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FISH AND WILDLIFE  
COMPENSATION PROGRAM

COQUITLAM/BUNTZEN  
WATERSHED  
*SALMONID ACTION PLAN*  
FINAL DRAFT

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# Coquitlam – Buntzen Salmonid Action Plan

## 1. INTRODUCTION

The Fish and Wildlife Compensation Program (FWCP): Coastal Region evolved from its origin as the Bridge-Coastal Restoration Program (BCRP), a program initiated voluntarily by BC Hydro in 1999 to restore fish and wildlife resources that were adversely affected by the footprint of the development of hydroelectric facilities in the Bridge-Coastal generation area. Footprint impacts include historical effects on fish and wildlife that have occurred as a result of reservoir creation, watercourse diversions and construction of dam structures.

In 2009, the program developed a strategic framework that guides overall planning for compensation investments (MacDonald 2009). The framework has guided the development of strategic plans for each watershed within the FWCP program area, which are in turn informing action plans that focus on specific priorities within each watershed (Figure 1).

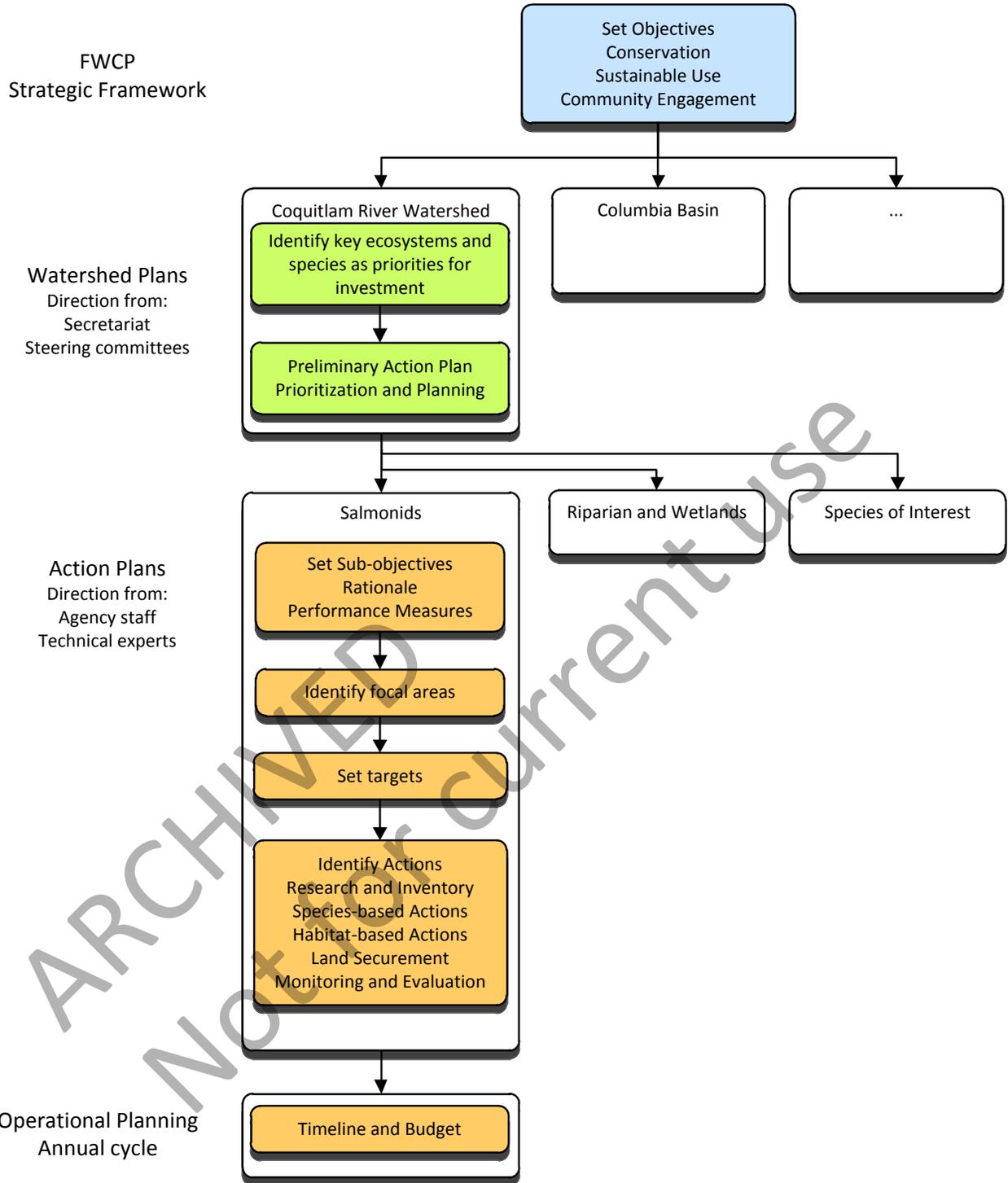
This Salmonid Action Plan sets out priorities for the Fish and Wildlife Compensation Program to guide projects in the Coquitlam River – Buntzen Lake project area. It identifies actions to be undertaken throughout the Coquitlam River and Buntzen Lake watersheds in support of salmonid fish species. The plan builds on the FWCP's strategic objectives and the Coquitlam River Watershed Plan (FWCP 2011). Action plans have also been developed for riparian and wetland areas and species of interest; and some actions may be complementary across the different plans.

