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FISH AND WILDLIFE
COMPENSATION PROGRAM

CHEAKAMUS WATERSHED

SPECIES OF INTEREST

ACTION PLAN

FINAL DRAFT

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Cheakamus River Species of Interest 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 original 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 the 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 Species of Interest Action Plan sets out priorities for the Fish and Wildlife Compensation Program to guide projects in the Cheakamus River project area, which for the purposes of this planning document includes the Squamish River diversion reach to the Squamish estuary. As many species of interest, such as grizzly bear, may have ranges that extend beyond the watershed boundaries, the action plan may also consider actions in areas beyond the Cheakamus River system.

The plan focuses on species of conservation concern (including species-at-risk) or other regionally important species for management planning process. The plan builds on the FWCP's strategic objectives and the Cheakamus River Watershed Plan (FWCP, 2011). Action plans have also been developed for riparian and wetland areas and salmonids; 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 workshop¹ to allow First Nations, public stakeholders, and interested parties to comment and elaborate on the priorities. In addition to mapping and inventory of species of concern in general, priority species included in this plan are:

- Wolverine
- Grizzly bear

¹ Squamish (17 June, 2010)

- Black-tailed deer
- Western Screech Owl
- Band-tailed Pigeon
- Red-Legged Frog
- Western Toad

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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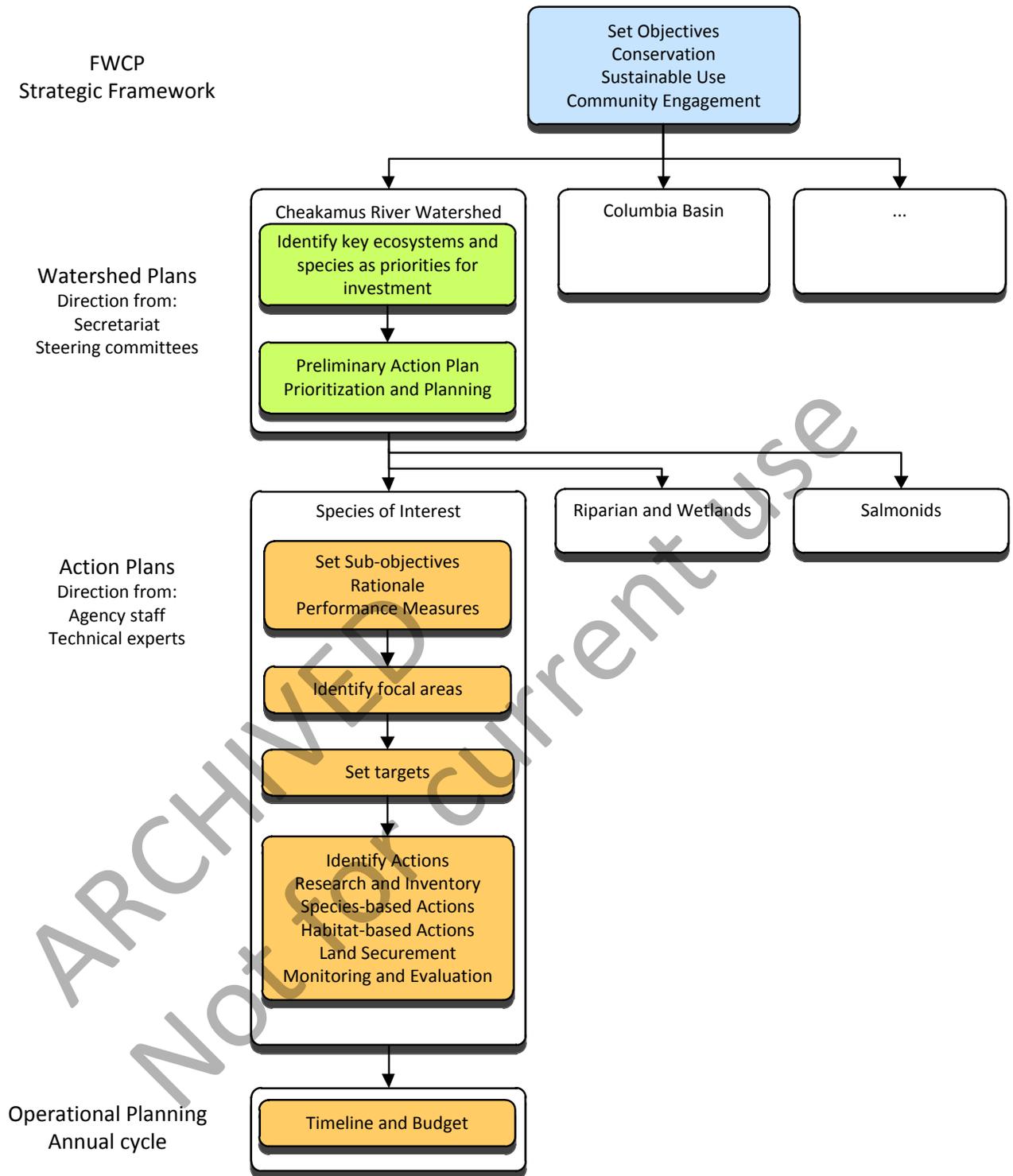


