COQUITLAM-BUNTZEN WATERSHED ACTION PLAN

FINAL August 23, 2018
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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 impacted by construction of a BC Hydro dam in this watershed. Coquitlam Dam (Credit BC Hydro). Cover photos: Coho fry (Credit iStock), Coastal Tailed Frog (Credit J. Hobbs).

FWCP Fish & Wildlife COMPENSATION PROGRAM fwcp.ca

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: COQUITLAM RIVER WATERSHED

The Fish & Wildlife Compensation Program is 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 Coquitlam River watershed. The focus of the next five-year period will be Priority Actions identified for fish, wildlife, and habitats in three broad ecosystems 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 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. Actions fall into one or more of the following types:

1. **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.
2. **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.
3. **Land Securement** – These actions will contribute to the establishment of easements or covenants or the purchase of private land for conservation purposes.
4. **Species-based Actions** – These actions will alleviate limiting factors for a species. Examples include restoration planning, captive breeding/rearing and reintroduction.
5. **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 out 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 selection 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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COQUITLAM 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 they reflect FWCP's vision and mission. The Action Plans describe the strategies and Priority Actions to support FWCP objectives. Please refer to the Action Plan Overview for more information on the process that was followed to develop Action Plans. The structure of this Action Plan is shown in Figure 1.

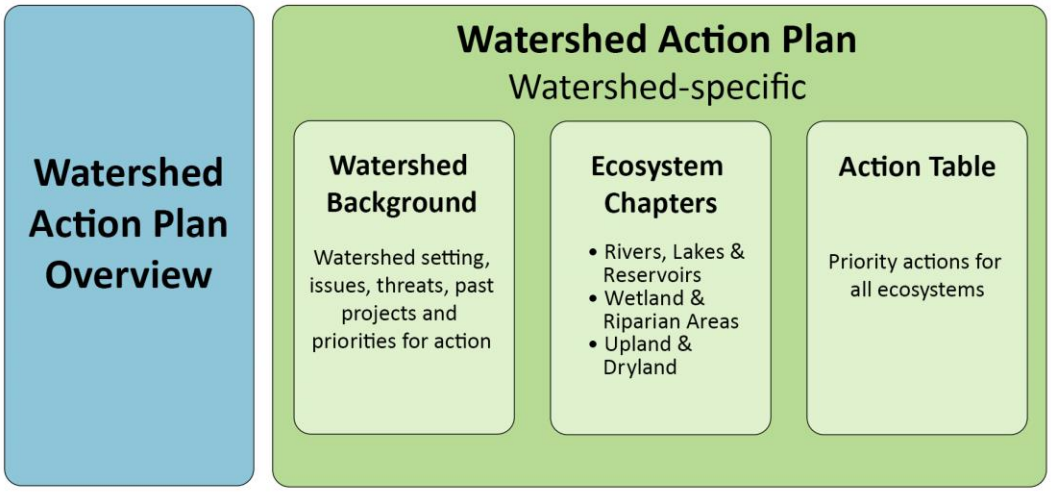

Figure 1: Structure of FWCP Action Plan Overview and d Action Plan components.

Setting

The Coquitlam River and Buntzen Lake watersheds lie in the southernmost extension of the Pacific Ranges of the Coast Mountains of British Columbia, about 30 km northeast of Vancouver (Figure 2). The Coquitlam River Watershed area is 253 km^2 (193 km^2 above the dam and 60 km^2 below), with elevations ranging from 153 m to over 2000 m. The Buntzen Lake watershed has an area of 21 km^2, with elevations ranging from 127 m to 1257 m. The Coquitlam basin is open to south-westerly flows of warm, moist air, which bring heavy rainfall. Approximately 50% of annual precipitation normally falls between October and January. Average precipitation in November is 560 mm; however, it can reach levels of 1000 mm or more.

The Coquitlam-Buntzen generating complex includes two dams, a diversion tunnel, two outlet tunnels, and two power houses (Figure 2). Coquitlam Dam is at the south end of Coquitlam Reservoir. The dam provides the means for most water storage in the system and controls releases into the lower Coquitlam River. Water from Coquitlam Lake Reservoir is diverted through a tunnel into Buntzen Lake. Water from Buntzen Lake Reservoir flows via two release facilities, one at Buntzen Dam and another on the westernmost shore of the reservoir, to two powerhouses on the shore of Indian Arm. Metro Vancouver operates a separate diversion tunnel from Coquitlam Reservoir for drinking water, with a maximum flow of 13.7 m^3/s.

The watershed has a diverse group of users. The Coquitlam-Buntzen system is in the traditional territories of Kwikwetlem First Nation, Katzie First Nation, Musqueam First Nation, Seabird Island Band, Shxw'ow'hamel First Nation, Skawahlook First Nation, Soowahlie First Nation, Squamish Nation, and Tsleil-Waututh Nation. It is also within the asserted traditional territory of Sto:lo Nation. Downstream of the Coquitlam Dam the Coquitlam River flows through the municipalities of Coquitlam and Port Coquitlam. The Upper Coquitlam River is within the area addressed by Metro Vancouver's Drinking Water Management Strategy. Buntzen Lake is surrounded by both Indian Arm Provincial Park and Buntzen Lake Regional Park.

Several community and stewardship groups are active in the watershed. The Kwikwetlem Sockeye Restoration Program has the goal of restoring Sockeye Salmon to the Coquitlam River Watershed and its members include Kwikwetlem First Nation, DFO, MOE, BC Hydro, Metro Vancouver, the cities of Coquitlam and Port Coquitlam, and other stewardship organizations (Plate et al. 2014). The Coquitlam River Watershed Roundtable is also active and has developed a Lower Coquitlam River Watershed Plan (Coquitlam River Watershed Roundtable 2016).

