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FISH AND WILDLIFE
COMPENSATION PROGRAM

BRIDGE/SETON RIVER WATERSHED

SPECIES OF INTEREST ACTION PLAN FINAL DRAFT

The FWCP is a partnership of:



OCTOBER 2011

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Bridge and Seton Watersheds 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 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 Bridge and Seton Rivers project area. 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 Bridge and Seton watersheds 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 Bridge and Seton Watersheds Plan. 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, the highest priority species included in this plan are:

- Grizzly bear
- Mule deer
- Fisher

¹ Lillooet, 26 March, 2009.

- Moose
- Pallid bat
- Spotted bat
- Western Screech-owl
- Spotted Owl

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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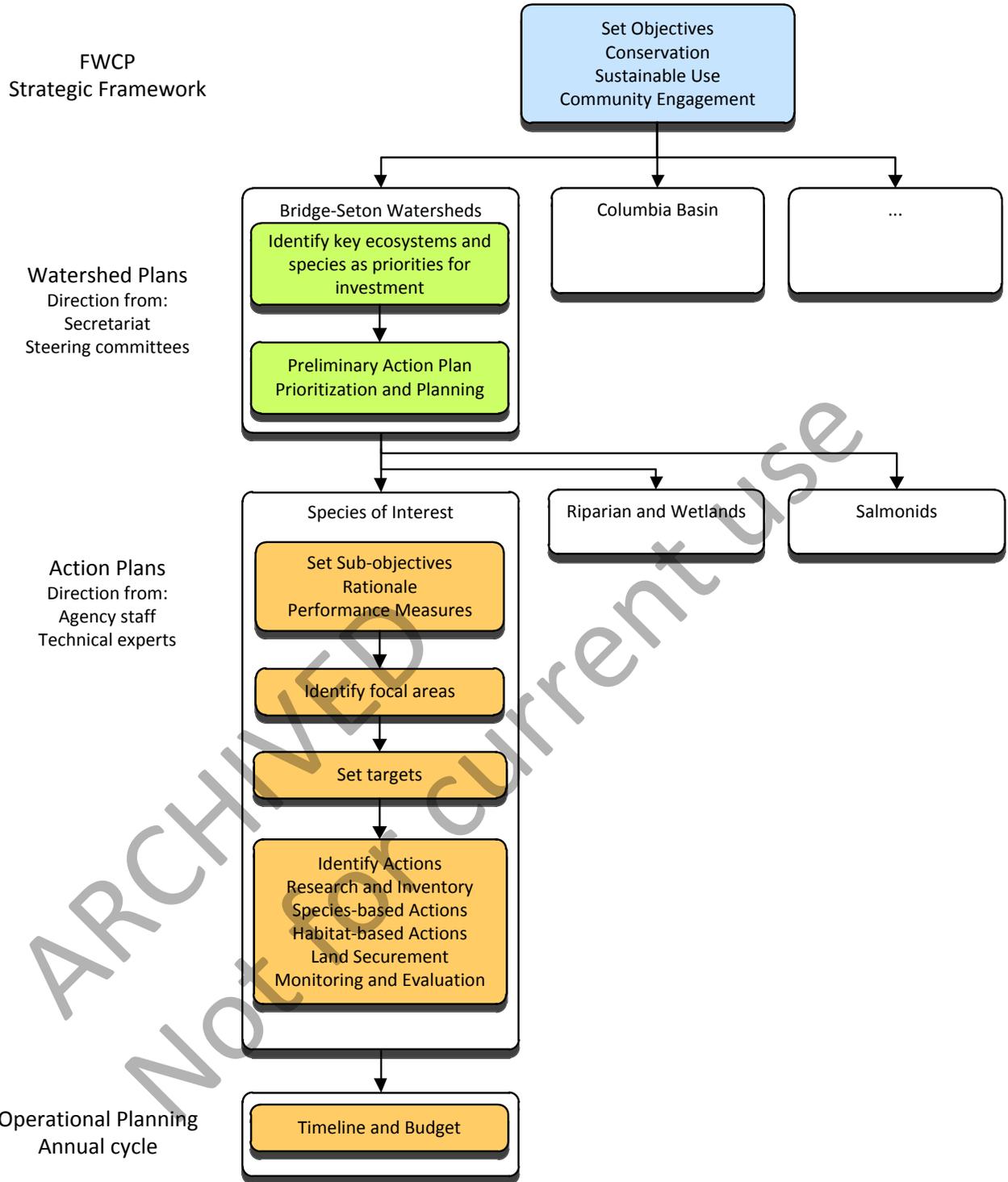


Figure 1: Relationship between the Species of Interest Action Plan and higher level planning and objectives.

2 OVERVIEW CONTEXT

The Bridge and Seton watersheds are located in the rain shadow of the southern Coast Mountains, about 200 km northeast of Vancouver. The two watersheds are adjacent and separated by the Bendor Range and Mission Ridge. Together, they drain an area of approximately 3,700 km². Elevations range from less than 200 m at the confluence with the Fraser River to rugged peaks of about 3,000 m, and steep-sided slopes and narrow and broad lower valleys predominate. The Bridge River flows into the Fraser River just north of the town of Lillooet, and the Seton River meets the Fraser immediately south of the town (Figure 2).

The Bridge and Seton rivers are primarily affected by continental and modified maritime weather producing high snow pack in the winter and occasional short-duration rainfall between June and July. The hydrograph is dominated by snowmelt between May and August. Inflow is usually low from September to April, but autumn storm events result in occasional large inflows. The source of Bridge River is the Bridge Glacier covering 140 km² of the upper watershed.

