



FISH AND WILDLIFE COMPENSATION PROGRAM

PEACE BASIN

LAKES ACTION PLAN

March 31, 2014

BC Hydro 
FOR GENERATIONS


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Peace Lakes Action Plan

1. Introduction

The Fish and Wildlife Compensation Program (FWCP) is a partnership between BC Hydro, the Province of British Columbia and Fisheries and Oceans Canada, First Nations and local communities and groups. It serves to conserve and enhance fish, wildlife and their supporting habitats affected by the creation of BC Hydro owned and operated generation facilities in the Coastal, Columbia and Peace regions in British Columbia. The FWCP program in the Peace region (see Figure 1) was initiated in 1988 and has been investing in fish and wildlife initiatives ever since.

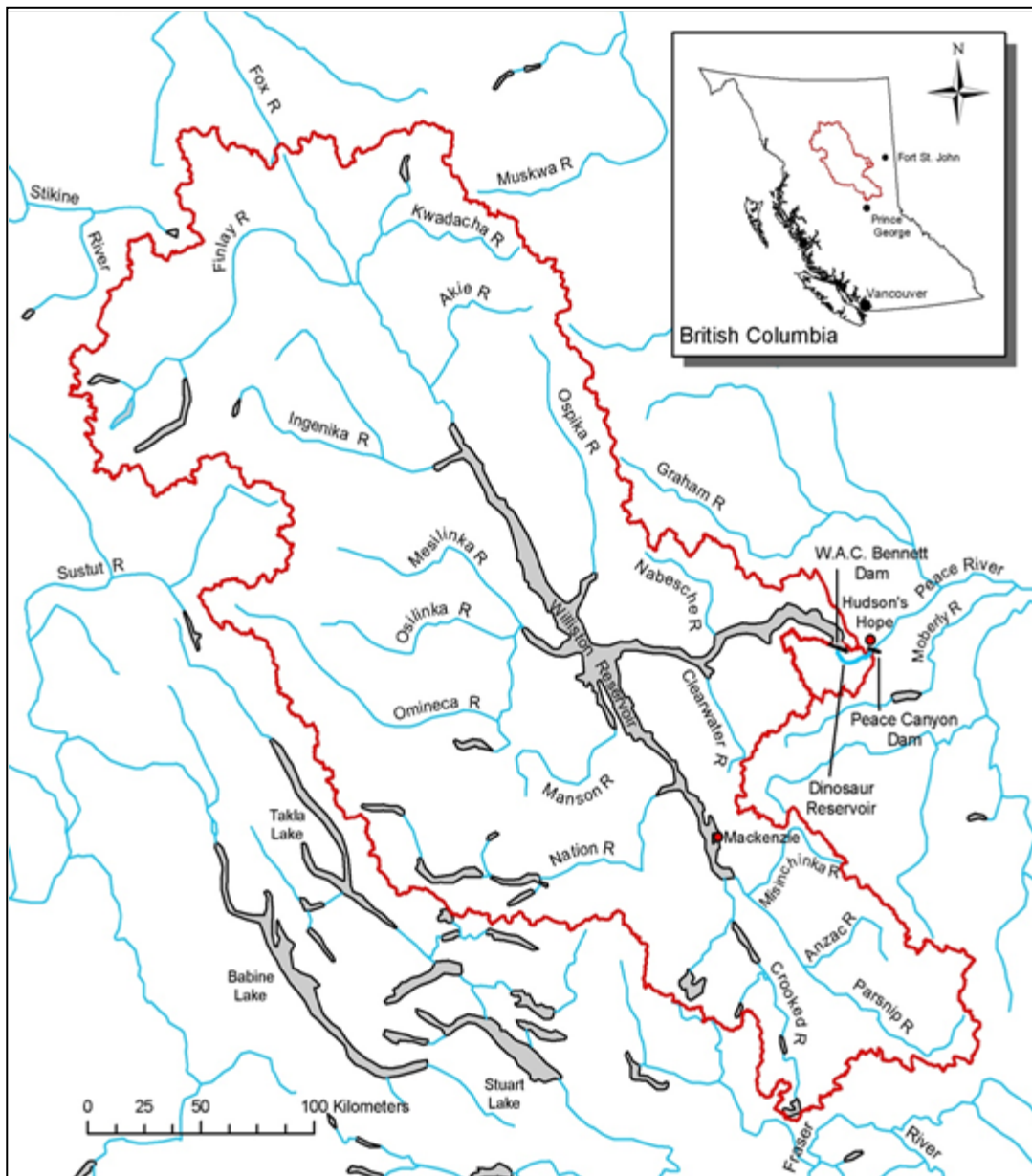


Figure 1. The Upper Peace Basin and FWCP-Peace Program Area

The FWCP developed a strategic framework that guides overall planning for compensation investments (MacDonald 2009). The framework has guided the development of strategic plans for each basin within the FWCP program area, which in turn inform Action Plans that focus on specific priorities within each basin (Figure 2).