The actions and priorities outlined in this plan have been identified through a multi-stage process involving BC Hydro, Fisheries and Oceans Canada (DFO), Canadian Wildlife Service (CWS), Ministry of Environment (MOE), local First Nations, and local communities. Initial priorities were developed through consultation with agency staff. These priorities were then reviewed and discussed at a workshop<sup>1</sup> to allow First Nations, public stakeholders, and interested parties to comment and elaborate on the priorities.

It is important to understand, however, that planning priorities within action plans may not translate immediately into funded projects. Limited program funding requires that priority-setting has to also be developed across the program as a whole, not just within action plans. The process of selecting which actions will be implemented in any given year will occur during the annual implementation planning cycle.

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<sup>1</sup> Coquitlam (17 February, 2009)



**Figure 1. Relationship between the Salmonid Action Plan and higher level planning and objectives.**

## 2. OVERVIEW CONTEXT

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 watershed area is 253 km<sup>2</sup> (193 km<sup>2</sup> above the dam and 60 km<sup>2</sup> below), with elevations ranging from 153 m to over 2000 m. The Buntzen Lake watershed has an area of 21 km<sup>2</sup>, with elevations of 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 system is in the asserted traditional use area of five First Nations, including Kwikwetlem First Nation, Tseil-Waututh First Nation, Katzie First Nation, Squamish First Nation and Musqueam First Nation. It is also within the asserted traditional territory of the Sto:lo Nation. Downstream of the Coquitlam Dam the Coquitlam River flows through the municipalities of Coquitlam and Port Coquitlam. The Upper Coquitlam watershed 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.

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 Lake 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<sup>3</sup>/s.