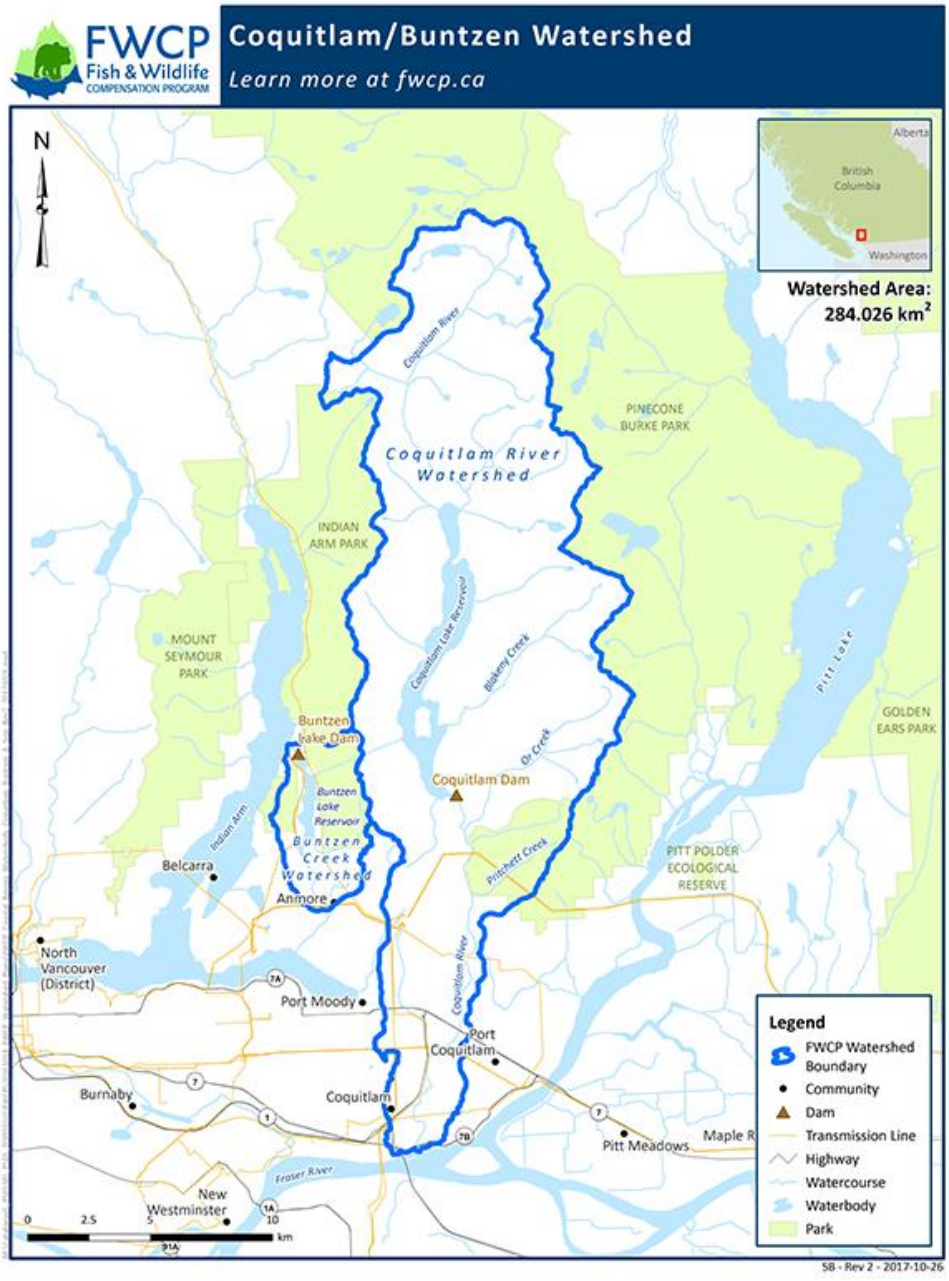

Figure 2: The FWCP Coquitlam-Buntzen Watershed boundary.

Land Ownership in the Coquitlam River Watershed

Much of the headwaters and the reservoir are located within Metro Vancouver's drinking water supply area, and access by the public as well as restoration opportunities are limited. Pine Cone Burke Provincial Park covers a portion of the watershed southeast of the reservoir. The lower (south) portion of the watershed is highly urbanized except for the Coquitlam River Wildlife Management Area which abuts the Port Mann bridge on the north shore of the Fraser River.

One Kwikwetlem First Nation reserve is in the lower portion of the watershed. Proponents need to ensure proposed activities and access requirements do not conflict with local land ownership and, where necessary, provide the status of project/land owner discussions in the proposal. Any restoration work undertaken should consider potential impacts to archaeological heritage in the area.

Footprint Impacts and Threats

Dam construction, hydropower development, and 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 combined reservoir area is 1,380 hectares, after flooding 225 hectares of land. The combined shoreline length is now 46 kilometres. The reservoir flooded 1.3 km of mainstem, 6 km of tributary channels, and 29 ha of associated riparian areas. Buntzen Lake Reservoir flooded 2 km of mainstem and 0.5 km of tributary habitats, and their associated riparian areas.

Habitat Loss: Coquitlam Dam and Buntzen Dam footprints have caused the loss of instream, riparian and upland habitats and the potential loss of lake outlet spawning habitat. Flooding of 17 hectares of river and lowland forest, the 30 km perimeter of Coquitlam Lake, and 177 hectares of upland forest has caused the loss of riverine and coniferous valley side habitats and associated wildlife losses (e.g., ungulates and carnivores have lost valley side habitat). During construction of the dam large volumes of sediment were sluiced, which likely degraded downstream habitats.

