GIANT'S HEAD MOUNTAIN

TRAILS RE-DEVELOPMENT PLAN

JUNE 2018

DISTRICT OF SUMMERLAND

BENCH SITE DESIGN

MOUNTAIN PACIFIC ENVIRONMENTAL CONSULTANTS LIMITED
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Cover photo: View of Giant's Head Mountain from the west. (Credit: Kyle Pearce)

EXECUTIVE SUMMARY

Giant's Head Mountain Park is a beautiful 87-hectare park with historical, ecological, and recreational importance in the District of Summerland, BC. Operated since 1967, the park is predominantly known for its network of hiking trails that offer views of Okanagan Lake and the surrounding agricultural and natural landscapes.

This trails re-development plan process included consultation with District staff and council, community groups, and residents, as well as field exploration and analysis. Key issues include identifying recreational needs among user groups, recognizing sensitive and valuable ecosystems, and respecting historic values.

The plan balances recreation opportunities and desires with important natural conservation activities that are presented as a series of challenges, goals, and actions. In this way, trail users are offered a variety of experiences through a consolidated trails system with clear wayfinding, interpretive information, and support infrastructure and amenities. With ongoing growth in Summerland and the Okanagan Valley, the District will need to maintain a balancing act to endorse Giant's Head Mountain Park trails as a valuable recreational amenity while at the same time protecting ecosystem values and sustaining infrastructure and maintenance activities for an increasingly-used trails system. The goals and actions presented here are intended to provide the foundation for addressing future challenges and demands with a complete and holistic trails re-development plan.

Just as Giant's Head Mountain Park was formed through a formidable community, business, and government effort, its future will also benefit from partnerships, volunteerism, and community engagement. Recommendations for phasing and potential partnerships have been identified so that the improvements outlined in this plan can be implemented as resources become available.

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Above: View of Giant's Head Mountain from the north, ca. 1911. (Credit: Summerland Museum & Archives)

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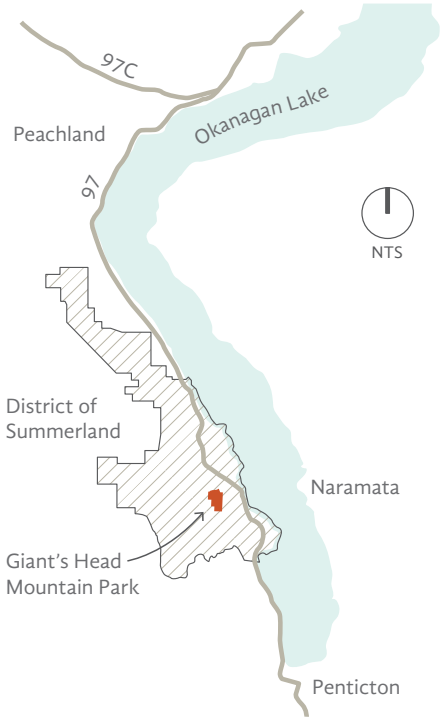
1 INTRODUCTION

1.1 PURPOSE

Since Giant's Head Mountain Park was created in 1967, its original two apex trails have expanded into a 12 km network of dozens of trails. The unplanned and unconstructed nature of these trails has given rise to a series of concerns over the accommodation of all user groups, the health and integrity of the sensitive ecosystems on the mountain, and ever-increasing usership.

The purpose of this Trails Re-Development Plan is to assess current trail conditions and uses within the park, and to provide a guiding framework for improvements and priorities over the next 10 years. It is important to note that this is a trails re-development plan, not a parks master plan. While a snapshot of the park's ecosystem health has been provided, this is not a complete environmental assessment nor is it a comprehensive management plan. This document is intended to give an understanding of the current state of park trails and to advise on future work to the trail and trail infrastructure system in order to meet both recreational and environmental needs. An environmental assessment of the existing and future trails proposed in this report was completed in 2018 and is included as Appendix C.

It is anticipated that, over the life of the plan, the proposed enhancements will be implemented through District of Summerland capital funding, grant programs, partnerships, and volunteer activities.



Summerland and Giant's Head Mountain Park Regional Context

1.2 LOCATION AND CONTEXT

REGIONAL CONTEXT

Giant's Head Mountain Park is located in the District of Summerland, within the Regional District of Okanagan Similkameen. The park is part of the municipal parks system and is the District of Summerland's largest park. The mountain is approximately 1km west of Okanagan Lake and is bordered by agricultural lands to the south and

Top: View to west
Bottom: Viewtubes, a well-loved feature at the mountain summit
Right: Giant's Head Mountain Park location

southeast, industrial lands to the southwest, and residential lands to the west, north, and east.

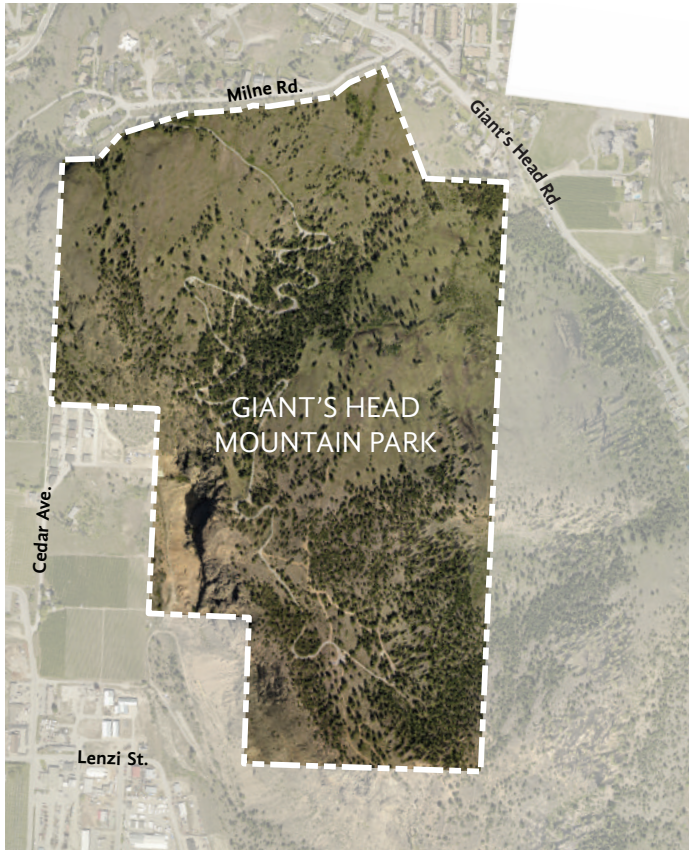
The surrounding community of Summerland has a population of 11,615 (2016) and is 74.08 square kilometers in area. The community maintains a rural/agricultural character and relies on agriculture, light industry, health care, and tourism as primary industries.

Giant's Head Mountain Park is within the Thompson-Okanagan Plateau ecoregion, one of the warmest and driest ecoregions in Canada. The mountain itself is an extinct volcano that dominates the Summerland landscape.

POLICY CONTEXT

There is currently no park management plan, biophysical inventory, or other planning documents that relate specifically to Giant's Head Mountain Park. The District's 2001 Parks & Recreation Master Plan identified key maintenance priorities for Giant's Head Mountain Park, but noted that infrastructural development beyond basic improvements to trails, rest areas, the road, and parking areas was not desirable at the time. At the time of writing, the Parks & Recreation Master Plan is being updated.

The District has a Community Wildfire Protection Plan, which contains recommendations specific to Giant's Head Mountain Park to reduce wildfire risk.