The Bridge and Seton watersheds have a total human population of approximately 4,500, of which almost 3,000 are located near Lillooet. Other communities include Gold Bridge, near the La Joie Dam, and Yalakom on the lower Bridge River. It is within the traditional territory of the St'at'imc Nation and indigenous people from the majority of the population. The watersheds contain the Spruce Lake protected area among others.

The Bridge River project consists of La Joie Dam, which impounds Downton Reservoir, and Terzaghi Dam, which impounds Carpenter Reservoir. Water is diverted through tunnels and penstocks from Carpenter Reservoir to two powerhouses on the shore of Seton Lake Reservoir. Downton Reservoir has a total average inflow of 40 m³/s. Additional inflow to Carpenter Reservoir is 51 m³/s for a total diversion of about 91 m³/s into Seton Lake; the licensed diversion from Bridge River is 147 m³/s.

When Terzaghi Dam was completed in 1960 (and the Mission Dam before it in 1948), no continuous releases from Carpenter Reservoir were required, and any flows in the lower Bridge River derived exclusively from groundwater and inflow from tributaries. With the exception of occasional spills over the dam to manage unpredictable high inflows, a 4 km stretch of channel immediately below the dam was left essentially dry, and the other 15 km experienced a more than hundred-fold reduction in flow (Failing et al. 2004). In the late 1990s, Terzaghi Dam was modified to allow continuous flow release, and since August 2000 BC Hydro has implemented an average release of about 3 m³/s. The magnitude of the release is still managed under an adaptive management program. The dam remains impassable for fish.

The Seton project consists of Seton Dam at the outlet of Seton Lake, where water is diverted by canal then penstock to a powerhouse on the banks of the Fraser River downstream of the natural Seton-Fraser confluence. The Cayoosh Dam (owned and operated by Walden North) diverts water from Cayoosh Creek via

tunnel to Seton Lake near its outlet. About 80% of the total discharge through the Seton powerhouse comes from the Bridge River diversion. The Seton Dam incorporates fish passage structures, which allow anadromous salmon to ascend beyond the outlet of Seton Lake.

Seton Lake has a total average inflow of about 117 m³/s: 19 m³/s comes naturally from within the Seton basin, 16 m³/s from the Cayoosh Creek diversion, and 91 m³/s from the Bridge River diversion. The seasonal flow regime of the Bridge River watershed dominates the operation of Seton Lake Reservoir.

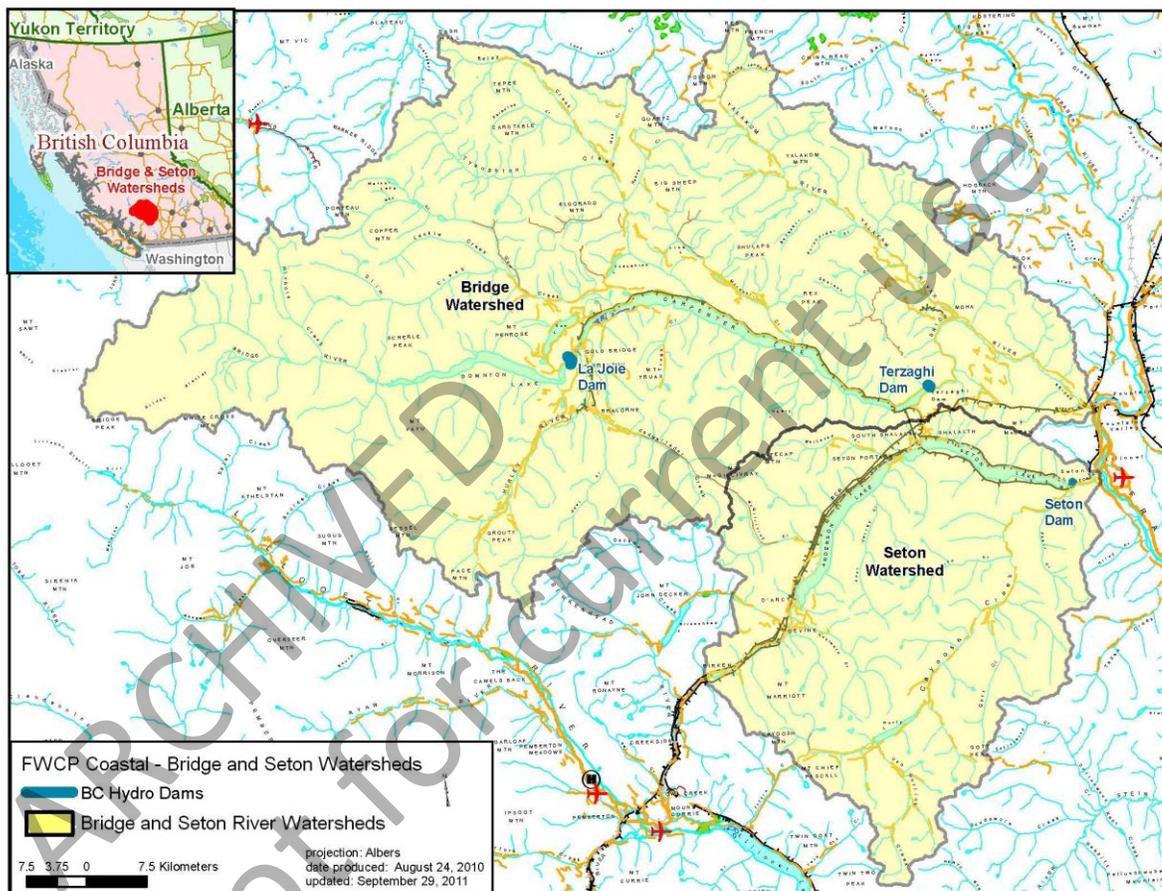


Figure 2: The Bridge Seton hydropower project.

