



CAMPBELL RIVER WATERSHED ACTION PLAN

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The Fish & Wildlife Compensation Program is a partnership between BC Hydro, the Province of B. C., Fisheries and Oceans Canada, First Nations and Public Stakeholders to conserve and enhance fish and wildlife impacted by BC Hydro dams.



The Fish & Wildlife Compensation Program is conserving and enhancing fish and wildlife in this watershed impacted by BC Hydro dam construction. Clockwise from top left: Strathcona Dam, Salmon River Dam, Quinsam Diversion, John Hart Dam, Ladore Falls Dam, and Quinsam Storage Dam. Credit: BC Hydro. Cover photos: Roosevelt Elk, Credit: Flickr; Vancouver Island Marmots, Credit Calgary Zoo; and Chinook, Credit: NOAA.



The Fish & Wildlife Compensation Program (FWCP) is a partnership between BC Hydro, the Province of BC, Fisheries and Oceans Canada, First Nations and Public Stakeholders to conserve and enhance fish and wildlife impacted by BC Hydro dams. The FWCP funds projects within its mandate to conserve and enhance fish and wildlife in 14 watersheds that make up its Coastal Region.

Learn more about the Fish & Wildlife Compensation Program, projects underway now, and how you can apply for a grant at fwcp.ca. Subscribe to our free email updates and annual newsletter at www.fwcp.ca/subscribe. Contact us anytime at fwcp@bchydro.com.

EXECUTIVE SUMMARY: CAMPBELL RIVER ACTION PLAN

The Fish & Wildlife Compensation Program is a partnership between BC Hydro, the Province of B.C., Fisheries and Oceans Canada, First Nations and Public Stakeholders to conserve and enhance fish and wildlife impacted by BC Hydro dams.

This Action Plan builds on the Fish & Wildlife Compensation Program's (FWCP's) strategic objectives, and is an update to the previous *FWCP Watershed and Action Plans*. The Action Plan was developed with input from BC Hydro, Fisheries and Oceans Canada (DFO), Canadian Wildlife Service (CWS), Ministry of Environment (MOE), Ministry of Forests, Lands and Natural Resource Operations (FLNRO), participating First Nations, and local communities. It specifies actions that will conserve, restore and enhance fish and wildlife species and their habitats.

This Action Plan sets out Priority Actions for the FWCP that will guide funding decisions for FWCP projects in the Campbell River watershed. The focus of the next five-year period will be Priority Actions identified for fish, wildlife and habitats in three broad ecosystem categories:

1. [Rivers, Lakes & Reservoirs](#);
2. [Wetland & Riparian Areas](#); and
3. [Upland & Dryland](#).

These ecosystem categories are described in the Ecosystem Chapters, and proposed Priority Actions are captured in the [Action Table](#) at the end of this document. The Priority Actions are intended to support FWCP's strategic objectives of conservation, sustainable use, and community engagement. Priority Actions eligible for FWCP funding fall into one or more of the following action types:

- **Research and Information Acquisition** – These actions will collect information necessary to evaluate, review and implement subsequent conservation, restoration and enhancement actions. Examples include inventory, limiting factor assessments and other activities to address data gaps and information needs to complete other actions.
- **Habitat-based Actions** – These actions will conserve, restore, and enhance habitats. Examples include habitat creation, restoration, and enhancement, enhancing habitat connectivity, and invasive species management.
- **Land Securement** – These actions will contribute to the establishment of easements or covenants or the purchase of private land for conservation purposes.
- **Species-based Actions** – These actions will alleviate limiting factors for a species. Examples include restoration planning, captive breeding/rearing and reintroduction.
- **Monitoring and Evaluation** – These actions will monitor and evaluate projects supported by FWCP to understand the effectiveness of habitat- or species-based actions.

This Action Plan, and specifically the [Action Table](#), sets FWCP priorities for investments in compensation activities within the watershed. However, actions may not translate into funded projects. FWCP funding limitations require priority setting across the Coastal Region's 14 watersheds. The process of selecting which actions will be implemented in any given year will occur during the annual grant intake and project cycle. See fwcp.ca for more.

About our Action Plan

This Action Plan provides important background information about the watershed, including hydro development projects by BC Hydro, and conservation and enhancement projects funded by the Fish & Wildlife Compensation Program (FWCP). This Action Plan outlines our priority actions for fish and wildlife eligible for an FWCP grant.

Anyone interested in applying for an FWCP grant should review our Priority Actions (see [Action Table](#)) and develop a grant application that aligns with a Priority Action(s).

[Contact us](#) to discuss our grants, priority actions and how we can help you develop your grant application. [Subscribe](#) and we will keep you posted about our grants and the projects we fund. Learn more at fwcp.ca

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CAMPBELL RIVER WATERSHED BACKGROUND

Introduction

The FWCP Action Plans provide strategic direction for each region based on the unique priorities, compensation opportunities, and commitments in the region and reflect FWCP's vision and mission. The Action Plans describe the strategies and Priority Actions needed to support FWCP objectives. Please refer to the Action Plan Overview for more information on the on the process that was followed to develop Action Plans. The structure of this Action Plan is shown in Figure 1.

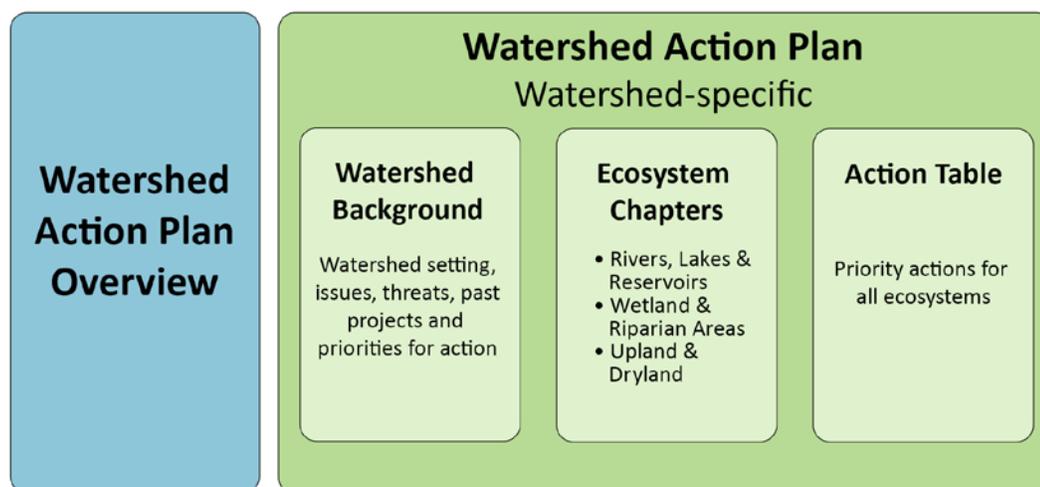


Figure 1: Structure of FWCP Action Plan Overview and Action Plan components.

Setting

The Campbell system, including the upper sub-basins of the Salmon and Quinsam rivers, straddles the Vancouver Island mountain range near the town of Campbell River (Figure 2). Elevations range from sea level in the Campbell and Salmon river estuaries to rugged peaks of over 2200 m with small areas of permanent snowpack. Inflows are typical of British Columbia coastal basins, with high inflows from snowmelt in May through July, low flows in August and September and high precipitation from October to March with mixtures of snow and heavy rain. The average monthly precipitation in November is 420 mm, but monthly precipitation can reach 800 mm.

The Campbell River hydro-electric development consists of three dams and generating stations on the Campbell River mainstem and one diversion dam on each of the Salmon and Quinsam rivers. On the mainstem, John Hart Dam, the lowermost facility, impounds John Hart Reservoir and diverts water to a powerhouse located about 2 km downstream of Elk Falls. The John Hart Generating Station has the lowest water discharge capacity (124 m³/s) and the system is usually operated to optimise production at this and the Strathcona generating stations. The local basin area behind John Hart Dam is relatively small, at only 24 km², and inflows are dominated by upstream releases. At the time of writing, BC Hydro was replacing the existing above ground penstocks and generating station with a new underground facility which is planned for commissioning in fall 2018. As well, BC Hydro is proposing to seismically upgrade the John Hart dam as early as 2021.

Ladore Dam (1958) is the middle facility on the mainstem and impounds Lower Campbell Lake Reservoir, which has a basin area of 243 km². The powerhouse downstream of the dam has a discharge capacity of 161.5 m³/s. The terrain and Lower Campbell Lake consists of heavily forested hills with a mean basin elevation of 250 m. Inflows are primarily influenced by upstream releases at Strathcona Dam and from diversions from the Salmon and Quinsam rivers.