Coquitlam dam also has blocked the flow of woody debris recruitment downstream. Flow reductions and urban encroachment have reduced the floodplain complexity of the downstream channels, affecting both fish and wildlife. The lack of riparian vegetation in drawdown zones has affected ungulates, furbearers, small mammals and several species of passerines including some neotropical migrants. Habitat loss has affected amphibians, water shrews and other small mammals and their predators, browse for ungulates and breeding habitat for some species of neotropical migrants.

Migration Barriers: Coquitlam Dam blocked passage of anadromous stocks. The tailrace discharges of the powerhouses into Indian Arm attract Chinook salmon. The number of fish affected and the impacts of the delay on reproductive success are unknown. There is reduced fish access between the reservoir and tributary habitats due to large drawdown regimes. Structures, reservoirs, and diversions impede wildlife movement (especially for large mammals).

New Habitat: The reservoir has created new habitat for lake species, and spawning channels have been constructed below the dam.

Fluctuating Reservoir: Annual drawdown of about 17 m affects access to tributaries and reduces littoral productivity. Drawdown in fall increases turbidity in the reservoir.

Altered Flow Regime: Coquitlam Lake has been affected long-term by large reservoir drawdown regimes and the loss of historic salmon carcasses. The altered flow regime has changed riverine and riparian habitats. Potential effects on wildlife include changes to habitat quality and quantity for tailed frogs, water shrews, harlequins and dippers.

Diversions: Diversions at the Coquitlam Reservoir into the Buntzen Lake have decreased annual flow volume in the Coquitlam River, and increased inflow to Buntzen Lake. These altered flows have affected the wetted channel area, habitat quality, debris and gravel recruitment, sediment flushing, migration, seasonal temperatures, and aquatic productivity. Diversion reduces Coquitlam reservoir's productivity. 70% of the Coquitlam drainage area is diverted and the residual mainstem flows have been reduced for 90 years. Low flows do not flush multiple sediment inputs and

constrain spawning habitats. Chinook Salmon are attracted to the Buntzen Powerhouse tailrace area, but the effects of this are unquantified.

Entrainment: Entrainment occurs at Coquitlam diversion, Coquitlam Dam and Buntzen diversions, but the effects are unquantified.

Salinity: Discharge at the powerhouses has caused footprint and salinity impacts on the marine foreshore.

Non-hydro Impacts

Other impacts in the Coquitlam River Watershed include historic effects of forest harvesting activities, mill operations, dredging and gravel mining, urbanization and domestic water withdrawal. Land continues to be developed in the southern portion of the watershed.

Objectives for the Coquitlam 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. Priority 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 (Coho, Chinook, Chum, Pink, and Sockeye) and Steelhead; and (b) Resident salmonids (Rainbow, Cutthroat, and Bull Trout/Dolly Varden).	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: Coquitlam River Watershed

FWCP has been funding projects in the Coquitlam River Watershed since 1999 under the Bridge-Coastal Restoration Program (BCRP) and subsequently under the Fish & Wildlife Compensation Program[1] 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

Nine Rivers, Lakes & Reservoirs projects were undertaken in the Coquitlam River watershed during the 2010/2011 to 2015/2016 FWCP project years with $462,589 of FWCP funding. Of these, six projects were associated with the Priority 1 Action of obtaining baseline information in relation to the reintroduction of anadromous salmon above Coquitlam Dam. Since 2005, BCRP/FWCP has been funding studies in partnership with DFO, Ministry of Environment, Kwikwetlem First Nation, and Watershed Watch Salmon Society to assess the feasibility of restoring anadromous Sockeye (as well as Coho and Steelhead) to Coquitlam Reservoir. The Coquitlam Dam Sockeye Capture and Transport project enumerates the Kokanee smolts below the Coquitlam Dam and transports adult sockeye by truck into the reservoir. From 2007 to 2013, 27 adult Sockeye were caught returning to the Coquitlam River (range = 1-11 fish) below the dam, and DNA analyses confirmed that many of these fish were offspring of Coquitlam Reservoir Kokanee. Three recent projects assessed juvenile Kokanee abundance and distribution patterns in Coquitlam Lake, and have identified that one of the main obstacles to sockeye re-establishment is the low numbers of Kokanee smolts that are able to leave the reservoir. In 2014-2015, FWCP supported a knowledge synthesis and re-establishment plan for the Coquitlam Reservoir Sockeye Salmon (14.COQ.02), which lays out options and direction for subsequent work in the watershed. The implementation of this plan is underway, including the start of a multi-year species based action to boost Sockeye smolt production through Coquitlam Kokanee broodstock collection and hatchery augmentation.

The three remaining projects were habitat-based actions in the lower Coquitlam River conducted through the North Fraser Salmon Assistance Project Society, and received $235,960 of FWCP funding. These projects focused on restoration and maintenance of off-channel and side-channel spawning and rearing habitat targeting Chinook, Coho, Chum and Pink Salmon as well as Cutthroat and Steelhead Trout.

Wetland & Riparian Areas

Two Wetland & Riparian Area multi-year projects were undertaken during the 2010/2011 to 2015/2016 FWCP project years with $167,786 of FWCP funding. The first (2013, 2016) was focused on inventory, habitat suitability mapping, and identification of sites with potential for restoration or enhancement, for a number of Wetland & Riparian Area species at risk (Pacific Water Shrew, Great Blue Heron, Western Screech-owl, Northern Red-legged Frog, Coastal Tailed Frog, Western Toad, Western Painted Turtle), and conceptual enhancement plans were developed for two prioritized sites that focused on seven species at risk. This project also included investment in one Upland/Dryland species (see below). The second multi-year project (2012, 2013, 2016) addressed a habitat-based action to conduct riparian/wetland restoration at two high priority sites.

Upland & Dryland

One Upland & Dryland multi-year project was undertaken during the 2010/2011 to 2015/2016 FWCP project years. This project, which received a total of $83,720 of FWCP funding over two years (2013, 2016), is the same as the project focused on inventory, habitat suitability mapping, and identification of potential restoration sites that primarily targeted Riparian/Wetland species and habitat; however, it also inventory for Northern Goshawk (medium priority).