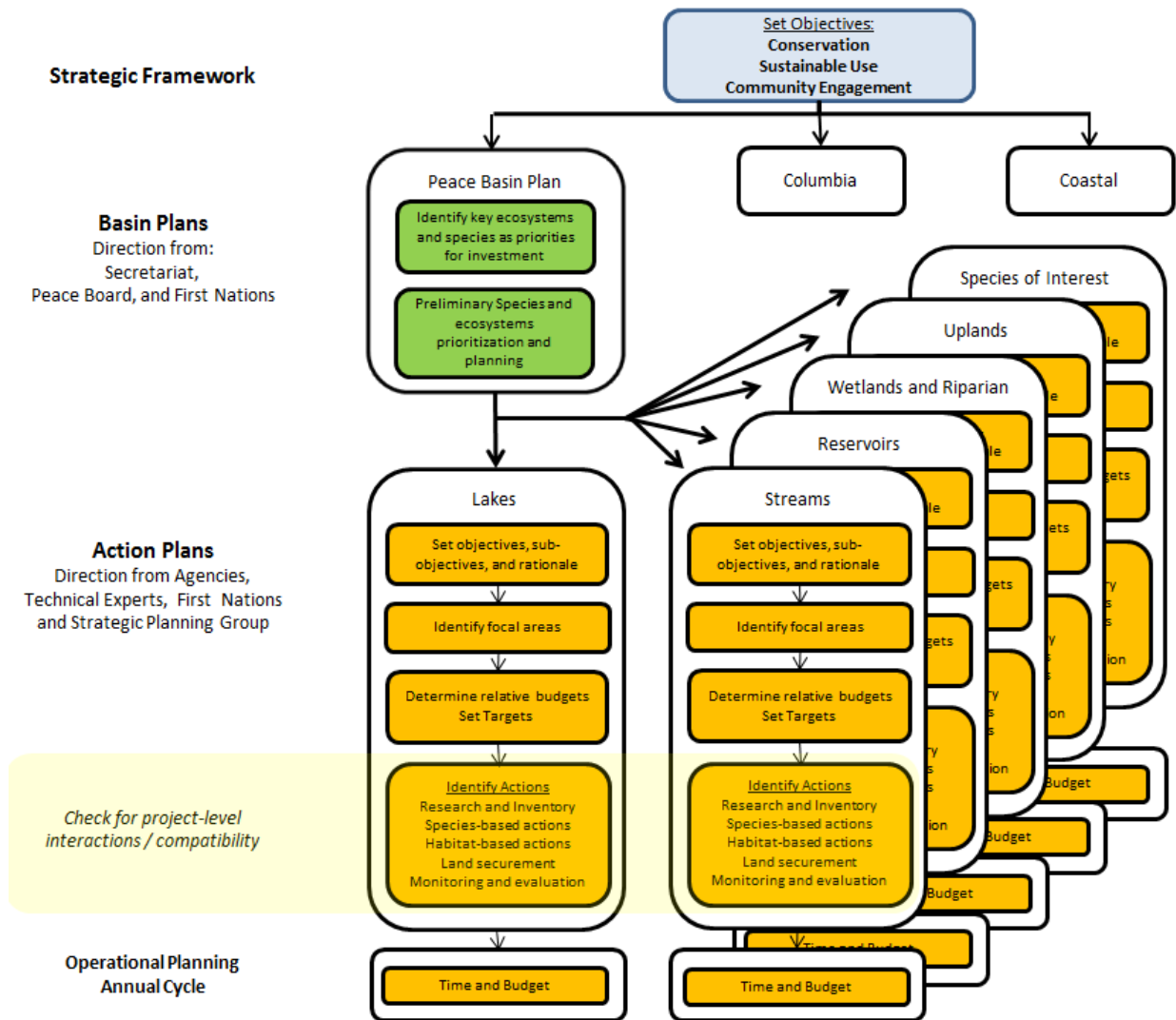


Figure 2. Relationship between the Lakes Action Plan and higher level planning and objectives

This Lakes Action Plan sets out priorities for FWCP to guide project funding priorities within the Peace region program area (Figure 1). The plan builds on the FWCP’s strategic objectives and the FWCP-Peace Basin Plan (Fish and Wildlife Compensation Program, 2013). Williston Reservoir has a large annual drawdown and Dinosaur Reservoir has fast throughput of water, making both reservoirs very different ecologically relative to natural lakes in the region. Action Plans have been developed for Riparian and Wetlands, Uplands, Species of Interest, Streams, Lakes, and Reservoirs; some actions are complementary across different plans.

The Lakes Action Plan addresses natural lakes of all sizes within the Peace Basin (there is a separate Reservoirs Action Plan). Lakes provide critical ecosystem components for many plant and animal species and are an invaluable freshwater resource for humans (Schiefer and Klinkenberg

2004). The number of Peace Basin lakes inundated by reservoirs is unknown; however, natural lakes decreased in number, and there were effects on many aquatic species (e.g. Blackman, 2001; Stockner *et al.* 2000).