Figure 1: Relationship between the Species of Interest Action Plan and higher level planning and objectives.

2 OVERVIEW CONTEXT

The Cheakamus River is a tributary of the Squamish River, which flows into the head of Howe Sound. The Cheakamus River originates in the Fitzsimmons Range of the Coastal mountains approximately 100 km north of Vancouver, between the communities of Whistler and Squamish (Figure 2). The watershed has an area of 1,070 km² and ranges in elevation between 30 m at its confluence with the Squamish River to 2300 m at its headwaters. 75% of the watershed is upstream of Daisy Lake Reservoir. The valley is steep and consists of coastal hemlock and Douglas fir in the lower reaches and mountain hemlock in the upper elevations. It experiences a Pacific Coastal climate resulting in prolonged and heavy precipitation between October and January, predominantly on the western facing slope, with as much as 700 mm in November. Summers are often sunny and warm. Runoff is dominated by spring snow melt with high flows in May and June and low flows in the late summer. Late autumn and winter storms may also result in large inflow.

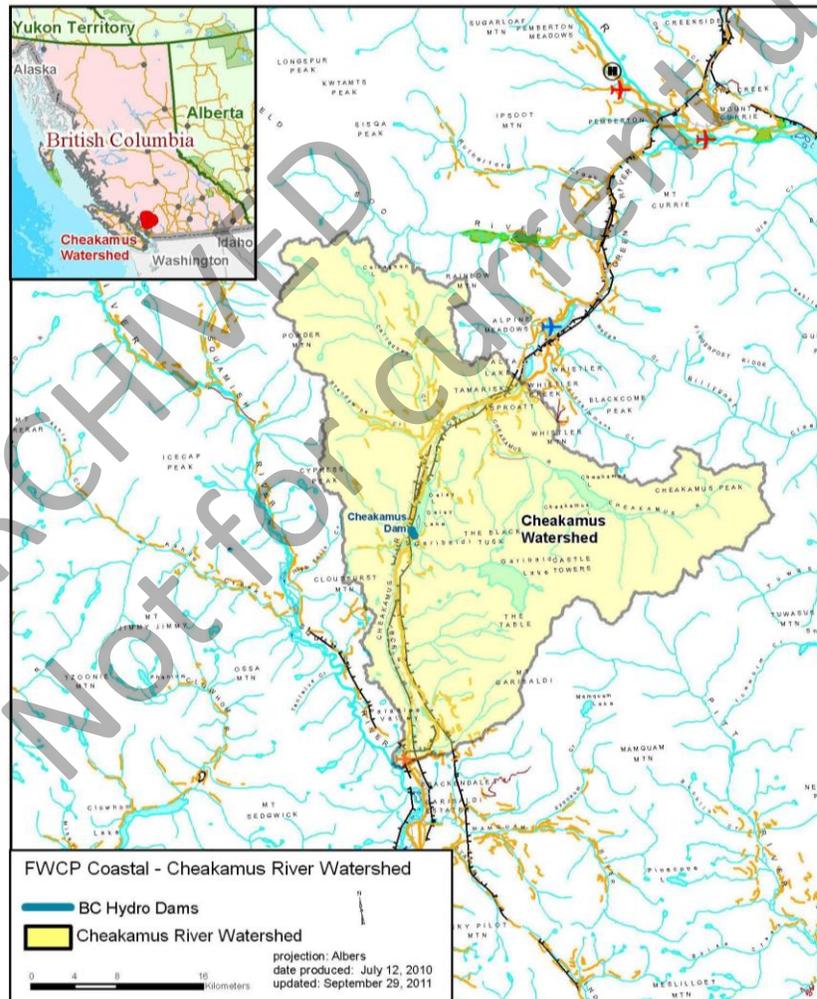


Figure 2: The Cheakamus River watershed.