Strathcona Dam (1958) is the uppermost facility on the mainstem and has a powerhouse located at the toe of the dam with a discharge capacity of 1756 m³/s. The uppermost reservoir was formed by impounding Upper Campbell and Buttle lakes, and is about 50 km long and up to 5 km wide. The creeks feeding the reservoir tend to be short and steep. The Elk River sub-basin contains the longest watercourse, which is 24 km long and falls roughly 760 m. The mean basin elevation is 950 m and the basin area is 1192 km². During periods of high inflow, Strathcona discharges can be increased to 550-600 m³/s to control rising levels in Upper Campbell Lake, resulting in spills downstream at the Ladore and John Hart facilities.

Diversion dams on the tributaries include the Salmon River Dam and the Quinsam River Dams. The Salmon River Dam diverts water from the upper Salmon River and Paterson Creek into Brewster, Gray, Whymper and Fry lakes and then into Lower Campbell Lake. The Salmon diversion contributes to power generation both at the Ladore and John Hart power stations. At the time of writing, BC Hydro was proposing, subject to regulatory approval, to decommission the Salmon River facility and remove the dam for fish passage in summer 2017. The Quinsam project includes the Quinsam Dam at the outlet of Wokas Lake and a diversion dam further downstream on the Quinsam River. Water is diverted through Gooseneck and Snakehead lakes, Miller Creek and into Lower Campbell Lake Reservoir. The Quinsam diversion contributes to power generation at both Ladore and John Hart Generating Stations. Crest Creek, a historically periodic tributary to Heber River, is bermed to flow into the Drum lakes. Crest Creek contributes to power generation at all three power stations on the Campbell River mainstem.

The watershed has a diverse group of users. Industry uses other than hydro-electric generation include forestry and mining. The watershed is used recreationally by hunters, anglers, boaters, campers, hikers, mountain bikers and off-road motorized recreationists. The Campbell River system lies within the traditional territory of We Wai Kai First Nation, Wei Wai Kum First Nation, K'omoks First Nation, Mowachaht/Muchalaht First Nation, and Homalco First Nation (Xwemalhkwa).

The Lower Campbell River flows through the community of Campbell River before discharging into Discovery Passage. The Upper Campbell River Watershed lies partly within Strathcona Provincial Park.



Figure 2: The FWCP Campbell River Watershed boundary.

Land Ownership in the Campbell River Watershed

The northern half of the watershed (north of Strathcona dam and Lower Campbell Lake) is primarily Crown land. Most of the western part of the southern half of the watershed lies within Strathcona Provincial Park. Areas south of the Lower Campbell Lake Reservoir and Strathcona dam, but north and east of Strathcona Park, are privately-owned timberlands (Timberwest Forest Corp.). Proponents should consider land ownership and access when they are developing project proposals.

Impacts and Threats

Dam construction, hydro-electric operation, and associated alterations in the hydrologic regime of the system have resulted in considerable changes to habitats and the fish and wildlife populations that rely on them.

Hydro-related Impacts

Inundation: The reservoir area of the watershed is 9,725 ha, which originally consisted of 5,208 ha of land (riparian and forest) and 4,517 ha of natural lakes. The current total reservoir shoreline length is 282 km.

Habitat loss: Inundation has caused significant loss of instream, riparian/floodplain and coniferous lowland habitats along the entire Campbell River mainstem. Hydro-related structures have reduced large woody debris and gravel recruitment, particularly the Strathcona, Ladore, and John Hart dams in the Campbell River. Loss of habitat has had corresponding effects on wildlife, notably the inundation of former winter range habitat for Roosevelt elk.

Migration and access barriers: Reduced access for fish using channels occurred when flows were diminished due to diversions and Quinsam Dam (although minimum flows now address this issue) or where historic access has been blocked by dams (at Strathcona and Ladore dams as well as in the Upper Quinsam watershed). Conversion of Campbell and Elk rivers to reservoir have resulted in barriers to migration of ungulates and bears.

New Habitat: Increased spawning habitat for cutthroat in Mud Creek and Drum Lakes system has been created due to increased flow from the Crest Creek diversion. Also, there has been a general increase in lake and shoreline, riparian habitat for aquatic wildlife.

Altered Flow Regime: Regulated flows due to dams and diversions have altered the flow regimes in the mainstem Campbell River and diversion stream, significantly altering the natural conditions for fish spawning, incubation and rearing.

Diversions: The diversion at Quinsam River has reduced annual flow volumes in the downstream channel and has increased volumes in the new channels. These altered flows have affected the wetted channel area and habitat. Reduced flows may have affected aquatic-related wildlife such as waterfowl and furbearers.

Entrainment: The extent and influence of entrainment from Strathcona, Ladore and John Hart dams are unknown but currently under study through BC Hydro's Fish Entrainment Strategy.

Terrestrial footprint: Terrestrial impacts have resulted from the footprint of infrastructure associated with the project, most notably the reservoirs, dams and switchyards, and to a smaller extent the Quinsam diversion canal.

Non-hydro Impacts

Other impacts on fish and wildlife populations in the Campbell system include current and historic effects of logging, mining, linear developments, flood protection and urbanization. A significant portion of the upper watershed is protected within Strathcona Provincial Park. Historic logging in the Elk River watershed has increased the rate of sediment delivery to the main channel, and has contributed to channel instability. Logging has resulted in increased debris and sediment delivery to the Salmon River. Activities at Westmin Mines near the head of Buttle Lake at one time resulted in increased concentrations of toxic metals. Biological communities in Buttle Lake have now returned to their former abundance after remedial measures. Mining impacts have also occurred on the Quinsam River. Logging has reduced the distribution and abundance of older forests and wildlife species dependent on them (e.g., Marbled Murrelets). Increased access has led to significant recreational use that likely affects a variety of species and ecosystems.

Objectives for the Campbell River Watershed

Clear management objectives are needed to guide information gathering and effective prioritizing of management actions. Each Ecosystem Chapter has three objectives, which are high-level statements of desired future conditions (outcomes), consistent with FWCP strategic objectives, partner mandates and policies. Each Ecosystem Chapter also has more detailed sub-objectives, which provide more specific direction on desired future conditions. Actions in the [Action Table](#) align with the objectives and sub-objectives, summarized in Table 1.

Table 1: Summary of objectives and sub-objectives in each Ecosystem Chapter.

Objectives	Sub-objectives		
	Rivers, Lakes & Reservoirs	Wetland & Riparian Areas	Upland & Dryland
Ensure a productive and diverse ecosystem	Conserve and restore habitat capacity and diversity for fish and other aquatic organisms.	Protect, enhance and create new wetland and riparian habitat.	Protect and enhance rare and ecologically significant upland/dryland habitat.
Maintain or improve the status of species of interest	Sustain and increase the population viability of: (a) Anadromous salmon (Chinook, Chum, Pink, Coho) and steelhead; and, (b) Resident salmonids (Rainbow and Cutthroat).	Maintain and, where feasible, increase the abundance of species of interest (e. g., federally listed species-at-risk and species identified through government, community, and First Nations engagement). See Action Table for specific species.	Maintain and, where feasible, increase the abundance of species of interest (e. g., federally listed species-at-risk and species identified through government, community, and First Nations engagement). See Action Table for specific species.
Maintain or improve opportunities for sustainable use	Maintain or improve opportunities for sustainable use, including for food, social, ceremonial, recreational, or commercial purposes.		

FWCP Projects Implemented: Campbell River Watershed

FWCP has been funding projects in the Campbell River Watershed since 1999 under the Bridge-Coastal Restoration Program (BCRP) and subsequently under the Fish & Wildlife Compensation Program¹ Coastal Region. A full list of the reports from projects undertaken to date is available online at www.fwcp.ca. Below is a brief summary of the work undertaken during the 2010/2011 to 2015/2016 FWCP project years.

Rivers, Lakes & Reservoirs

A total of 16 Rivers, Lakes & Reservoirs projects were undertaken in the Campbell River Watershed during the 2010/2011 to 2015/2016 FWCP project years with \$797,908 of FWCP funding. Two multi-year Research and Information Acquisition projects successfully assessed Coho Salmon and Steelhead passage at the Salmon River Diversion Dam. Seven projects were completed that were associated with Habitat Based Actions in the lower Campbell River, including Elk Canyon, and in the estuary. Three of these projects added spawning gravel and improved access to important Chinook Salmon spawning locations in the lower Campbell River near First and Second Islands. Gravel is in limited supply in the lower Campbell River, and these projects have been successful at increasing spawning habitat for all salmonids. A spawning gravel delivery system has now been designed for Elk Canyon with FWCP support and was operated for the first time in the 2015/2016 season. Gravel mobilization throughout the lower Campbell River is an ongoing concern, and therefore augmentation will need to continue along with monitoring to assess gravel movement and to confirm the rate of gravel delivery. Other Habitat Based Actions conducted in the last six years include a successful restoration of the Ocean Blue site in the Campbell River estuary and side channel development and maintenance in the Salmon River. Two Monitoring and Evaluation projects have also occurred, which have assessed the efficacy of nutrient augmentation programs and some of the habitat enhancements undertaken by FWCP.