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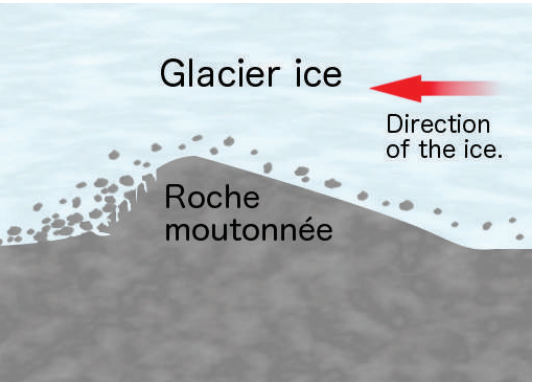
2 PARK & TRAIL OVERVIEW

2.1 SITE DESCRIPTION



Top: The giant's profile from Gartrell Road, ca. 1918 (Credit: Summerland Museum & Archives)
Bottom: Rôche moutonnée feature (Credit: Jasmin Ros)

Giant's Head Mountain has an elevation of 845m above sea level and is 350m in height. It is characterized by moderate to steep slopes. The mountain ecosystem is classified as Okanagan, Very Dry Hot Ponderosa Pine variant (PPxh1) (Lloyd et al, 1990) within the provincial Biogeoclimatic Ecosystem Classification (BEC) System. PPxh1 is typified by mature stands of Ponderosa pine (*Pinus ponderosa*) with a dominant understory of bluebunch wheatgrass (*Pseudoreogneria spicata*), rough fescue (*Festuca campestris*), and arrow-leaved balsamroot (*Balsamorhiza sagittata*).

Broadly, the landscape types present in the park can be grouped into steppe/grassland, open coniferous woodland, and rocky or cliff areas with sparse to no vegetation. Sensitivity to disturbance has been identified as moderate to very high for the park, with several of the steppe/grassland areas being of particularly high quality and sensitivity.

These ecosystems support diverse wildlife, and it is not uncommon to encounter species such as white-tailed deer, gopher snake, California quail, northern flicker, owl, and sharp-shinned hawk. Refer to the Site Analysis section for a more in-depth inventory and discussion of plant and animal species present and potentially present within the park.

The mountain is an Eocene-aged (between 55 and 34 million years) composite volcanic dome. The 'giant's head' formation on the south side was molded by the movement of several-kilometer thick glacial ice. The mountain is an excellent example of a glaciological feature called a *rôche moutonnée* (Roed & Fulton, 2011), or sheepback rock formation. The smoother north side of the mountain was formed by abrasion as glacial ice moved southwards, with the rough and steep south side formed by frost shattering as the glacier's forward progress plucked rocks from the formation.

Excellent views of Prairie Valley, Okanagan Lake, Trout Creek, and surrounding vineyards

Top: Entry gate at Milne Road, 1970. (Credit: Summerland Museum & Archives)
Bottom: Unveiling of time capsule at the centennial celebration, July 1, 1967. (Credit: Summerland Museum & Archives)

and orchards are available from the summit and many other trails and secondary viewpoints on the mountain.

2.2 PARK HISTORY

The original inhabitants of the region containing the present day park were the Sqilxw/Syilx, or Okanagan Nation (Okanagan Indian Band, 2017). First Nations archaeological history within the Summerland area is significant but poorly studied. Several native burial sites have been documented in the area, some located to overlook Okanagan Lake and others oriented towards Giant's Head Mountain. Numerous arrowheads have been found on nearby Trout Creek Point, suggesting that this was a popular native gathering area (Foster, 2006), but the literature available at the time of writing did not document specific uses of Giant's Head Mountain.

First European contact occurred in the 1820s as the fur trade established routes through the Okanagan Valley. These European traders originally referred to the Summerland region as Nicola's Valley, after Chief Nkwala, an important Okanagan Nation Chief (Okanagan Indian Band, 2017).

Permanent European settlement began in the 1880s in response to the burgeoning orcharding industry, and Summerland was incorporated in 1906. From this moment, Giant's Head Mountain, especially the rock profile for which it is named, contributed significantly to the identity of the surrounding Summerland settlement, lending it's name and famous profile to numerous local businesses, logos, and events. So locally iconic is the landform that it features prominently in the District of Summerland's coat of arms, created in anticipation of Canada's 1967 Centennial celebrations.

Giant's Head Mountain Park was created as a direct result of these celebrations and was opened on July 1, 1967. The idea of a park with an access road had been proposed decades before the Centennial, but cost had prevented its implementation. When federal financial assistance became available for Centennial projects, the Giant's Head Mountain Park project was made official, with additional funds contributed by individuals, 30 local organizations, municipal council, and the provincial government. A wrought iron entry gate was placed between stone columns at the Milne Road entrance, and a road was built to an upper parking area. The summit featured a bronze plaque, flag pole, sundial, and a commemorative cairn of local granite containing a time capsule (Foster, 1998), all of

District of Summerland Coat of Arms (Credit: Summerland Museum & Archives)

which remain today with the exception of the sundial. The park was hailed as "one of Canada's most imaginative Centennial Year projects" (Marshall, 1968) and has remained a popular Summerland landmark.

Originally, there were only two official trails. Both connected the upper parking area to the summit, the steeper trail called Confederation Trail and the more gradual called Centennial Trail.

2.3 EXISTING FACILITIES & PARK USE

Giant's Head Mountain Park has been relatively unchanged since its creation, with most of the original commemorative features still present albeit showing age and wear. The road has been repaved but otherwise maintains the original route and width; a washroom has been added near the upper parking area. In the 1990s, the Summerland Rotary Club contributed trees, tables, and benches to the summit and, more recently, a native planting initiative was undertaken at the Milne Road entrance.

The most significant change to the park has been the creation of unsanctioned and unplanned trails that weave across most of the mountain north of the summit. The park is popular with residents and visitors, primarily hikers, who have created these trails to take advantage of the varied terrain and views available on the mountain.

While hikers form the largest user group in the park, other uses include road walking, road cycling, downhill mountain biking, and road longboarding. Some of the activities in which park users participate include dog walking, bird-watching, and driving to the upper parking lot to access the summit viewpoint.

While the majority of park use is unprogrammed, there are several notable events including the Giant's Head Freeride (a privately sponsored weekend downhill skateboarding race) and the Giant's Head Grind/Christopher Walker Memorial Race, which has been sponsored by the Rotary Club of Summerland since 2014. Both are considered social and economic contributors to the community and will likely continue to garner support and participation.

2.4 SITE ANALYSIS

ECOLOGICAL

A full environmental assessment of the existing trails was completed in the spring of 2018 by Mountain Pacific Environmental Consultants (see Appendix C for the complete report). The purpose of the assessment was to identify ecological communities, rare vegetation, noxious weeds, wildlife and wildlife habitat, and to analyze trail disturbance conditions and establish recommendations for the trail re-development plan.

As previously noted, a large portion of Giant's Head Mountain Park is a grassland ecosystem, an ecosystem considered extremely rare in British Columbia and Canada. Much of the grasslands in the Okanagan have been lost to residential and agricultural development or are compromised by introduced plants, habitat fragmentation, fire suppression, climate change, and grazing.

The British Columbia Conservation Data Centre (CDC) assigns ecological communities to one of four provincial lists to reflect importance for conservation (see sidebar). The biophysical site investigation found that the park contains several areas of important blue- and red-listed ecological communities that potentially support a range of at-risk plant and animal species.

Overall, invasive plant species percentage cover ranged from 5-15%, with the highest incidence of invasive species occurring adjacent to the road and trails. Trees within the park vary in age, from 35-100 years old at lower elevations to 180-200 years old at higher elevations. The most disturbance within the park occurs near the summit and adjacent to the roadway.

The west and southwest faces of the park are primarily categorized as Sparsely Vegetated, as

BC Conservation Status Rankings for Ecological Communities & Species

BC CONSERVATION DATA CENTRE (CDC)

Extinct: Ecological communities that no longer exist.

Red: Includes any ecological community that is Extirpated, Endangered, or Threatened in British Columbia. Extirpated ecological communities no longer exist in British Columbia, but do occur elsewhere. Endangered ecological communities are facing imminent extirpation or elimination. Threatened ecological communities are likely to become endangered if limiting factors are not reversed. Placing ecological communities on these lists flags them as being at risk and requiring investigation.