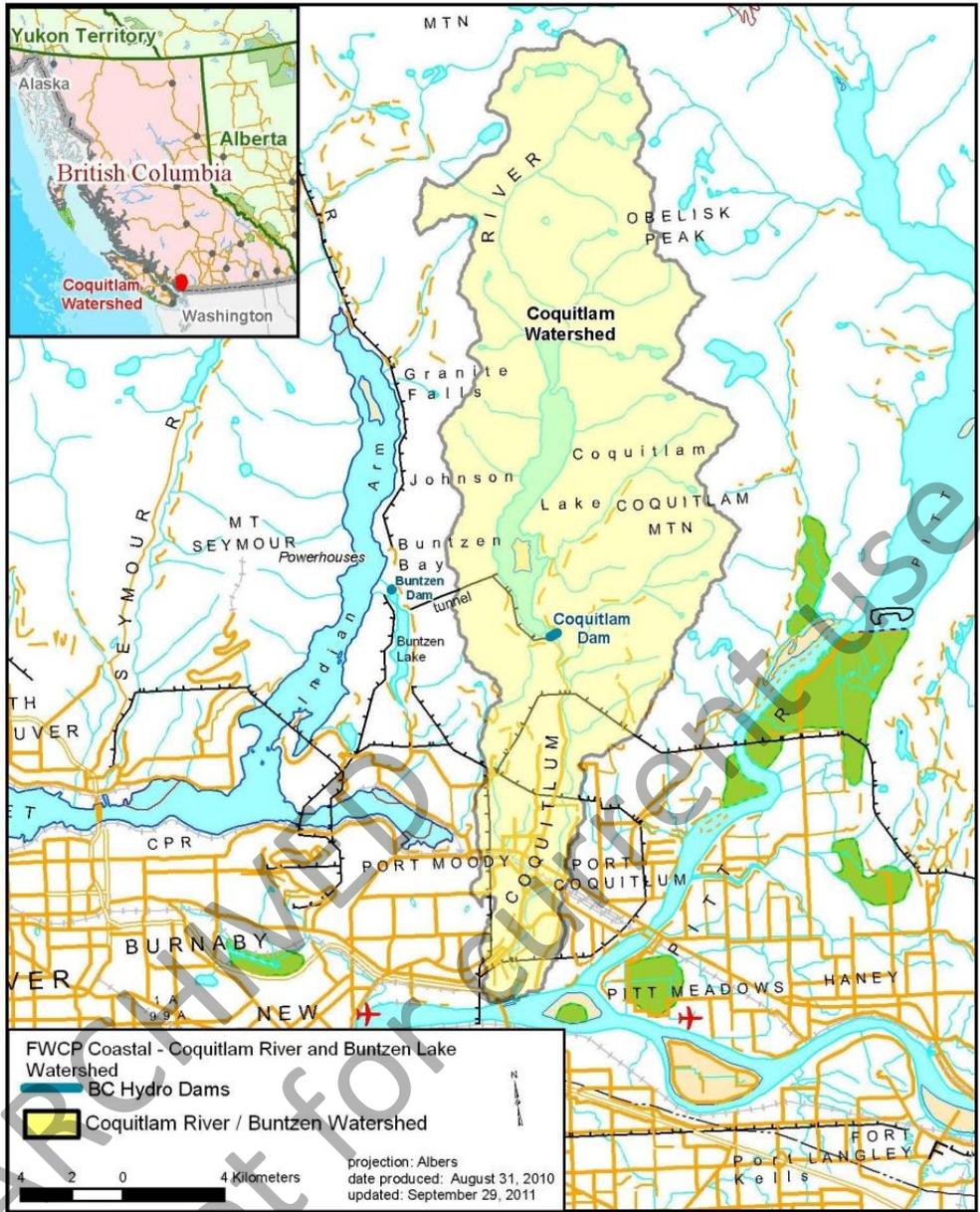


Figure 2. The Coquitlam River hydropower project.

## 2.1. FISH AND FISH HABITAT IN THE COQUITLAM RIVER AND BUNTZEN LAKE WATERSHEDS

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 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). Also as part of the WUP, there is a program assessing the feasibility 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, redband 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, redband 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.

Nooksack dace and Salish sucker may occur in the Coquitlam watershed, but their presence has not been confirmed (M. Pearson, Pearson Ecological, personal communication). Both species are listed as Endangered under the Species at Risk Act, and they are priority 1 species under the BC Conservation Framework. Determining whether these species occur in the Coquitlam watershed is a high priority for DFO. The primary actions at this time are to complete inventory and genetic analyses.

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 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 occur, particularly in smaller tributaries and in headwaters (Rick Taylor, UBC, personal communication). For convenience we refer to char in this report as bull trout, but acknowledge the considerable uncertainty regarding proper identification.

## 2.2. IMPACTS AND THREATS

Fish and Wildlife habitat and species have been significantly altered due to the construction of the dams, the development of hydro-power, and alterations in the hydraulic regimes of the systems. The following summary of the primary footprint impacts is derived from:

- Bridge-Coastal Restoration Program: Revised Strategic Plan, Volume 2: Watershed Plans, Chapter 8: Coquitlam River (December 2003);
- Coquitlam River Water Use Plan Consultative Committee Report (August 2003); and

- Findings in the Community Workshop (Coquitlam, 17 February, 2009).

**Hydro-related Impacts** — The impacts that occurred are based on location in the watershed as follows:

*Upstream of Coquitlam Dam.*

1. The reservoir flooded 1.3 km of mainstem, 6 km of tributary channels, and 29 ha of associated riparian areas.
2. Annual drawdown of about 17 m affects access to tributaries and reduces littoral productivity.
3. Drawdown in fall increases turbidity in the reservoir.

*Coquitlam Dam and Lower Coquitlam River.*

4. Dam footprint led to loss of instream, riparian and upland habitats, and potentially the loss of lake outlet spawning habitat.
5. The dam blocked access to Coquitlam Lake and upstream areas for anadromous salmonids and migratory resident fish.
6. The dam reduced recruitment of gravel and large woody debris to downstream habitats.
7. During construction of the dam large volumes of sediment were sluiced, which likely degraded downstream habitats.

*Buntzen Lake.*

8. Buntzen Lake Reservoir flooded 2 km of mainstem and 0.5 km of tributary habitats, and their associated riparian areas.
9. Inflows from diversion dilute productivity.
10. Buntzen Dam footprint led to loss of instream, riparian and upland habitats, and potentially the loss of lake outlet spawning habitat.

*Diversions*

1. Entrainment occurs at Coquitlam diversion, Coquitlam Dam and Buntzen diversions, but the effects are unquantified.
2. 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, migration, seasonal temperatures and stream productivity.
3. There are footprint and salinity impacts on the marine foreshore at Buntzen Powerhouse. Chinook salmon are attracted to the tailrace area, but the effects of this are unquantified.