Wetland & Riparian Areas

Five projects were undertaken during the 2010/2011 to 2015/2016 FWCP project years that addressed Wetland & Riparian Areas species and habitat with \$469,940 of FWCP funding. Among these was a significant Land Securement project that addressed both Wetland & Riparian Areas and Upland & Dryland objectives through the purchase of a property near the Salmon River estuary. This property contains valuable wetland habitat for many fish and wildlife species, including species-at-risk. The other four funded projects identified critical breeding habitat and potential sites for the establishment of Wildlife Habitat Areas for Northern Red-legged Frog, mapped wetland/riparian habitats and highlighted potential areas for land securement, and restored habitat on Baikie Island.

Upland & Dryland

Eleven projects were undertaken during the 2010/2011 to 2015/2016 FWCP project years that addressed Upland & Dryland species and habitat with \$914,489 of FWCP funding. Mentioned above, a property was purchased near the Salmon River estuary to achieve both Wetland & Dryland and Upland & Dryland objectives. A key project objective was to secure critical foraging and winter habitat for Roosevelt Elk, which is a high priority Upland & Dryland species. Six of the projects made progress on a Species Based Action to support the Vancouver Island Marmot recovery strategy through the release of captive-reared individuals, along with research and monitoring designed to evaluate program success. Year one of a proposed two-year project also addressed important objectives identified for Western Screech-owl (a high priority species) by building on progress from a previous inventory and nest box installation project. Other projects targeting Upland & Dryland species included the identification of suitable nesting habitat and potential Wildlife Habitat Areas for Marbled Murrelets, monitoring to evaluate effectiveness of bat houses installed in a previous FWCP-

¹ The Program changed its name in 2011 from the BCRP to the FWCP.

supported project, and enhancement and creation of dens for American Black Bears. Further monitoring is required to evaluate effectiveness of the installed or enhanced structures, including the owl nest boxes, bear dens and bat houses.

Interactions with Other Ongoing Processes

Water Use Plan (WUP) – BC Hydro undertook Water Use Planning on the Campbell River to find a better balance of power and non-power interests (such as fish, wildlife and recreation) when operating the system. The resulting WUP Order directed incremental operational changes and monitoring studies to determine the effectiveness of the operational changes. FWCP partners support and coordinate with the WUP ordered monitoring studies, however FWCP does not fund the monitoring associated with operations.

Fish Passage Decision Framework – Any studies to assess the feasibility of restoring fish passage at existing BC Hydro facilities must adhere to the [Fish Passage Decision Framework](#) (BC Hydro 2016) to be funded by the FWCP.

Fish Entrainment Strategy – Fish entrainment issues are addressed through BC Hydro’s Fish Entrainment Strategy (BC Hydro 2006). Grant applications to study or mitigate entrainment issues are not eligible for FWCP funding.

ECOSYSTEM CHAPTERS

CAMPBELL RIVER WATERSHED

ECOSYSTEM CHAPTER: RIVERS, LAKES & RESERVOIRS

Actions for Rivers, Lakes & Reservoirs

The [Action Table](#) in this document (see page 22) identifies our Priority Actions to conserve and enhance fish & wildlife in this watershed. Priority Actions are organized by Action type: Research and Information Acquisition, Habitat-based Actions, Species-based Actions, Land Securement and Monitoring and Evaluation. Actions are assigned a priority ranking from 1 (highest priority) to 3 (lowest priority).

Aquatic Habitat in the Campbell River Watershed

The Campbell River originates in the mountains of Strathcona Provincial Park and drains into Discovery Passage. Historically, anadromous fish were unable to access the Campbell River Watershed upstream of Elk Falls, a major barrier 5.6 km upstream of the ocean. Below Elk Falls canyon, the lower river is inhabited by five salmon species (although Sockeye are not plentiful as they are strays), Steelhead, anadromous Cutthroat Trout, Pacific Lamprey, and resident fish species that are also found upstream. Campbell River is famous for its exceptionally large Chinook salmon known as *tyee*. DFO has been active in enhancing Quinsam salmon production, including hatchery operations, outplanting programs, and other activities. Six resident fish species are currently found in the Campbell River Watershed above and below Elk Falls, including the resident salmonid species, Cutthroat and Rainbow Trout and Dolly Varden Char.

The Quinsam River was used historically by Pink, Chum, Chinook and Coho salmon, and Steelhead Trout, although they tended to be restricted to the lower reaches until modifications to barriers in the lower portion of the watershed occurred. Steelhead and Coho have occasionally ascended the falls into Quinsam Lake. DFO has been active in enhancing Quinsam salmon production, including hatchery operations, outplanting programs, and other activities. Resident Rainbow and Cutthroat Trout and Dolly Varden Char occur throughout the watershed, and Kokanee occur in Quinsam and Quinsam lakes, and spawn in the mainstem.

Historically, access for anadromous stocks to the upper Salmon River was blocked by a 5 m high falls/obstruction located about 12 km downstream of the current diversion dam. Remedial blasting in 1975 and 1976 made this barrier passable and the Salmon River above the diversion dam now supports wild Steelhead and Coho salmon. The lower reaches are an important fish-producing system used by Chum, Coho, and Chinook salmon and Steelhead Trout. Resident fish species are Kokanee, Rainbow and Cutthroat Trout, Dolly Varden Char, and sculpins.

Limiting Factors

Limiting factors vary among species and need to be further assessed. They are expected to include:

- **Habitat Area:** Former spawning, rearing and overwintering areas are permanently lost or seasonally reduced by dam footprint, reservoir drawdown and flooding, diversions, or dam and generating station operations; or from non-hydro sources. Urban encroachment along banks of the lower Campbell River and estuary has reduced off-channel, riparian and wetland areas.
- **Habitat Quality:** Physical habitat below dams is altered by reduced recruitment of gravel and large woody debris. In particular, reduced gravel recruitment in the lower Campbell limits the quality of Chinook spawning habitat. In addition, naturally occurring high flows in the lower Campbell during fall and winter storms can cause

significant gravel movement, which further limits habitat quality. In the Salmon River rearing habitat is limiting for Coho.

- **Access:** Dams block access to formerly useable habitat, and altered flow regimes affect passage conditions in some locations. This occurs particularly on the Salmon and Quinsam rivers.
- **Diversions:** The river diversions have reduced annual flow downstream of the diversion dams, and increased volumes in the receiving water bodies. Altered flows have affected wetted area and stream productivity in the Salmon and Quinsam Rivers, though the magnitude of effect is variable and mostly unquantified.
- **Hatchery practices:** Intervention by the hatchery on Quinsam River has probably had positive and negative effects on wild salmonid stocks. Hatcheries typically increase overall abundance, but this may attract increased harvest, reduce genetic diversity, and increase competition for food and space. Under the DFO's Wild Salmon Policy, the Salmon Enhancement Program takes steps to minimize these risks.

Knowledge Status

Habitat

All dams in the Campbell system were constructed upstream of anadromous fish barriers, but construction affected habitat for resident stocks and operations affect both upstream and downstream habitats. Changes in physical works and operations agreed to by BC Hydro as a part the Water Use Plan have likely improved habitat conditions downstream of diversions. FWCP habitat compensation projects have been conducted in the watershed since 1999 and have had a positive effect on habitat at many locations in the Campbell River Watershed, for example:

- Salmon spawning gravel placements (e. g., Mainstem Campbell River, including Ebert Road, First Island, Elk Falls canyon);
- Development of side-channel or off-channel aquatic habitat (e.g., Elk Falls #3 side-channel upgrades, Salmon River/Big Tree Main side-channel);
- Salmon River nutrient enrichment; and,
- Restoration of the Ocean Blue site in the Campbell River estuary.

Knowledge Gaps

The following knowledge gaps have been highlighted by agencies, First Nations and stakeholders:

- To help set priorities for restoration, the program needs a better understanding of limiting factors that can be addressed by restoration initiatives
- Understanding the effectiveness of previous restoration efforts and a need to develop detailed restoration plans to achieve long-term salmon conservation objectives
- The effects of existing gravel placement should continue to be monitored for Chinook and other species in the lower Campbell River to better understand the benefit to fish populations. A gravel placement and monitoring plan needs to be developed due to the effect of large fall and winter flows on gravel mobility.
- Restoration and fish passage in the Quinsam watershed remains a concern, including potential effects of summer low flows.
- Additional locations for land securement that could support salmonid conservation objectives

Objectives and Measures

The following objectives have been developed to define the scope of the Rivers, Lakes & Reservoirs Ecosystem Chapter. While the objectives are expected to remain stable over time, the projects funded may evolve as management priorities shift, or new information becomes available.

Objective 1: Ensure a productive and diverse aquatic ecosystem.

This objective addresses overall ecosystem integrity and productivity and directs compensation activities to develop productive, useable aquatic habitats. Where cost-effective opportunities exist, compensation works will be aimed at aiding multiple aquatic species to conserve and restore habitat capacity and diversity for fish and other aquatic organisms.