Blue: Includes any ecological community considered to be of Special Concern in British Columbia. Ecological communities of Special Concern have characteristics that make them particularly sensitive or vulnerable to human activities or natural events. Blue-listed ecological communities are at risk, but are not Extirpated, Endangered or Threatened.

Yellow: Includes ecological communities that are apparently secure and not at risk of extinction.

No Status: Includes ecological communities that have not been ranked.

Upper Right: Red-listed grassland community, Giant's Head Mountain Park (Credit: Mountain Pacific Environmental Consultants)

Top: Blue-listed Ponderosa pine / Douglas fir woodland (Credit: Mountain Pacific Environmental Consultants)
Bottom: Typical sparsely-vegetated rock bluff (Credit: Mountain Pacific Environmental Consultants)
Right: Rock cliffs on west side of mountain (Credit: Mountain Pacific Environmental Consultants)

they consist of bedrock outcrops and steep cliff areas. The remainder of the park contains both Grasslands and Conifer Woodlands areas.

The grassland on the lower north portion of the mountain is of the poorest condition in the park, with a number of invasive weed species and existing trails. The large grassland area on the east side of the mountain has little disturbance and is in good condition, with minimal invasive weed cover (2-5%) and few trails. This area is dominated by rough fescue and bluebunch wheatgrass, which is considered a red-listed ecological community by the CDC.

The woodland area in the northern portion of the park consists of a mixed Ponderosa pine and Douglas fir stand that is also red-listed by the CDC. However, a number of existing trails have caused significant disturbance. The woodland areas in the southern portion of the park are likewise affected by human use; while consisting of blue-listed areas, the highest amount of disturbance occurs near the summit where numerous trails, road access, and invasive plant species occur. Nevertheless, the oldest trees in the park grow in this area and stand health is good.

Increased trail densities contribute to increased habitat fragmentation and sensory disturbance; as this is a trails re-development plan, it should be unsurprising that the physical form and distribution of the trails themselves are of primary concern to the ecological health of the park.

Trail creation is particularly damaging to grassland areas, which are characterized by slow plant growth and soils that are slow-forming, coarse in texture, and prone to erosion. Arid and semi-arid ecosystems, such as grasslands, rely on a microbiotic crust, or community of living organisms (lichen, fungi, cyanobacteria, bryophtes, and algae) on the soil surface (BC Min. of Sust. Res. Mgmnt, 2004). This crust is critical to soil

SITE ANALYSIS

GIANT'S HEAD MOUNTAIN PARK

ACTIVITY NODE

IMPORTANT VIEWS

EXISTING FEATURE

TRAILS

ROAD

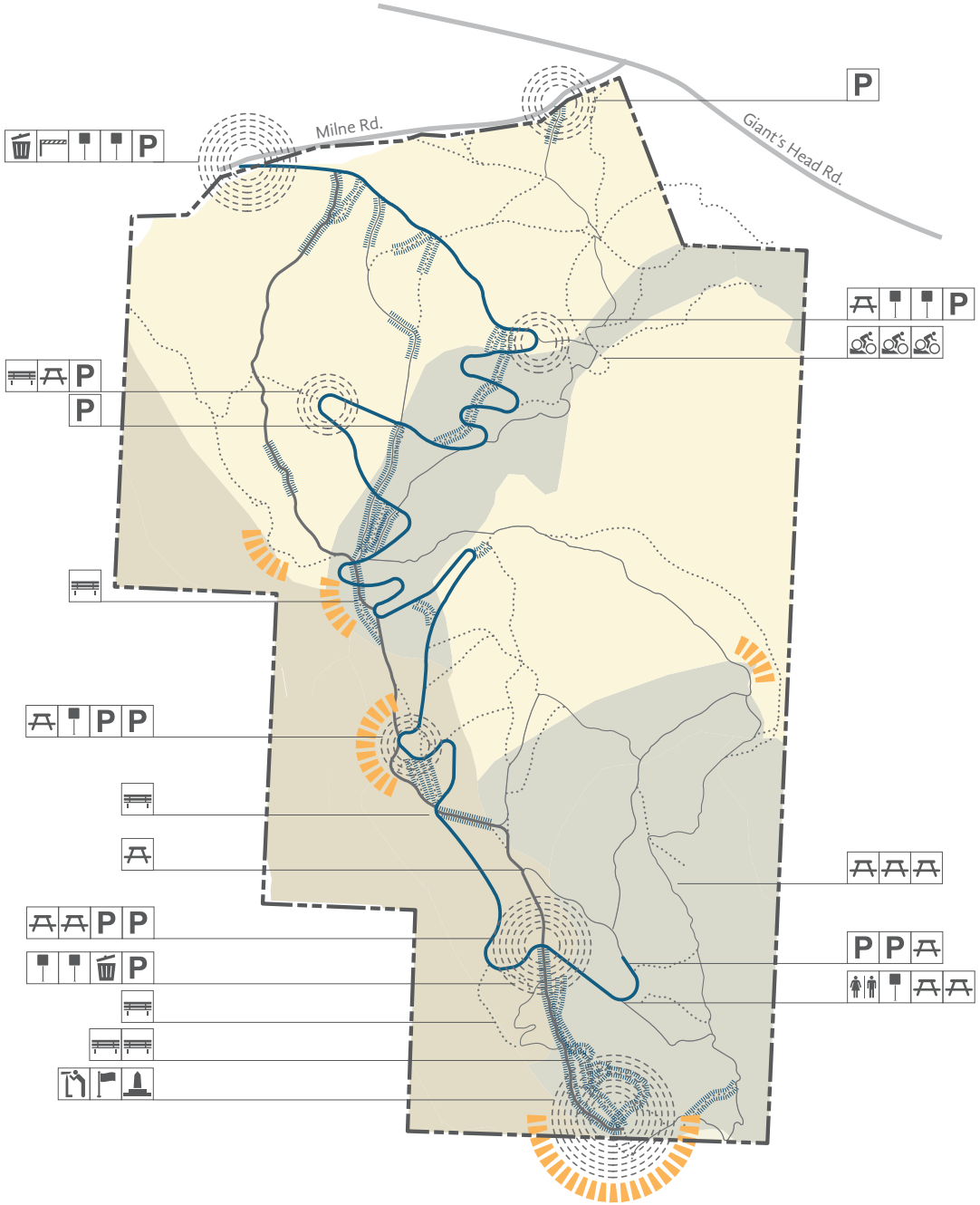
EROSION

SENSITIVE ECOSYSTEM CLASSES:

SPARSELY VEGETATED/CLIFF

GRASSLAND

CONIFEROUS WOODLAND



Top: Trail erosion and cross-cutting near summit (Credit: Mountain Pacific Environmental Consultants)
Bottom: Eroding hiking trail
Right: Soil crust with lichens, fungi, and grasses

stabilization, nutrient provision, plant germination, and thermal regulation. When disturbed, as occurs with trails and roads, it can take decades, or even centuries, to re-form this crust and re-establish plant and animal communities.

WILDLIFE & WILDLIFE HABITAT

The South Okanagan has one of the highest levels of biodiversity and concentrations of species at risk in Canada; more than half (31 out of 57) of the red- and blue-listed species in the South Okanagan and Lower Similkameen are associated with grasslands (BC Min. of Env. Lands and Parks, 1998). The integrity of the at-risk ecological communities identified in Giant's Head Mountain Park indicates that the park provides important habitat within the area. The purpose of Mountain Pacific Environmental Consultants' environmental assessment was to document individual species in relation to existing and proposed trails, and to give a broader picture of ecosystem health, habitat, and potential range of plant and animal species, including blue- and red-listed species, within the park. The assessment suggests that the diverse array of ecological communities in the park provides a relatively complex wildlife habitat assemblage within a limited spatial boundary, and that the park represents a unique ecological island within the constraints of the District's agricultural, residential, and commercial developments.