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

Interactions with Other Ongoing Processes

Water Use Plan (WUP) – BC Hydro undertook Water Use Planning in the Coquitlam River Watershed 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
COQUITLAM RIVER WATERSHED

ECOSYSTEM CHAPTER: RIVERS, LAKES & RESERVOIRS

Actions for Rivers, Lakes & Reservoirs

The Action Table in this document (see page 23) 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 Coquitlam River Watershed

Descriptions of fish and fish habitat come primarily from BCRP (2003). Historically, anadromous salmon and steelhead had access to Coquitlam Lake and its tributaries. The original dam at the outlet of Coquitlam Lake was built in 1903, and then reconstructed from 1911 to 1914, and then rehabilitated again in 1985. The dam has no fish passage facilities, and extirpated the Coquitlam Sockeye Salmon stocks and reduced the amount of accessible habitat for several other anadromous species. Pink Salmon were also extirpated in the lower Coquitlam River, presumably by reduced flows.

Chum, Coho, Chinook and Steelhead occur in the Coquitlam River below the dam, and Pink Salmon have been re-established. Additional fish habitat improvements are expected from operational changes implemented as part of the Coquitlam-Buntzen Water Use Plan (BC Hydro 2005). The Kwikwetlem Sockeye Restoration Program is also underway that has a goal of "re-anadromizing" Kokanee from the reservoir, to form a local sockeye run.
Resident fish species occur in the mainstem, reservoir and tributaries today, including Rainbow Trout, Cutthroat Trout, Bull Trout/Dolly Varden, Redside Shiner, Prickly Sculpin, and Threespine Stickleback. Lake Trout were introduced in 1968, but did not establish a self-supporting population. Rainbow Trout, Cutthroat Trout, Bull Trout, Kokanee, Largescale Sucker, Northern Pikeminnow, Peamouth Chub, Redside Shiner, Prickly Sculpin, and Threespine Stickleback are also recorded in Buntzen Lake (BCRP 2000), but some of these seem unlikely based on the small size of the lake.

There is taxonomic uncertainty about the char that occur in the Coquitlam system, and it is possible they are Bull Trout, Dolly Varden, or both. The two species are difficult to distinguish in the field and both occur in this region. Various documents refer to both Bull Trout and Dolly Varden in the Coquitlam River Watershed, but there have been no definitive surveys or studies. Typically, the char that occur in large lakes in this region are Bull Trout, but Dolly Varden also occurs, particularly in smaller tributaries and in headwaters. For convenience, we refer to char in this report as Bull Trout, but acknowledge the considerable uncertainty regarding proper identification.

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 flooding, flow diversions, or operating flows; or from non-hydro sources, such as dykes and urban development in the lower watershed. DFO and MOE indicate that rearing habitat is currently limiting for Coho Salmon and Steelhead, and spawning habitat is likely limiting for Pink and Chum Salmon.
- **Habitat quality**: Physical habitat below dams has been altered by reduced gravel and wood recruitment, particularly in the upper portion of the lower river. Productivity of Coquitlam Lake Reservoir has been affected by long-term reservoir drawdowns and loss of salmon-derived nutrients. Lakes and streams in this region have naturally low nutrient levels.

- **Access**: Anadromous and migratory resident stocks have been excluded from the upper Coquitlam for more than a century. Access has been reduced in the lower river through alteration of the natural flow regime. For example, access to side channel habitat is reduced due to lower mainstem flows and dyking and channelization in the lower watershed. Access to tributaries has been affected by reservoir drawdowns and lower flows in the mainstem. Lack of fish passage at the Coquitlam Dam has blocked inputs of salmon-derived nutrients.
- **Diversions**: The diversion of water from the Coquitlam to Buntzen Lake, and other diversions for drinking water, have altered water temperature, flow volumes and chemistry, which have in turn affected habitat quantity and quality, seasonal temperatures and stream productivity.
- **Entrainment:** Entrainment occurs at Coquitlam diversion, Coquitlam Dam and Buntzen diversions. At Coquitlam Dam, injury and mortality of outmigrating salmon smolts occurs during passage through the Low Level Outlets into the tunnel and the Lower Coquitlam River. From 11% to 61% Kokanee mortality has been observed in rotary screw traps below Coquitlam Dam, much of which has been attributed to high velocity contact with the tunnel walls.
- **Hatchery practices:** Chinook Salmon populations are augmented by hatchery production currently, and other populations have been historically augmented in the Coquitlam system. Hatchery production may have positive and negative effects on wild salmonid stocks. The hatchery increases abundance, which at times is necessary for maintaining runs. At the same time, wild populations may be harvested along with hatchery fish. Genetic diversity of wild salmon can be altered by hatchery practices and hatchery-raised fish compete for food and habitat with wild salmon. Under the Wild Salmon Policy, the Salmon Enhancement Program takes steps to minimize these risks.

Knowledge Status

Habitat

A detailed account of habitat impacts from hydropower development is provided in BCRP (2000) and is summarized on page 9. In addition to present and historic hydropower impacts there are impacts in the watershed from agriculture and urban land use, particularly in the lower reaches of the river.

Changes in operations as part the Coquitlam-Buntzen Water Use Plan have been implemented to improve aquatic habitat conditions (BC Hydro 2005). The expected benefits of the WUP include improvements to fish spawning and rearing habitat for Chinook, Chum, Coho and Pink Salmon, and Steelhead. Monitoring is underway to assess the effects of the operational changes.