This Action Plan describes objectives and actions to improve lake habitats in the Peace Basin, in the context of the Fish and Wildlife Compensation Plan's (FWCP) strategic framework. Feedback received during development of the Action Plans indicated that lake habitats are of generally lower priority for FWCP investment compared to aquatic habitats in streams, but of higher priority compared to reservoirs.

The actions and priorities described in this Action Plan have been developed with input from the BC Ministry of Environment (MOE), BC Ministry of Forests, Lands and Natural Resource Operations (FLNRO), BC Hydro, First Nations and local stakeholders. It is important to understand, however, that planning priorities within action plans may not translate immediately into funded projects. Limited program funding requires that priority-setting has to also be developed across the program as a whole, not just within action plans. The process of selecting which actions will be implemented in any given year will occur during the annual implementation planning cycle.

2. Overview Context

2.1 Impacts and Threats

Background – The Peace Basin is approximately 70,000 km², and includes the Williston and Dinosaur reservoirs, as well as thousands of lakes, streams and wetlands. The Peace Basin contains 20 large lakes (>1,000 ha); 91 medium lakes (>100 & <1,000 ha); and 2,547 small lakes (<100 ha) (Blackman *et al.* 1990). There are no natural lakes larger than 10,000 ha within the watershed (Schiefer and Klinkenberg 2004).

Hydro-related Impacts — Fish species composition in Williston and Dinosaur reservoirs has undergone a major change in the decades since reservoir creation. It is not known whether the change in species composition in Williston and Dinosaur has impacted natural lakes that are connected to the reservoirs.

The creation of Williston Reservoir changed angling practises in the watershed. The dangerous nature of navigating on a reservoir with abundant floating and submerged debris (Sebastian *et al.* 2009) means there is limited angler use on the reservoir itself, and a major portion of the angling effort is concentrated on small lakes and streams in the watershed (Blackman *et al.* 1990). This has led to increased fishing pressure on some lakes of the watershed.

Non-Hydro Impacts — Natural lakes in the Peace watershed have become increasingly accessible due to logging activity, and easier access has resulted in overfishing in some of the more popular areas (Blackman *et al.* 1990). Logging, tree planting, mining and road construction camps are scattered throughout the watershed and fishing pressures near these facilities can be high (Blackman *et al.* 1990). Poorly maintained road culverts can act as barriers to fish migration and movement. In addition, non-native species introduced to the reservoirs (e.g., Kokanee) can make their way to natural lakes through stream systems; the impact to small lakes from non-native species has not been quantified. The risks of stocking non-native sportfish species like Brook Trout are managed through policies that prevent stocking to new waterbodies and use of special triploid stocks that cannot reproduce.

2.2 Limiting Factors

Factors limiting the quality and abundance of lake habitats fall into three broad categories:

Extent

The number of natural lakes flooded by inundation of the Williston and Dinosaur reservoirs is unknown. Many features of small lakes in particular cannot be replicated in a reservoir system. For example, many wildlife species associated with small lakes are dependent on features along lake shorelines such as shallow waters, emergent vegetation, and wildlife trees. There was loss of this important habitat when inundation decreased the ratio of useable shoreline length to area in the basin.

Connectivity

Connectivity among lakes, and between lakes and streams is important for seasonal movement of some species and for spawning fish. Lower elevation lakes that were lost to inundation were more productive and accessible in comparison to the higher elevation lakes that remain. Lakes that are isolated from the rest of the upper Peace River system by barriers have lower diversity of native species compared to connected lakes (Zemlak and Cowie 2003).

Productivity

The replacement of natural lake systems with reservoir habitat led to a decrease in productive lake habitat. This is because the Williston Reservoir, like all older reservoir systems, is ultra-oligotrophic (Harris *et al.* 2005), while natural lakes within the watershed range from oligotrophic to mesotrophic (Slaney and Lewynsky 1991).

2.3 Trends and Knowledge Status

Habitat Trends — The availability of natural lake habitat in the Peace Basin has changed from historical conditions, as lower altitude lakes were replaced with lower productivity reservoir habitat. Native fish communities in the remaining, higher altitude lakes are threatened by invasive species (Slaney and Lewynsky 1991).

Provincial Stocking Policy — In British Columbia, about 800 lakes and streams are stocked annually with salmonids produced from the five facilities operated by the Freshwater Fisheries Society of BC. Decisions of where and when to stock fish are guided by provincial policy that considers the risk and benefits related to introducing fish into any given waterbody. Stocking is typically concentrated in small lake habitats because risks (e.g., spread of introduced species, hybridization with wild fish) are most easily managed in this environment. Provincial policy gives first priority to the conservation of wild indigenous species and supports the stocking or transplant of fish into lakes where:

- the stocking is part of an approved management, research or recovery plan; or
- there is an identified demand for additional recreational opportunity or opportunity to reduce angling pressure on wild stocks; and
- an evaluation has been completed that assesses the risks to native species that are dependent on the freshwater environment, and that these risks are considered to be acceptable; and
- appropriate consultation has been completed to assess issues surrounding First Nations' rights and title.

