland side of the road.
- Any future developments should be carefully designed with the assistance of a Qualified Environmental Practitioner.

### [VIEW WHITESWAN LAKE REPORTS](#)

WHITESWAN LAKE  
PHOTO © WIKIMEDIA



## MOYIE LAKE

**ORIGINAL SURVEY:** September 2008

**RE-SURVEY:** August 2020

**FISHERIES VALUES:** Westslope Cutthroat Trout, Burbot, Kokanee and Bull Trout

**RESULTS:** The majority of the foreshore (20.9 km; 55%) was observed to be in natural condition while the remainder was classified as disturbed (16.7 km; 45%).

**RE-FIMP FINDINGS:** Comparisons between the 2008 and 2020 surveys indicated that the total length of disturbed shoreline had increased by 471 m or 1.2% of the total shoreline and the shoreline rate of change was approximately 0.1% per year.

### RECOMMENDATIONS:

- Conduct a detailed wetland inventory and classification.
- Conduct various wildlife surveys, including wildlife and Kokanee and Burbot spawning locations. Update FHSI accordingly.
- Incorporate Indigenous Knowledge into FIMP maps and reports, if it becomes available in the future.
- Conduct a compliance audit of recent shoreline modifications.
- Consider designating the four productive littoral/wetland complex areas in Moyie Lake as conservation zones.
- Develop a stewardship strategy for Moyie Lake.
- Update the Moyie & Area OCP Bylaw (No. 2912, 2019).

### [VIEW MOYIE LAKE REPORTS](#)



MOYIE LAKE. PHOTO © WSP CANADA



# LAKE WINDERMERE

**ORIGINAL SURVEY:** 2006

**RE-SURVEY:** August 2020

**FISHERIES VALUES:** Westslope Cutthroat Trout, Burbot, Bull Trout and Kokanee

**RESULTS:** A total shoreline length of 37.4 km, 43% (16.2 km) was found to be in a natural condition, while the remaining 57% (21.2 km) was considered disturbed. The natural areas were mostly present along undeveloped Akisqnuq First Nation territory at the southeast end of the lake, while the area with greatest disturbance occurred within the District of Invermere.

**RE-FIMP FINDINGS:** Since 2006, the percentage of disturbed shoreline has increased by approximately 1% across the entire lake shoreline, representing a loss of approximately 369m of natural habitat. The observed changes occurred through incremental losses at a small scale, often associated with the clearing of small natural areas on private property.

## RECOMMENDATIONS:

- Develop a greenspace legacy plan.
- Increased effort and funding should go towards compliance and enforcement of Crown land encroachments, mooring buoys and adherence to navigational standards, best management practices, OCP adherence in DPAs, or the Water Sustainability Act in the region similarly to what is being done in the Okanagan, Shuswap, and coastal regions.
- Incorporate all ZOS into revised planning documents such as OCPs, bylaws, or other policy documents as appropriate.
- Improved cooperation amongst regulatory agencies.
- Appropriate riparian setbacks for development should be determined using the top of bank and/or using a stream boundary definition that includes consideration of the biological floodplain processes.
- Continued financial support for the local lake stewardship group (Lake Windermere Ambassadors).
- An inventory of encroachments, and development of a plan to determine the next appropriate steps should occur to bring structures into compliance. Ultimately, a process to begin the removal of illegally constructed structures, as is commonly occurring in the Okanagan and Shuswap regions, is warranted.

The Lake Windermere recommendations have been categorized based into recommendations for local government, provincial government, and federal government respectively.



LAKE WINDERMERE. PHOTO © LIVING LAKES CANADA

However, all agencies need to work in collaboration. Federal and provincial agencies are to work with local government and First Nations to help implement important tools available within existing legislation, such as the Water Sustainability Act, Land Act, Fisheries Act, or an OCP<sup>15</sup>.

[VIEW LAKE WINDERMERE REPORTS](#)



# 2021-2022 FIMP LAKE SURVEYS



COLUMBIA LAKE. PHOTO © JÜRGEN REGEL

## COLUMBIA LAKE // KOOTENAY LAKE // SLOCAN LAKE

The third project year took place from April 1, 2021 to March 31, 2022, and included three re-FIMP surveys on three high priority lakes: Columbia Lake in the East Kootenays, and Kootenay and Slocan Lakes in the West Kootenays. All three of these lakes had been surveyed previously, providing a baseline for the re-surveys in 2021. Re-surveying these three lakes allowed the FIMP project team to re-assess foreshore values and present the rate of change on natural shorelines.

The re-FIMP results demonstrate that rates of loss are very similar across lakes, regardless of which jurisdiction of local government they fall within. These assessments involved further field testing of the revised FIMP methodology to ensure modifications were appropriate and effective for addressing Species at Risk and their habitats and communicated accurately via the standards and methods document.

*Please note: The following lake-specific recommendations below have been summarized for the purpose of this report. Exhaustive lists can be found in respective lake reports. We encourage readers to visit the links below to learn more about lake-specific recommendations.*

## COLUMBIA LAKE

**ORIGINAL SURVEY:** 2009 | **RE-SURVEY:** September 2021

**FISHERIES VALUES:** Westslope Cutthroat Trout, Burbot, Bull Trout and Kokanee

**RESULTS:** Total shoreline length was 39.6 km. The majority (23.4 km; 59%) was in a natural state. The remaining (16.2 km; 41%) was considered disturbed.

**RE-FIMP FINDINGS:** Comparing these results with the 2009 study indicated that the total length of disturbed shoreline did increase by 75 m, with a rate of loss of 0.02% per year.

### RECOMMENDATIONS:

- Update existing ZOS to reflect any new information.
- Conduct an inventory of freshwater mussel bed locations.
- Conduct an assessment of overnight moorage.
- Remove private mooring buoys and docks in areas not zoned for their placement or those placed in ZOS.
- Improved consideration of downstream impacts of hydrological changes, as well as conservation actions and priorities when considering or reviewing applications for future shoreline development.
- Consider potential impacts of climate change during foreshore and lake planning.
- Update the Fairmont Hot Springs & Columbia Lake Area OCP (Bylaw No. 2779, 2017).
- Support conservation efforts of the Columbia Lake Stewardship Society.