Since 2000, many restoration projects have been undertaken by BCRP and community partners (e.g., North Fraser Salmon Assistance Project Society, GVRD Parks, Burke Mountain Naturalists, Colony Farm Park Association). The work has focussed on upgrading existing off-channel and tributary areas such as Archery Channel, Or Creek channel and ponds, Overlander channel and ponds in the upper reaches of the lower Coquitlam, Oxbow Lake, and the Grist/Maple channel in the lower reaches. New channels were constructed at Colony Farm. These restoration efforts have resulted in improvements to over 7,300 m^2 of spawning habitat and 54,130 m^2 of rearing habitat for Chum and Coho Salmon, with other species such as Steelhead and Cutthroat Trout also benefiting.

The Kwikwetlem Sockeye Restoration Program has led efforts to re-introduce and re-establish a sustainable Sockeye Salmon population into Coquitlam Reservoir for the last 12 years. Through these efforts, a knowledge base about current conditions and future directions for the Coquitlam Reservoir Sockeye Salmon reintroduction and population establishment has been built (Plate et al. 2014). In addition, Freshwater Fisheries Society of BC stocks Buntzen Lake with Rainbow Trout annually.

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 effects of previous restoration efforts and a need to develop detailed restoration plans to achieve long-term salmon conservation objectives
- There are various knowledge gaps with respect to feasibility of Sockeye Salmon re-introduction to the Coquitlam River Watershed. Any work must build upon the knowledge synthesis and re-establishment plan for Coquitlam Reservoir Sockeye Salmon (14.COQ.02), the Restoring Sockeye in Coquitlam Reservoir (COA-F18-F-2362), the tagging salmon in Coquitlam Reservoir (COA-F18-F-2485) and any subsequent work by the Kwikwetlem Sockeye Restoration Program. One critical uncertainty is the feasibility of providing safe and effective downstream passage for smolts from the reservoir to the lower river.
- Bull Trout/Dolly Varden stock status and distribution in the Coquitlam River Watershed is a continued uncertainty
- Cutthroat Trout stock status and trends, and limiting factors that could be addressed by restoration work

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:

1. **Sustain and increase the population viability of anadromous salmon and Steelhead.**
   Measures – Measures will be species- and project-specific.

2. **Sustain and increase the population viability of resident salmonids.**
   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.
Measures — There are no specific measures required at this time, aside from those associated with Objective 1 and 2.

ECOSYSTEM CHAPTER: WETLAND & RIPARIAN AREAS

Actions for Wetland and Riparian Areas

The Action Table in this document (see page 23) 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 Coquitlam 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 and soil conditions (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 (other than direct BC Hydro footprint impacts). The area of inundation has not increased since dam construction, but the productivity of adjacent habitats has continued to be affected, either directly or indirectly as a result of BC Hydro operations.

Some riparian and wetland restoration has been conducted by FWCP partners, particularly in the area of Colony Farms. However, some agricultural practices and urban encroachment have negatively affected wetland and riparian areas in the Lower Coquitlam River.

Significant changes include:

- Unknown loss of habitat from conversion to other land uses or succession to different habitat types; and,
- Deterioration in productivity from hydrology changes and stressors such as invasive species.

Changes in the abundance, distribution and productivity of wetlands and riparian habitat will result in species-specific impacts.

Knowledge Gaps

Extensive mapping, surveys and assessments of riparian and wetland areas have occurred in the watershed, as well as inventories for key species at risk. Additional inventory is required address other species of interest (see Action Table).

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 AREAS

Actions for Upland and Dryland

The Action Table in this document (see page 23) 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 Coquitlam 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 Coquitlam River Watershed, elevations vary from close to sea level to unvegetated alpine areas. Winters are wet and mild and summers are comparatively dry and warm. Upper elevations experience deep snowpacks as a result of winter precipitation. The watershed lies within the Georgia Depression Ecoprovince (Demarchi 1996) and low elevations are dominated by the Coastal Western Hemlock Dry Maritime (CWHdm), Submontane Very Wet Maritime (CWHvm1), and Montane Very Wet Martime (CWHvm2) subzone variants. 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*), Salal (*Gaultheria shallon*) and Dull Oregon-grape (*Mahonia nervosa*). 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 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

High levels of urbanization and gravel mining in the lower Coquitlam River watershed and forest-harvesting in the upper watershed have substantially altered upland and dryland habitats. Loss of upland habitat in the lower portion of the watershed, which historically comprised conifer and mixed wood forests, has been permanently loss to urban and suburban development. Land use restrictions established to protect the domestic water supply have limited development in the upper watershed.

Knowledge Gaps

Knowledge of species and ecosystems in upland and dryland areas of the Coquitlam River Watershed is limited because most projects have targeted riparian and wetland habitats in the southern portion of the watershed. Partly due to land access issues, there have not been extensive inventories targeting the upland habitats and north of the dam. However, species such as Peregrine Falcons and Western Screech-owls have been detected during the surveys that have taken place. Knowledge gaps to be filled in future years focus inventory of a number of species of interest as well as filling knowledge gaps identified in management plans and recovery strategies of Species At Risk known to be present in the watershed.

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., 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.

COQUITLAM 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	**COQ.ALL.RI.01.01 Develop a current habitat assessment map-P1**	**1**	Fish & Wildlife	Develop a **current habitat assessment map** for priority fish and/or wildlife species in the Coquitlam watershed. Habitats to be assessed & mapped include: • Wetlands • Riparian Areas • Stream 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 Mapping is to include as much on-the-ground information as possible relevant to the subject fish and/or wildlife species and should build upon existing mapping work in the watershed (e.g., FWCP projects 13.W.COQ.02 and COQHAB-0040, the Coquitlam River Watershed Roundtable Fish Habitat and Enhancement Projects Map, and the Level I Fisheries Habitat Assessment conducted by Instream Fisheries Research in 2014; and 16.W.COQ.02 Species at Risk Stewardship in the Coquitlam River and Buntzen Lake Watersheds or more recent). For fish, further development of the fish habitat assessment map could occur, which should inform 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.). Recommendations should be made through this work for future management actions and assessments.	Improved strategic planning for conservation and restoration opportunities.	Directed	Throughout