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 10: Bridge River and Chapter 11: Seton River (December 2000);
- Bridge River Water Use Plan Consultative Committee Report (December, 2003); and
- Findings in the Community Workshop (Lillooet, March 26, 2009).

Hydro-related Impacts — Footprint impacts of structures, reservoirs and their operations, have occurred throughout the system and are described as follows, based on location.

Upstream of La Joie Dam (Downton Reservoir and upper Bridge River).

1. The impoundment flooded:
 - 2234 ha of land, significant loss of valley bottoms, riparian and side habitat for bighorn sheep, other ungulates and carnivores,
 - 65 km of mainstem, 441 ha of side channels, and 390 ha of adjacent riparian areas,
 - 25 km of tributary habitat and 75 ha of adjacent riparian area, and
 - 237 ha of wetlands - feeding/breeding habitat for birds, bats, amphibians and furbearers, and feeding habitat for bears & ungulates.
2. Construction of La Joie Dam sluiced a large volume of sediment that degraded downstream habitat in the Middle Bridge River.
3. Access roads reduced instream and riparian habitat.
4. Large annual drawdown (as much as 49m) in Downton Reservoir affects access to tributaries and the establishment of aquatic and riparian vegetation.
5. Flooding of mainstem and tributaries created a barrier to wildlife particularly bears and ungulates.
6. The creation of open water for osprey and waterfowl, as well as the flooding of forest areas created snags and nesting cavities.

Upstream of Terzaghi Dam to La Joie Dam (Carpenter Reservoir and middle Bridge River).

7. The impoundment flooded
 - 4996 ha of land, loss of valley side habitat for bighorn sheep, other ungulates and carnivores,

- 92 km of mainstem, 761 ha of channels, and 552 ha of adjacent riparian areas,
 - 55 km of tributary habitat and 165 ha of adjacent riparian area, and
 - 46 ha of wetlands - feeding/breeding habitat for birds, bats, amphibians and furbearers, and feeding habitat for bears & ungulates.
8. Terzaghi Dam blocked fish passage for anadromous and resident migratory fish.
 9. Loss of salmon resource above the dam as a food source for grizzly bears, scavengers, and piscivorous birds feeding on fry and smolts.
 10. Barriers to migration of mammals, particularly bears and ungulates.
 11. Large annual drawdown (as much as 44m) in Downton Reservoir affects access to tributaries and the establishment of aquatic and riparian vegetation.
 12. Change in flow regime of the remaining river has unknown effects on wildlife.
 13. The creation of open water for osprey and waterfowl, as well as the flooding of forest areas created snags and nesting cavities.

Bridge River downstream of Terzaghi Dam.

14. Reduced flows downstream of Terzaghi Dam reduced wetted area and access to off-channel habitats. Despite the reduced flows, inflows from tributaries and groundwater provided a relatively productive area. Since August 2000, BC Hydro has provided a fish flow release of about 3 m³/s. The benefits of this release are currently under study.
15. Spills can strand and kill fish or displace them downstream
16. Terzaghi Dam has reduced gravel and large woody debris recruitment to the lower river.
17. Periodic spilling scours gravel and degrades downstream habitat, strands or displaces fish and may temporarily increase total gas pressure.
18. Reduced flow has altered temperature in the river, potentially benefiting fish, particularly in the summer. Less cold water from the Bridge has likely increased water temperature below the Yalakom confluence. Conversely, in the winter the water from the Bridge system was warmer than Yalakom water and so the water temperature below the confluence is now colder.
19. Reduced flows in the 49.5 km of the lower Bridge River has unknown effects on aquatic wildlife such as American Dipper, Harelquin and other birds, aquatic mammals and amphibians.

Upstream of Seton Dam (Seton Lake).

20. The impoundment flooded

- 2503 ha of lake and 52km of shoreline, loss of coniferous forest,
- 27 ha of land, and
- 0.5 km of mainstem, 3 ha of channels, and 3 ha of adjacent riparian areas.

21. Diversion from Bridge River and the Seton Dam raised the level of Seton Lake, resulting in inundation of 27 ha land around the lake.

22. Adult pink salmon are impinged on screens at power canal intake structure.

23. Adult salmon are attracted to discharges greater than 60 m³/s through the radial gate and are delayed ascending the fish ladder.

24. The fish ladder does not accommodate large Chinook or sturgeon.

25. Dredging during construction caused a major loss of spawning habitat for pink salmon and other species.

26. Water chemistry, temperature, water clarity and nutrients have been altered significantly since the diversion of Bridge River water into the system.

27. Flooding of shoreline created snags and nesting sites.

Lower Seton River.

28. Larger spills since the Bridge River diversion has scoured gravel and reduced spawning and rearing habitat. Spills also cause the stranding of fish.

29. Cooler water from Bridge River may benefit upstream migration, however migrating fish are delayed at entrance to the spawning channels.