**Non-Hydro Impacts** — Other impacts on fish in the Coquitlam River watershed include historic effects of logging activities, mill operations, dredging and gravel mining, urbanization and domestic water withdrawal. Historical changes in the watershed are dominated by hydroelectric footprint impacts, primarily flow reduction and migration blockage, and by urban development. 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. There is an array of urban, industrial and recreational uses that affect aquatic habitat and limit the scope of fish habitat restoration opportunities available in this watershed.

### 2.3. LIMITING FACTORS

Limiting factors vary among species and include availability of useable habitat, access to habitats (e.g., passage) and nutrient limitations. There are both natural and human-induced aspects, and the latter include effects from hydropower and other developments. The factors are summarized here.

1. **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 and steelhead, and spawning habitat is likely limiting for pink and chum.
2. **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.
3. **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.
4. **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.
5. **Entrainment:** The extent and effect of entrainment from Coquitlam Lake Reservoir is unknown.

6. **Hatchery practices:** Chinook 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.

## 2.4. TRENDS AND KNOWLEDGE STATUS

### HABITAT TRENDS

A detailed account of habitat alterations from hydropower development is provided in BCRP (2003). 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 the following improvements to fish habitat within the Coquitlam River: spawning and rearing habitat for steelhead trout and Chinook salmon, flows for short term survival, spawning and rearing, and invertebrate habitat. The WUP is not expected to affect fish productivity in Coquitlam Lake Reservoir or Buntzen Lake Reservoir. Monitoring is underway to assess the effects of the operational changes.

Since 2000 several restoration projects have been undertaken by BCRP and community partners (e.g., North Fraser Salmon Assistance Project, 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, and the Grist/Maple channel in the lower reaches. New channels were constructed at Colony Farm. These restoration efforts have resulted in improvements to 7,300 m<sup>2</sup> of spawning habitat and 54,130 m<sup>2</sup> of rearing habitat for chum and coho, with other species such as steelhead also benefiting.

### STOCK TRENDS

**Coho** — Coho are DFO's highest priority in the Coquitlam system. Historically, coho likely accessed the upper reaches of the watershed, but are now confined to the lower Coquitlam River. The population is thought to be stable, but below potential for a stream of this size and location. Based on a coho production model by Bradford et al. (1997) an interim target has been set at 1400 smolts / km. Monitoring associated with the WUP indicates current production of 1000 to

1200 smolts / km, most of which is coming from off-channel habitats. Coho escapements to Coquitlam River from 2002 to 2008 were 1,200 to 3,200 adults (or 45 to 124 females / km) and likely exceeded that necessary to seed available juvenile habitat. Options for new restoration projects appear to be limited and pose some engineering challenges. Projects that provide small incremental improvements appear to offer the best options at this time.

**Pink** — Pink are the second principal restoration priority for DFO as the agency is attempting to restore the population after it was extirpated. DFO has set an interim target escapement for pink salmon at 15,000 spawners (or alternatively 1 million pink fry), and considers this a modest target, consistent with that set for the Alouette River, which has similar issues. Pink salmon are an important source for marine derived nutrients and an important prey for rearing coho. Adult pink escapements now range from 2,900 to 5,300 adults and yield 180,000 to 320,000 fry (Decker et al. 2010). Pink salmon tend to spawn in upper portions of the lower Coquitlam River, which is less influenced by perturbations than areas downstream of Or Creek.

**Chinook** — DFO regards Chinook as the next priority in the Coquitlam system, after coho and pink salmon. Hatchery augmentation has been used since the mid 1990s when Harrison stocks were transplanted. Prior to 2007 estimated escapements were 100 to 300 adults; however, the population has increased in recent years, in part due to increased augmentation from the hatchery (Decker et al. 2010). DFO has set an interim escapement target for Chinook salmon of 500 naturally producing adult spawners. The best opportunities to improve spawning are likely located upstream of Or Creek; Chinook salmon would also benefit from the development of off channel habitats in the lower Coquitlam, particularly within the tidal reach.

**Chum** — Chum escapements have been increasing over the past several years; adult escapements were estimated to be 12,000 to 54,000 adults from 2002 to 2009 for the lower Coquitlam. Spawning habitat does not appear to be limiting for chum at this time. Many of the restoration projects already constructed for coho salmon in the Coquitlam River will provide benefits for chum salmon as well and expectations are that future coho projects will also provide some benefits. DFO has set in interim escapement target of 10,000 spawners based on historic records. Additional restoration works directed at chum are considered by DFO to be a low priority at this time, though monitoring of outmigration to determine population status and trends remains a high priority. This monitoring is currently funded by the WUP.