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Action #	**Ecosystem Chapter**	**Action Type**	**Priority Action Short Description**	**Priority**	**Target Species**	**Priority Action**	**Intended Outcome**	**Delivery Approach**	**Location**
2	All	Research & Information Acquisition	**COQ.ALL.RI.02.01 Conduct a limiting factors analysis-Lower Coquitlam River-P1**	**1**	Fish & Wildlife	Conduct a **limiting factors analysis** for priority fish and/or wildlife in the Coquitlam 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 considerate of the root causes of degraded habitats and limitations to productive potential. For fish, sub-basins for assessment include the Lower Coquitlam River (Priority 1) and the Upper Coquitlam including Coquitlam Reservoir and tributaries (Priority 2). Analyses should build upon previous 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, landowners and other land managers. The Coquitlam River Watershed Roundtable has developed the Lower Coquitlam River Watershed Plan (http://www.coquitlamriverwatershed.ca/content/watershed-plan) that considers a suite of limiting factors in the watershed and this plan must be consulted for further work in the watershed. *Please note that the FWCP may develop templates for this work. Please check with FWCP to see if these templates are available.	To determine cost-benefit of potential FWCP actions and support prioritization of future projects. Leads to the creation of robust habitat or species-based restoration plans for the watershed or sub-basins.	Open	Throughout
			COQ.ALL.RI.02.02 Conduct a limiting factors analysis-Upper Coquitlam incl. Coquitlam Reservoir&tributaries-P2	**2**					
			COQ.ALL.RI.02.03 Conduct a limiting factors analysis-Upper Coquitlam incl. Coquitlam Watershed-P2	**2**					
3	All	Research & Information Acquisition	**COQ.ALL.RI.03.01-Develop a comprehensive restoration and protection plan-Lower Coquitlam River-P1**	**1**	Fish & Wildlife	**Develop a comprehensive restoration and protection plan** for fish and/or wildlife in the Coquitlam 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: • 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	To determine high priority, cost-effective habitat and/or species-based actions that can be supported by the FWCP.	Directed	Throughout
			COQ.ALL.RI.03.02-Develop a comprehensive restoration & protection plan-Upper Coquitlam incl. Coquitlam Res.&tributaries-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**
3 cont.			**COQ.ALL.RI.03.03-Develop a comprehensive restoration and protection plan-Coquitlam Watershed-P2**	**2**		priorities; • Restoration priorities with rationale/discussion; • Selected indicators and performance standards for effectiveness monitoring program; and, • Monitoring protocol and schedule. 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, Sockeye, Coho, Chum and Pink Salmon, Steelhead/Rainbow Trout, Cutthroat Trout, Bull Trout, Nooksack Dace and Salish Sucker. High priority wildlife include bats, amphibians, and riparian-associated mammals and birds, as well as Category 1 wetland and riparian areas. Plans should be developed in association with local agency, First Nation and BC Hydro staff, landowners and other land managers. Sub-basins for fish plans include the Lower Coquitlam River (Priority 1) and the Upper Coquitlam including Coquitlam Reservoir and tributaries (Priority 2).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. A knowledge synthesis and re-establishment plan for Coquitlam Reservoir Sockeye Salmon (14.COQ.02) has been developed by the Kwikwetlem Salmon Restoration Program, and this plan must be consulted for further work on Sockeye Salmon. The Coquitlam River Watershed Roundtable has developed the Lower Coquitlam River Watershed Plan (http://www.coquitlamriverwatershed.ca/content/watershed-plan) and this plan must be consulted for further work in the Lower Coquitlam. All restoration work must consider potential impacts on archaeological heritage. *Please note that the FWCP may develop templates for this work. Please check with FWCP to see if these templates are available.			

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4	All	Habitat-based Actions	**COQ.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 16**), 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	**COQ.ALL.SB.04.02 Implement high priority species-based actions-P1**	**1**					
5	All	Land Securement	**COQ.ALL.LS.05.01 Conduct an options assessment for land securement-P2**	**2**	Fish & Wildlife	Considering ecosystem, conservation, and/or local management objectives, **conduct an options assessment for land securement** that establishes priority areas to be protected through 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	**COQ.ALL.LS.06.01 Land securement-P2**	**2**	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. Refer to options assessment findings, in **Action 5** above, before conducting land securement activities.	Conserve, protect and restore ecosystem function and resilience through land securement.	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**
7	All	Monitoring & Evaluation	**COQ.ALL.ME.07.01 Develop and implement an integrated monitoring plan for fish and/or wildlife -P1**	**1**	Fish & Wildlife	**Develop and implement an integrated monitoring plan for fish and/or wildlife** in the Coquitlam River 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
8	All	Monitoring & Evaluation	**COQ.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.	Assess success of habitat-based actions and support future planning and prioritization.	Open	Throughout
9	All	Monitoring & Evaluation	**COQ.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