30. Present flow releases at Seton Dam restrict instream habitat and access to former off-channel habitat.

31. Seton Dam has reduced LWD recruitment to the river.

32. Reduced flows have unknown effect on aquatic wildlife.

Bridge to Seton Diversion

33. Anadromous salmon homing to the Bridge and Seton rivers are attracted to the tailrace at the Seton generating station on the Fraser River.

34. Potential temperature stress on Fraser upstream migrants trying to pass Bridge River Rapids due to loss of cool Bridge discharge.

Cayoosh Diversion

35. Partial mitigation is provided for Seton fish by diverting Cayoosh Creek water to Seton Lake.
36. Juvenile sockeye and pink salmon are impinged on trash racks and entrained into the Seton power canal.
37. Diversion of Cayoosh water from July to November assist sockeye to home to Seton River and not the tailrace discharge (positive effect).
38. Diversion diminishes available habitat area in the downstream channel.
39. Diversion has diminished gravel and LWD in downstream channel.
40. Reduced flows have unknown effect on aquatic wildlife.

Seton to Fraser Diversion

41. Juvenile sockeye and pink salmon are impinged on the penstock intake.
42. Seton adult spawners are attracted, delayed or injured at the tailrace before finding the Seton River. This is partially mitigated by controlling the % of Cayoosh Creek water diverted into Seton Lake.
43. Seton canal (4.6 km) is a hindrance to the movement of animals.

Non-Hydro Impacts — Other impacts in the Bridge and Seton watersheds include invasive species, mining (particularly in the area of Gold Bridge around Ferguson Creek), forestry, and rail and road construction (in particular rail construction near Seton Lake likely filled limited shoal areas). Also, the slides in the Fraser River at Hell's Gate in 1913 and 1914 negatively affected anadromous fish passage into the Bridge-Seton watersheds. Fish passage at Hell's Gate was established in 1945 and extended in 1956; however, fish stocks took a long time to recover. The effects of the Hell's Gate slides are thought to have contributed to underestimating the productivity of Bridge-Seton fish stocks during evaluation of hydro-development in the watersheds. Urban development has not been a significant factor in the area.

Grizzly bears. Impacts to grizzly bears relate primarily to access to grizzly range and the resulting issues associated with human-bear conflicts and harvesting (trophy hunting). This includes historic access associated with mining, particularly around Gold Bridge. Current threats facing the ability of the population to sustain itself include mortalities resulting from interactions with humans (usually over agriculture and garbage), changes to habitat suitability through forest and range management practices (including fire suppression), and disturbance from human activities associated with roads. The effects of proposed independent power projects, increases in back-country recreation, and climate change may further

exacerbate existing and previous population impacts. The cumulative effect of these impacts have resulted in low populations with decreased gene flow in the Bridge and Seton watersheds

2.2 LIMITING FACTORS

The limiting factors for species of interest are dependent upon the specific species. Suitable and productive habitat is, in general, a key limiting factor for most species. Specific habitat may be limiting for different life requisites, such as breeding, nesting, or foraging, or at various times of year for migratory species. Species are therefore greatly impacted by activities affecting critical habitat as well as their associated food supply.

The general factors are summarized here:

Loss of Habitat: Loss of riparian and wetland habitats has occurred in flooded valley bottoms which were productive moose, grizzly bear and black bear habitat. Potential effects also include availability of habitat for amphibians, small mammals and their predators, and breeding habitat for many species of birds including neotropical migrants. In addition, the north slopes of Carpenter Lake were important mule deer and owl winter range. Loss of large diameter trees is a limiting factor for many birds as well as species such as fisher.

Habitat Alterations: An altered hydrological 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 neotropical migrants.

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

Grizzly Bears

With specific reference to grizzly bears, despite 5 years of research on grizzly bears in the Stein-Nahatlatch and South Chilcotin GBPU, the factors that limit population growth remain difficult to determine due to low sample sizes. Some likely factors include:

Loss of foraging habitat and food sources. Two radio-collared bears in this study appeared to have starved to death, which suggests that foraging habitat and food supply may be limiting.

Loss of migration corridors and connectivity (increased isolation). Genetic analyses of grizzly bears in the Bridge-Seton² (funded by BCRP) indicate a lack of genetic variability within these population units. While the cause of lack of genetic variability is likely due to a sudden decrease in population size, isolation has kept genetic diversity from increasing.

Bear-human interaction. With increasing recreational use of the area there has been a corresponding increase of bear-human interaction, and subsequent bear mortality.

2.3 TRENDS AND KNOWLEDGE STATUS

SPECIES

Table 1 shows a list of potential species of interest (conservation concern and sustainable use) that likely occur in the Bridge-Seton watershed. It is based on species with CF² ratings of 1-2 for any goal known to occur in both the Cascade Forest District and the Squamish-Lillooet Regional District.³

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

Note while fish are also listed in Table 1 they are addressed under the Bridge-Seton Watersheds Salmonid Action Plan.

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.

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 present in the Bridge-Seton Watersheds (This is based on CF rating 1 or 2 for Cascade Forest District and Squamish Lillooet Regional District). High priorities for FWCP investment are in bold.