**Sockeye** — The Coquitlam River originally had a stock of early run sockeye, that was extirpated by the dam. There is currently no sockeye run in the Coquitlam. BC Hydro has a decision framework for evaluating the re-establishment of fish passage on current dams (BC Hydro 2008), and the agencies, community groups, First Nations and BC Hydro are currently working through the decision process for the Coquitlam-Buntzen system.

**Steelhead** — Steelhead are the highest priority for MOE in the Coquitlam River. Current steelhead escapements are in the order of 200-300 adults. MOE has established a target of 7,000 smolts and 800 adults, based on habitat capacity and assumed marine survival of 13 %. MOE has also identified a Conservation Concern level of approximately 240 adults, which suggests that currently the Coquitlam River steelhead stock is at or near this level.

Redd counts during 2005-2009 suggested that steelhead escapements were 230-870 adults (24 to 80 adults / km) and were well above that necessary to seed available juvenile habitat (Decker et al. 2010). Steelhead did much better under the second trial flows of the WUP in 2009. Several opportunities exist for restoring steelhead habitat, including establishing new side channel sites and creating parr habitat by installing LWD and pools in the Coquitlam mainstem.

It was noted at the workshop that steelhead numbers have been declining since augmentation at the hatchery has recently been discontinued.<sup>2</sup>

**Cutthroat and Rainbow trout** — There is limited knowledge of cutthroat trout status and trends, or opportunities for restoration in the Coquitlam system. Coastal cutthroat trout are blue-listed and therefore a high priority. There appear to be several high priorities for restoration work, including assessment of tributaries to determine current cutthroat use, limiting factors and potential restoration opportunities, assessment of issues related to tributary access, improved access to tributaries by removal of, or passage around, man-made obstructions.

Buntzen Lake and Anmore Creek support rainbow and cutthroat trout, but opportunities for restoration are likely confined to Anmore Creek. MOE staff indicated that a feasibility assessment should be undertaken to determine restoration opportunities in Anmore Creek.

MOE staff recognize that currently there is no public access to the upper Coquitlam because it is protected as a Metro Vancouver drinking water source. Consequently, there is little information about fish use and few opportunities to promote or develop fishing opportunities. Therefore MOE staff do not see restoration above the dam as a priority at this time.

**Other fish** — Eulachon are an important fish, particularly for the Kwikwetlem First Nations, however, their status appears to be declining (BCRP Coquitlam River Watershed Plan Update Report of Public Workshop February 17, 2009).

## KNOWLEDGE GAPS

Knowledge gaps vary among species. Steelhead, chum, coho and pink salmon have been monitored steadily since 2002 as part of the WUP monitoring program.

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<sup>2</sup> At the workshop there was an offer by the hunting and fishing club to donate 10,000 smolts at no cost to the province.

Consequently, there is good information on current habitat and population status and trends in the lower river. Biotic response to previous restoration works and assessing further restoration opportunities remains a knowledge gap, particularly for coho and steelhead. Opportunities for increasing pink salmon spawning area are not well known. Very little is known about cutthroat status and trends, and limiting factors that could be addressed by restoration work. There is also very little known about the status of eulachon or white sturgeon within the project area, or opportunities for restoration projects to address these species.

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### 3. ACTION PLAN OBJECTIVES, MEASURES AND TARGETS

Clear and realistic management objectives are necessary to guide information acquisition and prioritize management actions. Priority actions and information needs will change as both improvements to the system are realized and information is gained. The current plan reflects the information available and values expressed by stakeholders (FWCP partners, First Nations and local communities) through reports, interviews and regional workshops held between 2009 and 2011.

#### 3.1. OBJECTIVE AND TARGET SETTING

The following terminology is used in this report.

Objectives:	Objectives are high-level statements of desired future conditions (outcomes), consistent with FWCP partner mandates and policies.
Sub-objectives and Status Indicators:	Sub-objectives are detailed statements of desired future conditions within objectives, from which status indicators can be derived and alternative management actions evaluated. Sub-objectives and indicators provide the details necessary to translate policy into actions and to evaluate their consequences. They may be arranged hierarchically within objectives, and usually indicate conditions necessary to attain the objective to which they refer.
Measures:	Measures are specific metrics whose values indicate the degree to which desired future conditions have been achieved. They can be either qualitative or quantitative. There is a preference to develop the latter where possible for ease of monitoring.
Targets:	Targets are the values of measurable items that indicate the attainment of a desired condition. In the current context these may be expressed as a single value or as a range to acknowledge the inherent variability of ecosystems.
Actions:	Management actions, plans or policies for achieving the objectives.