Forty-four at-risk plant, bird, bat, mammal, herptile, and insect species have the potential to occur within the park (see Appendix C for a complete list). Rock outcrops and bluffs, especially along the south edge of the park, offer hibernacula, burrow, and cliff nesting opportunities. In particular, the cliff face along the southwest portion of the park was identified as offering important wildlife habitat for a number of at-risk species, including peregrine falcon, barn swallow, and canyon wren. Wildlife trees and snags were identified within the park which

Top: Giant's Head Mountain Park road
Bottom: Summit parking area with unsanctioned expansion onto adjacent grassland area (Credit: Google Maps)
Right: Existing parking conditions at Milne Rd. entry

provide habitat for avian cavity nesters such as woodpeckers, sapsuckers, owls, creepers, and chickadees.

With the exception of deer and coyote, it is unlikely that large mammal species (such as cougar and bear) are commonly present within the park because of spatial constraints and sensory disturbance. Examples of wildlife observed during the site assessment include white-tailed deer, grasshopper sparrow, white-throated swift, common raven, dark-eyed junco, and Cooper's hawk; see Appendix C for a complete list.

PHYSICAL & CULTURAL

Site analyses to assess risk and to identify trail locations and conditions, recreational uses, and park features were completed by BENCH Site Design and Cabin Forestry in October and November 2016. These analyses were performed with GPS to map trail locations both on foot and on mountain bike. In addition, the District of Summerland hosted an open house on June 15, 2017 to present these site analyses and to solicit feedback about existing and future trail uses and issues in the park. The feedback collected at this open house is included in Appendix B.

In addition to its high value ecosystems and ecological communities, Giant's Head Mountain Park has many strengths that contribute to its value as a recreational amenity. Its central location within the community allows easy access by both road and trail, and it is a well-loved and well-used park that is valued by residents. Its varied terrain and geography support several recreational opportunities, predominantly hiking, and there are abundant existing trails that provide access to much of the park.

Trail with erosion, widened by use over time

SUMMARY OF EXISTING TRAIL SYSTEM STRENGTHS AND WEAKNESSES

STRENGTHS

- *Abundance of existing trails means that no or minimal new trail building is required*
- *Multiple scenic views*
- *Varied terrain and geography supports a range of trail recreation (e.g. walking, hiking, mountain biking, viewing)*
- *Central location within the community with access via road and trail*
- *Presence of intact high value ecosystems*
- *Locally-known recreation destination*
- *Established user base that cares about the park*

WEAKNESSES

- *Lack of designated trails has encouraged unsanctioned trail creation*
- *Unconstructed and unmaintained trails on steep grades are experiencing erosion and damage*
- *Vehicle parking is scattered throughout park; lack of designated parking areas*
- *Overflow parking spills along Milne Rd., creating conflict between park users and adjacent residents*
- *Several existing trails bisect sensitive habitat zones*
- *Lack of trail wayfinding signage*
- *Safety concerns at park road and trail intersections*
- *Safety concerns at steep slopes & cliff*
- *Unsanctioned 4x4 access has caused erosion and habitat damage in multiple locations*
- *Trail furniture is inconsistent and nearing end of life span*
- *Trail signage and furnishings lack coherent identity*

Existing Milne Rd. entry with plant restoration project

SUMMARY OF EXISTING TRAIL SYSTEM OPPORTUNITIES AND THREATS

OPPORTUNITIES

- *Consolidate parking at trailheads and destinations*
- *Improve access points, possibly with a new entry and consolidated parking area*
- *Erosion control to improve trail usability and protect habitat*
- *Habitat enhancement through trail consolidation and decommissioning*
- *Wayfinding enhancement through trail consolidation and decommissioning*
- *Enhance trails to suit needs of different user groups*
- *Improve safety by providing clear trail routes and transitions, and guardrails in required locations*
- *Wayfinding and regulatory signage to improve user experience and discourage unsanctioned trail use*
- *Improve branding and identity through consistent site furnishings and wayfinding signage*
- *Designate viewpoint locations & consolidate with parking or rest areas*

THREATS

- *Increased future usership could increase user conflict, habitat degradation, and trail maintenance requirements*
- *Wildfire*
- *Climate change (e.g. pine beetle kill, invasive species)*

Top: Existing cable guardrail at summit
Bottom: Example of existing weathered furniture

However, there are several key areas suggested by the site analyses that warrant attention for the long-term use and management of the park's trails and related amenities. The trail inventory found that there are over 12 km of predominantly user-created trails within the park. These trails vary in slope, width, and use, from heavily-used hiking trails to minimally-used and narrow mountain bike tracks. The trails have not been constructed but worn into native substrate through repeated use. This, combined with steep slopes, has caused extensive erosive damage, damage which continues to occur as trail users attempt to cut wider and safer trails around the eroded areas.

A narrow two-way asphalt road switchbacks up the mountain to an area near the summit. This road is used by vehicles, road cyclists, longboarders, and walkers, and is a key component of the overall trail and access system within the park. However, limited visibility at switchbacks, trail and road intersections, downhill speeds, and multiple user groups make the road a priority for safety and wayfinding improvements.

The primary trail users are hikers of varying ages and abilities who use the trails for recreational activities including fitness, bird-watching, dog-walking, and viewpoint access. Other trail and road user groups include, to a much lesser frequency, downhill mountain bikers, road cyclists, and road longboarders.

The main destination of both road and trails is the summit viewpoint, the location of the time capsule and view tubes. However, there are numerous other excellent viewing opportunities along the north, west and east slopes on the upper half of the mountain as well. With steep slopes and cliff faces present in several areas of the park, there are opportunities for safety improvements with the use of guardrails and signage.

Vehicle parking, both adjacent to the park entrance and within the park itself, is a significant issue. Parking at the base of the mountain is limited to parallel parking on the gravel road shoulder along Milne Road, which is both limited in quantity and a potential nuisance or hazard to the adjacent residential development. Unsanctioned parking occurs all along the park road (particularly at switchbacks and viewpoints), some of which is causing further erosion, de-vegetation, and encroachment into former picnic or viewpoint areas. A small parking area near the summit has approximately 6 official parking spaces, but the absence of parking lot delineation has seen additional parking encroachment onto the adjacent grassland.

Community and park user input suggests that there is currently minimal conflict between trail users (e.g. hikers and downhill mountain bikers). If park use increases, there is potential for this to become an issue in the future. However, at this time it is not recommended that trail separation by user group occur.

Site furnishings in the park include a washroom building at the top of the road near the upper parking area, numerous benches and picnic tables of varying vintages, regulatory signage, trash receptacles, and the centennial monuments and view tubes at the summit. Much of the site furniture is weathered and in need of replacement. The addition of wayfinding and trail signage will facilitate ease of use for many user groups.

3 TRAILS RE-DEVELOPMENT PLAN

View to north

3.1 VISION

The vision establishes overall direction for the planning and design of park trails and amenities. It is based on stakeholder, community, and local government input.

Giant's Head Mountain Park is a unique place of significant community and ecological importance, both in the District of Summerland and in the South Okanagan region, where people can access a well-developed trail network to experience passive recreation activities, natural and cultural heritage, and outstanding views of the surrounding valley.

3.2 MANAGEMENT CHALLENGES, GOALS, & ACTIONS

Broadly, the trails re-development plan addresses the following key areas: trails enhancement and decommissioning; vehicle and pedestrian access, including parking; ecological sensitivity; and wayfinding, safety, and comfort. These have been framed as a series of **challenges**.

Goals for the park trail system identify the overall intentions of the re-development plan as they relate to the identified challenges.

The **actions** then elaborate on the goals, providing direction on how the goals may be accomplished.

The following pages present these challenges, goals, and actions in table format, and are organized under topic headings.