Measures — Measures will be ecosystem and project-specific.

Objective 2: Maintain or improve the status of species of interest

This objective is supported by two sub-objectives:

- **Sustain and increase the population viability of anadromous salmon and steelhead**

Efforts are underway to restore anadromous salmon (i. e. , Chinook, Chum, Pink, Coho and Steelhead) spawning and rearing habitat in the Campbell River system to rebuild natural populations.

Measures – Measures will be species- and project-specific.

- **Sustain and increase the population viability of resident salmonids.**

Rainbow and Cutthroat Trout reside in the three reservoirs of the Campbell River (John Hart, Lower Campbell, and Upper Campbell Reservoirs) as well as the Quinsam watershed.

Measures – Measures will be species- and project-specific.

Objective 3: Maintain or improve opportunities for sustainable use.

This objective reflects the important sustainable use benefits that can be derived from healthy fish populations. Many salmonid species are the focus of First Nations, commercial and recreational fisheries. Consequently, any actions aimed at achieving the above objective also support this sustainable use objective. 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 met through other ongoing processes and it is not the direct responsibility of FWCP to accommodate First Nations treaty rights and aboriginal interests. That being said, First Nations' interests in overall conservation and sustainable use benefits have been incorporated into the development of this plan.

Measures — There are no specific measures required at this time, aside from those associated with Objective 1 and 2. As part of their overall management responsibilities, DFO uses information such as abundance trends and escapement estimates to regulate angling and commercial harvest. MOE collects information on angler days, catch per unit effort, and number of fishing licences sold in the region, which informs decisions related to angling regulations.

ECOSYSTEM CHAPTER: WETLAND & RIPARIAN AREAS

Actions for Wetland & Riparian Areas

The [Action Table](#) in this document (see page 22) identifies our Priority Actions to conserve and enhance fish & wildlife in this watershed. Priority Actions are organized by Action type: Research and Information Acquisition, Habitat-based Actions, Species-based Actions, Land Securement and Monitoring and Evaluation. Actions are assigned a priority ranking from 1 (highest priority) to 3 (lowest priority).

Wetland and Riparian Areas in the Campbell River Watershed

Wetland and riparian areas are the most diverse and biologically rich terrestrial ecosystems in BC and are considered highly valuable from an ecological standpoint. Riparian areas are the areas bordering on streams, lakes, and wetlands that link water to land. The blend of streambed, water, trees, shrubs and grasses directly influences and provides habitat for fish and wildlife. The abundance, distribution and condition of wetland and riparian habitats may be limiting factors for many species, especially amphibians, which depend upon them either for the majority of their lifecycles or for key periods such as breeding. Riparian and wetland habitats are often critical in terms of maintaining function and structure for natural systems, including helping to support trophic level functioning and genetic diversity, as well as providing key ecological services such as erosion control, flood control, assimilation of nutrients and water purification. Furthermore, many wetland and riparian species are the focus of sustainable use activities by First Nations and non-First Nations people. Riparian and wetland areas are commonly inundated by impoundments or adversely affected by changes in hydrological regimes that result from water management for power generation. Loss and alteration can significantly affect the services provided by these ecosystems.

The FWCP uses three general categories of riparian and wetland areas for setting objectives (Table 2). These categories define a general level of ecosystem functioning and require different management actions to maintain and improve their condition.

Table 2: Categories of riparian and wetland habitats used by the FWCP.

Category	Description
Category 1 – Natural riparian or wetland habitat	Largely intact ecosystems with natural disturbances sufficient to maintain subclimax communities and processes characteristics of wetlands and riparian ecosystems.
Category 2 – Disclimax or degraded wetland or riparian habitat, or creation of habitat	Formerly natural wetland or riparian ecosystems that have lost most or all of their natural disturbance regime and are no longer functioning effectively as wetland or riparian habitat. These areas are candidates for restoration.
Category 3 – Restored or created riparian or wetland habitat	Ecosystems resulting from water impoundments, diversions or other artificial disturbances that require active management to maintain productivity and function.

Limiting Factors

The limiting factors for wetland and riparian areas are predominantly related to extent of the available habitat, connectivity and distribution of the habitat, and its productivity. Limiting factors need to be further assessed and are expected to include:

- **Extent:** The contribution of riparian and wetland habitats to broader ecological function is predominantly limited by the extent of the habitats on the land base. Habitats are lost through inundation and conversion to other land uses.
- **Distribution:** Connectivity among riparian and wetland habitats, and between these habitats and other habitats and features, are important for dispersal of plants and animals and for seasonal movements of some species. Wetland and riparian habitats that are isolated will likely have decreased diversity compared to those which experience a healthy connectivity between areas. Distribution is therefore related not only to the extent of healthy riparian and wetland habitats, but also to adjacent land uses.
- **Productivity:** Even where riparian and wetland habitats are adequately represented and connected, there are several factors that can affect their productivity:
 - Hydrologic conditions such as water level variability and flow rates are among the most important variables driving riparian and wetland habitat development, structure, functioning and persistence (National Research Council 2001). Wetlands and riparian ecosystems require dynamic water regimes to maintain their productivity, but managed systems can result in unnatural cycles of stability and de-watering that can impair function or result in succession to different habitat types (e.g., forest, mudflats).
 - Stressors such as invasive species or disruptive human access can affect community structure and function.
 - Loss of specific habitat features can affect life requisites of specific species, e. g., dense nesting cover for waterfowl, suitable tree cavities for nesting owls or waterfowl, basking sites to turtles.
 - Poorly understood factors limit the productivity of created wetlands. These are generally thought to be related to unnatural hydrologic regimes, soil conditions, and/or cattle grazing (e.g., Atkinson et al. 2010).

Knowledge Status

Habitat

Basin-wide trends in the abundance, distribution and productivity of riparian and wetland habitats have not been compiled, but inundation following dam construction was likely the most significant source of habitat loss (see *Footprint Impacts and Threats* above). The area of inundation has not increased since construction of the last dam, but the productivity of adjacent habitats has continued to be affected, either directly or indirectly as a result of BC Hydro operations.

Knowledge Gaps

Options for wetland and riparian habitat restoration have been assessed in the Campbell River Watershed, and a number of species-based actions have been completed. The effectiveness of actions needs to be determined.

Objectives and Measures

The following objectives have been developed to define the scope of the Wetland & Riparian Areas Ecosystem Chapter. While the objectives are expected to remain stable over time, the projects funded may evolve as management priorities shift, or as new information becomes available.

Objective 1: Ensure productive and diverse wetland and riparian ecosystems.

This objective addresses overall ecosystem integrity and directs compensation activities to maintain ecosystem productivity by protecting, enhancing or creating new wetland and riparian habitat. This objective is supported by three sub-objectives:

1. Secure remaining Category 1 riparian and wetland habitat.

Wetland and riparian areas can be heavily impacted by conversion to other lands uses, such as agriculture development or forestry, amongst others. Securing remaining habitat to prevent loss is very important. Habitat is considered secure if it is protected from conversion to other land use, for example by purchasing the land or negotiating a covenant agreement.

Measures — Measures will be ecosystem- and project-specific.

2. Reduce threats to Category 1 riparian and wetland habitat.

Wetlands and riparian areas are subject to a variety of threats both internally and externally. Many naturally functioning riparian and wetland habitats (Category 1) can benefit from management actions that reduce specific threats (e. g., treatment for invasive species, access control, forestry in adjacent areas etc.).

Measures — Measures will be ecosystem- and project-specific.

3. Restore degraded or create new riparian and wetland habitat (Category 2).

While conservation of existing high quality habitat is always preferable, category 1 habitat may be limited or the opportunities for conservation are difficult. Restoration opportunities may be more available in areas where changes in water regime have altered successional pathways in pre-existing riparian and wetland ecosystems. Typically the regime in managed watersheds becomes more stable. Riparian and wetland ecosystems require the disturbances caused by fluctuating water levels to maintain their productivity. When these disturbances are reduced or eliminated, riparian and wetland ecosystems transition to other ecosystem types. Projects can be designed to restore the original ecological function of these areas, or to create new riparian or wetland habitats that differ from what was present historically, but still represent an improvement in function.

Measures — Measures will be ecosystem- and project-specific.

Objective 2: Maintain or improve the status of species of interest.

Actions under this objective focus on addressing limiting factors that are not otherwise addressed by general improvements to ecosystem function under Objective 1. The intent is to maintain, or where feasible, increase the abundance of species of interest (e.g., federally listed species-at-risk or species identified through government, industry, public and First Nations engagement).

Measures — Measures will be species- and project-specific.

Objective 3: Maintain or improve opportunities for sustainable use.

Many wetland and riparian species are the focus of sustainable use activities by First Nations and non-First Nations people (e.g., duck hunting, medicinal plants, wildlife viewing). Actions addressing Objectives 1 and 2 will often support this sustainable use objective.

Measures — Measures will be species- and project-specific.