The Cheakamus and Squamish Rivers are in Squamish First Nations territory. The eastern portion of much of the Cheakamus watershed lies within Garibaldi Provincial Park. The lower reaches of the Squamish River is in Tantalus and Brackendale Eagles Provincial Parks and Baynes Island Ecological Reserve, and the mouth of Squamish lies in the Skwelwil'em Squamish Estuary Wildlife Management Area.

The Cheakamus project includes Daisy Lake Dam, Daisy Lake Reservoir, a diversion tunnel and two penstocks, the Cheakamus Generating Station, and a channel that takes flow from the powerhouse to the Squamish River. Water withdrawn from Daisy Lake Reservoir flows via canal under the Sea-to-Sky Highway into Shadow Lake, a small (< 4 ha) headpond at the diversion tunnel entrance. All flows diverted from the Cheakamus are released to the Squamish River about 21 km upstream of its natural confluence with the Cheakamus. 80% of the annual inflow to Daisy Lake Reservoir is diverted to the Squamish River, with the remainder released to the 26 km stretch of Cheakamus River below the Daisy Lake Dam. The hydropower facilities were constructed by BC Electric Co. and became operational in 1957.

DFO operates the Tenderfoot Hatchery on the Cheakamus 5 km above its confluence with the Squamish River. The hatchery augments Chinook, coho, steelhead, pink and chum populations.

2.1 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: Strategic Plan, Volume 2: Watershed Plans, Chapter 13: Cheakamus River (December 2000);
- Cheakamus River Water Use Plan Consultative Committee Report (October, 2003); and
- Findings in the Community Workshop (Squamish, 17 June, 2009).

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

Cheakamus River upstream of Daisy Lake Dam.

1. Daisy Lake Reservoir inundated a pre-existing lake (21ha), flooded 15 km of mainstem channel, 5 km of tributary channels, 12 ha of wetlands, and riparian habitat around each.

2. Large drawdown (13 m) reduces littoral productivity, and may affect access to tributaries for fish.

Daisy Lake Dam and lower Cheakamus River

3. The dam footprint led to loss of instream and riparian habitat.
4. The dam has reduced recruitment of gravel and large woody debris (LWD) to downstream areas.
5. Reduced flow in the lower Cheakamus has diminished habitat capacity.
6. Loss of active side channel habitat is likely due to dyking and altered flow regime.
7. Reduced flow from upper Cheakamus allows colder Rubble Creek flow to dominate the lower Cheakamus River, which may have caused declines in some species.
8. Entrainment occurs, but the magnitude and impact is unquantified.

Diversions

9. The large diversion of water from Cheakamus to Squamish River impacts productivity in the Cheakamus River downstream of Daisy Lake Dam.
10. There is potential for short-term elevated TGP events.
11. Flow fluctuations in the Cheakamus Generating Station tailrace channel may affect salmon spawning.

Non-hydro Impacts - Other impacts on fish populations in the Cheakamus watershed include effects of harvest, dyking, logging activities and the construction of roads, railways and power lines. A large spill occurred in 2005 from a CN Rail derailment, which spilled 40,000 litres of sodium hydroxide into the Cheakamus River just downstream of Daisy Lake Reservoir, with estimates of over 500,000 fish killed, including coho, Chinook, pink, chum and rainbow trout. The ultimate effects of the spill are not known, and monitoring of effects continues to be conducted.

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2.3 LIMITING FACTORS

The limiting factors for species of interest are dependent upon the specific species of interest. Suitable and productive habitat is, in general, a key limiting factor for most species. Species are therefore greatly impacted by activities affecting habitat and its associated food supply.

The factors are summarized here.