In the FWCP-Peace area many of the historic stockings were experimental to judge the likely success of additional stocking. Currently, 15 lakes within the FWCP-Peace area are regularly stocked, primarily with Rainbow Trout.

Stock Trends — The small lakes and streams within the Peace basin have a long history of fish introductions through stocking (Langston and Murphy 2008). This has provided a benefit for angling opportunities in some cases, but is viewed as a detriment to the system by some First Nations, notably the introduction of Kokanee. A summary of stocking in 47 lakes in the Peace/Williston Fish and Wildlife Compensation Program area from 1976 to 2005 is presented in Langston and Murphy (2008). Rainbow Trout and Bull Trout were the most common fish species observed (Langston and Murphy 2008). The low abundance and depressed size structure of several species of sport fish in Moberly and Gwillim lakes indicates that over-exploitation is a bigger threat to fish stocks than habitat quality (Slaney and Lewynsky 1991), but the extent to which this pattern extends to other waterbodies is not clear.

Bull Trout — Bull Trout are in serious decline in some parts of their range and are currently blue listed in BC, meaning the species is of “special concern” and considered sensitive to human activities or natural events (McPhail and Baxter 1996). Bull Trout in the Peace watershed are part of the Western Arctic Population assessed as Special Concern by COSEWIC (COSEWIC 2012). Even moderate levels of harvest in cold unproductive lakes can result in over-exploitation (Slaney and Lewynsky 1991). The current status of Bull Trout in the watershed is not well understood (but see Hohndorf *et al.* 1993; Langston and Cubberley 2008; Euchner 2011). Trends in populations

within the Peace/Williston area are either unknown or a mix of increasing and decreasing (e.g., Langston and Cubberley 2008).

Kokanee — Two native Kokanee populations occur in headwater lakes in the Finlay (Thutade Lake) and Parsnip (Arctic Lake) drainages (Langston and Zemplak 1998). Kokanee were found in Williston Reservoir prior to introduction of Columbia Basin Kokanee in 1990 (see below). Maturing Kokanee were found in significant numbers in the Finlay River (Fielden 1991, 1992) suggesting that they originated from the Thutade Lake stock. These fish did not develop the bright red spawning colour commonly displayed by the stocked Kokanee. The dull spawning colours observed in these fish are typical for shore-spawning Kokanee stocks. Despite being found in the reservoir and the Finlay River, the native Kokanee were apparently unsuccessful at colonizing these areas, perhaps because they are shore spawning stocks and cannot spawn effectively in a reservoir with a deep drawdown or its tributary streams.

Stream-spawning Kokanee from Arrow Reservoir (Hill Creek) and Kootenay Lake (Meadow Creek) were stocked extensively in tributaries of Williston Reservoir from 1990 to 2005 (2005 cumulative total of 1.7 million in tributaries to the Peace reach; 2.1 million in tributaries of the Parsnip reach; and 75,000 in the Finlay reach) (Langston and Murphy 2008). Reservoir creation has favoured Kokanee populations as they are a pelagic lake-dwelling species (Euchner 2011). Since their first introduction in the 1990s, Kokanee have been gradually increasing in abundance, and they have recently overtaken Lake Whitefish as the most abundant species in Williston Reservoir. It is anticipated that spawning numbers will continue to vary as Kokanee colonize new areas (Sebastian *et al.* 2009). A survey of lakes in the Peace Basin to track Kokanee colonization of natural lake systems has not been conducted, and the number of Kokanee moving from the reservoir to nearby lakes is unknown.

Lake Trout —The large-scale habitat change associated with the creation of Williston Reservoir has been favourable for Lake Trout (Euchner 2011). As of 2008, Lake Trout have not been stocked in the Williston Reservoir, and the source of present populations in the reservoir is thought to be migration from nearby lakes (Langston and Murphy 2008). Wild populations of Lake Trout exist in hundreds of lakes in the Peace Basin (McLean and Langston 1993). Lake Trout are an important predator in northern lake ecosystems and are vulnerable to over-harvest. There are many data gaps in the region for this species.

Lake Whitefish — Lake Whitefish have been identified in dozens of lakes in the Peace Basin (Langston and Murphy 2008), but trends in their population numbers have not been quantified.

Mountain Whitefish — Mountain Whitefish are primarily a fluvial species. Current trends in lake populations are unknown, but Mountain Whitefish have been identified in dozens of lakes in the Peace Basin (Langston and Murphy 2008).

Pygmy Whitefish — 17 lakes in the Peace Basin are known to contain Pygmy Whitefish (Zemplak and McPhail 2004), but relatively little is known of trends.

Rainbow Trout — Wild and stocked populations of Rainbow Trout exist in hundreds of small lakes in the Peace Basin (McLean and Langston 1993; Langston and Zemplak 1998; Langston 1999; Langston and Murphy 2008). Trends in their population numbers have not been quantified, and the origin (wild vs. hatchery) of many populations in the watershed has not been determined.