ECOSYSTEM CHAPTER: UPLAND & DRYLAND

Actions for Upland and Dryland Areas

The [Action Table](#) in this document (see page 22) identifies our Priority Actions to conserve and enhance fish & wildlife in this watershed. Priority Actions are organized by Action type: Research and Information Acquisition, Habitat-based Actions, Species-based Actions, Land Securement and Monitoring and Evaluation. Actions are assigned a priority ranking from 1 (highest priority) to 3 (lowest priority).

Upland and Dryland in the Campbell River Watershed

Upland and dryland habitats are those that occur above areas of permanent inundation or periodic flooding. They are usually the habitats least affected by hydroelectric generating infrastructure or operation; however, footprint impacts have occurred and they contribute to the cumulative effects of human-related activities in these habitats. Upland/dryland habitats are diverse and can range from unvegetated areas to grasslands, forests, and alpine ecosystems. Different habitats are associated with distinct species assemblages that react to direct or indirect stressors in their distinct habitat niches.

Within the Campbell River Watershed, elevations range from sea level to 2200 m. The watershed lies within the Georgian Depression Ecoprovince (Demarchi 1996) and variants of the Coastal Western Hemlock very dry maritime (CWHxm1 and CWHsm2) and moist maritime (CWHmm1) very wet (CWHvm1) subzones at low elevations. Higher elevations are dominated by Mountain Hemlock (MHmm1) and alpine ecosystems (Green and Klinka 1994). Most of the watershed is forested, with lower elevations dominated by Western Hemlock (*Tsuga heterophylla*), Amabilis Fir (*Abies amabilis*), Western Redcedar (*Thuja plicata*), and Douglas-fir (*Pseudotsuga menziesii*). Shrub layers include Red Huckleberry (*Vaccinium parvifolium*), Alaskan Blueberry (*V. alaskaense*) and Salal (*Gaultheria shallon*). Higher-elevation forests are dominated by Yellow-cedar (*Chamaecyparis nootkatensis*) and Mountain Hemlock (*Tsuga mertensiana*; Green and Klinka 1994).

Limiting Factors

Limiting factors vary among species and need to be further assessed. They are generally associated with:

- **Habitat loss and alteration:** The cumulative effects of forestry, mining, and hydro-electric development have resulted in substantial losses and alterations to habitat and habitat connectivity.
- **Habitat connectivity:** Habitat loss and road development have resulted in lost connectivity between habitats, which alter wildlife movement.

Knowledge Status

Habitat

The Campbell River Watershed has experienced extensive industrial development since the late 1800s including forest harvesting, mining as well as flooding and construction related to hydroelectricity infrastructure. Natural disturbance has also contributed to changes in the watershed as a result of the large Sayward fire in 1938.

Industrial development continues today with ongoing forest harvesting in the upper watershed. This has altered the distribution of forest ages and species composition. It has also resulted in an extensive road network and associated direct and indirect impacts, such as increased recreation. The extent of these landscape changes has not been specifically quantified.

Knowledge Gaps

Knowledge of species and ecosystems in the Campbell River Watershed is limited. There have not been extensive inventories specifically targeting the Campbell.

Objectives and Measures

The following objectives have been developed to define the scope of the Upland & Dryland Ecosystem Chapter. While the objectives are expected to remain stable over time, the projects funded may evolve as management priorities shift, or as new information becomes available.

Objective 1: Ensure productive and diverse upland and dryland ecosystems.

Actions under this objective are aimed at protecting/enhancing rare or ecologically significant features.

Measures — Measures will be ecosystem- and project-specific.

Objective 2: Maintain or improve the status of species of interest.

Actions under this objective focus on addressing limiting factors that are not otherwise addressed by general improvements to ecosystem function under Objective 1. The intent is to maintain, or where feasible, increase the abundance of species of interest (e.g., federally listed species-at-risk or species identified through government and First Nations engagement).

Measures — Measures will be species- and project-specific.

Objective 3: Maintain or improve opportunities for sustainable use.

Upland and dryland habitats and associated species are also a focus of sustainable use activities by First Nations and non-First Nations people (e.g., fishing, hunting, medicinal plant collection, wildlife viewing). Actions addressing Objectives 1 and 2 will often support this sustainable use objective.

Measures — Measures will be species- and project-specific.

ACTION TABLE

This Action Table identifies the FWCP's Priority Actions to conserve and enhance fish and wildlife impacted by BC Hydro dams in this watershed. Actions identified as OPEN (see Delivery Approach column) are eligible for a grant. When completing your online grant application, you will be required to identify a Priority Action(s) that best aligns with your project idea. A high-quality grant application will clearly demonstrate alignment with Priority Action(s) in an Action Table.

CAMPBELL RIVER WATERSHED ACTION TABLE										Version: 9Aug17
Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location	
1	All	Research & Information Acquisition	CBR.ALL.RI.01.01 Develop a current habitat assessment map-P1	1	Fish & Wildlife	<p>Develop a current habitat assessment map for priority fish & wildlife species in the watershed. Habitats to be assessed & mapped include:</p> <ul style="list-style-type: none"> • Wetlands • Riparian Areas • Stream Habitats • Estuary Habitats • Connectivity Corridors • Forested Ecosystems (e.g., seral stage distribution) • Over-wintering habitat for species that utilize talus or rock features (e.g., bats, snakes) • Culturally Important Areas <p>Mapping is to include as much on-the-ground information as possible relevant to the subject fish & wildlife species. The assessment should focus on practical conservation and restoration opportunities. For fish, this work should inform development of habitat restoration and protection plans for priority species and habitats. Consideration should be given to potential impacts from available climate change predictions relevant to the specific habitats (i.e., potential changes to vegetation communities, precipitation, wetland hydro-periods, snowpack, wildfire risk, wildlife movements, etc.). Ensure consistency with other regional ecosystem mapping (e.g., Strathcona Timber Supply Area) and that done by the Comox Valley Regional District. Strathcona Park (Forbidden Plateau) has TEM mapping that needs digitizing and some reclassification work. Recommendations should be made through this work for future management actions and assessments.</p>	Improved strategic planning for conservation and restoration opportunities.	Directed	Throughout	
2	All	Research & Information Acquisition	CBR.ALL.RI.02.01 Conduct a limiting factors analysis...Campbell River Estuary-P2	2	Fish & Wildlife	<p>Conduct a limiting factors analysis for priority fish and/or wildlife for the Campbell River watershed or sub-basins to support prioritization of future projects. This will include an assessment of population status, habitat status or habitat capacity and/or a cost-benefit analysis of any habitat-based actions proposed by the program, and should be</p>	To determine cost-benefit of potential FWCP actions and support	Open	Throughout	

CAMPBELL RIVER WATERSHED ACTION TABLE

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
2 cont.			CBR.ALL.RI.02.02 Conduct a limiting factors analysis...lower Campbell Riv mainstems & tributaries P1	1		considerate of the root causes of degraded habitats and limitations to productive potential. For fish, sub-basins for assessment include the Campbell River estuary (Priority 2), the lower Campbell River mainstem and tributaries (Priority 1), the Quinsam watershed (Priority 1), the Salmon watershed (Priority 2), and the upper Campbell reservoirs and tributaries (Priority 1). Analyses should build upon previous projects and ongoing assessments, including the Water Use Plan studies and any existing restoration plans, in association with local agency, First Nation and BC Hydro staff. Work should be done in cooperation with private landowners and other land managers. *Please note that the FWCP may develop templates for this work. Please check with FWCP to see if these templates are available.	prioritization of future projects. Leads to the creation of robust habitat or species-based restoration plans for the watershed or sub-basins.		
			CBR.ALL.RI.02.03 Conduct a limiting factors analysis...Quinsam watershed-P1	1					
			CBR.ALL.RI.02.04 Conduct a limiting factors analysis...Salmon watershed-P2	2					
			CBR.ALL.RI.02.05 Conduct a limiting factors analysis...Campbell River reservoirs/tributaries-P2	1					
			CBR.ALL.RI.02.06 Conduct a limiting factors analysis...-Campbell River Watershed-P2	2					
3	All	Research & Information Acquisition	CBR.ALL.RI.03.01 Develop a comprehensive habitat restoration...plan-Campbell River Estuary-P2	2	Fish & Wildlife	Develop a comprehensive habitat restoration and protection plan for priority fish and/or wildlife for the Campbell River watershed or sub-basins in relation to limiting factors analyses and assessment of population status/habitat capacity. Restoration refers to habitat or species-based actions that restore habitat capacity or population viability, while protection includes habitat-based actions or land securement that protect important habitat from further degradation. Plans must include:	To determine high priority, cost-effective habitat and/or species-based actions that can be	Directed	Throughout