### RECOMMENDATIONS MADE BY THE SHUSWAP BAND:

- Strengthen the wording within the Canal Flats and Fairmont Hot Springs and Columbia Lake Area OCPs to protect riparian areas. For example, both OCPs could default to the provincial Riparian Areas Protection Regulation (RAPR) Hardship Protocol using Good Guidance (i.e., the 2009 Draft Variance Protocol) instead of putting the onus entirely on the QEP when a property is rendered undevelopable by a riparian setback.
- Local governments (e.g., Canal Flats and RDEK) should develop environmental protection bylaws that enact a wider variety of options for fines and enforcement as opposed to just using an OCP, which can only be enforced via court injunction.
- Conduct field-based tributary assessments. This should be done as part of a lake-wide project or by a Qualified Environmental Professional (QEP) on a development-by-development basis.
- Conduct a cumulative impacts study for Columbia Lake.
- Seek funding to support increased involvement by First Nations, including complete field mapping and integration of Culturally Valuable Resources (CVRs).

### [VIEW COLUMBIA LAKE REPORTS](#)



## KOOTENAY LAKE

**ORIGINAL SURVEY:** 2012

**RE-SURVEY:**

August 2021

**FISHERIES VALUES:**

Columbia White Sturgeon, Rainbow Trout (Gerrard strain), Kokanee, Bull Trout and Burbot

**RESULTS:** 407 km of Kootenay Lake foreshore was inventoried. Overall, 63% of the foreshore was considered natural and the remaining 37% was considered disturbed.

**RE-FIMP FINDINGS:** Since 2012, there has been an approximate loss of 4,525 m of natural shoreline from 2012 to 2021. The rate of loss is 0.12% per year or approximately ~488 m of natural shoreline per year. Losses were primarily evident on existing urbanized lots or on more recently created lots that were being developed. This resulted in multiple recommendations for all levels of government.

**RECOMMENDATIONS:**

- Incorporate new data, such as identified ZOS, into appropriate planning documents (i.e., RDCK and municipality OCPs).
- Establish a DPA for the entire lake within each Electoral Area and/or municipality.
- After initial guidelines and enforcement are established, effort should be focused on development of regional lakeshore plans such as a greenspace legacy plan or using tools for watershed planning under the Water Sustainability Act.
- Develop a greenspace legacy plan.
- All agencies need to participate in education. Education can take many forms and is often supported by data collection. Foreshore Inventory and Mapping, FHSI, and ZOS can all be used in educational materials.
- Ensure that enforcement action is taken, is consistent, and occurs on an ongoing basis in collaboration between agencies.
- Continue efforts to monitor and mitigate aquatic invasive species.

[VIEW KOOTENAY LAKE REPORTS](#)



KOOTENAY LAKE. PHOTO © IULIJA STASHEVSKA

## SLOCAN LAKE

**ORIGINAL SURVEY:** 2010

**RE-SURVEY:** September 2021

**FISHERIES VALUES:** Columbia White Sturgeon, Shorthead Sculpin, Rainbow Trout, Bull Trout, Burbot and Kokanee

**RESULTS:** Of the 88.6 km total shoreline length, 79.4 km or 90% was considered natural. The remaining 10% was classified as disturbed.

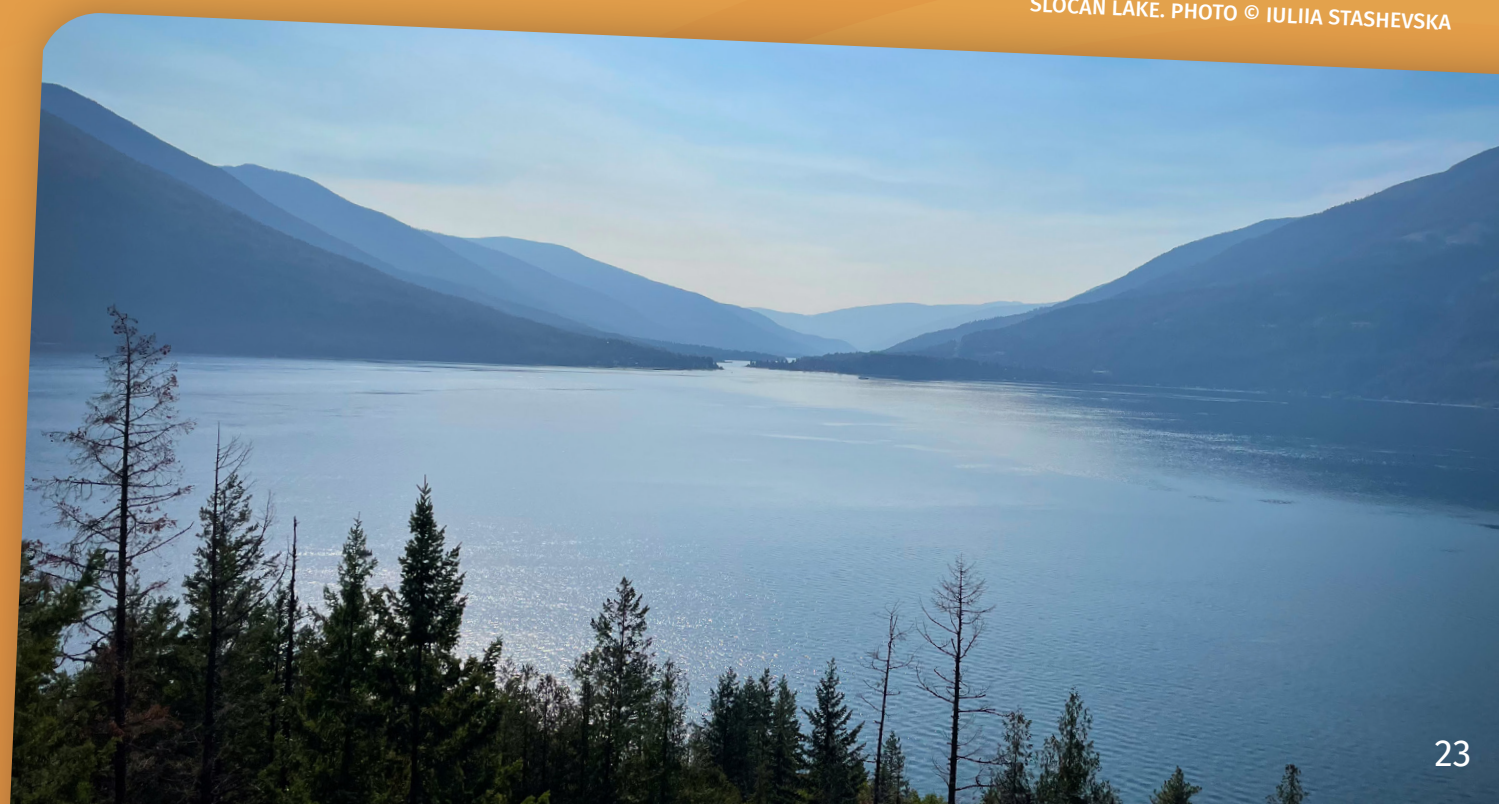
**RE-FIMP FINDINGS:** Comparison between the 2010 and 2021 FIM surveys indicated that the total length of disturbed shoreline increased by 80 m from 2010 to 2021 (0.1% of the total shoreline) and the observed shoreline rate of change was approximately 0.01% per year.