ENVIRONMENT & CONSERVATION

Challenge	Goal	Action
Unsanctioned trail creation has caused extensive erosion and damage to the sensitive grassland ecosystem	Mitigate user impacts to sensitive park ecosystems	1. Establish park trail network that favours the use of existing trails and anticipates trail user desire lines 2. Decommission redundant trails through a combination of restoration, educational signage, and natural physical barriers 3. Restore eroded trail sections and prevent future erosion on the steepest sections with the use of crib stairs and switchbacks 4. Prevent vehicle access of off-road areas with natural physical barriers such as large boulders
Maintain healthy grassland ecosystems free of invasive plant and animal species	Prevent dispersal of invasive plants in park	5. Develop standards or create education program for local landscaping that to prevent the use of invasive plant species 6. Minimize bare soil conditions and revegetate disturbed park areas with site-appropriate native species 7. Restrict future road development within the park
Protect and enhance rare and endangered species within the park, as identified in the 2018 Environmental Assessment Report (see Appendix C)	Minimize impacts to sensitive habitats Monitor occurrences of rare and endangered species	8. Locate park trails and amenities to reduce impacts on known sensitive habitat 9. Develop a system for monitoring rare and endangered species and their habitats within the park? 10. Encourage park users and community groups to participate in the Conservation Data Centre's program for recording and monitoring rare and endangered species
Insufficient quantity of parking and lack of designated parking has causing unsanctioned parking along the roadway and at lookout/feature areas	Consolidate and formalize parking at park trailheads and destinations Minimize environmental impacts of parking areas and trailheads	11. Provide regulatory signage or physical barriers as needed to decommission unsanctioned parking areas 12. Provide animal proof garbage and recycling containers 13. Limit impervious surfaces 14. Intercept and infiltrate in planted areas any runoff generated by impervious surfaces 15. Use native and drought-tolerant species in planted areas
Climate change	Maintain trails and infrastructure that are climate change resilient	16. Implement recommendations within the Community Wildfire Protection Plan, including forest thinning and fuel management 17. Maintain and strengthen habitat connectivity and wildlife corridors within the park and with surrounding lands

RECREATION & ACCESS

Challenge	Goal	Action
A variety of users with varying needs, desires, and abilities use the park trails	Offer a range of trail types and difficulties Minimize potential user group conflicts Prioritize safety improvements	18. Use best practices in trail construction and renovation (e.g. maximum slopes, drainage rills) 19. Provide signage on shared hiking/mountain bike trails to minimize user conflict 20. Upgrade and reconfigure the 'The Grind', making it a hallmark hiking trail 21. Identify and improve a network of hiking and walking trails 22. Include vehicle/pedestrian pulloffs on the main road to minimize conflicts and improve safety 23. Provide separate trailhead and parking area for mountain bikers 24. Provide guardrails and signage in high-traffic areas near steep drop-offs 25. Implement a schedule for road closure that accommodates all park users 26. Add roadside mileage markers to assist emergency responders
Vehicular access and parking is limited	Improve vehicle parking areas Improve pedestrian linkages to the community	27. Improve parking at Milne Road entrance by providing a designated parking area outside of the road right-of-way 28. Improve parking at the upper viewpoint access by expanding the existing parking area and consolidating with the trailhead 29. Relocate vehicular gate at Milne Road entrance to improve visibility and prevent conflicts with adjacent residents 30. Consider future land acquisition at the base of the park if usership increases to necessitate additional parking 31. In the context of the larger community parks and trail system, consider improved pedestrian routes that connect to the downtown area and surrounding neighbourhoods
Viewpoints are, and will continue to be, intensively used	Improve access to and usability of viewpoints	32. Designate viewpoint locations along trail system 33. Provide seating opportunities at key viewpoints 34. Improve access to upper viewpoint with parking lot improvements and the institution of a one-way road loop at the upper parking area
Meet auxiliary recreation needs of park trail users	Facilitate a pleasant user experience by providing key amenities and information on trail and park use Respect historical features within park	35. Provide a second washroom facility at Milne Rd. entry 36. Upgrade site furnishings (e.g. benches and picnic tables) throughout park 37. Install kiosks at lower and upper trailheads to consolidate useful information (e.g. regulatory, interpretive, trail maps, etc.) 38. Preserve flagpole and time capsule monument at peak 39. Refurbish existing view tubes and, if necessary, relocate to a safe distance back from steep slopes and drop-offs 40. Incorporate park trails and amenities into an operations maintenance plan

Poor pedestrian connections to the downtown area and surrounding neighbourhoods	Improve pedestrian routes that connect to the downtown area and surrounding neighbourhoods	41. Review current pedestrian access to the park from downtown and surrounding neighbourhoods 42. Provide upgraded or new trail linkages to these areas 43. Include new wayfinding signage directing pedestrians to these linkages
Potential for conflict between dogs and trail users	Minimize human/dog and dog/dog conflict Prevent dog feces and plastic dog bags from littering the landscape Prevent dogs from disturbing sensitive habitat	44. Require that dogs within the park be on-leash 45. Include clear regulatory signs regarding dogs in the park and on trails 46. Prepare and implement a dog waste management strategy

INTERPRETATION & AWARENESS

Challenge	Goal	Action
Some visitors are unaware of the significance of park ecosystems	Increase awareness and appreciation of the park's ecology	47. Educate park users on the importance of trail decommissioning and rehabilitation in sensitive areas through signage 48. Provide interpretive information at key locations on the uniqueness and quality of the Giant's Head grasslands ecosystem, including information on restoration efforts and rare and endangered plant and animal species that are found in the park 49. Promote the uniqueness of the grasslands through promotional materials (e.g. District of Summerland website)
Giant's Head Mountain Park is unique in the District's park and recreation system	Increase awareness of the park and its recreational opportunities	50. Install sign at Milne Rd. park entry and to improve branding and identity 51. Improve park branding with consistent, durable, and attractive site furnishings, constructed items (e.g. retaining walls), signage, and graphics

STEWARDSHIP

Challenge	Goal	Action
Increased usership has potential to increase user conflicts or impacts on neighbouring properties	Maintain good relationships and communication with neighbouring property owners	52. Correspond and meet with neighbours regarding trail upgrade phasing & projects 53. Correspond and meet with neighbours as required to monitor concerns (e.g. increased traffic on Milne Rd.) 54. Monitor user groups use of park facilities to ensure needs are being met; adopt management actions as required
Increased usership has potential to increase habitat degradation	Engage community groups and stakeholders in park stewardship activities	55. Identify and engage community groups (e.g. schools, Rotary Club, naturalist groups, outdoor recreation groups) that may wish to have ongoing involvement in park stewardship and programs

Top: Trail near summit
Bottom: Mountain bike and hiking trail on east side of mountain

3.3 PROPOSED TRAILS PLAN

The proposed trails plan is an attempt to balance park users' recreational requirements with ecological and management needs. A preliminary version of this plan was presented at the June 15, 2017 open house; the final version included here has been modified to reflect the community feedback generated from this open house.

The following principles guided the preparation of the proposed trails plan:

- Use and restore existing trails where possible to minimize new trail work
- Reduce the overall number of trails in the park to facilitate habitat restoration activities and to protect sensitive ecosystems
- Emphasize a variety of trail experiences for various user groups (e.g., vary trail difficulty, facilitate viewing opportunities, emphasize looping trails)
- Prioritize hikers as the largest park user group
- Reduce conflict between vehicular and pedestrian uses
- Respect historic values of the park

The proposed trails plan includes the reuse and improvement of 6,200m of existing trails, the decommissioning and restoration of 6,390m of existing trails, and the addition of 1,035m of new trails. With less than 15% of the trails in the proposed trail network to be new construction, the environmental impact of this work is considered to be low. In addition, the new trails make key linkages to existing trails that will allow the decommissioning of several kilometers of trail, enhancing wildlife habitat and reducing the area of trails where human/wildlife conflicts may occur.