CAMPBELL RIVER WATERSHED ACTION TABLE										Version: 9Aug17
Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location	
3 cont.			CBR.ALL.RI.03.02 Develop a comprehensive habitat restoration...plan-lower Campbell Riv mainstem & tributaries-P1	1		<ul style="list-style-type: none"> • Baseline description of the watershed (hydrology, climate, topography); • Priorities of local First Nations for conservation and restoration; • Previous assessment and restoration works; • Distribution, timing, biological and critical habitat requirements and status of species in the watershed; • Clear goals and objectives based on a desired future condition; • Summary of habitat indicators and limiting factors (based on analyses of habitat pressure indicators, habitat state indicators, limiting factors analysis); • Knowledge gaps and recommended research and/or assessment priorities; • Restoration priorities with rationale/discussion; • Selected indicators and performance standards for effectiveness monitoring program; and, • Monitoring protocol and schedule. <p>Plans may be multi-species and habitat-based or they may be focused on individual high priority species in the watershed. High priority fish species include Chinook, Coho, Pink and Chum Salmon, Steelhead, Cutthroat Trout and Rainbow Trout. High priority wildlife include bats, amphibians, and riparian-associated mammals and birds and high priority wildlife habitat includes Category 1 wetland and riparian areas. Note that all estuary, riparian and wetland projects should include inventory of rare plants and invertebrates to prevent the destruction of at-risk habitats while carrying out other projects. Plans should be developed in association with local agency, First Nation and BC Hydro staff, landowners and other land managers.</p> <p>Sub-basins for fish plans include the Campbell River estuary (Priority 2), the lower Campbell River mainstem and tributaries (Priority 1), the Quinsam watershed (Priority 1), the Salmon watershed (Priority 2), and the Campbell River reservoirs and tributaries (Priority 1). Restoration plans are best developed as 'living documents' so that they can be updated over time. A number of priority actions have been developed already and are described in this Action Table, but further development of restoration actions would be beneficial.</p> <p>*Please note that the FWCP may develop templates for this work. Please check with FWCP to see if these templates are available.</p>	supported by the FWCP.			
			CBR.ALL.RI.03.03 Develop a comprehensive habitat restoration...plan-Quinsam watershed-P1	1						
			CBR.ALL.RI.03.04 Develop a comprehensive habitat restoration...plan-Salmon watershed-P2	2						
			CBR.ALL.RI.03.05 Develop a comprehensive habitat restoration...plan-Campbell River reservoirs&tributaries-P1	1						
			CBR.ALL.RI.03.06 Develop a comprehensive habitat restoration...plan-Campbell River Watershed-P2	2						

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location	
4	All	Habitat-based Actions	CBR.ALL.HB.04.01 Implement high priority habitat-based actions-P1	1	Fish & Wildlife	Implement high priority habitat and/or species-based actions for fish and/or wildlife as recommended by mapping activities (Action 1), inventory (Action 24), or by the restoration and protection plan (Action 3) or other similar plans already developed in the watershed. Note that a number of priority habitat and/or species-based actions have been developed already and are described in this Action Table, but further development of restoration actions would be beneficial.	Implement high priority, cost-effective habitat and/or species-based actions that can be supported by the FWCP.	Open	Throughout	
		Species-based Actions	CBR.ALL.SB.04.02 Implement high priority species-based actions-P1	1						
5	All	Land Securement	CBR.ALL.LS.05.01 Conduct an options assessment for land securement-P1	1	Fish & Wildlife	Considering ecosystem, conservation and/or local management objectives, conduct an options assessment for land securement that establishes priority area to be protected through and land securement and identifies feasible mechanisms (e.g., fee-simple purchase, covenants, WHAs, etc.).	Prioritize locations and secure partnerships for land securement.	Open	Throughout	
6	All	Land Securement	CBR.ALL.LS.06.01 Land Securement-P1	1	Fish & Wildlife	Land securement in association with partner organizations to address fish and wildlife management objectives or to support habitat-based actions proposed by the FWCP. Land securement could address ecosystem function objectives across the watershed plan chapters of Rivers, Lakes & Reservoirs, Riparian/Wetland, and Upland/Dryland. Priority habitats include wetlands and old growth forests (consider acquisition of older second-growth forests that will eventually acquire old-growth forest characteristics). Refer to options assessment findings, in Action 5 , before conducting land securement activities.	Conserve, protect and restore ecosystem function and resilience through land securement.	Open	Throughout	
7	All	Monitoring & Evaluation	CBR.ALL.ME.07.01 Develop and implement an integrated monitoring plan-P1	1	Fish & Wildlife	Develop and implement an integrated monitoring plan for fish and/or wildlife in the Campbell watershed or sub-basins in relation to existing agency monitoring programs, limiting factors analyses (Action 2), restoration plans (Action 3) and/or habitat or species-based actions supported by the FWCP. Monitoring should inform limiting factors analyses and/or habitat restoration and should be compatible with existing programs.	Support prioritization of monitoring associated with actions to sustain and restore habitat capacity and population viability of fish & wildlife.	Open	Throughout	

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location	
8	All	Monitoring & Evaluation	CBR.ALL.ME.08.01 Assess success of habitat-based actions supported by FWCP-P1	1	Fish & Wildlife	Assess success of habitat-based actions supported by the FWCP. Success could be assessed through monitoring of biological and/or physical habitat responses. Success could be assessed on a graduated schedule such as every 1, 3, 5 and 10 years or based on high flow events or other natural or human-caused disturbances. Enhancements of interest: <ul style="list-style-type: none"> • Creation of black bear dens (16.W.CBR.02) • Campbell River Bat Project: Inventory and Habitat Enhancement (01.W.09), Bat House Mitigation (06.W.CBR.03) • The nest box program for Western Screech-owls (e.g., 16.W.CBR.03: Western Screech-owl Habitat Enhancement and Inventory). Evaluate effectiveness in cooperation with evaluations being undertaken by the Province • Monitor the effects of past management actions on Northern Red-legged Frog (09.W.CBR.01: Identification and Protection of Critical Breeding Habitat for Red-legged Frogs in the Campbell River Watershed) 	Assess success of habitat-based actions and support future planning and prioritization.	Open	Throughout	
9	All	Monitoring & Evaluation	CBR.ALL.ME.09.01 Conduct condition assessments and/or maintenance on habitat enhancements-P1	1	Fish & Wildlife	Conduct condition assessments and/or maintenance on habitat enhancements supported by the FWCP. This could include the development of an inspection and maintenance schedule if required. If part of a multi-year study, provide information about future objectives and actions.	Maintain functioning of habitat enhancements supported by the FWCP.	Open	Throughout	
10	Rivers, Lakes & Reservoirs	Research & Information Acquisition	CBR.RLR.RI.10.01 Develop a gravel placement and monitoring plan-P1	1	Anadromous & Resident Salmonids	Develop a gravel placement and monitoring plan for the lower Campbell River mainstem including Elk Falls Canyon. The plan should address the quantity and locations for gravel placement on annual basis and should be considerate of the high fall/winter flows in the lower Campbell.	Sustain and restore salmon spawning and incubation habitat capacity in the Lower Campbell River.	Open	Lower Campbell River	
11	Rivers, Lakes & Reservoirs	Habitat-based Actions	CBR.RLR.HB.11.01 Implement habitat restoration, enhancement...measures-Campbell River Estuary-P2	2	Anadromous & Resident Salmonids	Implement habitat restoration, enhancement and/or protective measures within sub-basins of the Campbell watershed (refer to priorities of sub-basins above) to improve salmonid spawning, incubation or rearing habitat. If a restoration plan has been completed under Action 3 , please reference that plan for more information.	Sustain and restore habitat capacity and population viability of	Open	Throughout	

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
11 cont.			CBR.RLR.HB.11.02 Implement habitat restoration, enhancement...measures- lower Campbell Riv mainstem&tributaries-P1	1			anadromous and resident salmonids.		
			CBR.RLR.HB.11.03 Implement habitat restoration, enhancement...measures-Quinsam watershed-P1	1					
			CBR.RLR.HB.11.04 Implement habitat restoration, enhancement...measures-Salmon watershed-P2	2					
			CBR.RLR.HB.11.05 Implement habitat restoration, enhancement...measures-Campbell River reservoirs&tributaries-P1	1					
			CBR.RLR.HB.11.06 Implement habitat restoration, enhancement...measures-Campbell River Watershed-P2	2					
12	Rivers, Lakes & Reservoirs	Habitat-based Actions	CBR.RLR.HB.12.01 Continue augmentation of gravels in Elk Falls Canyon-P1	1	Anadromous & Resident Salmonids	Continue augmentation of gravels in Elk Falls Canyon. If a gravel monitoring plan has been completed under Action 10, please reference that plan for more information.	Sustain and restore habitat capacity in Elk Falls Canyon.	Open	Lower Campbell River