**RECOMMENDATIONS:**

- Update existing OCP with new FIMP information.
- Avoid placing mooring buoys and other shoreline modifications in ZOS.
- Conduct habitat restoration at historical industrial sites.
- Improve protection of important connectivity habitats.
- Conduct public education about the Columbia River Treaty and Syilx peoples.
- Conduct additional bird and wildlife surveys.
- Consider potential impacts of climate change during foreshore and lake planning.

[VIEW SLOCAN LAKE REPORTS](#)

SLOCAN LAKE. PHOTO © IULIJA STASHEVSKA





# 2022-2023 FIMP LAKE SURVEYS

## ARROW LAKES // ST. MARY LAKE // TROUT LAKE

The fourth and final year of the Columbia Basin FIMP project saw three more priority lakes surveyed. Arrow Lakes and St. Mary Lake were completed with DFO funding given the presence of Aquatic Species and Risk. Trout Lake was completed with funding from the Fish and Wildlife Compensation Program due to Trout Lake's proximity to BC Hydro dams in the Kootenay Lake watershed. Implementation of these results into decision making is ongoing. The final year of FIMP surveys in the Columbia Basin included involvement from the RDEK, the RDCK and, for the first time in this project, the Columbia Shuswap Regional District (CSRD) as a portion of Arrow Lake and Trout Lake fall within the CSRD jurisdiction.

*Please note: The following lake-specific recommendations below have been summarized for the purpose of this report. Exhaustive lists can be found in respective lake reports. We encourage readers to visit the links below to learn more about lake-specific recommendations.*

## ARROW LAKE

**SURVEY:** July 2022

**FISHERIES VALUES:** Columbia White Sturgeon, Kokanee, Rainbow Trout, Bull Trout and Burbot

**RESULTS:** The data revealed that 440.2 km or 87% of the shoreline was in a natural condition (at full pool), while the remaining 67.2 km or 13% was considered disturbed (at full pool).

### RECOMMENDATIONS:

- Establish standardized Development Permit Areas (DPA) for the entire lake within each electoral area and/or municipality.
- Establish a collaborative integrated watershed management plan with diverse input.
- Presence/absence sampling is recommended for the sensitive fish species with uncertain accounts.
- Conduct a mussel survey during lower water levels and map the locations and species present.
- Continue to conduct wildlife inventories, in particular for sensitive species to improve understanding of high value habitats that require protections. Also, identify and implement enhancement opportunities, such as those completed by BC Hydro (wetlands, bat habitat, etc.).
- Increase efforts and funding towards enforcement and compliance.
- Include riparian restoration in all new or redevelopment shoreline planning scenarios.

This was the first FIMP survey for Arrow Lakes. The FIMP study area included the section from Hugh Keenleyside Dam upstream to Arrowhead/Shelter Bay. The northernmost section extending upstream to Revelstoke (or the Revelstoke Reach) was not included due to the riverine nature of this section at mid to low reservoir levels. This study area included an approximately 425 km of shoreline, which was broken into 185 continuous segments.

It is hoped the survey results will be of some value to the Columbia River Treaty negotiation team working on the ecological function part of the treaty. The treaty expires in 2024 and is currently being renegotiated by Canada and the United States of America.

[VIEW ARROW LAKES REPORTS](#)



ARROW LAKE. PHOTO © IULIJA STASHEVSKA





ST. MARY LAKE. PHOTO © LIVING LAKES CANADA

## ST. MARY LAKE

**SURVEY:** 2010

**RE-SURVEY:** August 2022

**FISHERIES VALUES:** Westslope Cutthroat Trout

**RESULTS:** A total of 10.5 km of St. Mary Lake foreshore was surveyed. More than half of the shoreline was in natural condition (7.36 km; 70.4%), while the remainder was disturbed (3.1 km; 29.6%).

**RE-FIMP FINDINGS:** A total of 10.5 km of St. Mary Lake foreshore was surveyed. More than half of the shoreline was in natural condition (7.36 km; 70.4%), while the remainder was disturbed (3.1 km; 29.6%).

### RECOMMENDATIONS:

- Consider designation of conservation area for the wetland complex at the west end of St. Mary Lake.
- Enforce OCP policies and conduct a compliance audit of recent shoreline modifications
- Conduct a freshwater mussel bed inventory.
- Develop a management plan for the St. Mary Lake Regional Park.
- Post signage encouraging responsible boat use.

This is the highest rate of change the FIMP project team has documented since re-FIMP projects began in 2020. It is a serious concern that much of these changes occurred over a one- to two-year period with one large development contributing to most of the disturbed foreshore length.