Knowledge Gaps — There have been dozens of studies of fish stocking and enhancement potential in Peace Basin lakes (e.g., Mclean and Langston 1993; Langston and Zemplak 1998; Langston and Murphy 2008), but there remain substantial knowledge gaps, particularly with respect to important habitats (e.g., connectivity to spawning streams), trends in abundance of important species (e.g., Bull Trout, Rainbow Trout, Burbot), and the impact of migration of introduced species from the reservoir to natural lakes. There is a need to synthesize existing data, clearly identify knowledge gaps, and use this to inform future actions.

3. Action Plan Objectives, Measures and Targets

Clear and realistic management objectives are necessary to guide information acquisition and prioritize restoration actions. Priority actions and information needs will change as improvements are realized and information is gained. The current plan reflects information and opinion collected through:

- Interviews with BC Hydro staff, First Nations community members, agency biologists and FWCP board members;
- FWCP strategic planning meetings: Strategic Planning Group, Fisheries Technical Working Group, First Nations Working Group;
- Public feedback received during three public sessions held in June 2013 and through an on-line public survey carried out through most of June 2013; and,
- Survey of past FWCP reports and Water Use Plan program reports.

3.1 Objective and Target Setting

The following definitions are used for setting objectives in this report:

Objectives: Objectives are high-level statements of desired future conditions (outcomes), consistent with FWCP partner mandates and policies.

Sub-objectives: Sub-objectives are detailed statements of desired future conditions within objectives, from which status indicators can be derived and alternative management actions evaluated. They may be arranged hierarchically within objectives, and usually indicate conditions necessary to attain the objective to which they refer.

Performance Measures: Measures are specific metrics that indicate the degree to which desired future conditions have been achieved.

Targets: Targets are the value of the performance measure that indicates the attainment of a desired condition.

Actions: Actions are management activities, plans or policies for achieving the objectives.

Objectives are the “ends” or the outcomes we ultimately care about. Actions are the “means,” or the things we do to achieve them. This report focuses on describing the actions required to achieve the objectives. Complementary actions may also be identified in other aquatic and terrestrial Action Plans.

Current information was insufficient to establish performance measures and targets as part of the Action Plans; however, implementation of proposed actions could lead to the development of clear performance measures and targets in future iterations of the Action Plans.

3.2 Objectives and Sub-Objectives

The FWCP program has the following over-arching strategic objectives:

1. **Conservation** - Maintain or improve the status of species or ecosystems of concern

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2. **Conservation** - Maintain or improve integrity and productivity of ecosystems and habitats
 3. **Sustainable Use** - Maintain or improve opportunities for sustainable use, including harvesting and other uses
 4. **Community Engagement** - Build and maintain relationships with stakeholders and aboriginal communities

Based on input from partners, First Nations and stakeholders, the following objectives and sub-objectives were identified for lake habitats in the Peace Basin.

OBJECTIVE 1. CONSERVE OR ENHANCE HIGH PRIORITY SPECIES AND HABITATS

Sub-Objective 1a. Conserve native species and prevent those of concern from becoming further at-risk

Sub-Objective 1b. Conserve and enhance the productivity of aquatic habitats

Rationale – Natural lakes within the FWCP-Peace program area have been impacted by reservoir creation through habitat alterations, shifts in fishing pressure, and realized or potential risks of introductions of species from the reservoirs. Despite a general understanding of these effects, there are significant gaps in information around the status, trends and limiting factors of high priority native species and habitats. This objective addresses overall ecosystem integrity and productivity and directs compensation activities to developing productive, useable aquatic habitats. Where cost-effective opportunities exist, compensation works will be aimed at aiding multiple fish species and habitats. Collating and reviewing existing information is regarded as a critical early step in identifying opportunities to protect, restore or enhance native species. A better understanding of status and trends will facilitate development of feasible performance measures, targets and actions. Although species-specific sub-objectives were not identified for lakes, projects may be developed for high priority native species under Sub-Objective 1a. For example, Lake Trout are an important predator, especially in larger lakes, and are vulnerable to over-harvest. There are a number of important data gaps for this species within the FWCP-Peace area.

Although there may be some opportunities for habitat enhancement in small lakes, cost-effective restoration and enhancement may not be feasible in larger lakes. No specific actions have been identified for conservation and enhancement of lake productivity at this time.

OBJECTIVE 2. IMPROVE UNDERSTANDING OF STATUS AND TRENDS OF AQUATIC ECOSYSTEM HEALTH

Sub-objective 2a. Understand the effects of Kokanee introductions on the aquatic food web

Sub-objective 2b. Monitor status and trends of aquatic ecosystem health, review results and develop specific plans in response to results

Rationale – The status and trends of many habitats and species (native and introduced) have shifted since the reservoirs were created, and a better understanding of these changes will facilitate effective enhancement. This work will require review of existing information, developing a cost-effective monitoring program, and monitoring key indicators of ecosystem health (i.e., species and/or habitats). The sub-objective and various actions related to Kokanee introductions are described in detail in the Reservoirs Action Plan.