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
13	Rivers, Lakes & Reservoirs	Habitat-based Actions	CBR.RLR.HB.13.01 Gravel placement in the Lower Campbell River-P1	1	Chinook Salmon	Gravel placement in the Lower Campbell River to improve egg-to-fry survival of salmonids (primarily for Chinook). Possible locations include, extension of First Island Mainstem project, and gravel pads in the mainstem upstream of Second Island. If a gravel monitoring plan has been completed under Action 10 , please reference that plan for more information.	Sustain and restore salmon spawning and incubation habitat capacity in the Lower Campbell River.	Open	Lower Campbell River
14	Rivers, Lakes & Reservoirs	Habitat-based Actions	CBR.RLR.HB.14.01 Conduct habitat restoration activities in Upper Campbell Reservoirs&tributaries-P1	1	Resident Salmonids	Conduct habitat restoration activities in the Upper Campbell Reservoirs and tributaries. If a restoration plan has been completed under Action 3 , please reference that plan for more information.	Sustain and restore habitat capacity and population viability of resident salmonids.	Open	Upper Campbell Reservoirs and Tributaries
15	Rivers, Lakes & Reservoirs	Habitat-based Actions	CBR.RLR.HB.15.01 Implement recommendations from Wokas Lake storage feasibility study-P1	1	Anadromous & Resident Salmonids	Implement recommendations from Wokas Lake storage feasibility study (Craig J. and M. Kehler. 2009. Negative Storage Feasibility on Upper Quinsam and Wokas Lakes - Environmental Issues Associated with Maintaining Quinsam River Minimum Fisheries Flows). This includes dredging of the channel between Wokas Lake and Upper Quinsam Lake to increase summer low flows in the Quinsam watershed and implementing mitigation strategies to minimize local impacts.	Improve summer rearing habitat capacity in the Quinsam watershed.	Open	Quinsam
16	Rivers, Lakes & Reservoirs	Habitat-based Actions	CBR.RLR.HB.16.01 Conduct habitat restoration activities in the Campbell River estuary-P2	2	Anadromous & Resident Salmonids	Conduct habitat restoration activities in the Campbell River estuary. If a restoration plan for the estuary has been completed under action 3, please reference that plan for more information.	Sustain and restore habitat capacity and population viability of anadromous salmonids.	Open	Campbell River estuary
17	Rivers, Lakes & Reservoirs	Habitat-based Actions	CBR.RLR.HB.17.01 Conduct habitat complexing in the Quinsam watershed-P2	2	Anadromous & Resident Salmonids	Conduct habitat complexing in the Quinsam watershed to improve rearing habitat for salmonids. This work should be informed by a restoration plan for the Quinsam watershed (under Action 3) and should be considerate of the Water Use Plan monitoring studies JHTMON-6 and JHTMON-8.	Sustain and restore salmon rearing habitat capacity in the Quinsam.	Open	Quinsam

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
18	Rivers, Lakes & Reservoirs	Habitat-based Actions	CBR.RLR.HB.18.01 Conduct continued nutrient augmentation in the Salmon River-P2	2	Anadromous & Resident Salmonids	Conduct continued nutrient augmentation in the Salmon River. Augmentation has been successful and been shown to improve juvenile Steelhead condition. Continued nutrient augmentation could follow from cost-benefit assessment (e.g., under Action 3).	Sustain and improve rearing habitat capacity in the upper Salmon River	Open	Salmon
19	Rivers, Lakes & Reservoirs	Habitat-based Actions	CBR.RLR.HB.19.01 Conduct side channel monitoring & maintenance in the Salmon River-P2	2	Anadromous & Resident Salmonids	Conduct side channel monitoring and maintenance in the Salmon River (e.g., Big Tree side channel).	Sustain and restore habitat capacity and population viability of anadromous and resident salmonids.	Open	Salmon
20	Rivers, Lakes & Reservoirs	Habitat-based Actions	CBR.RLR.HB.20.01 Conduct instream complexing in Drum Creek-P2	2	Resident Salmonids	Conduct instream complexing in Drum Creek. This work would need to be preceded by a cost-benefit analysis (e.g., under action 3).	Sustain and restore habitat capacity in Drum Creek.	Open	Upper Campbell Reservoirs and Tributaries
21	Rivers, Lakes & Reservoirs	Habitat-based Actions	CBR.RLR.HB.21.01 Improve fish passage in the Quinsam watershed-P3	3	Anadromous & Resident Salmonids	Improve fish passage in the Quinsam watershed. Note: reference the Water Use Plan monitoring study JHTMON-6. Work in JHTMON-6 is ongoing and is due to be completed in approximately 2019.	Increase access to salmon spawning, incubation and rearing habitat in the Quinsam watershed.	Open	Quinsam
22	Rivers, Lakes & Reservoirs	Species-based Actions	CBR.RLR.SB.22.01 Support hatchery incubation of Chinook for out-planting-P2	2	Chinook Salmon	Support hatchery incubation of Chinook for out-planting to Campbell mainstem upstream of Quinsam confluence if limiting factors analysis (e.g., Action 2) indicates sufficient benefit.	Sustain and restore Chinook Salmon population viability.	Open	Lower Campbell River

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
23	Rivers, Lakes & Reservoirs	Monitoring & Evaluation	CBR.RLR.ME.23.01 Conduct gravel monitoring in the lower Campbell River-P1	1	Anadromous & Resident Salmonids	Conduct gravel monitoring in the lower Campbell River mainstem including Elk Falls Canyon. Gravel monitoring should follow from a gravel placement and monitoring plan (under Action 9) and should inform the quantity and locations for gravel placement on annual basis.	Sustain and restore salmon spawning and incubation habitat capacity in the Lower Campbell River.	Open	Lower Campbell River
24	Wetland & Riparian	Research & Information Acquisition	CBR.WAR.RI.24.01 Inventory for species of interest that are likely in the watershed-P2	2	Wildlife	Inventory for species of interest that are likely in the watershed. Inventory actions must meet the following criteria: <ul style="list-style-type: none"> • The data collected will clearly inform a specific natural resource management decision or conservation action; this includes a clear understanding of: <ul style="list-style-type: none"> - The data or knowledge gap that is currently limiting a decision-maker or party(ies) from making a conservation decision or undertaking a conservation action; - How the inventory has been specifically designed to fill the above-noted data/knowledge gap; and - The decision-makers' commitment to using the data or information to support a specific decision. • The data collection is well informed by a clear and specific management objective (land use plan, recovery plan etc.) that also informs the management decision or conservation action; this includes clarity of: <ul style="list-style-type: none"> - How the inventory work has been designed to specifically assess the status or condition of the objective; and, - How the data will be used to inform/improve/clarify the management objective. <p>Species of interest reflect engagement from FWCP partners and include,</p>	Maintain or, where feasible, increase the abundance of species of interest.	Open	Throughout

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
24 cont.	Upland & Dryland	Research & Information Acquisition	CBR.UAD.RI.24.02 Inventory for species of interest that are likely in the watershed-P2	2	Wildlife	<p>but are not limited to:</p> <ul style="list-style-type: none"> • Wolverine. Conduct genetic analysis on known Vancouver Island wolverine samples and compare to existing samples from mainland populations to assess subspecies designation. Unclear if <i>vancouverensis</i> is a distinct subspecies and warrants COSEWIC assessment and recovery planning. If analysis suggest subspecies difference, conduct inventory in high-probability watersheds. • Mesocarnivores (i.e., Ermine, Pacific Marten, American Mink and North American River Otter). Conduct risk assessment and evaluate population sustainability through a monitoring program. Note that genetic analyses may be needed to determine Ermine subspecies (<i>anguinae</i>) validity (Priority 2). Liaise with Vancouver Island marmot researchers to access their motion-sensitive camera data. If necessary, implement enhancement strategies to maintain sustainable populations. If part of a multi-year study, provide information about future objectives and actions. • Black bear dens. Inventory the location and activity status of known den sites, categorize and compare management strategies applied to known black bear den sites, conduct field investigations to evaluate effectiveness, develop management recommendations and den site identification reference material. Raise awareness of habitat enhancement opportunities for creating winter dens for black bears in large trees or stumps (building on methodologies developed in Jordan River watershed). • Western Screech-Owl (<i>kennicottii</i> subspecies). Inventory is still needed in some areas of the Campbell River watershed. Surveys need to broaden the habitats surveyed away from riparian areas. 			