Objectives are the “ends” or the outcomes we ultimately care about. Actions are the “means,” or the things we do to achieve them. This report focuses on describing the actions required to achieve the objectives in relation to Salmonid species and fish in general. Actions relating to specific species or habitats may also be related to actions in other Action Plans such as the Riparian and Wetlands or Species of Interest plans.

## 3.2. OBJECTIVES, MEASURES AND TARGETS

Management objectives are common to all locations in the Coquitlam River and Buntzen Lake watersheds, although the species of interest vary among locations and thus the list of indicators and targets may differ.

This section briefly summarizes the objectives, sub-objectives and status indicators. While the objectives are expected to remain stable over time, the indicators and targets may evolve as management priorities for agencies shift, or new information becomes available.

There are two management objectives for salmonids in the Coquitlam system:

1. Conservation – Ensure a productive and diverse aquatic ecosystem,
2. Sustainable Use – Maintain or improve opportunities for sustainable use.

Supporting these objectives are sub-objectives that break each into its key components and provide further clarity.

### **Objective 1. Ensure a productive and diverse aquatic ecosystem.**

**Rationale** — This objective addresses overall ecosystem integrity and productivity and directs compensation activities to developing productive, useable aquatic habitats. Where cost-effective opportunities exist, compensation works will be aimed at aiding multiple fish species.

There are two sub-objectives, which divide salmonids into anadromous and resident species, since priorities tend to fall along these lines in different locations in the watershed.

1. Maximize the viability of anadromous salmon and steelhead,
2. Maximize the viability of resident salmonids.

The sub-objectives are supported by the following status indicators:

1. Anadromous salmon and steelhead
  - a. coho salmon
  - b. pink salmon
  - c. Chinook salmon
  - d. chum salmon
  - e. sockeye salmon
  - f. steelhead trout
2. Resident salmonids
  - a. cutthroat trout
  - b. rainbow trout
  - c. bull trout

The indicators focus on species of greatest management concern. There is a tacit assumption that these are to some extent true indicator species and that meeting targets for these species will support conservation of other fish species.

There are different priority species in different parts of the Coquitlam system. Projects need not focus solely on these species, but they are the species of greatest interest to most stakeholders. From a conservation perspective, the priorities are as follows.

Coho is the highest priority for DFO in the lower Coquitlam, and pink salmon are also a high priority as stocks are rebuilt after being extirpated. There are opportunities to enhance Chinook and coho habitat in the lower Coquitlam River, which would likely benefit other species also. The chum salmon population is currently healthy and is a lower priority for DFO relative to other anadromous salmon. The agencies and other stakeholders support feasibility studies funded by the WUP monitoring program regarding the re-establishment of a sockeye stock in the Coquitlam.

Cutthroat and steelhead are high priorities for MOE in the lower Coquitlam River. The steelhead population is at or near the Conservation Concern level. Relatively little is known about cutthroat trout, rainbow trout and bull trout population status, distribution and opportunities for restoration.

**Measures** — Measures for the sub-objectives relate to the long-term viability of indicator fish populations, and may include distribution, population structure, abundance, and size or age distribution. At this time, the focus will be on abundance. Compensation activities may focus on improving habitat, but success will ultimately be assessed with measures of abundance. Abundance is currently measured through escapement estimates, snorkel swims, and Water Use Plan monitoring activities, such as the Coquitlam fish productivity indexing program (Decker et al. 2010). Where necessary, additional monitoring may be required for the compensation program to assess progress under this objective.

**Targets** — Species targets were determined by DFO and MOE and are indicated in Table 1.

**Table 1: Species management targets by location in the Coquitlam system.**

Location	Species	Target (5 year average)
Lower Coquitlam	Coho	1,400 smolts / km
	Pink	15,000 spawners (or 1 million fry)
	Chinook	500 naturally spawning adults
	Chum	10,000 spawning adults.
	Sockeye	no target; work is ongoing with assessing re-anadromization of reservoir kokanee.
	Steelhead	7,000 smolts and 800 adults, based on 13% marine survival.
	Cutthroat	no target
	Rainbow	no target
Coquitlam Reservoir and Upper Coquitlam	Cutthroat	no target
	Rainbow	no target
	Bull Trout	no target
	Kokanee	no target

**Objective 2. Maintain or improve opportunities for sustainable use.**

**Rationale** — 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 objective 1 also support this sustainable use objective. Although there are no direct actions for improving sustainable use at this time, it is conceivable that projects aimed at generally improving opportunities or increasing the participation in the fisheries could be identified by the program partners in the future. As noted earlier, much of the headwaters and the reservoir are located within Metro Vancouver’s drinking water supply area, so access by the public is limited. As a result, there are very limited opportunities to develop angling or harvest opportunities in this part of the watershed.