These results are concerning given that St. Mary Lake is a system that supports at-risk species and sensitive ecosystems. Additionally, the impacts associated with these disturbances are generally more pronounced given the relatively small size of the lake.

### [VIEW ST. MARY LAKE REPORTS](#)

## TROUT LAKE

**SURVEY:** August 2022

**FISHERIES VALUES:** Bull Trout, Burbot and Rainbow Trout

**RESULTS:** A total of 52 km of foreshore was surveyed. The majority of lake foreshore (51.4 km; 97.5%) was natural and the remaining (1.26 km; 2.5%) was disturbed.

### RECOMMENDATIONS:

- Conduct inventories of fish and terrestrial species of conservation concern.
- Conduct updated wetland mapping in valleys adjacent to Trout Lake.
- Establish a standard Development Permit Area (DPA) to protect conservation values on private land.
- Make Development Permit Area setbacks consistent to protect conservation values on private land.
- Consider downstream impacts of industrial sites, hydrological changes in tributaries, and impacts related to road building in drainages with tributaries in the Trout Lake watershed.

### [VIEW TROUT LAKE REPORTS](#)



TROUT LAKE. PHOTO © WSP CANADA



# FORESHORE IMPACT TRENDS IN THE UPPER COLUMBIA BASIN

To summarize, LLC conducted FIMP surveys on four un-surveyed lakes (Arrow, Trout, Whitetail and Whiteswan) and FIMP re-surveys on six previously surveyed lakes (Windermere, Moyie, Columbia, Kootenay, Slocan, and St. Mary).

The re-surveys were conducted nine to 14 years after the initial surveys. Re-surveys allow for the comparison of the FIMP data sets to show trends in development pressure, habitat impacts, updates to the initial sensitivity analysis, audit of various management actions recommended in the initial FIM, and proposals for improving management strategies.

## NATURAL VS DISTURBED FORESHORE

A key FIMP metric is a change from natural to disturbed foreshore, which is an indicator of vegetation loss and the construction of access roads and buildings. The change can be calculated by the whole lake or individual lake segments.

Natural areas may be subject to future disturbances if the land ownership is not secured in a conservation area, park, or permanent development footprint such as a road or rail infrastructure right-of-way.

The following table depicts the percentage of natural versus disturbed foreshore of re-surveyed lakes:

Lake Name	Survey	Re-Survey	Return Period (years)	% Natural Shoreline 2nd Survey	% Disturbed Shoreline 2nd Survey
Windermere	2006	2020	14	43	57
Moyie	2008	2020	12	55	45
Columbia	2009	2021	12	59	41
Kootenay	2012	2021	9	63	37
Slocan	2010	2021	11	90	10
St. Mary	2010	2022	12	70	30

Table 2: Natural vs Disturbed Foreshore for Columbia Basin FIMP re-surveyed lakes.

## Natural Shoreline vs. Disturbed Shoreline (%)

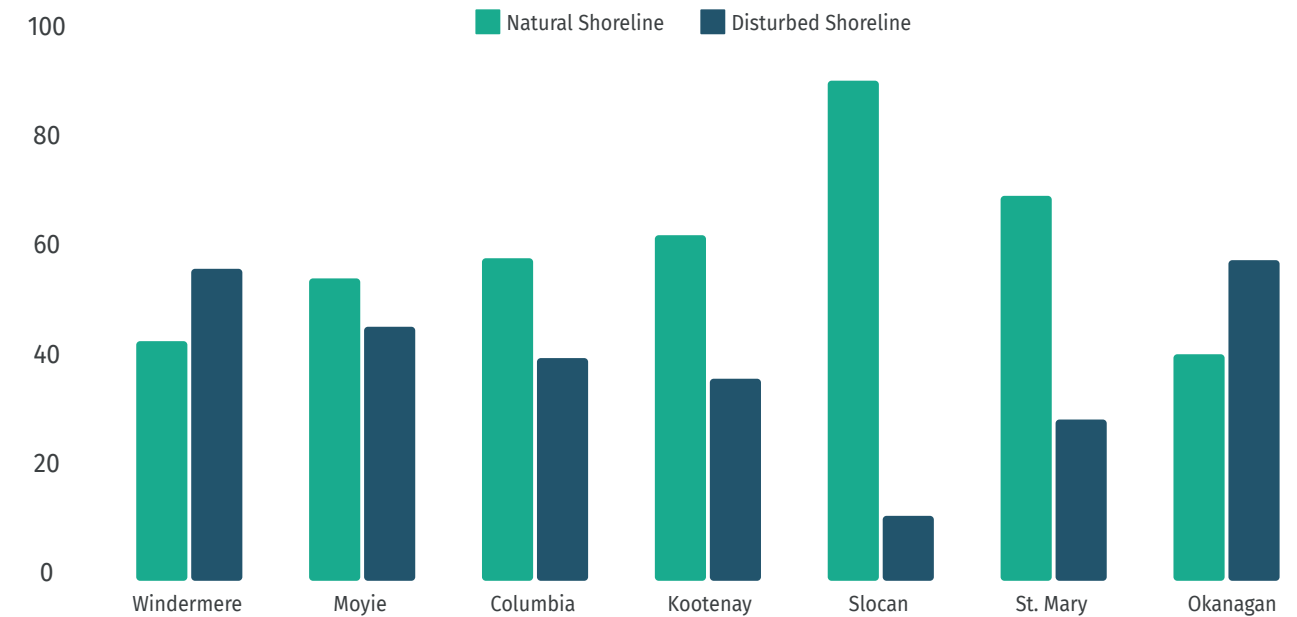


Figure 2: Natural vs Disturbed Foreshore for Columbia Basin FIMP re-surveyed lakes. Lake Okanagan included for reference.

The changes in disturbed shoreline can be calculated and shown in metres or as a rate of change over time. It is reasonable to assume that a lake with a large amount of private land ownership may over time be converted from natural to disturbed as rural areas are subdivided or single-family areas are redeveloped.