OBJECTIVE 3. SUSTAIN OR ENHANCE OPPORTUNITIES FOR HUMAN USE OF FISH

Sub-objective 3a. Enhance sustenance resource uses based on input from First Nations and agency partners

Sub-objective 3b. Enhance angling based on input from First Nations, angler groups, general public and agency partners

Rationale – This objective reflects the important sustainable use benefits that can be derived from healthy fish populations. Enhancement activities in lake systems may have either a species- or habitat-focus (primarily small lakes), and be developed in collaboration with agency partners, First Nations and all interested stakeholders. As additional context, it should be noted that fisheries management agencies have an overall responsibility to manage the fisheries resource at a level of abundance and distribution to support First Nations' traditional uses and rights. These responsibilities are dealt with through the ongoing process of decision-making, which is not a formal part of this FWCP plan.

4. Action Plan

4.1 Overview

The Action Plan outlines individual actions by objective and sub-objective. Actions are assigned priorities from 1-3, based on their estimated feasibility, cost-effectiveness, and alignment with FWCP strategic objectives. The priority ratings are provided to guide investment planning efforts, but it should be noted that low priority actions are not included in the plan. A proposal method is also identified for each action, and includes either 'open' proposal invitations, 'directed' contracts, or 'either'. Proponents are encouraged to develop proposals to address some or all components of 'open' projects; whereas, directed proposals will be developed by FWCP staff and partners and released as RFPs for proponents to bid on.

Actions are stratified into five categories:

1. **Research and information acquisition** - actions to inventory resources or undertake research on critical effect pathways and relationships;
2. **Habitat-based actions** - actions focused on improving habitat conditions or ecosystem function;
3. **Species-based actions** - actions that directly enhance abundance of particular species or life stages (e.g., stocking);
4. **Land securement** – actions that contribute to establishing easements or covenants, or purchase of private land for conservation purposes; or,
5. **Monitoring and adaptive management** – actions that assess status and trends of key species and habitats, assess the outcomes of management actions, and develop management responses to this information.

Action categories (along with the action rationale text) provide a general guide for the sequencing of actions. In general, research and information acquisition actions will occur first in sequence. Habitat- and species-based actions typically occur following prioritization and recommendations from research- and/or monitoring-based actions, and monitoring and adaptive management may occur before, during and/or after the implementation of on-the-ground actions. Land securement actions are mostly independent of other action categories, although post-securement monitoring activities may occur within an acquired area. In the tables below, the 'pre-requisite' column highlights those actions that should not be carried out until the identified preceding actions have been completed.

It should be noted that community involvement and education activities are encouraged where there are opportunities in the identified actions outlined in the Action Plans. In addition, there is a separate Stewardship and Education category (described in Section 4.3 of the Peace Basin Plan) that provides another avenue for interested proponents.

4.1.1 Cross-Plan Actions

Several broad 'cross plan' actions are relevant to all terrestrial and aquatic Action Plans, but are not readily nested under any particular sub-objective:

1. **Conduct a high-level review of past FWCP-Peace projects.** Consolidating and summarizing existing data is a top priority across all Action Plans. An understanding of the work that has been done in the past, results, recommendations, and information gaps are necessary for developing new actions and avoiding repetition of ineffective past actions.

Capturing “institutional memory” from published reports and past program staff will be an important exercise for ensuring that historic information is retained in a concise and accessible format to inform future projects.

2. **Evaluate success of FWCP projects.** An independent performance audit will serve to evaluate the success of FWCP-Peace projects. This action is designed to assess the effectiveness of the program in meeting its objectives.

There are several ‘cross-plan’ actions that are relevant to two or more Action Plans and will require the consideration of multiple ecosystems. The details of such actions are presented in other Action Plans, but those that address objectives and sub-objectives defined for lake ecosystems are summarized below:

1. **Undertake a Kokanee assessment study to summarize status, trends, and aquatic and terrestrial ecosystem impacts and potential ecological risks associated with Kokanee introductions. Develop appropriate recommendations for actions, as needed.** This action is described in the Reservoirs Action Plan.

The introduction of Kokanee is affecting lake ecosystems in the Peace Basin, and could potentially expand through further colonization of lakes connected to reservoir tributaries. The effects (positive and/or negative) are not well understood but could include competition with other species (e.g., for plankton food source) or providing a prey source (e.g., for piscivorous Bull Trout). This project is common to all Action Plans and is designed to gain a basin-wide understanding of the effects Kokanee introductions, and to develop and evaluate potential responses, as needed.

2. **Partner with other organizations to assess cumulative effects (Uplands Action Plan).** The construction of reservoirs enabled incremental industrial development in the reservoirs by improving access to formerly remote areas. Subsequent development likely led to unintended cumulative effects. FWCP cannot influence the tenuring or permitting of crown land, but can partner with other organizations to understand cumulative effects in the Peace Basin to more clearly define future priorities for FWCP funding.

4.2 Actions

Actions for lake habitats in the Peace Basin are presented in the following tables. Proposals will be sought through either an open call for proposals or through a directed call for quote to pre-qualified bidders. Separate tables are provided for each objective and sub-objective.

Objective 1: Conserve or enhance high priority species and habitats

Sub-objective 1a: Conserve native species and prevent those of concern from becoming further at-risk.