Animal	COSWIC	CF LIST	FWCP Priority	Comments
Mammals				
Pallid Bat ⁴	Threatened	3,6,2	High	Grassland / riparian. Little is known about this species in the area.
Spotted Bat	SC (May 2004)	5,2,3	High	Wetland; riparian. Little is known about this species in the area.
Wolverine, <i>luscus</i> subspecies	SC (May 2003)	3,2,3	Medium	Terrestrial. Inventory is important (there are likely fewer than grizzly bears) Access to their habitat is a problem, in particular disturbance in winter (snow-mobiles and heli-skiing).
Fisher		4,6,2	High	Terrestrial
Mountain Goats		4,1,2	Medium	While mountain goats have a medium overall priority ranking, the Mission Ridge and Bridge River goats are of high priority. Projects that identify why mountain goat populations are declining are also of high priority. First Nations have identified two areas where mountain goats used to be but aren't seen anymore: Mission Ridge and Bridge River. Priorities include population and habitat inventory, enhancement of the winter range, conservation of the movement corridor through buffers and habitat enhancement, access management (including disturbance by ground and air) documentation and conservation of mineral lick sites and investigation into whether transmission lines and access roads affect populations.
Bighorn Sheep		4,3,4	Medium	Terrestrial / semi-arid grasslands, steep cliffs for escape terrain
Great Basin Pocket Mouse		4,6,2		Terrestrial / grasslands. (inventory needed – Kamloops record 1949)
American Badger	E (May 2000)	6,6,1		Terrestrial

⁴ The Pallid Bat was identified in interviews and the workshop; however, CF listing places it in the Okanagan-Shuswap forest district and the Okanagan-Similkameen Regional District only.

Grizzly Bear	SC (May 2002)	3,2,3	High	<p>Wetland; riverine; terrestrial. Priorities include the enhancement and increasing of foraging & denning habitat, the conservation of movement corridors to prevent genetic isolation, population and habitat inventory, access and disturbance management and mortality risk reduction (through Bear Aware and Bear Smart. Enhancement of habitat should be away from human access (other valleys etc.).</p> <p>Projects should link to the provincial Grizzly Bear conservation Strategy and to the St'at'imc Resource Management Plan.</p> <p>Compensatory habitat should be away from human activity due to mortality risk.</p> <p>Important forage, such as Whitebark pine.</p>
Mule Deer		6,6,6	High	<p>Priorities include studies on use, mapping, access management (particularly in relation to IPPs), conservation of the migration corridor through buffers and habitat enhancement, investigation into factors that may limit health</p> <p>Enhancement and conservation of the winter and spring range considered important, but not a priority as it is unlikely to be able to secure sufficient range to have much impact.</p>
Moose		6,6,6	High	<p>Priorities include population and habitat inventory, enhancement and increasing of the winter range and foraging habitat and access management.</p>
Birds				
Boreal Owl	NAR (May 1995)	6,3,4		
Great Blue Heron, <i>herodias</i> subspecies		6,2,3		Estuarine; lake; wetland; riverine.
Common Nighthawk	T (Apr 2007)	6,2,4		Little is known about this species in the area
Northern Harrier	NAR (May 1993)	4,2,4		Grasslands
Olive-sided	T (Nov 2007)	5,2,3		Terrestrial / mid to high elevation

Flycatcher				
Sooty Grouse		5,2,3		
Sharp tailed Grouse (columbianus sub-sp)		2,6,2		There is breeding and winter habitat enhancement potential for this species. There was debate about whether this species should remain a priority, since they are located farther out in the grasslands (a threatened ecosystem) on the Fraser (outside of the footprint) and are affected by ungulate and cattle grazing. They remain a priority as there is a high need for inventory.
Rusty Blackbird	SC (Apr 2006)	3,2,3		Wetland (red-listed)
Prairie Falcon	NAR (May 1996)	6,6,2		Terrestrial
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		Important to St'at'imc along with other riparian raptors.
Barn Swallow		6,2,3		Estuarine; lake; wetland; riverine; terrestrial
Western Screech-Owl		6,2,4		Riparian with large diameter trees
Western Screech-Owl, <i>kennicottii</i> subspecies	SC (May 2002)	3,1,2	High	Wetland; terrestrial
Western Screech-Owl, <i>macfarlanei</i> subspecies	E (May 2002)	4,6,1		Wetland; terrestrial
Lewis's Woodpecker	T (Apr 2010)	3,6,2		Wetland; terrestrial
Long-billed Curlew	SC (Nov 2002)	4,2,3		Estuarine; wetland; terrestrial – nests in grasslands
Flammulated Owl	SC (Apr 2010)	5,2,3		Terrestrial – old growth forest

Band-tailed Pigeon	SC (Nov 2008)	5,2,3		Wetland; terrestrial
Spotted Owl	E (Mar 2008)	5,6,2	High	Wetland; terrestrial. The Bridge-Seton Watershed comprises some of the little remaining habitat for the species. Landscape-level management is necessary. Projects should link with the Recovery Strategy. Due to the extent and causes of the problem (such as the large-scale land use issue) there is limited ability for FWCP Coastal restoration activities to address it.
Harequin Duck ⁵		4,1,3	Medium	BC Hydro operations have had multiple, cumulative effects on riverine birds, including Mergansers, American Dipper, and Harlequin Duck. Riparian conservation and enhancement is important for these species, including water quality, stream productivity and fisheries relationships. Priorities include research on genetics and the dispersal of birds between river systems, including the connectivity of populations over larger scales, and expansion and restoration beyond the Bridge and Seton watersheds.
Amphibians, reptiles and turtles				
Western Toad	SC (Nov 2002)	3,2,4		
Pacific Tailed Frog	SC (May 2000)	4,1,2	High	Previously known as Coastal Tailed Frog. Priorities include the conservation of streams, riparian habitats and covenants on private lands, water quality initiatives, inventory on secondary and tertiary streams, and baseline studies on existing streams to determine the extent of species habitat and distribution. Research is important as the species lives in fishless streams that have received little attention to date. Need for inventory on secondary and tertiary streams before IPP development.
Racer	SC (Nov 2004)	6,2,3		Wetland; terrestrial

⁵ 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: mergansers and American Dipper.