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Action #	**Ecosystem Chapter**	**Action Type**	**Priority Action Short Description**	**Priority**	**Target Species**	**Priority Action**	**Intended Outcome**	**Delivery Approach**	**Location**
10	Rivers, Lakes & Reservoirs	Research & Information Acquisition	**COQ.RLR.RI.10.01 Assess Bull Trout/Dolly Varden stock status& distribution… determine opportunites for restoration-P1**	**1**	Bull Trout/Dolly Varden	**Assess Bull Trout/Dolly Varden stock status and distribution in the Coquitlam watershed and determine opportunities for restoration.** The study could include assessments of historical versus present status in the Upper Coquitlam. Any assessment/inventory should meet the criteria outlined in action 16.	Determine the current distribution and viability of Bull Trout/Dolly Varden and opportunities for restoration.	Open	Upper Coquitlam
11	Rivers, Lakes & Reservoirs	Research & Information Acquisition	**COQ.RLR.RI.11.01 Assess Pink & Chinook Salmon spawner distribution... Coquitlam River mainstem above Or Creek-P2**	**2**	Chinook Salmon & Pink Salmon	**Assess Pink and Chinook Salmon spawner distribution and density in Coquitlam River mainstem above Or Creek (reach 4)** and identify sites to restore Pink and Chinook Salmon spawning. This work must build upon that conducted in the Lower Coquitlam River Fish Productivity Index of the Coquitlam-Buntzen Water Use Plan. Any assessment/inventory should meet the criteria outlined in **Action 16.**	Sustain and restore habitat capacity and population viability of Pink and Chinook Salmon.	Open	Lower Coquitlam
12	Rivers, Lakes & Reservoirs	Habitat-based Actions	**COQ.RLR.HB.12.01 Implement habitat enhancements in Lower Coquitlam River-P1**	**1**	Anadromous & Resident Salmonids	**Implement habitat enhancements in Lower Coquitlam River.** 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 anadromous and resident salmonids.	Open	Lower Coquitlam

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13	Rivers, Lakes & Reservoirs	Habitat-based Actions	**COQ.RLR.HB.13.01 Improve rearing habitat capacity for Chinook & Coho Salmon & Steelhead-P1**	**1**	Coho Salmon & Steelhead	**Improve rearing habitat capacity for Chinook and Coho Salmon and Steelhead** in the Lower Coquitlam River. Examples include development of off-channel habitat and increasing pool, wood and boulder habitat.	Sustain and restore habitat capacity and population viability Chinook and Coho Salmon and Steelhead.	Open	Lower Coquitlam
14	Rivers, Lakes & Reservoirs	Habitat-based Actions	**COQ.RLR.HB.14.01 Identify and implement habitat enhancements in the Upper Coquitlam-P2**	**2**	Anadromous & Resident Salmonids	**Identify and implement habitat enhancements in the Upper Coquitlam**, including Coquitlam Reservoir 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 Coquitlam
15	Rivers, Lakes & Reservoirs	Species-based Actions	**COQ.RLR.SB.15.01 Continue technical feasibility assessment, monitoring...associated with Sockeye Salmon passage-P1**	**1**	Sockeye Salmon	**Continue technical feasibility assessment, monitoring and/or species-based actions associated with Sockeye Salmon passage at Coquitlam Dam** to support re-introduction of anadromous fish to the Upper Coquitlam system. Any work must build upon the knowledge synthesis and re-establishment plan for Coquitlam Reservoir Sockeye Salmon (14.COQ.02), the Restoring Sockeye in Coquitlam Reservoir (COA-F18-F-2362), the tagging salmon in Coquitlam Reservoir (COA-F18-F-2485) and any subsequent work by the Kwikwetlem Sockeye Restoration Program. One critical uncertainty is the feasibility of providing safe and effective downstream passage for smolts from the reservoir to the lower river. Proponents looking for an FWCP grant to evaluate opportunities to restore fish production above BC Hydro facilities that previously blocked fish passage are required to work through the Fish Passage Decision Framework (http://fwcp.ca/fish-passage-decision-framework/). Any application needs to be submitted through collaboration with the Kwikwetlem Sockeye Restoration Program.	Support Sockeye Salmon re-introduction above Coquitlam Dam.	Open	Lower Coquitlam/ Coquitlam Lake Reservoir/ Upper Coquitlam

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16	All	Research & Information Acquisition	**COQ.ALL.RI.16.01 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:** • The data collected will clearly inform a specific natural resource management decision or conservation action; this includes a clear understanding of: - 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: - 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. Species of interest reflect engagement from FWCP partners and include, but are not limited to: • Mesocarnivores. Conduct risk assessment and evaluate population sustainability through monitoring program as part of multi-carnivore surveys in the watershed. Species of interest: Pacific Marten, American Mink. If necessary, implement enhancement strategies to maintain sustainable populations. • Inventory required to assess if and where Long-Tailed Weasel (altifrontalis subspecies), wolverine and spotted skunk still occur in Lower Mainland watersheds. No specific surveys for the subspecies have been conducted to date, so unclear if the species are extant in these watersheds. • Snowshoe Hare, *washingtonii* subspecies. Inventory required to evaluate occurrences in watershed. • Short-Eared Owl. Inventory and landscape-level management.	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**
17	All	Habitat-based Actions	**COQ.ALL.HB.17.01 Implement priority species- and habitat-related conservation actions...-P1**	**1**	Wildlife Species at Risk	**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.** Conservation actions must be well informed by a clear and specific management objective and must be well informed by previous inventory in the watershed. • Management plan for the Mountain Goat (Oreamnos americanus) in British Columbia (B.C. Ministry of Environment 2010). • Management Plan for Roosevelt Elk in British Columbia (Ministry of Forests, Lands and Natural Resource Operations 2015). • Recovery Strategy for the Pacific Water Shrew (Sorex bendirii) in Canada (Environment Canada 2014). There is critical habitat mapped for the species in the watershed (CDC 2016). Priority 2. • Recovery strategy for the Northern Spotted Owl (Strix occidentalis caurina) in British Columbia (Environment Canada 2006). • Management Plan for the Peregrine Falcon, pealei subspecies (Falco peregrinus pealei) in British Columbia (B.C. Ministry of Environment 2016). Build upon 16.W.COQ.02 Species at Risk in the Coquitlam River and Buntzen Lake Watersheds. • Recovery plan for the Western Screech-Owl, kennicottii subspecies (Megascops kennicottii kennicottii) in British Columbia (Ministry of Environment 2013). Build upon 16.W.COQ.02 Species at Risk in the Coquitlam River and Buntzen Lake Watersheds; there is potential for establishment of additional survey stations in addition to repeating previous stations. • Management Plan for the Great Blue Heron fannini	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**
17 cont.						subspecies (Ardea herodias fannini) in Canada [Proposed] (Environment Canada 2016). Are of interest: lower Coquitlam. Foraging observations have been made as part of multi-year SAR project (16.W.COQ.02), but no nests or colonies detected via that method. Any wetland, riverine or fish restoration activities will benefit herons. Any detected colonies should have trees mapped and protected (possibly identified as wildlife trees). Nest tree recruitment will likely have long-term benefits for this species. Build upon 16.W.COQ.02 Species at Risk in the Coquitlam River and Buntzen Lake Watersheds. • Recovery Strategy for the Common Nighthawk (Chordeiles minor) in Canada (Environment Canada 2016). • Recovery Plan for the Barn Owl (Tyto alba) in British Columbia (B.C. Ministry of Environment 2014). Build upon 16.W.COQ.02 Species at Risk in the Coquitlam River and Buntzen Lake Watersheds. • Recovery plan for the Painted Turtle – Pacific Coast Population (Chrysemys picta pop. 1), in British Columbia (The Western Painted Turtle Recovery Team 2016). Build upon 13.W.COQ.02 Species at Risk Conservation and Stewardship in the Coquitlam Watershed and coordinate with Metro Vancouver Parks, Western Painted Turtle Recovery team. • Management Plan for the Coastal Tailed Frog (Ascaphus truei) in Canada [Proposed] (Environment and Climate Change Canada 2016). Build upon 13.W.COQ.02 Species at Risk			