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location	
24 cont.						<ul style="list-style-type: none"> Western Water Shrew (<i>brooksi</i> subspecies). Inventory through environmental DNA or other innovative methods (e.g., hair collection). There are various records for the species in the watershed (BCCDC 2016). Environmental DNA methodology can also be used concurrently to survey for at-risk amphibian species. Priorities: 1) Confirm the taxonomic status of this population. Tissues for additional genetic analyses are housed at the RBCM, 2) Apply the management guidelines in the Identified Wildlife Account. The guidelines should be modified to address mortality from accidental drowning in minnow traps used in fish surveys. Barred Owls. Gather baseline population information in the Campbell River watershed. Start by gathering data from previous Western Screech-owl inventories. Northern Saw-whet Owls. Inventory is needed in upland & dryland habitat because there is currently little information on the species in the Campbell River watershed. 				
25	Wetland & Riparian	Habitat-based Actions	CBR.WAR.HB.25.0 1 Implement priority species- and habitat-related conservation actions-P1	1	Wildlife Species at Risk	<p>Implement priority species- and habitat-related conservation actions in the following (or most recent) Recovery Strategies and Management Plans for species at risk that are known to be in the watershed.</p> <p>Conservation actions must be well informed by a clear and specific management objective and must be well informed by previous inventory in the watershed.</p> <ul style="list-style-type: none"> Recovery Strategy for the Vancouver Island Marmot (<i>Marmota vancouverensis</i>) in British Columbia (Vancouver Island Marmot Recovery Team 2008; being updated 2017). Management Plan for Roosevelt Elk in British Columbia (Ministry of Forests, Lands and Natural Resource Operations 2015). Build upon previous FWCP projects (Strathcona Elk Winter Range Restoration Project (04.W.Ca.03), Campbell/Buttle Elk Winter Range Enhancement (03.W.Ca.01), Strathcona Elk Winter Range Enhancement Project 	Stable or increasing population of at-risk species. Habitat enhancement opportunities.	Open	Throughout	

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location	
25 cont.	Upland & Dryland	Habitat-based Actions	CBR.UAD.HB.25.02 Implement priority species- and habitat-related conservation actions-P1	1	Wildlife Species at Risk	(04.W.Ca.03)). <ul style="list-style-type: none"> • Management Plan for the Great Blue Heron <i>fannini</i> subspecies (<i>Ardea herodias fannini</i>) in Canada [Proposed] (Environment Canada 2016). Conserve intertidal foraging areas. • Recovery Plan for the Western Screech-Owl, <i>kennicottii</i> subspecies (<i>Megascops kennicottii kennicottii</i>) in British Columbia (BC Ministry of Environment 2013). • Recovery Strategy for the Common Nighthawk (<i>Chordeiles minor</i>) in Canada (Environment Canada 2016). • Management plan for the Wandering Salamander (<i>Aneides vagrans</i>) in British Columbia (BC Ministry of Environment 2017). • Management plan for the Western Toad (<i>Anaxyrus boreas</i>) in British Columbia (Provincial Western Toad Working Group 2014)- Identify breeding locations in the Buttle Lake area and opportunities to reduce road-kill along highway 28. 				
26	Upland & Dryland	Habitat-based Actions	CBR.UAD.HB.26.01 Determine presence, identify/protect bat Maternity roosts & winter hibernacula-P1	1	Bats	1) Determine presence of bat species, especially those species potentially vulnerable to White Nose Syndrome; 2) Through acoustic monitoring or other methods (e.g., radio-tracking, DNA), identify bat maternity roosts and winter hibernacula ; and 3) Pursue protection of bat hibernacula and maternity roosts (e.g., critical habitat, WHAs or wildlife habitat feature designations) that are identified.	Maintain or, where feasible, increase the abundance of species of interest. Identification of which species are present in the watershed. This work should lead to identification and protection of maternity roosts and hibernacula.	Open	Throughout	

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
27	Upland & Dryland	Habitat-based Actions	CBR.UAD.HB.26.01 Restoration /enhancement of American Marten denning-P2	2	Pacific Marten	Evaluate options and implement restoration/enhancement of American Marten denning (or other) habitats.	Habitat enhancement opportunities. Maintain or, where feasible, increase the abundance of species of interest.	Open	Throughout
28	All	Habitat-based Actions	CBR.ALL.HB.28.01 Conserve or enhance important habitats or mitigate habitat threats for priority bird species-P2	2	High Priority Birds	Conserve or enhance important habitats or mitigate habitat threats for priority bird species in the watershed. This watershed is within Bird Conservation Region 5 and falls under the Pacific Birds Habitat Joint Venture. See the lists of priority species under the North American Wetlands Conservation Act at: http://www.pacificbirds.org/nawca-priority-species/ . Proposed projects should refer to the priority lists and recommended conservation actions/guidance in the implementation plans (http://www.pacificbirds.org/science-and-planning/state-or-regional-plans/). The Strathcona Provincial Park Important Bird Area (BC265; Bird Studies Canada 2016) overlaps the western side of the Ash watershed (important for White-Tailed Ptarmigan).	Varied types of species and habitat conservation, protection and enhancement opportunities.	Open	Throughout
29	Wetland & Riparian	Habitat-based Actions	CBR.WAR.HB.29.01 Enhance the existing nesting box program for Western Screech-owl-P3	3	Western Screech-owl, <i>kennicottii</i> subspecies	Enhance the existing nesting box program for Western Screech-owl if monitoring (under Action 8) indicates it is effective, with particular emphasis on habitats in the Upper Campbell Reservoir.	Habitat enhancement opportunities. Maintain or, where feasible, increase the abundance of species of interest.	Open	Upper Campbell Reservoir
30	Wetland & Riparian	Habitat-based Actions	CBR.WAR.HB.30.01 Install nest boxes for Purple Martin-P2	2	Purple Martin	Install nest boxes for Purple Martin in cooperation with existing enhancement programs.	Habitat enhancement opportunities. Maintain or, where feasible, increase the abundance of species of interest.	Open	Throughout

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Action #	Ecosystem Chapter	Action Type	Priority Action Short Description	Priority	Target Species	Priority Action	Intended Outcome	Delivery Approach	Location
31	Wetland & Riparian	Habitat-based Actions	CBR.WAR.HB.31.01 Implement wetland and riparian restoration projects-P1	1	Wildlife	Implement wetland and riparian restoration projects that are identified as high priorities through inventory, mapping or assessment. If a restoration plan has been completed under action 3, please reference that plan for more information. This can include managing invasive plants as needed.	Protect, restore and/or create new wetland and riparian habitat.	Open	Throughout
32	All	Research & Information Acquisition	CBR.ALL.RI.32.01 Inventory & restoration for at-risk...and/or culturally important plant species-P3	3	At-risk Plants	Inventory and restoration for at-risk (e.g., SARA-listed, red- and blue-listed) and/or culturally important plant species and ecological communities. Potential species of interest: Salish Daisy, Snow Bramble, Olympic Mountain Aster, Western Hedysarum, Pointed Rush, Oldgrowth specklebelly, <i>Trematodon asanoi</i> , Olympic Onion, Smooth Douglasia, Sand-dwelling wallflower, Three-leaved <i>Lewisia</i> , Corrupt spleenwort, Upswept moonwort, Vancouver Island Beggarticks, Deltoid Balsamroot, and Henderson's Checker-mallow.	Habitat restoration opportunities.	Open	Throughout

REFERENCES

- Atkinson, R. B., J. E. Perry, G. B. Noe, W. L. Daniels, and J. Cairns, Jr. 2010. Primary productivity in 20-year old created wetlands in southwestern Virginia. *Wetlands* 30: 200-210.
- BC Hydro. 2004. Consultative Committee Report: Campbell River Water Use Plan. Executive Summary available at: <https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/environment-sustainability/water-use-planning/vancouver-island/campbell-river/wup-campbell-river-executive-summary.pdf>
- BC Hydro. 2006. BC Hydro Fish Entrainment Strategy. Prepared for BC Hydro Generation Operations, Burnaby, BC.
- BC Hydro. 2016. Fish passage decision framework for BC Hydro facilities.
- BC Hydro. 2012. Campbell River Water Use Plan. Available at: <https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/environment-sustainability/water-use-planning/vancouver-island/campbell-river/campbell-river-water-use-plan.pdf>
- Green, R. N., and K. Klinka. 1994. A Field Guide for Site Identification and Interpretation for the Vancouver Forest Region. Report Land management handbook #28. British Columbia Ministry of Forests, Burnaby, BC.
- Lough, M. J. , R. B. Rollins, and S. E. Rutherford. 2010. Campbell River Water Use Plan Monitoring Program: Diversion Reservoir Fish Indexing – 2010 (JORMON-4). Prepared for BC Hydro Vancouver Island Generation, Campbell River by MJ Lough Environmental Consultants, Nanaimo, BC.
- McElhany, P., M. H. Ruckelshaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. U. S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-42,156 p.
- National Research Council. 2001. Compensating for wetland losses under the Clean Water Act. National Academy Press, Washington, DC.

PREVIOUS STRATEGIC PLANNING DOCUMENTS

- Bridge-Coastal Restoration Program. 2000 Strategic Plan, Volume 2, Watershed Action Plans, Chapter 2: Campbell River.
- Fish & Wildlife Compensation Program. 2011 Campbell River Watershed – Watershed Plan. Final Draft.
- Fish & Wildlife Compensation Program. 2011 Campbell River Watershed – Riparian and Wetlands Action Plan. Final Draft.
- Fish & Wildlife Compensation Program. 2011 Campbell River Watershed – Salmonid Action Plan. Final Draft.
- Fish & Wildlife Compensation Program. 2011 Campbell River Watershed – Species of Interest Action Plan. Final Draft.