A COMPARISON BETWEEN TWO SURVEY YEARS SHOWING THE DEVELOPMENT DIFFERENCE ON THE SAME STRETCH OF LAKE WINDERMERE FORESHORE: TOP PHOTO WAS TAKEN IN 2006, BOTTOM PHOTO IS FROM 2020. PHOTOS © ECOSCAPE ENVIRONMENTAL CONSULTANTS





Table 2 (natural vs disturbed - page 28) and Table 3 (land ownership - page 32) show that, of the 10 lakes surveyed, Kootenay, Moyie and Windermere Lakes have the most private land available for future development (47.5% – 55%). Even though this private land currently has significant natural areas (43% - 63%) this may be subject to potential change. On Kootenay Lake, for example, 75.4% of rural residential land (large private parcels) in 2021 was in a natural condition while single family land was only 25% natural.

If the rural residential land is developed in the same manner as single-family land has been, the amount of rural residential land in a natural state would fall to 25% or greater than 50,000 metres of shoreline would change to disturbed from natural classification.

If all the private land available on Kootenay Lake that is currently in a natural condition is developed to the current standard, the amount of disturbed shoreline could rise to greater than 50% from 37% in 2021.

The current rate of change on Kootenay Lake is 0.12% per year or 488 m per year (4,525 m in nine years). The three lakes facing the most development pressure (Kootenay, Windermere, Moyie) have the highest amount of private land and the lowest amount of legally protected conservation lands. St. Mary Lake had the highest annual rate of change at 47 m per year. The rate of change was skewed by one large development. Even so, St. Mary Lake has 31% private land available of which currently only 40-50% is in a natural state. If this land was developed in a similar manner to the existing private land, the amount of disturbed land would increase significantly. Much of the remaining natural lands are sensitive Species at Risk habitats on this small lake.

## CHANGE IN DISTURBED AREAS

Observations from the Columbia Basin FIMP project indicate that disturbed foreshores tended to be concentrated in the private land use areas that concentrate development into smaller sub-areas (e.g., bays) of a lake. Consequently, the rate of change may be much higher in some lake segments and habitat types than others (see lake-specific reports on the Columbia Basin Water Hub). Concentrating development/disturbance in some areas can contribute to the fragmentation of fish and wildlife habitats. Consequently, whole lake analysis should be supplemented with a review of other parameters such as segment and shore type analysis (i.e., gravel beach, sand beach, stream mouth, etc.). Segment analysis may show a rate of change much greater than for the whole lake. One may assume that, over time, many non-conservation lands will eventually be disturbed. Better regulation, land conservation, and stewardship are vital to prevent this trend from continuing.

## Increase in Distributed Shoreline Between Surveys (metres)

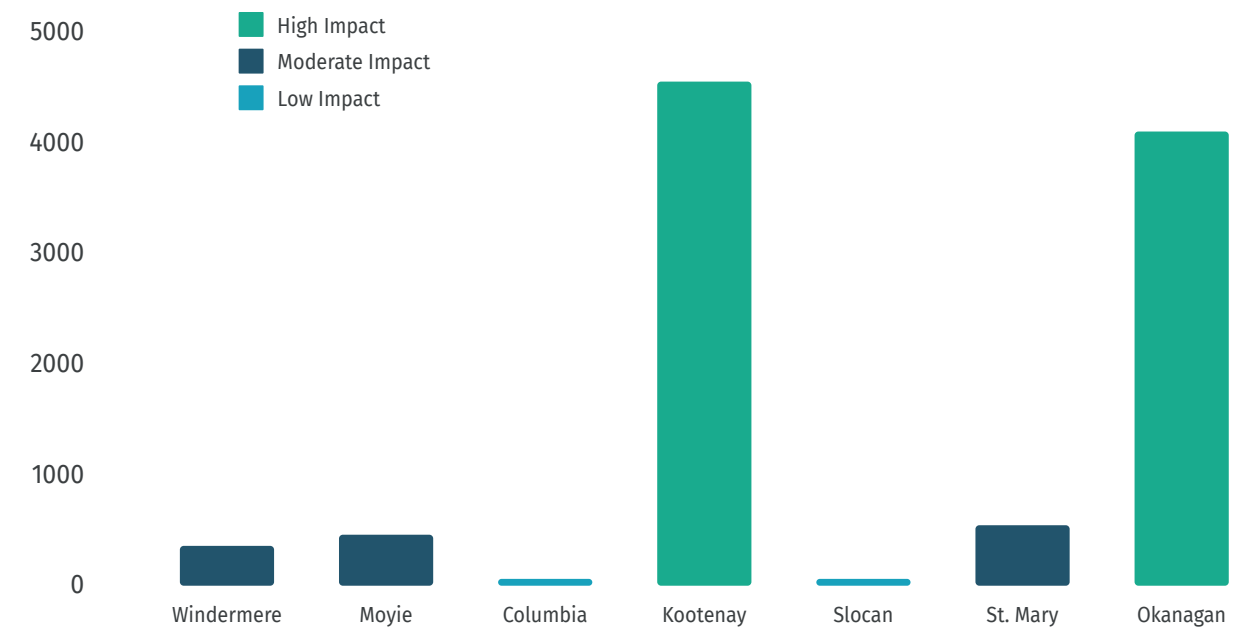


Figure 3: Depicting the increase of disturbed shorelines on Columbia Basin FIMP re-surveyed lakes. Lake Okanagan included for reference.