Gopher Snake		6,6,2	
Gopher Snake, <i>deserticola</i> subspecies	T (May 2002)	6,6,2	Lake; wetland; riverine; terrestrial
Columbia Spotted Frog	NAR (May 2000)	3,2,4	
Fish			
White Sturgeon	E (Nov 2003)	4,6,2	Riverine
White Sturgeon (Middle Fraser River population)	E (Nov 2003)	3,6,3	Lake; riverine
Coho Salmon	E (May 2002)	4,2,4	
Bull Trout		2,2,3	Lake; riverine
Dolly Varden		4,2,3	Estuarine; lake; marine; riverine

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A comprehensive inventory of the species present in the in the Bridge-Seton watersheds system does not exist. However, some research has been conducted by FWCP (BCRP) to map owl and bat distribution and habitat use, as well as 5 years of work on grizzly bears.

Grizzly Bears

Grizzly bears were listed as a species of Special Concern (2002) under COSEWIC; they are 'Blue' listed Provincially, and are ranked 3,2,3, under the CF (Table 1).

The 2 Grizzly Bear Population Units (GBPUs) in the Bridge-Seton watershed are considered "Threatened". It is estimated that only 23 grizzly bears remain in the Stein-Nahatlatch GBPU and 53 in the southern portion of the South Chilcotin GBPU (Apps, 2009). Populations at such low numbers are unlikely to persist at projected natality and mortality rates. Grizzly bears are the highest priority wildlife species to the public, First Nations (St'át'imc 2004) and Ministry of Environment in the Bridge and Seton watersheds. Due to their high profile and conservation status, BCRP has funded multiple projects related to grizzly bears including habitat use and distribution studies in the Bridge and Seton watersheds.

KNOWLEDGE GAPS

In general there is limited knowledge regarding the distribution or abundance of species at risk or of conservation concern in the Bridge-Seton watersheds.

Grizzly Bears

- i) Limiting factors for grizzly bear population are not conclusive.
- ii) Population dynamics and trends are not known and are difficult to determine with such low populations. It is not known if the population has been increasing or decreasing in recent years.
- iii) The carrying capacity of the area for grizzly bears is not known. It is not known whether the current population is below or above the carrying capacity.
- iv) Appropriate and effective management options for sustainable populations are not known.

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 Bridge-Seton Rivers River system as a whole.

Objective 1: Maintain or improve the status of species of interest in the Bridge-Seton Rivers watersheds.

Rationale — There is a high priority placed on improving the population and distribution of species of concern that are found within the Bridge-Seton Rivers 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.

Sub-objective 1: Determine population trend and limiting factors affecting the grizzly bear population in the Bridge and Seton watersheds.

Rationale — The current low populations of grizzly bears, particularly in the Stein-Nahatlatch, are a conservation concern. While grizzly bears in the province are not necessarily threatened, they do rank 2 in terms of prevention from becoming at risk. It is further important to enhance genetic diversity between the GBPU to ensure continued gene flow and to help ensure a more stable population. Key to maintaining or improving the status will be to understand whether the grizzly bear population is increasing or decreasing and what is limited the population.

Performance measures and targets will be project-specific.

Sub-objective 2: Implement identified species and habitat based management actions for grizzly bear productivity.

Rationale — In addition to research and restoration projects that FWCP typically supports, there are several priority projects that target public education (e.g., Bear Aware) in critical linkage areas to reduce human-bear conflicts and attractant problems. These and other projects that reduce human-bear conflict through access management have also been identified by researchers as high priorities as reported in a recent assessment of historic human impacts on grizzly bear habitat in the Bridge River valley (Senger and Hamilton, 2008). Additionally, habitat based management recommendations have been developed based on previous work funded through FWCP (BCRP).⁶

⁶ The following projects have been completed and a final report was to have been produced in March 2010: 04.W.Br.04, 06.W.BRG.05, 07.W.BRG.03.

Performance measures and targets will be project-specific.

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 (e.g., mule deer) while bird and wildlife viewing may also be 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 PLAN

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.