Loss of Habitat: Loss of riparian and wetland habitats has occurred in flooded valley bottoms. Potential effects include availability of habitat for amphibians, water shrews and other small mammals and their predators, foraging and overwintering habitat for ungulates, and breeding habitat for some species of neo-tropical migrants.

Habitat Alterations: Altered flow regime has changed riparian and wetland habitats, either increasing the period or extent of inundation or drying. This leads to changes in the composition and structure of the ecological community, precipitating changes in the suitability of the habitat for wildlife. Potential effects on wildlife include changes to habitat quality and quantity for species, including a lack of seasonal nesting sites, a lack of snags and for cavity nesters, or potential structures for raptors, etc. Also, the lack of riparian vegetation in drawdown zones affects ungulates, furbearers, small mammals and several species of passerines including some neo-tropical migrants.

Wildlife Migration: Structures, reservoirs and diversions can create impediments to wildlife movement.

2.4 TRENDS AND KNOWLEDGE STATUS

SPECIES

Table 1 shows a list of potential species of conservation concern that could occur in the Cheakamus River watershed. It is based on species with CF² ratings of 1-2 for any goal known to occur in both the Squamish Forest District.³

² Conservation Framework (CF) Goals are 1- contribute to global efforts for species & ecosystem conservation; 2- prevent species & ecosystems from becoming at risk; 3- Maintain the diversity of native species & ecosystems. They are rated between 1-6, where 1 is high priority and 6 is low priority.

Priority species for FWCP investment were based on the results of interviews and workshops with agency staff and stakeholders (see the *Cheakamus Watershed Plan*).

Note that while fish are reported in Table 1 they are addressed in the Cheakamus River Salmonid Action Plan.

A comprehensive inventory of the species present in the in the Cheakamus River system does not exist. However, some research has been conducted by FWCP partners as well as other groups to identify important areas for amphibians.

KNOWLEDGE GAPS

While some mapping has been done for amphibians, in most cases there is limited knowledge regarding the population and distribution of species at risk or of conservation concern. In particular limiting factors associated with their population and distribution.

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³ The search was performed using the Provincial Conservation Data Base at <http://www.env.gov.bc.ca/atrisk/toolintro.html>

Table 1: Species of conservation concern that are likely to be present in the Cheakamus River Watershed (This is based on CF rating 1 or 2 for Squamish Forest District). High priorities for FWCP investment are in bold.

Animal	COSEWIC	CF List	FWCP Priority	Comments
Mammals				
Townsend's Big-eared Bat		5,2,3		Wetland; terrestrial
Wolverine	SC (May 2003)	3,2,3		
Wolverine, <i>luscus</i> subspecies	SC (May 2003)	3,2,3	High	Terrestrial; alpine. Migration corridors are important. Projects: 1) Inventory. 2) Breeding/foraging habitat restoration potential best managed at landscape levels.
Fisher		4,6,2		Wetland; terrestrial
Keen's Myotis	DD (Nov 2003)	1,6,1		Wetland; terrestrial
Pacific Water Shrew	E (Apr 2006)	5,6,1		Estuarine; wetland; riparian; terrestrial
Grizzly Bear	SC (May 2002)	3,2,3	V. High	Wetland; riparian; terrestrial. Integrate all projects with the Grizzly Bear Conservation Strategy. High impact from highway, railway, and human activities. Because of their social importance, their relevance to First Nations issues and their potential to be hunted it was felt that the sustainable use value should be 3-4 Projects: 1) Crossing structures to facilitate dispersal and gene flow across highway and railways.
Elk		6,6,6	Medium	An important harvested species. Winter range and riparian habitats are critical. Projects: 1) Some potential for restoration and securement of habitat. 2) Monitoring of herds 3) Crossing structures and fencing to facilitate movements across highway and railway barriers. As elk have been extirpated and it was felt that for the moment they should not be seen as such a high sustainability priority as they are not hunted, nor is there a potential to hunt them in the near future.