## Rate of Natural Shoreline Loss (%)

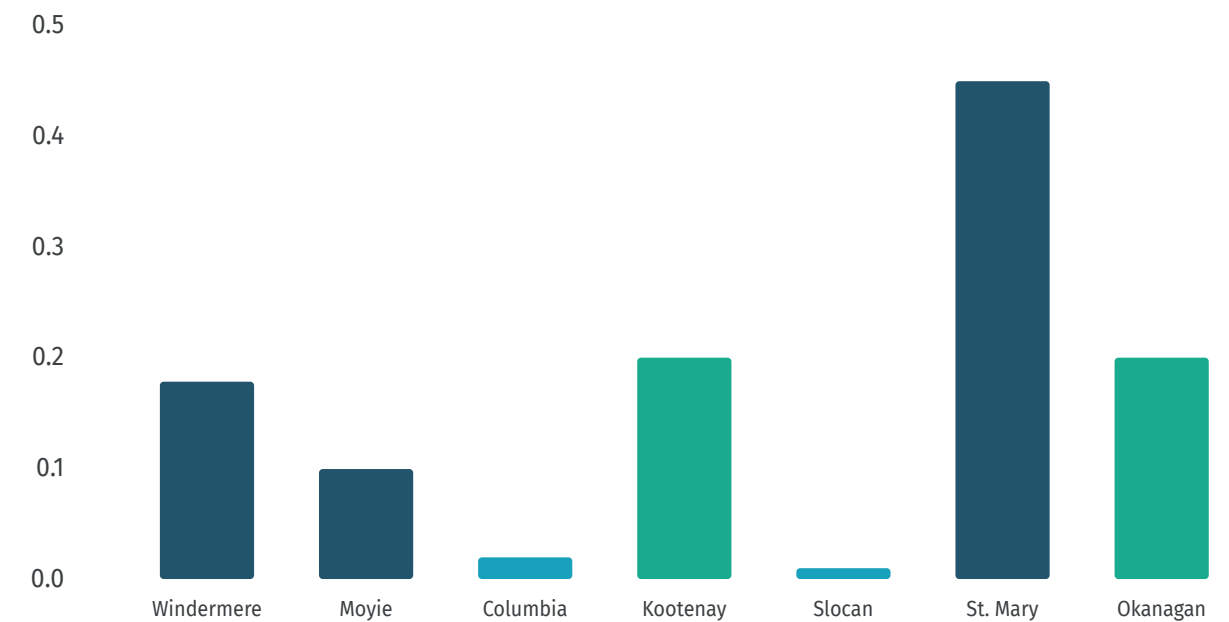


Figure 4: Depicting the rate of loss in natural shoreline on Columbia Basin FIMP re-surveyed lakes. Lake Okanagan included for reference.



Lake Name	Total Shoreline (metres)	Private Shoreline %	Conserved Shoreline %	Increase in Disturbed Shoreline (metres)	Yearly increase (metres)	Rate of change per year
Moyie	37,638	55	minimal	471	39.25	0.1000%
Windermere	37,399	52	15	369.5	26	0.0070%
Kootenay	406,811	47.5	minimal	4525	488	0.1200%
St. Mary	10,500	31	none	560	46.7	0.4500%
Slocan	88,566	8	20	80	7.25	0.0010%
Columbia	39,563	6.3	58	75	6.25	0.0015%

Table 3: Change in Disturbed Areas by Lake and Land Ownership. Private includes rural residential, single family, industrial, and commercial combined.

Based on the observations, it was found that lakes with the least pressure on natural foreshore tended to have the most protected conservation areas (Columbia and Slocan Lakes) and the lowest amount of private land. Large conservation areas such as Valhalla Provincial Park on Slocan Lake, Columbia Wildlife Management Area and Columbia Lake Park on Columbia Lake, as well as Akisqnuq First Nation Reserve lands, Windermere Lake Provincial Park, and Columbia Wetlands Wildlife Management Area on Windermere Lake, provide long-term reserves of fish and wildlife habitats, and buffer lakes from the long-term conversion of natural to disturbed shorelines.

Trend analysis on Okanagan Lake for comparison showed a 0.2% per year change<sup>16</sup>, which is a similar rate of change as some Columbia Basin lakes. Interestingly, the rate of change/trends were similar in the Central Okanagan Regional District, East Kootenay Regional District, and Central Kootenay Regional District despite differing land use planning efforts and policies. This indicates that, irrespective of jurisdiction, government planning and policies may not be achieving lake foreshore management and fish and wildlife habitat protection goals.

### CHANGE IN NUMBER OF FORESHORE MODIFICATIONS

Table 4 shows how some physical shoreline alterations such as erosion control structures, retaining walls, beach grooming, and associated groyne construction have increased along with riparian vegetation removal (disturbed versus natural) of the foreshore area. In addition, the increasing number of docks and mooring buoys point to other potential concerns due

to increasing boat use, such as disturbance to nesting waterfowl, impacts to wetlands from propellers, mooring buoys placed in wetland areas, and propeller wash impacts.

The combination of removing foreshore vegetation, physical alteration of the shoreline, and increasing activity (e.g., boats) should be a concern for the maintenance of healthy fish and wildlife populations on Columbia Basin lakes.

FIMP results indicate that permanent infrastructure, such as roads and rail lines after construction impacts are mitigated, may actually help isolate long stretches of foreshore and prevent future private land use development. The prevention of spills of toxic materials and mitigation of wildlife roadkill must however be considered.

Development on lakes to date appears to be concentrated on more easily accessible but sensitive habitats, such as stream mouths/alluvial fans, gravel beaches, and wetlands. However, after the easier-to-access and developed areas are built out, development is seen progressing to steeper and rockier areas that may require extensive engineering of access roads, retaining walls, etc.

In summary, the general public wants to live and recreate adjacent to water, but the development that accompanies those desires impacts natural features. The alteration of lake foreshores can have negative impacts to biodiversity and the sensitive species that depend on the riparian vegetation, wetlands, stream mouths, and other foreshore habitats along lake shores.

Lake Name	Docks 1st Survey (#)	Docks 2nd Survey (#)	Mooring Buoys 2nd Survey (#)	Erosion Protection %	Substrate Modification %
Columbia	14	30	26	41	
Kootenay	709	671	218		34
Slocan	43	57			11
Windermere	179	275	70	20	56
Moyie	109	208	63	36	36
St. Mary	7	9	2		

Table 4: Change in number of foreshore modifications on Columbia Basin re-surveyed lakes. Empty cells are the result of data collection anomalies between survey years.