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Action #	**Ecosystem Chapter**	**Action Type**	**Priority Action Short Description**	**Priority**	**Target Species**	**Priority Action**	**Intended Outcome**	**Delivery Approach**	**Location**
17 cont.						Conservation and Stewardship in the Coquitlam Watershed. • Management Plan for the Northern Red-legged Frog (Rana aurora) in Canada [Proposed] (Environment Canada 2016). Build upon 16.W.COQ.02 Species at Risk in the Coquitlam River and Buntzen Lake Watersheds. • Management Plan for the Western Toad (Anaxyrus boreas) in British Columbia (Provincial Western Toad Working Group 2014). Build upon 16.W.COQ.02 Species at Risk in the Coquitlam River and Buntzen Lake Watersheds. Identify threats to migration routes during summer emergence and recommend or implement mitigation for these threats (e.g., fencing and underpass crossings designed to keep toads from crossing roads at problem areas like Quarry Rd., etc.). • Recovery Strategy for the Oregon Forestsnail (Allogona townsendiana) in Canada (Environment Canada 2016). Build upon 16.W.COQ.02 Species at Risk in the Coquitlam River and Buntzen Lake Watersheds.			
18	Upland & Dryland	Research & Information Acquisition	**COQ.UAD.RI.18.01 Year-round acoustic monitoring…to determine if bats are active during winter-P3**	**3**	Bats	**Year-round acoustic monitoring** in the lower mainland watersheds is a priority to find migration routes and timing and to determine if bats are active during winter. Proponents should participate in the the North American Bat Monitoring Program acoustic monitoring and BC Community Bat Program Roost Counts.	Maintain or, where feasible, increase the abundance of species of interest.	Open	Throughout
19	Upland & Dryland	Habitat-based Actions	**COQ.UAD.HB.19.01 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 maternity roosts and winter hibernacula**; 3) Pursue **protection of hibernacula and maternity roosts** (e.g., critical habitat, WHAs or wildlife habitat feature designations).	Increased knowledge of species' habitat requirements and habitat protection opportunities.	Open	Throughout

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20	Upland & Dryland	2-Habitat-based Actions	**COQ.UAD.HB.20.01 Winter range securement, enhancement and access management-P2**	**2**	Black-Tailed Deer	**Winter range securement, enhancement and access management** would be beneficial, but opportunities are limited.	Sustain and increase the food, social, ceremonial, recreational and/or commercial use of fish and wildlife resources.	Open	Throughout
21	Upland & Dryland	Habitat-based Actions	**COQ.UAD.HB.21.01 Restore and enhance the supply of cavities in trees for large cavity users-P2**	**2**	Northern Flying Squirrel + Pacific marten	**Restore and enhance the supply of cavities in trees** for large cavity users (e.g., Pacific marten, flying squirrels, various bird species) after mesocarnivore surveys have been completed. Identify factors that control formation of large cavities in trees to better manage this population-limiting resource for priority wildlife species in the watershed. Increase education about the importance of wildlife trees to reduce their removal as "danger trees".	Protect and/or restore rare and ecologically significant upland/ dryland habitat.	Open	Throughout
22	All	Habitat-based Actions	**COQ.ALL.HB.22.01 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/).	Varied types of species and habitat conservation, protection and enhancement opportunities.	Open	Throughout

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23	Wetland & Riparian	Habitat-based Actions	**COQ.WAR.HB.23.01 Implement wetland&riparian restoration projects…through inventory, mapping or assesments-P2**	**2**	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. Build upon 16.W.COQ.01 Coquitlam River Riparian Planting projects and restoration suggestions in the Habitat Enhancement Conceptual Plan for Priority Species at Risk in Mundy Park & Eagle Mountain Park, Coquitlam, BC (within 16.W.COQ.02 Species at Risk in the Coquitlam River and Buntzen Lake Watersheds). This can include managing invasive plants as needed.	Protect, restore and/or create new wetland and riparian habitat.	Open	List of candidate locations in plan
24	All	Research & Information Acquisition	**COQ.ALL.RI.24.01 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: Yellow cedar, Streambank Lupine, Nutall's Waterweed, Green-sheathed Sedge, Northern Water-meal.	Habitat restoration opportunities. Maintain or, where feasible, increase the abundance of species of interest. Prevention of destruction of at-risk habitats while carrying out other projects.	Open	Throughout

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