As additional context, it should be noted that fisheries management agencies have an overall responsibility to manage the fisheries resource at a level of abundance and distribution to support First Nations’ traditional uses and rights. These responsibilities are dealt with through the ongoing process of decision-making, which is not a formal part of this FWCP plan. In addition to this, First Nations’ interests in overall conservation and sustainable use benefits have been incorporated into the development of this plan.

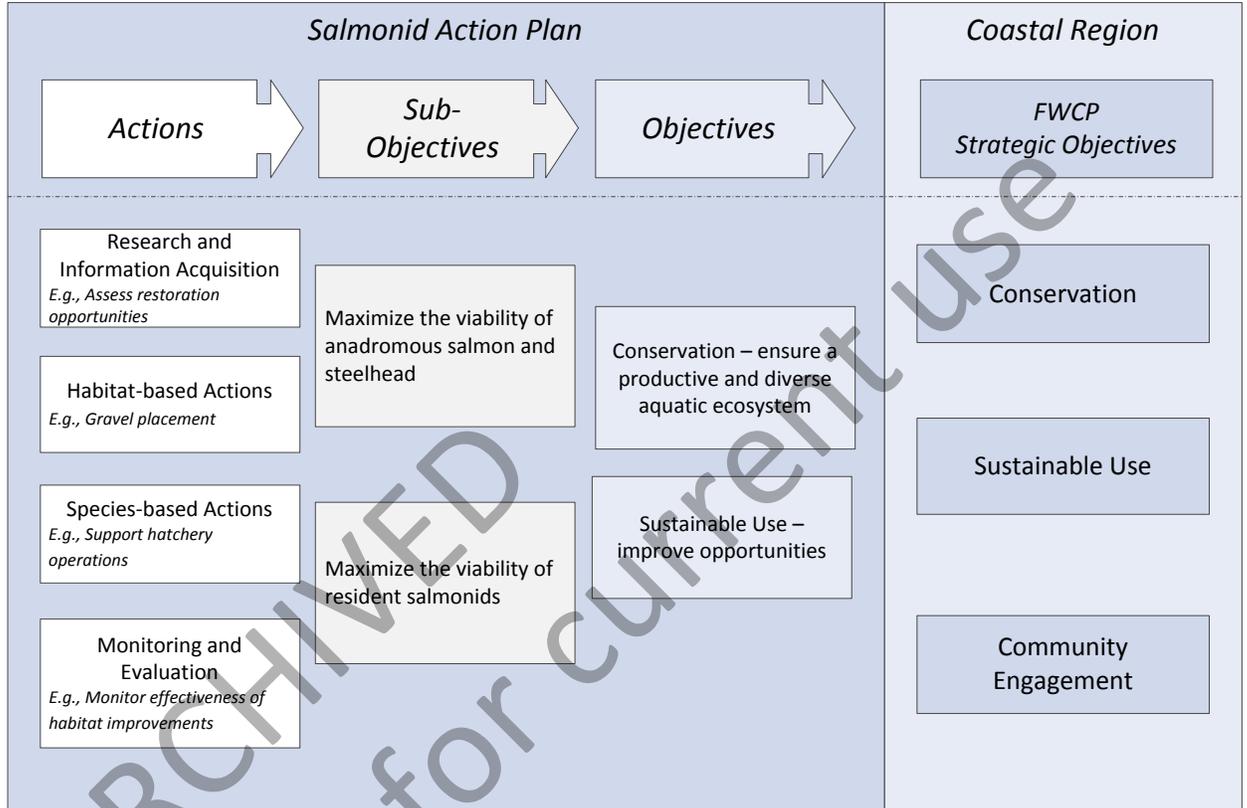
**Measures and Targets** — There are no specific measures or targets required at this time, aside from those associated with objective 1.

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.

## 4. ACTION PLAN

### 4.1. OVERVIEW

The Action Plan has many individual actions, which are presented in Section 4.2. Some actions support multiple sub-objectives, which in turn support multiple objectives. Figure 3 provides an overview of the link between actions and objectives.



**Figure 3: Relationship between actions, sub-objectives and objectives in this Salmonid Action Plan and the FWCP strategic objectives in the Coquitlam-Buntzen Watershed Plan.**

### 4.2. COMPONENTS

This section presents the main actions (Table 2) along with the supporting rationale for why the actions are required and what they will achieve. Actions are organized under five broad categories: Research and Information Acquisition, Habitat-based Actions, Species-based Actions, Land Securement and Monitoring and Evaluation. Also provided are priority ratings to guide investment planning efforts. Actions are assigned priorities from 1-3. Note that low priority actions are not included in the table.