# LAKE FORESHORE MANAGEMENT ISSUES & RECOMMENDATIONS

Following 10 different FIMP surveys in the Columbia Basin, several main issues shared across jurisdictions have been revealed. Based on previous surveys completed outside of the Columbia Basin, these issues appear to be common on developed lakes throughout the province.

## SINGLE LOT DEVELOPMENT

- Single lot development and redevelopment continue to result in the degradation of fish and wildlife habitats along lake shorelines. Programs or policies that are designed to meet fish and wildlife habitat and biodiversity goals along shorelines also do not appear to be meeting habitat conservation and protection goals based on the data.
- Development Permit Areas (DPA) adjacent shorelines are inconsistent, varying from 0-30 meters with no defensible ecological rationale for DPA width variances, resulting in inconsistent and inadequate protection and mitigation of disturbances to fish and wildlife habitats.
- Lake foreshore habitat surveys conducted using FIMP indicate that incremental loss of fish and wildlife habitats is occurring and will likely continue if approval agencies proceed with viewing lake foreshore development through the lens of single lot approvals versus cumulative impacts to the entire water body.
- Government agencies responsible for fish and wildlife habitats do not appear to be conducting:
  - > Adequate monitoring, compliance, or enforcement efforts
  - > Enforcement of local bylaws or provincial or federal laws enacted to protect fish and wildlife habitats, Species at Risk, or biodiversity

## RURAL RESIDENTIAL DEVELOPMENT

- Large private land holdings provide a view to the future development density on the surveyed lakes.
  - > For example, 47.5% of the shoreline of Kootenay Lake is privately owned. Full buildout of those lands could see the percentage of disturbed foreshore increase substantially from the 2021 figure of 37% if all private land were to be developed to the current standard.
  - > Lakes with large areas of rural residential land may experience similar changes in the level of disturbance.

## SHORELINE MODIFICATIONS

The removal of riparian vegetation along shorelines for development purposes is generally accompanied by:

- Extensive foreshore substrate alteration (beach grooming, groyne construction, etc.).
- Long retaining walls or other erosion protection measures (i.e., riprap) harden the shoreline and, in some cases, redirect erosion to adjacent shorelines or upland areas.
- Common modifications include docks and mooring buoys. Along with the physical impacts of the dock footprint and scouring that occurs around buoys, the increasing number of motorized boats can have impacts on nesting waterfowl or can cause the displacement of birds from preferred habitats.
- Despite government and community planning efforts, agency permitting and approval policies, procedures, education, and diverse outreach, foreshore fish and wildlife habitats continue to be degraded and/or altered with modifications.

## RECOMMENDATIONS

- 1) Development Permit Areas (DPAs) should be standardized by local governments. DPAs must be consistently applied and be wide enough to protect the foreshore features necessary for healthy fish and wildlife populations. A width of 30 m from the high water mark is recommended. Variances to DPA widths may be justified in some cases but should be reviewed and assessed by Qualified Environmental Professionals (QEP). Wider DPAs may also serve to mitigate potential flood damage due to climate change.



MOORING BUOYS ON COLUMBIA LAKE. PHOTO © WSP CANADA



- 2) The Riparian Areas Protection Regulation of the BC Fish Protection Act (2004) should be implemented in the Columbia Basin.
- 3) Government should consider financial incentives (i.e., tax relief) to property owners to encourage developers and property owners to either leave large areas of property development in a natural state or restore areas already disturbed.
- 4) A system of education and outreach that ensures landowners are aware of the regulatory requirements and stewardship objectives before lot sale closes, subdivision, or development begins (e.g., vegetation removal) should be implemented as soon as possible.
- 5) Cooperation among regulatory agencies to monitor and enforce regulation and guideline compliance should be improved and prioritized.

## ZONES OF SENSITIVITY/CONSERVATION ZONES

The FIMP methodology update highlighted emphasis on the identification of sensitive areas and habitat features on lakes.

This may include:

- Species at Risk habitats
- Fisheries sensitive zones (stream mouths, migration and holding areas, spawning beaches, etc.)
- Wildlife migration corridors
- Other important wildlife habitats and wetlands
- Biologically sensitive features (bird roosts or nests, mussel beds, and herptile areas such as turtle haul outs)
- Endangered or rare ecosystems such as cottonwood riparian ecosystems. These features are some of the most biologically productive and sensitive features on any given lake.

The lakes surveyed with the most natural habitat are those that contain large intact legally designated conservation areas such as parks, wilderness areas, or wildlife management areas. The inclusion of large conservation areas on lakes may be critical to maintaining healthy lake ecosystems as lakes approach full build out of private lands.

## RECOMMENDATIONS

- 1) Indigenous communities, conservation organizations (e.g., Canada Nature Conservancy), and stewardship groups should coordinate and cooperate to identify (see FIMP reports) and acquire for preservation, large and/or sensitive habitats such as stream mouth/alluvial fans, wetlands, and endangered ecosystems (i.e., Cottonwood riparian areas).
  - a) Private land covenants/bequests, existing conservation funding programs (i.e., Local Conservation Funds, Canada Nature Trust, Columbia Fish and Wildlife Compensation Program), the establishment of wildlife management areas, or provincial parks are all potential ways to protect large parts of lake foreshore and upland from being developed. It is critical that, going forward, large private and/or Crown land holdings be preserved in large conservation areas such as on Slocan and Columbia Lakes.
- 2) Legally designated zones of sensitivity identified in FIMP plans should be incorporated into land use and/or lake management plans to protect these important habitats from development impacts.

ST. MARY LAKE 2022 FIMP SURVEY. PHOTO © MASSE ENVIRONMENTAL





## LAND USE PLANNING

Lakeshore planning efforts in the Columbia Basin have been largely led by local governments. In some jurisdictions, FIM inventory data, sensitivity ratings (High, Medium, and Low), and FDGs have been incorporated into OCPs and used to draft bylaws such as DPA bylaws. Planning tools and regulations in effect in other parts of BC, such as the Riparian Areas Protection Regulation, that could improve the protection of riparian areas have not been applied in the Upper Columbia Basin.