Animal	COSEWIC	CF List	FWCP Priority	Comments
Black-tailed deer		6,6,6	V High	An important harvested species, particularly for First Nations. Winter range is critical. Impacted by highways and human settlements. Projects: 1) Crossing structures over highway. 2) Vegetation management along highway to reduce roadkills. 3) winter range enhancement
Birds				
Northern Goshawk, <i>laingi</i> subspecies	T (Nov 2000)	1,6,1		Terrestrial
Boreal Owl	NAR (May 1995)	6,3,4		
Great Blue Heron, <i>fannini</i> subspecies	SC (Mar 2008)	3,6,1	V. Low	Estuarine; lake; wetland; riparian; terrestrial. No active nesting colonies known in watershed. But Squamish estuary is very important regionally. Projects: Not much potential in the Cheakamus watershed, but some in the estuary.
Marbled Murrelet	T (Nov 2000)	1,1,2		Estuarine; lake; marine; terrestrial
Common Nighthawk	T (Apr 2007)	6,2,4		
Northern Harrier	NAR (May 1993)	4,2,4		
Olive-sided Flycatcher	T (Nov 2007)	5,2,3		Wetland; terrestrial
Sooty Grouse		5,2,3	V Low	High management interest. But restoration potential low.
Rusty Blackbird	SC (Apr 2006)	3,2,3		Wetland; terrestrial. High management interest. But restoration potential low.
Peregrine Falcon	SC (Apr 2007)	5,2,3		
Peregrine Falcon, <i>anatum</i> subspecies	SC (Apr 2007)	5,6,2		Estuarine; terrestrial
Bald Eagle	NAR (May 1984)	6,6,6	Medium	Riparian, wetland, terrestrial. It is the principal viewing species in the valley. There is a festival associated with Eagle viewing in Brackendale each year. Projects: 1) Protection of riparian forest for roost habitat. Note- there is

Animal	COSEWIC	CF List	FWCP Priority	Comments
				already significant protection in the area. Eagles will benefit from increased salmon production.
Barn Swallow		6,2,3		Estuarine; lake; wetland; riparian; terrestrial
Western Screech-Owl, <i>kennicottii</i> subspecies	SC (May 2002)	3,1,2	High	Wetland; terrestrial. Mature to old riparian forest and cavity dependent. Projects: 1) Inventory. 2) Habitat restoration (riparian and snag management, nest boxes)
Band-tailed Pigeon	SC (Nov 2008)	5,2,3	High	Wetland; terrestrial. Projects: 1) Breeding/foraging habitat restoration potential best managed at landscape levels. 2) Mineral site identification and protection.
Spotted Owl	E (Mar 2008)	5,6,2		Wetland; terrestrial.
Harlequin Duck ⁴		4,1,3	Medium	Riparian and riverine. Water quality, stream productivity, fisheries relationships and Riparian conservation are priorities. Main concern is cumulative impacts from all hydro projects combined. Mostly concerned with Harlequin Ducks (priority rating is high-4). • Projects: 1) Assess effects of dams and operations on populations and productivity
Amphibians, Reptiles and Turtles				
Northwestern Salamander	NAR (May 1999)	5,1,3		
Western Toad	SC (Nov 2002)	3,2,4	High	Wetland dependent for breeding. There are declining numbers. Projects: 1) Wetland conservation and restoration.
Pacific Tailed Frog	SC (May 2000)	4,1,2		Wetland.

⁴ This species did not appear during the search of the CF data base but was mentioned in the workshop. This represents other lower priority riverine birds including: Common mergansers, American Dipper, Belted Kingfisher, etc.

Animal	COSEWIC	CF List	FWCP Priority	Comments
Rubber Boa	SC (May 2003)	5,1,3		
Common Ensatina	NAR (May 1999)	6,2,4		
Northern Red- legged Frog	SC (Nov 2004)	3,1,2	High	Wetland. Projects: 1) landscape level planning for ephemeral breeding ponds. 2) Wetland construction. 3) Assessment of effects of Bullfrogs and other invasive species on populations
Fish				
Green Sturgeon	SC (May 1987)	4,6,2		Estuarine; marine; riparian.
Coho Salmon	E (May 2002)	4,2,4	High	
Bull Trout		2,2,3	High	Lake; riparian.
Dolly Varden		4,2,3		Estuarine; lake; marine; riparian.

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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 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 species of interest. Complementary actions may also be identified in the separate Salmonid and Riparian and Wetland Action Plans.