ID	Action	Rationale	Priority	Proposal Method	Pre-Requisite
Research and information acquisition					
1a-1	Support research projects to review existing information, identify important data gaps and undertake additional biodiversity research on lesser	The purpose of this action is to fill data gaps for lesser known species (primarily non-game fish species) in the FWCP area. Several species-, population- and habitat-based studies	2	Open	na

ID	Action	Rationale	Priority	Proposal Method	Pre-Requisite
	known species and populations towards the identification and development of specific habitat-based actions.	<p>have been conducted within the Peace basin (e.g., (McPhail and Zemlak 2001; Stamford 2001). Some species have been identified as high-priority candidates for biodiversity review/research, including: Burbot, Brassy Minnow, Pygmy Whitefish, sucker spp., native Rainbow Trout, and mussels, and Lake Trout, Bull Trout and Lake Whitefish in large lakes.</p> <p>This work may lead to development of enhancement actions, but that is not required. These are expected to be occasional, relatively short-duration and low-cost studies that provide specific information on distribution, ecology, or similar data gaps.</p> <p>There must be a clear linkage to how the information collected will lead to better understanding of status, trends, limiting factors, or the development of future on-the-ground habitat-based actions.</p>			

Sub-objective 1b: Conserve and enhance the productivity of aquatic habitats.

Conservation and enhancement of lake productivity was identified as a goal of the FWCP-Peace; however, no specific actions were defined under this sub-objective. Note that several enhancement projects have been conducted under the FWCP-Peace in the past (e.g., small lake inventory and enhancement program (Langston *et al.* 1991); status and potential enhancement projects of selected small lakes (McLean and Langston 1993)). In general, actions relating to this sub-objective will require the identification and prioritization of candidate lakes and appropriate techniques for restoration and enhancement.

Objective 2: Improve understanding of status and trends of aquatic ecosystem health

Sub-objective 2a. Understand the effects of Kokanee introductions on the aquatic food web

This sub-objective is described in detail in the Reservoirs Action Plan.

Sub-objective 2b: Monitor status and trends of aquatic ecosystem health, review results and develop specific plans in response to results.

ID	Action	Rationale	Priority	Proposal Method	Pre-Requisite
Research and information acquisition					

ID	Action	Rationale	Priority	Proposal Method	Pre-Requisite
2b-1	Review existing information and summarize status and trends of species and habitats for which there is sufficient information or for which there are species-specific management objectives in provincial fisheries plans, and develop a cost-effective monitoring program to assess aquatic ecosystem health.	Several species- and habitat-based studies have been conducted within select Peace Basin lakes (e.g., McPhail and Zemplak 2001) and province-wide management objectives exist for several species. This information will help inform the development of a general (i.e., not necessarily specific to a single species) monitoring program for status and trends of ecosystem health. The monitoring program will consider information collected to date, select indicators, develop methods, define action triggers/reference points, identify possible future actions, and coordinate with other monitoring efforts. There must be a clear linkage to how the information collected during the review process will lead to the development of future on-the-ground habitat-based actions.	2	Directed	na
Habitat-based actions					
2b-2	Undertake habitat-based enhancements based on identified priorities.	Enhancements of lake habitats may serve to conserve or enhance species and habitats that are important for supporting sustainable use, and for the maintenance of overall ecosystem health. Habitat enhancement of natural lakes should only occur if there is a clear issue related to past exploitation, and all enhancement activities should be monitored for success. This action depends on identification of priorities through monitoring or other information sources. Further, monitoring may identify declines in ecosystem health, and such issues may require intervention. (Note that the most effective enhancements for lake species are often in the tributary streams. The benefits accrue to lake-dwelling species that depend on tributary streams for part of their life history.)	2	Open	2b-1
Species-based actions					
2b-3	Undertake species-based enhancements based on identified priorities.	Species-based enhancements (e.g., stocking) may serve to increase populations of fish that are important for supporting sustainable use, and under some specific circumstances, can be used to recover populations at risk of extirpation. Stocking programs are	2	Open	2b-1, 3b-2

ID	Action	Rationale	Priority	Proposal Method	Pre-Requisite
		<p>managed by the province in partnership with the Freshwater Fisheries Society of BC. Decisions of where and when to stock fish are guided by provincial policy that considers the risk and benefits related to introducing fish into any given water body. The FWCP may support the costs of a fish stocking opportunity where it has been provincially approved, where the benefits are clear and aligned with program objectives and where the stocking would not otherwise be enabled through the normal provincial stocking program.</p> <p>A record of fish introductions is provided in Langston and Murphy (2008). Note that species-based enhancements are generally not cost-effective for large lakes. This action is dependent on the identification of priorities through monitoring or other information sources. Further, monitoring may identify declines in ecosystem health, and such issues may require intervention.</p>			
Monitoring and adaptive management					
2b-4	Undertake monitoring as per recommendations of the monitoring program and develop specific, prioritized recommendations for habitat-based actions that correspond to the monitoring results.	The status and trends of ecosystem health in Peace Basin lakes are not well understood. When indicators of ecosystem health are selected and a monitoring program has been designed, the program can be implemented.	2	Open	2b-1
2b-5	Review monitoring results, refine and implement specific plans in response, as needed.	It will be important to regularly review ecosystem health monitoring results, which should be scheduled in the monitoring program. The outcome(s) of the review may require adaptive actions (e.g., to expand or limit the extent of monitoring).	2	Either	2b-1, 2b-4