There are no official federal plans in effect in the Upper Columbia Basin outside the designation under the Species at Risk Act for some critical habitats (i.e., White Sturgeon). The protection of fish and wildlife habitats, which is the constitutional responsibility of the Province of BC and the federal government, appears to have been largely led by local government, Indigenous communities, and stewardship groups since DFO closed its Nelson office in 2012.

## RECOMMENDATIONS

- 1) All levels of government must improve cooperation and coordination on planning initiatives (Greenways Plans, Official Community Plans, Species at Risk Recovery and Management Plans, Water Stewardship Plans, etc.).

- a) There are many government planning tools but it would appear that not all of them are being utilized and the ones that are, are not being used to their full potential. The establishment and support, with human and financial resources, of regional or lake specific review bodies (i.e., East Kootenay Integrated Lake Management Partnership or Kootenay Lake Partnership) could provide coordination of development applications, monitoring, and enforcement of regulations.

- 2) Regulatory agencies must allocate resources and establish objectives and strategies for monitoring, compliance, and enforcement of landowners who ignore laws or regulations.

- a) Compliance and enforcement are a necessity where there is widespread non-compliance.

- 3) Boat capacity studies should be pursued on candidate lakes.

- 4) Lake-specific review bodies should plan and seek funding to conduct re-surveys on a 10-15 year cycle using FIMP methodology to monitor trends on lakes.

## GENERAL LAND USE ETHIC

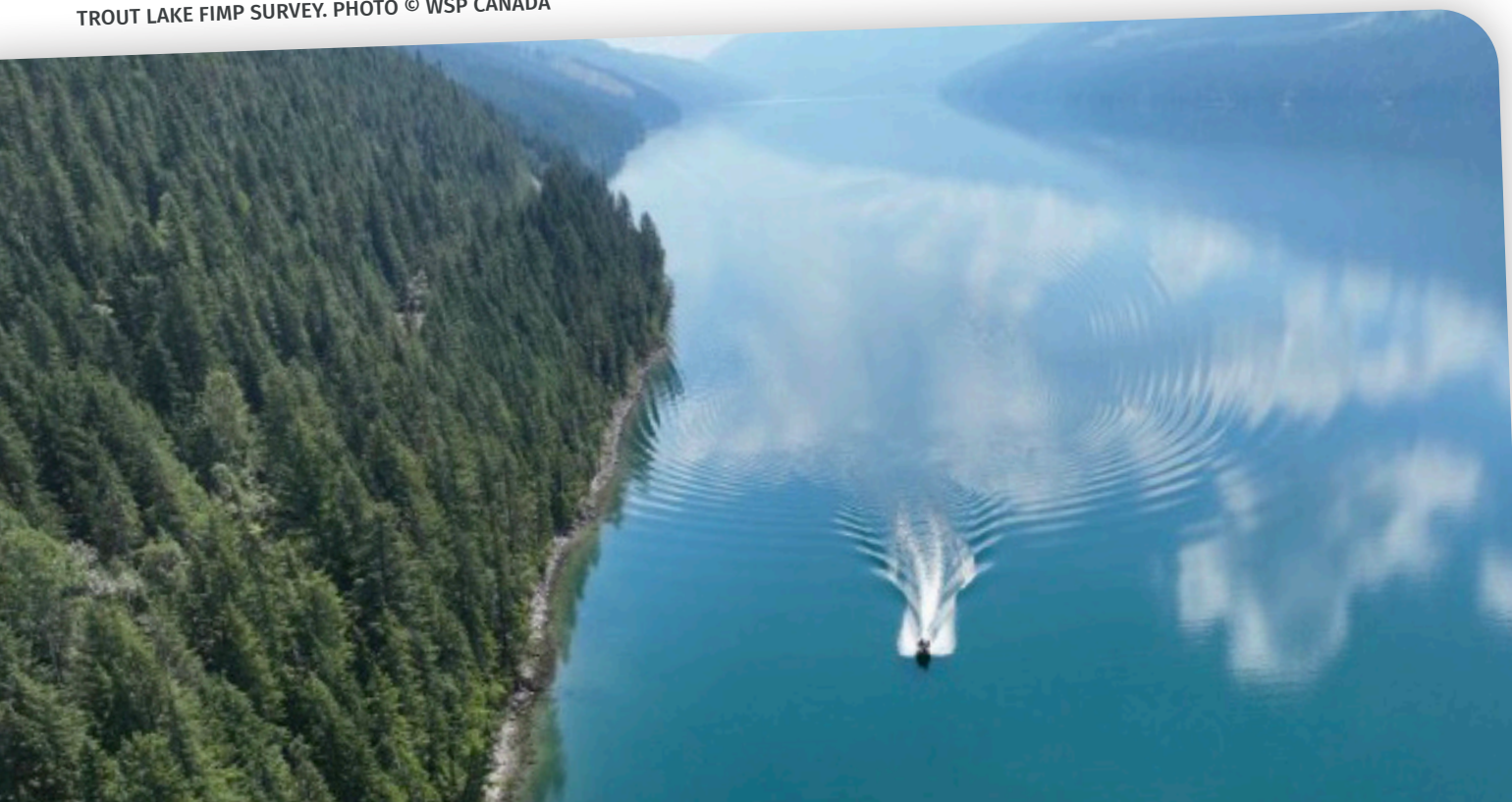
The environmental ethics and values of many lakeshore property owners must change if fish and wildlife habitats are to be protected. There is a responsibility that comes with ownership of waterfront property. Site specific impacts can and do affect the common resources that current and future generations wish to share.

Unless individual responsibility is taken, freshwater fish and wildlife biodiversity resources will be impacted.

If we want to have healthy natural lakes, we must have:

- better cooperation on land use plans and policies
- higher standards for development
- better monitoring and compliance of those standards
- more lands set aside for conservation
- protection of critical and important fish and wildlife habitats
- restoration of degraded habitats

TROUT LAKE FIMP SURVEY. PHOTO © WSP CANADA









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# Living Lakes CANADA