3.2 OBJECTIVES, MEASURES AND TARGETS

There are two management objectives for the Cheakamus River system as a whole.

Objective 1: Maintain or improve the status of species of interest in the system.

Rationale — There is a high priority placed on improving the population and distribution of species of concern that are found within the Cheakamus River system. Limiting factors for species of concern may be specific in nature, such as a lack of suitable nesting sites, or may be broader in scope. Consequently, action to improve the status of species may include improvements in the habitat and ecosystems they depend upon.

Measure — Measures may differ between species in term of success due to the nature of the species. For example marmots may be relatively easy to measure the absolute number and their distribution, while goshawks are more difficult and might require a different quantifier, such as ha of habitat suitable for breeding.

Targets — Specific targets will be developed for specific species focused projects.

Objective 2: Maintain or improve opportunities for sustainable use.

Rationale — Several species of interest are the focus of sustainable use activities by First Nations and non-first nations people. For example some species are hunted, while bird and wildlife viewing is also a popular recreational use in the watershed. Consequently, any actions aimed at achieving the above objectives indirectly support this sustainable use objective. Although there are no direct actions aimed at improving sustainable use at this time, it is conceivable that projects aimed at generally improving opportunities for sustainable use activities could be identified by the program partners in the future.

Measures and Targets — There are no specific measures or targets required at this time aside from those associated with the above objectives.

As part of their overall management responsibilities, MOE periodically collects information regarding abundance trends, hunter reports, catch per unit effort (CPUE) and number of hunting licences sold in the region.

4 ACTION PLANNING

4.1 OVERVIEW OF PLAN

Management for species of interest ultimately rests with the provincial and federal environment Ministries, but FWCP contributes resources towards planning and implementation of management actions that benefit species within its program area, usually based on the outcomes of multi-agency planning processes. FWCP's mandate limits its involvement in species of interest management to activities that meet FWCP objectives.

The Action Plan has several individual actions for each species, 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.