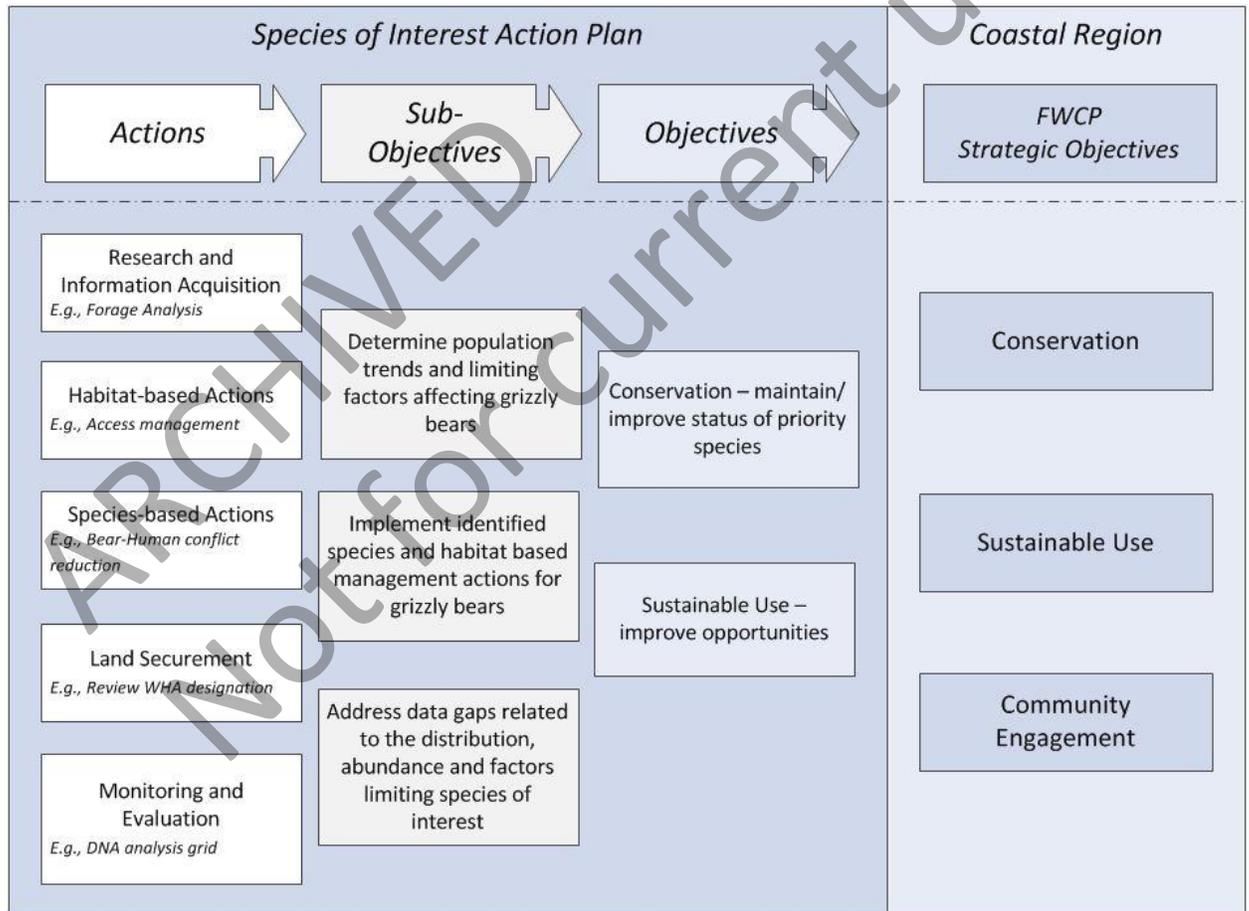


Figure 3: Relationship between actions, sub-objectives and objectives in this Species of Interest Action Plan and the FWCP strategic objectives in the Bridge-Seton Rivers Watersheds Plan.

4.2 COMPONENTS

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

- Grizzly bear
- Mule deer
- Fisher
- Moose
- Pallid bat
- Spotted bat
- Western Screech-owl
- Spotted Owl

Specific actions have been proposed in this watershed for grizzly bears. 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

The following table of actions address sub-Objective 1: Maintain or improve the status of species of interest in the Bridge-Seton Rivers watersheds; and sub-objective 2: Implement identified species and habitat based management actions for grizzly bear productivity.

#	Action	Rationale	Priority
Research and information acquisition			
1	<p>Effect of fire on food supply. Gather existing habitat data to determine whether 2009 forest fires present an opportunity to assess the effects of wildfire on bear forage production.</p>	<p>There is a desire to conduct prescribed burns to increase forage for grizzly bears and ungulates. However, little research has been done to measure the efficacy of fires for enhancing foraging sites for bears in the habitats of the Bridge-Seton area. Extensive wildfires burned in the watersheds in 2009. These fires may present an opportunity to measure the outcomes of fire on the supply of bear and ungulate forages. In order to do this, researchers need to examine the existing telemetry data to determine if radio-collared bears used the areas prior to the fires and if habitat data was gathered for these bear-use sites. If so, then follow-up site investigations can be performed and data compared from pre- and post-fire habitats. If positive results are found, partner with First Nations to determine priority sites for prescribed burning.</p>	1
2	<p>Radio-telemetry study to monitor grizzly bears in the Stein-Nahatlatch. Data from this study will form the foundation of a Recovery Plan.</p>	<p>This project should identify causes of bear mortality, document changes in habitat selection and bear food production among years, and identify human-bear conflicts in the GBPU. This is an opportunity to build on existing research data (funded by BCRP) and fulfills the need to continue to monitor these bears to prevent any unnecessary deaths due to human-bear conflict and to monitor responses of bears to recent wildfires. Ensure that grizzly bears with home ranges that are near human activities are radio-collared (not just those in remote wilderness). BCRP should support the relevant activities that are identified in the resulting recovery plan.</p>	2
3	<p>Support forage analyses using stable isotope analysis to determine diet composition.</p>	<p>There are many existing hair samples that can be utilised. This has an opportunity for partner funding for a graduate student and represents good return on investment as there is little risk with a high likelihood of producing valuable results. It is not necessary to fund all components of the analysis as identified in previously submitted applications to garner valuable results about grizzly bear diet through stable isotope research.</p>	2