Trail Type	Length (m)
Existing Total	**12,590**
Improved existing	6,200
Decommissioned	6,390
New	1,035
Proposed Total	**7,235**

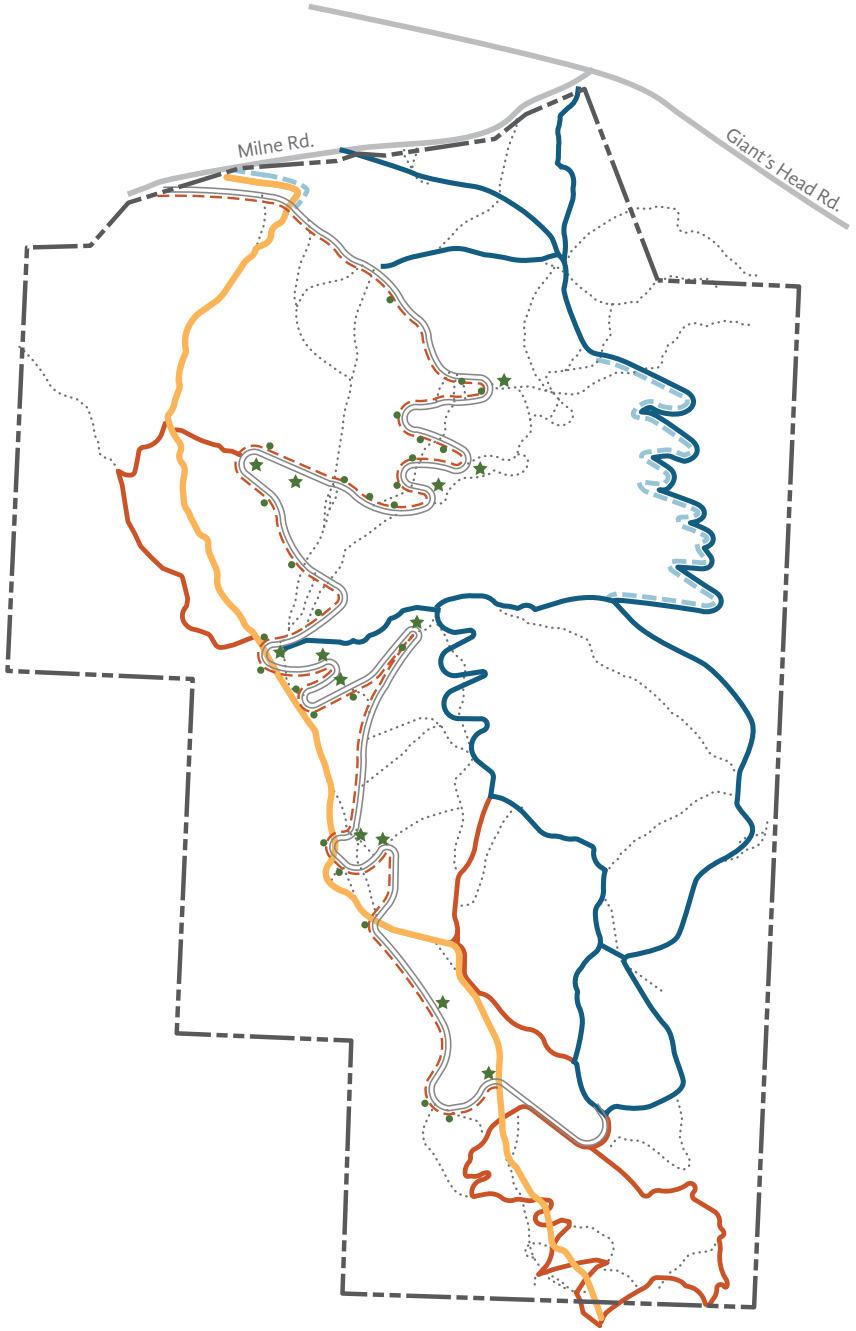
Many trails are redundant and have been created as shortcuts or as bypasses around difficult or eroded areas. By decommissioning these trails, these areas can be restored so that financial and maintenance resources can be concentrated onto a reduced number of trails. The decommissioning is not expected to detract significantly

PROPOSED TRAILS

GIANT'S HEAD MOUNTAIN PARK

NTS

- EXISTING ROADWAY
- THE GRIND TRAIL
- HIKING TRAIL
- MULTI-USE TRAIL
- ROAD WALKING ROUTE
- NEW TRAIL
- DECOMMISSIONED TRAIL
- VEHICLE PULL-OFF
- MOUNTAIN BIKE / PEDESTRIAN PULL-OFF



from the available terrain and trail experiences available to hikers in the park. Decommissioning activities will rely on a combination of passive trail closure (e.g. the strategic placement of boulders and logs to prevent access), active trail closure (e.g. addition of guardrails and/or signage), restoration activities (such as reseeding, planting, and mulching), and public education (including information at trailheads or on-trail signage explaining restoration activities).

Trail restoration activities take time and dedicated effort, but are important as fragmentation is one of the greatest threats to ecological integrity. Because restoration activities will require ongoing work and monitoring, this could be an good partnership opportunity with schools or volunteer organizations.

Hiking trails have been located to offer variation in difficulty and experience. The Grind offers both the quickest and the most difficult hike to the top of the mountain, while the other hiking trails are varied in slope and may have crib steps and stairs in steep terrain to accommodate users of varying abilities.

While mountain bike trail use is restricted to the east side of the park, the trails are multi-use and will accommodate hikers. This is the only area with proposed new trails; the preferred location for mountain bike use is in isolated areas to prevent cross-cutting onto adjacent trails. The layout of the trail is inclusive of the mountain bike experience, with provisions for descent speed, corners, and features specific to the activity. However, trail signage to outline trail etiquette should be provided to minimize conflicts and ensure that hikers, too, can enjoy a safe and enjoyable trail experience on the east side of the mountain.

The roadway is to be maintained as both a vehicular road and a walking and cycling route. Key points have been identified for the creation of pedestrian and vehicle pull-off shoulders to enhance safety. These areas are not intended for parking and will require natural barriers and signage to prevent such activity.

A programmatic element to note is the inclusion of vehicular restrictions on the roadway, which is heavily used by vehicular and pedestrian users alike. It is recommended that District staff explore potential closure times where the road will be closed to vehicles but remain open to all other park users, thereby improving safety conditions for walkers, cyclists, and longboarders.

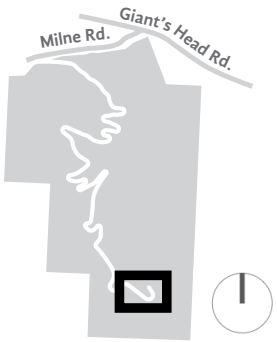
Trail and road improvements at the existing upper parking area will both address parking issues and maintain safe and free-flowing circulation.