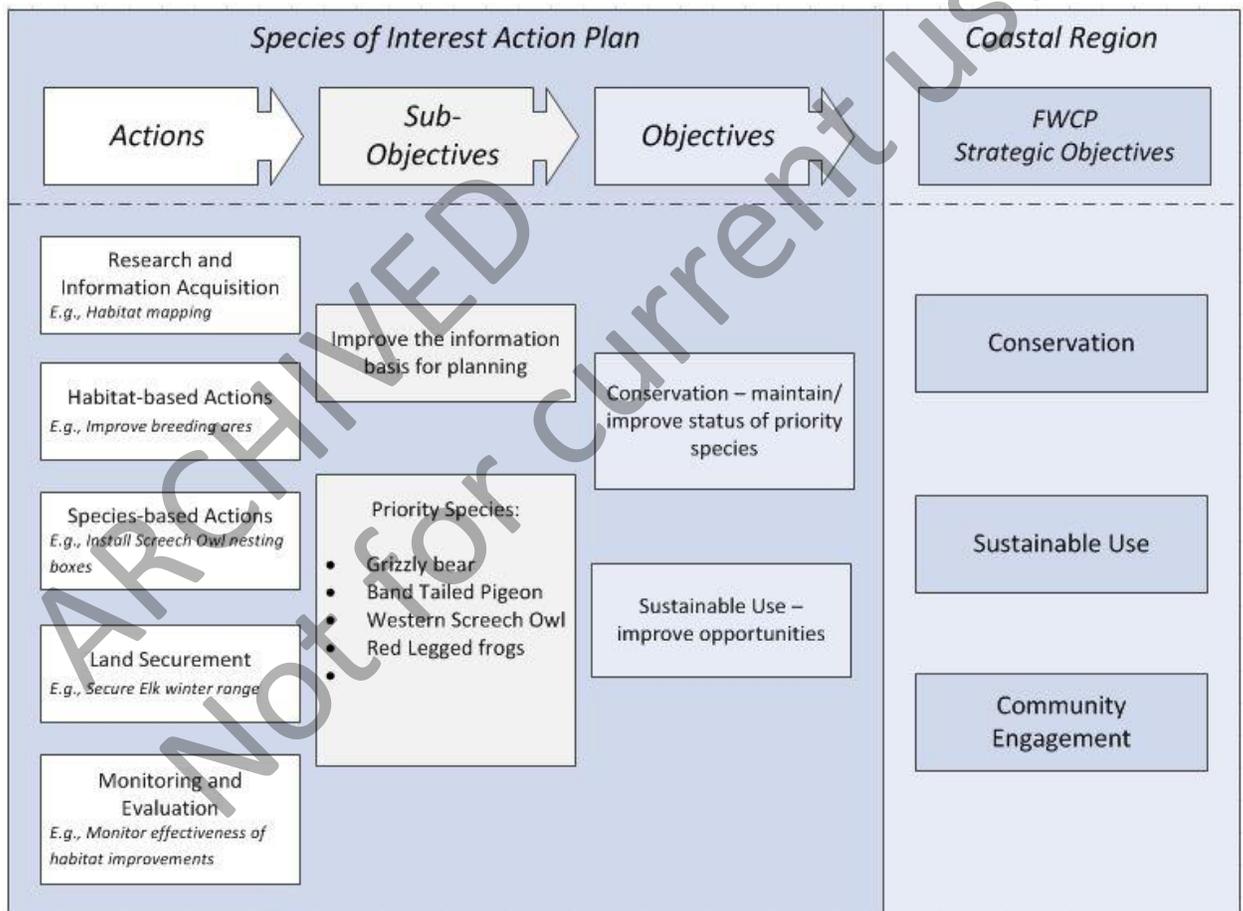


Figure 3: Relationship between actions, sub-objectives and objectives in this Species of Interest Action Plan and the FWCP strategic objectives in the Cheakamus River Watershed Plan.

4.2 COMPONENTS

The FWCP is most interested in receiving proposals to address the high-priority species listed in Table 1:

- Wolverine
- Grizzly bear
- Black-tailed deer
- Western Screech Owl
- Band-tailed Pigeon
- Red-Legged Frog
- Western Toad

Specific actions have been proposed in this watershed for grizzly bear and Western Screech-owl. The species-focussed actions are aimed at mitigating key limiting factors. Where actions address habitat limitations they do so in relation to specific factors affecting a specific species. There may of course be additional benefits for other species which depend upon the habitat in question. Many species of concern are related to streams, wetlands and riparian areas. In implementing actions under the Species of Interest Plan close coordination should be maintained with actions under the Riparian and Wetlands Plan and the Salmonid Action Plan to ensure compatibility and to develop synergy.

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.

INVENTORY AND ACTION DEVELOPMENT

Tables of actions have yet to be developed for several high-priority species. For these, proposals that address inventory requirements as well as the development and implementation of management actions are encouraged.

GRIZZLY BEAR

Rationale — Grizzly bears were listed as a species of Special Concern (2002) under COSEWIC; they are 'Blue' listed Provincially, and are ranked 3,2,3. Grizzly bears have been affected in the Squamish-Cheakamus area through reduction in food source (salmon) and to some degree through the inundation of Daisy Lake. The major impact has been due to the highway and its expansion. While not related to BC Hydro operations, a movement corridor for bears and ungulates would enhance any wildlife activities that were undertaken in riparian areas.

The cost of dealing with passage would be large, and FWCP investments could initiate studies for research with a goal of bringing in other funders when there was more certainty around what the solutions might be.

Measure — to be determined.

Targets — to be determined.

#	Action	Rationale	Priority
Research and information acquisition			
	Assess impact of restriction to movement of bears and assess options for corridor enhancement.	Research could help leverage funds and partners to develop solutions. It would impact multiple species (black bears, ungulates, cougars etc.)	1
Species-based actions			
Habitat-based actions			
Land Securement			
Evaluation and monitoring			

WESTERN SCREECH OWL

Rationale — Western screech owls are of conservation concern (COSWIC-Special Concern / CF-3,1,2). No inventories or work has been conducted to date

with FWCP investments. There is a lack of knowledge about the species in the area.

Measure — The measure will be related the abundance and distribution of the species.

Targets — to be determined.

#	Action	Rationale	Priority
Research and information acquisition			
Species-based actions			
Habitat-based actions			
1	Create snags	Suitable wildlife trees are scarce in second-growth forest and creating snags can accelerate their recruitment.	2
Evaluation and monitoring			

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