**Table 2: Actions with associated priorities and target species in the Coquitlam River and Buntzen Lake watersheds.**

Actions	Lower Coquitlam	Coquitlam Lake Reservoir	Upper Coquitlam	Buntzen	multiple species	Anadromous					Resident	
						Coho	Pink	Chinook	Chum	Sockeye	Steelhead	Cutthroat
<b>Research &amp; Information Acquisition</b>												
Assess the potential for creating new rearing habitat for coho, steelhead and Chinook, such as off-channel and tributary areas.	1					x		x			x	
Assess the potential for joint flood control and habitat improvement projects.	1				x							
Continue to collect baseline data for anadromous salmonids in relation to re-introduction above Coquitlam Dam.	1	1	1		x							
Assess pink and Chinook spawner distribution and density above Or Creek. (The study would augment results from Decker et al. 2010.)	2						x	x				
Identify sites and opportunities between Or Creek and the dam to enhance pink and Chinook spawning.	2						x	x				
Assess areas where stranding may occur, such as perched side channels, to identify areas that would benefit from re-contouring.	2				x							
Assess feasibility of steelhead augmentation through hatchery operations in support of targets.	2									x		
<b>Habitat Based Actions</b>												
Maintain existing constructed habitat enhancements for all salmonids.	1				x							
Identify and undertake opportunities to create coho and steelhead parr habitat by installing large woody debris and pools in the Coquitlam mainstem.	1					x				x		
<b>Species Based Actions</b>												
Support hatchery operations for Chinook in relation to targets.	1							x				
Support hatchery operation for pink salmon to support recovery of the stock.	1					x						
<b>Land Securement</b>												
There are possible opportunities in the lower Coquitlam where land securement may address fisheries management objectives.	2				x							
<b>Monitoring &amp; Evaluation</b>												
Assess efficacy of habitat enhancements undertaken by the program	2				x							
Assess adult returns and out-migrating smolts as a measure of overall fish production in relation to specified targets.	2				x							

**Rationale.**— To support targets for anadromous salmon and steelhead a number of actions are proposed. Most actions focus on improving habitat for different species and life stages, but there is much we don't know biologically and physically about the species and habitats of interest, so actions also include collecting information to help evaluate and implement compensation options, and assessing performance of implemented restoration activities.

Compensation requires increasing present biological productivity to offset hydro development-related declines in productivity. There are myriad ways to compensate for fisheries impacts, and some work better for some species than others and some may be more suited to certain physical settings. To make informed choices on implementing the most cost-effective projects requires understanding what is possible and the costs and benefits of different approaches. More detailed options assessments are required in some circumstances so that costs and projected benefits can be better understood when prioritizing among potential projects. This would aid priority setting both within and among waterbodies within the Coquitlam system.

FWCP (BCRP) and other programs have completed a number of habitat enhancements in the Coquitlam system, particularly in the lower Coquitlam River.

Past projects include upgrading existing off-channel and tributary areas, constructing new channels, and improving spawning and rearing habitat for chum and coho, with other species such as steelhead also benefiting. Certain key species such as coho, pink, Chinook, steelhead and cutthroat would benefit from additional restoration efforts. DFO has indicated that the agency's main priorities for restoration in the lower Coquitlam are coho, Chinook and pink salmon. Chum populations are relatively healthy and at or near capacity, but continued monitoring is needed to assess trends.

There are limited opportunities to restore and enhance habitats in the lower Coquitlam, due primarily to constraints of urban development. The historically diminished flow in the lower Coquitlam River combined with dyking and flood prevention has limited access to off-channel areas and tributaries. There are possible opportunities to increase access to existing channels or develop new habitat areas through the removal of man-made obstructions, but new works would have to work within constraints of flood management and property ownership.

Steelhead stocks are a conservation concern and MOE has indicated that rearing habitat for parr is limiting. There is little information on cutthroat trout stocks, and this knowledge gap should be addressed to identify opportunities for restoring important habitats for this species.

BCRP funding has typically not been directed at funding of hatchery operations, but program partners have a responsibility for management and development sustainable fisheries, and may consider these fisheries issues under the compensation program.

Monitoring is a cornerstone of good resource management because it provides information on present status and trends and allows post-implementation assessment of management decisions and programs. Monitoring provides direction on adjustments that may be necessary. There are multiple elements related to anadromous salmon and steelhead that require monitoring. Realistically, monitoring will likely focus on abundance of different life stages of sportfish and species of concern, and the level of effort will likely vary among locations and species. Results of monitoring should feed directly into compensation program evaluation and help revise objectives and targets, where necessary. Special care will be required to ensure that implementation and monitoring of FWCP: Coastal projects complements that of the Water Use Plan.

**Sub-objective 2: Maximize the viability of resident salmonids.**



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### Personal Communication

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