#	Action	Rationale	Priority
		Additionally, this could be a useful technique for restoration monitoring (see below).	
4	Utilize DNA grids to determine whether the Stein-Nahatlatch and S Chilcotin populations are responding to the implemented activities.	DNA grids are likely the best method for continued monitoring of the Stein-Nahatlatch population to determine whether conflict mitigation or restoration activities are having an effect at the population level. DNA sampling is performed on hair collected at hair-snagging stations and thus is non-invasive and has a low impact on bears. Baseline data may need to be collected in 2010/11, which will allow comparison to results from the BCRP-funded grid done in 2005. A suitable time interval between sampling years for continued monitoring should be determined depending on when restoration activities are undertaken.	2
5	Utilize stable isotope analysis on hair collected under DNA to judge change in diets.	Hair gathered from DNA hair-snagging stations can be analysed for stable isotopes to determine broad changes in diet composition. This technique could be useful to determine the effectiveness of restoration activities that are undertaken	2
6	Support a cumulative impacts research study in the Squamish-Lillooet GBPU	Support a fine-scale research study on cumulative impacts on grizzly bears in the Squamish-Lillooet GBPU that would contribute important data to a recovery plan. This may become a higher priority if independent power projects proceed in the area. Confirm habitat requirements and communicate with respective agencies (MOE, and MOF, etc.)	3
Species-based actions			
7	Implement human-bear conflict reduction strategies	Mortality due to human-bear conflict is high in the area. Reduction programs would include funding education (e.g., Bear Aware) and conducting hazard assessments. Also, good management for grizzly bears is also good management for black bears.	1

#	Action	Rationale	Priority
		See Appendix 1 for prioritised locations.	
8	Restrict human access to important bear foraging areas	Restricting human access to important bear foraging areas are relatively simple measures and will have positive impacts on the bear population. Ensure engagement with all affected parties. See Appendix 2 for prioritised locations.	1
Habitat-based actions			
9	Review telemetry report and identify management recommendations that can be implemented.	The final report from the grizzly bear telemetry project in the Bridge-Seton (04.W.Br.04, 06.W.BRG.05, 07.W.BRG.03) was expected in March 2010. The report assesses different options for restoring habitats for grizzly bears and describes management recommendations.	1
10	Support Grizzly Bear Conservation Strategy	Implement relevant restoration activities suggested in the Grizzly Bear Conservation Strategy.	1
Land Securement			
Evaluation and monitoring			

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Appendix 1: Priority locations for human-bear conflict reduction programs

The following is a prioritised list of locations where mitigation strategies to reduce human-bear conflict are needed. The list was compiled in 2009 by Tony Hamilton, Sue Senger and Larry Casper with input from Matt Manuel on locations occurring in the Lillooet First Nation territory, and with input from Conservation Officer Bob Butcher:

- Seton Portage/Shalalth
- Gold Bridge/Bralorne, Gun & Tyaughton Lakes
- Lillooet
- Boston Bar/North Bend

Site-specific attractant management is needed at the following sites (historical conflict or mortality sites):

- All Indian Reserves around Lillooet (Cayoosh, Lillooet, Bridge River)
- Particular attention to the Fraser River aboriginal fishing sites
- Texas Creek, Marshall Lake, Yalakom and other cottage communities
- Fountain Valley & Fountain Indian Reserve
- Pavillion and the Pavilion Indian Reserve
- Indian Reserves on the south end of the Stein-Nahatlach GBPU

There are also a variety of smaller sites, including Forest Service Recreation sites, smaller residential enclaves, IPP developments, and mineral exploration sites at which management of attractants also needs to be improved.

Appendix 2: Priority locations for motorized access management

The following is a prioritised list of locations where access restrictions would benefit grizzly bear populations. The list was compiled in 2009 by Tony Hamilton, Sue Senger and Larry Casper with input from Matt Manuel on the locations that were identified within the Lillooet First Nation territory.

- Kookipi to Big Silver connector: this road enables travel from the Nahatlatch River over the height of land and out the East Harrison road via Big Silver Creek and vice versa. Researchers have spoken to MOF in both Merrit and Chilliwack and the Boothroyd Band at the Nahatlatch and have some degree of support for at least a seasonal closure.
- Log Creek: this is a tributary of the Nahatlatch which holds a concentration of grizzly bear habitat, sightings and DNA/ hair snag hits, including more than one family group. Given its location and priority, it is a high priority candidate for at least a seasonal closure.
- Boulder Creek: there is extensive sighting and verified use of the Boulder drainage. It is currently only ATV / motorcycle accessible due to rock slides, but it is good candidate for a seasonal closure. There is an existing gate.
- Van Horlick Creek: there is clear justification for a seasonal closure to ensure adult female security and mortality risk reduction in the spring. The road is not currently being maintained, and is gradually growing in (it's at the vehicle scratching stage). A gate and a seasonal closure, backed by the Wildlife Act, would definitely assist recovery.
- Upper Bridge River, Bridge Delta: there is an incredibly important piece of habitat at the westernmost end of Downton Lake that acts almost like a coastal estuary in the spring. There have been as many as 8 grizzly bears at once in the area. It is vulnerable because of its proximity to a main haul road. A seasonal closure in the Upper Bridge would also provide security / reduce mortality risk for a number of bears using the upper valley, including those that use MacParlon and Nichols Creeks. There is an existing gate, but it's profile, signage, enforcement and regulation need improvement.
- Hot spots requiring access management could change as bear forage increases from regeneration of 2009 forest fires.