Objective 3: Sustain or enhance opportunities for human use of fish

Sub-objective 3a: Enhance sustenance resource uses based on input from First Nations and agency partners

ID	Action	Rationale	Priority	Proposal Method	Pre-Requisite
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ID	Action	Rationale	Priority	Proposal Method	Pre-Requisite
Research and information acquisition					
3a-1	Work with First Nations and appropriate agencies to characterize priority species, habitats, locations and methods for sustenance use enhancement.	Species of local interest to First Nations communities include those that are traditionally used for food and cultural purposes but may have a local low abundance. The intended output of this action is to support projects that work with First Nations to identify opportunities to enhance species of local traditional or cultural interest by enhancing habitats or other means in and around lakes.	1	Open	na
Habitat-based actions					
3a-2	Undertake habitat-based enhancements based on identified priorities.	Lakes provide important habitat for species and traditional fishing grounds for sustenance harvest. Enhancements of lake habitats may serve to conserve or enhance species and habitats that are important for sustenance use. This action is dependent on development of methods for enhancement. Note that this action requires coordination with activities under the angling sub-objective to ensure compatibility and to prevent redundancies.	1	Open	3a-1
Species-based actions					
3a-3	Support stock rehabilitation and enhancement work for native species based on identified priorities.	Species-based enhancements (e.g., stocking) may serve to increase populations of fish that are important for sustenance harvest, or to conserve populations that are declining or are at risk of declining. FWCP could potentially support new harvest opportunities where the risks are low and benefits are high or, in rare circumstances where a population is truly at risk of extirpation and all other options have been exhausted, may support a conservation fish culture approach. See sub-objective 2b for further requirements. Note that this action requires coordination with activities under sub-objectives 2b and 3b to ensure compatibility and to prevent redundancies.	1	Open	2b-1, 2b-3, 3b-2

Sub-objective 3b: Enhance angling based on input from First Nations, angler groups, general public and agency partners

ID	Action	Rationale	Priority	Proposal Method	Pre-Requisite
Research and information acquisition					
3b-1	Work with First Nations, angler groups and appropriate agencies to characterize priority species, habitats, locations and methods for angling enhancement.	Angler use patterns and preferences are not well understood in the Peace Basin. Efforts would need to be coordinated with the appropriate First Nations and other agency partners to inform enhancement activities.	2	Open	na
3b-2	Review of stocking of small lakes for recreational benefit.	<p>The FWCP has historically provided financial support for the stocking of some small lakes and has undertaken evaluations of many of these same lakes. (e.g., Langston and Murphy 2008)). It will be important to review past stocking efforts, determine whether they were effective, and to prioritize lakes for consideration in future stocking programs.</p> <p>The purpose of this action is to understand the successes and failures of past fish stocking efforts to inform future stocking programs in the FWCP-Peace area. This action would review historic stocking, evaluate actual and likely ecological effects, and evaluate actual and likely societal benefits, based on available evidence. The review should also assess whether current stocking policies would prevent or substantively reduce risks associated with past stocking.</p>	2	Directed	1a-1
Habitat-based actions					
3b-3	Undertake habitat-based enhancements based on identified priorities.	Lakes provide important habitat for species and fishing grounds for anglers. Enhancements of lake habitats may serve to conserve or enhance species and habitats that are important for angling. This action is dependent on development of methods for enhancement. Note that this action requires coordination with activities under the sustenance use sub-objective to ensure compatibility and to prevent redundancies.	2	Open	3b-1
Species-based actions					

ID	Action	Rationale	Priority	Proposal Method	Pre-Requisite
3b-4	Support species-based enhancements based on identified priorities.	Species-based enhancements (e.g., stocking) may serve to increase populations of fish that are important for angling. See sub-objective 2b for further requirements. Note that this action requires coordination with activities under sub-objectives 2b and 3a to ensure compatibility and to prevent redundancies	2	Open	3b-1, 3b-2

5. Conclusion

This Action Plan for lakes in the Peace Basin identifies objectives, sub-objectives and actions to address FWCP's strategic objectives. A variety of FWCP and WUP-projects have addressed inventory requirements in the past and have implemented a number of actions to improve conditions. The proposed actions in this Action Plan build on those projects and leverage their results to address outstanding needs in the Peace Basin. The expected outcomes of the Action Plan include:

1. Understanding the distribution, function, and connectivity of ecologically important lake habitats and populations, and identifying opportunities to conserve and restore function;
2. Improved ecological conditions of lakes through habitat improvements;
3. Improved sustenance use and angling opportunities; and
4. Improved coordination with existing planning and management activities in the Peace Basin.

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