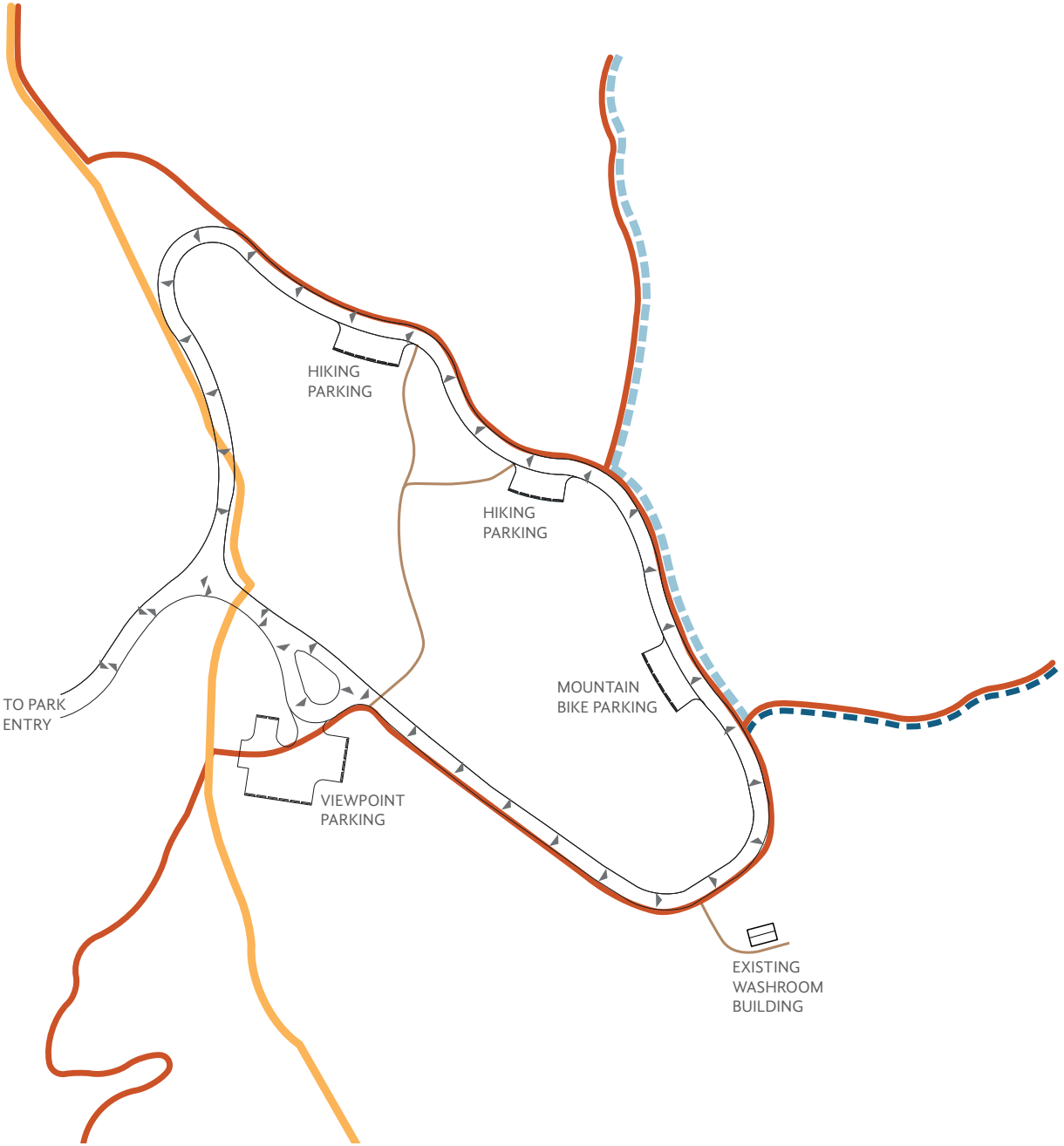
UPPER CIRCULATION

GIANT'S HEAD MOUNTAIN PARK

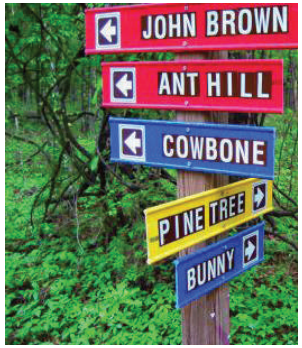
NTS

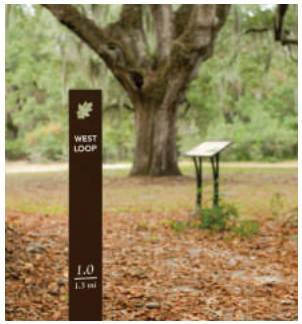
- ASPHALT ROADWAY
- THE GRIND TRAIL
- HIKING TRAIL
- MOUNTAIN BIKE UP TRACK
- MOUNTAIN BIKE DOWN TRACK
- CONNECTING TRAIL
- VEHICLE TWO-WAY CIRCULATION
- VEHICLE ONE-WAY CIRCULATION





Top: Upper circulation location plan





Above: Example of durable and distinctive trail markers and trail intersection signs
Right: Gabion basket benches

The existing parking area is both small and poorly-defined, and would benefit from modest expansion, granular resurfacing, and the inclusion of parking barriers to prevent parking on the adjacent grassland. See Section 3.4 for a more detailed plan of this area. The re-surfacing of an existing service road will provide one-way counter-clockwise vehicle circulation, and includes the addition of small parking areas that can function as overflow parking or be used by mountain bikers or hikers who use trails other than those connecting directly to the upper viewpoint.

3.4 PROPOSED TRAIL SIGNAGE PLAN

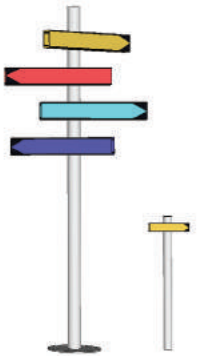
The proposed trail signage plan indicates key locations for a hierarchy of signage types that provide clear trail usage information to improve wayfinding throughout the trail network.

KIOSK

Displays overall trail navigation and etiquette information such as an overall park and trails map and regulatory trail signage with a higher degree of detail.

SAMPLE KIOSK

SAMPLE TRAILHEAD SIGN



SAMPLE DIRECTIONAL SIGNS

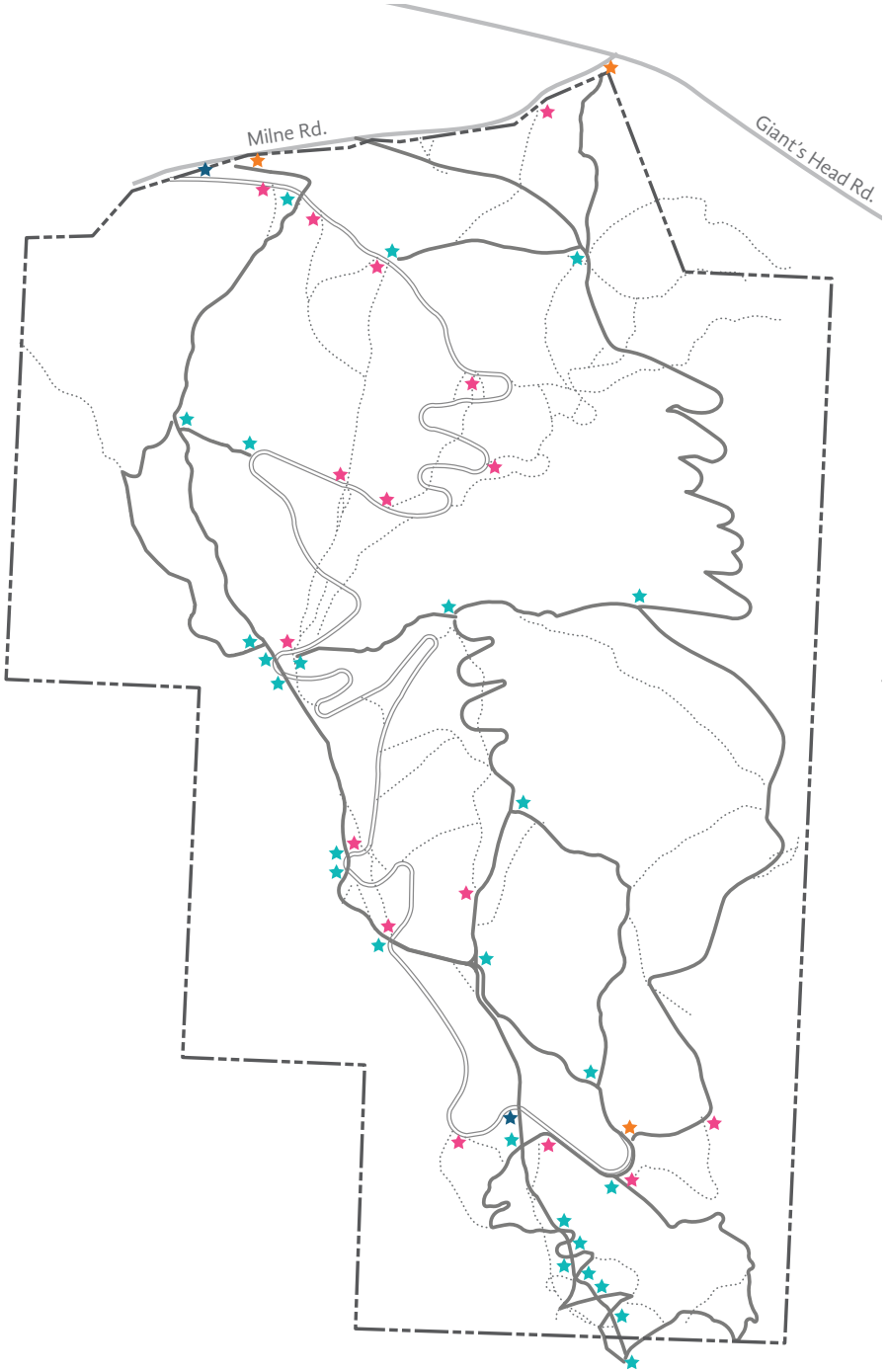
SAMPLE REGULATORY SIGN

PROPOSED TRAIL SIGNAGE PLAN

GIANT'S HEAD MOUNTAIN PARK

NTS

- EXISTING ROADWAY
- PROPOSED TRAIL NETWORK
- DECOMMISSIONED TRAIL
- KIOSK
- TRAILHEAD SIGN
- DIRECTIONAL SIGN
- REGULATORY SIGN



TRAILHEAD SIGN
Displays condensed overall trail navigation and etiquette information such as an overall trails map and regulatory trail signage.

DIRECTIONAL SIGN
Provides clear wayfinding at trail intersections throughout the network.

REGULATORY SIGN
Informs park users of sensitive areas in the park and areas with restoration in progress.

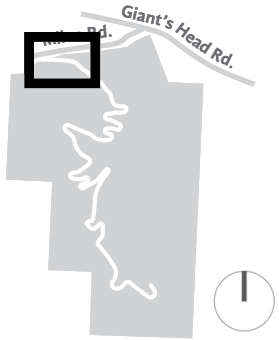
3.5 DETAILED PLANS

Three areas were identified as activity nodes with confluences of user groups and higher concentrations of trails and trail intersections, which warrant detailed plans for trail works and associated infrastructure. These are the Milne Rd. entry at the north base of the mountain, the upper parking area, and the upper viewpoint at the southern tip of the park.

MILNE RD. ENTRY

As the primary entry point to the park for all vehicular traffic and the majority of pedestrian traffic, the Milne Rd. entry is important both functionally and symbolically. The Milne Rd. entry plan focusses on improvements that improve parking and access conditions, emphasize the visual identity of the park entrance, and enhance user experience with key trail and amenity improvements.

Currently, the Milne Rd. shoulder is commonly used for parallel parking, but there are concerns with blocking access for emergency vehicles and residents of the surrounding neighbourhood. A long-term parking solution would address these issues as well as parking quantity. The plan proposes the creation of an expanded parking area to accommodate approximately 20-30 parking



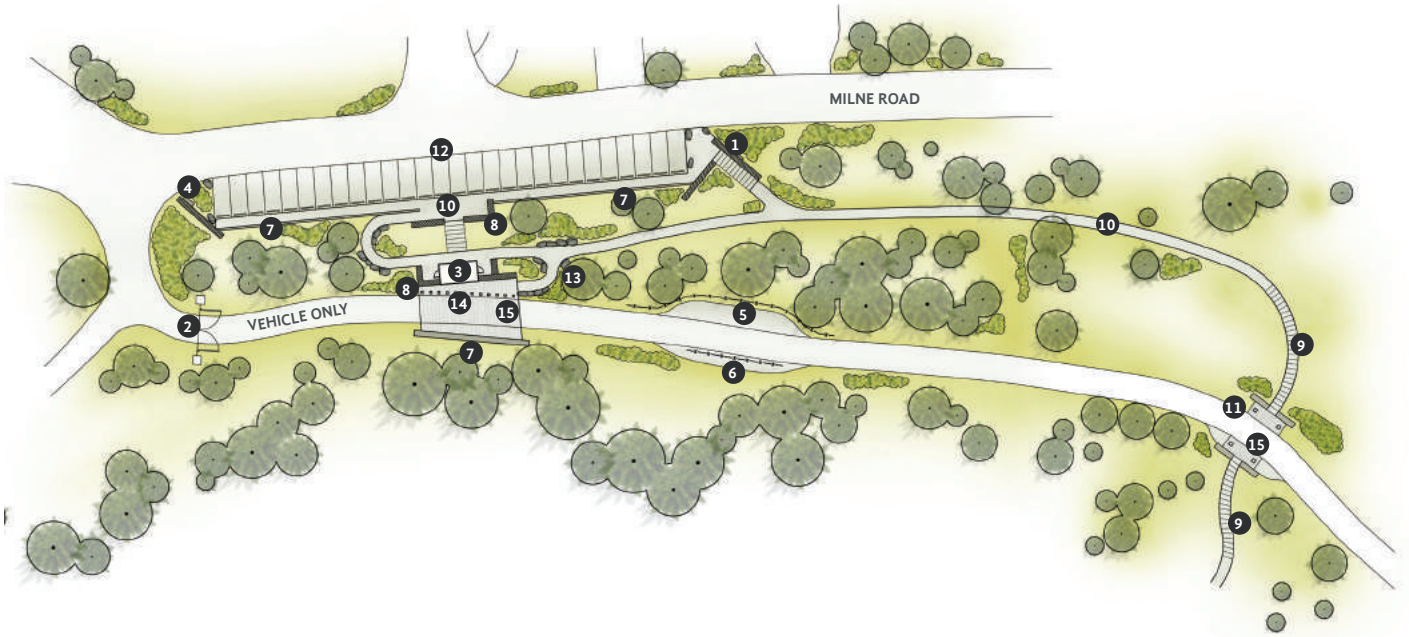
Top: Milne Rd. Entry location plan
Right: Washroom building precedent

MILNE RD. ENTRY

GIANT'S HEAD MOUNTAIN PARK

NTS

1. PARK ENTRY SIGN & GRIND ENTRY
2. VEHICLE GATE
3. WASHROOM BUILDING
4. PARK HOURS SIGN
5. VEHICLE YIELD PULL-OFF
6. ROAD WALKER / MOUNTAIN BIKE UPTRACK PULL-OFF
7. GABION BASKET RETAINING WALL
8. CONCRETE RETAINING WALL
9. CRIB STAIRS / TIMBER STAIRCASE
10. GRANULAR TRAIL
11. INTERSECTION MARKERS
12. GRAVEL PARKING LOT (28 STALLS)
13. BOULDERS
14. WOOD BOLLARDS
15. THRESHOLD PAVING



stalls perpendicular to Milne Rd. with a retaining wall to keep all parking within the park boundary and outside of the Milne Rd. right-of-way.

A new Giant's Head Mountain Park sign, placed at the front of the new parking area, will make the park entrance clear and welcoming, as well as assisting with park visual identity and branding.

The current gate is well within the park in a low-visibility location that does not allow for vehicle turnaround if the gate is closed. Moving the gate and its stone piers west will preserve this historic feature while making it more visible to vehicles approaching on Milne Rd. Maintaining a regulatory sign with park hours and gate closure information at the junction of the Giant's Head Mountain access road and Milne Rd. will further help with vehicle approach and access.

A key component of trail improvements in this area is the addition of crib steps and (if necessary) timber stairs. The trails in this region of the park are particularly steep. Combined with trail stabilization, steps and stairs will offer a more accessible entry point for all hikers whether they continue up the more difficult Grind trail or branch off onto easier trails.

The park currently has one washroom facility at the upper parking lot. The addition of a second washroom building at the Milne Rd. entry will be a useful user amenity and can double as a trailhead 'kiosk,' with regulatory signage and trail maps built into the side of the new building to help orient visitors and provide park information.

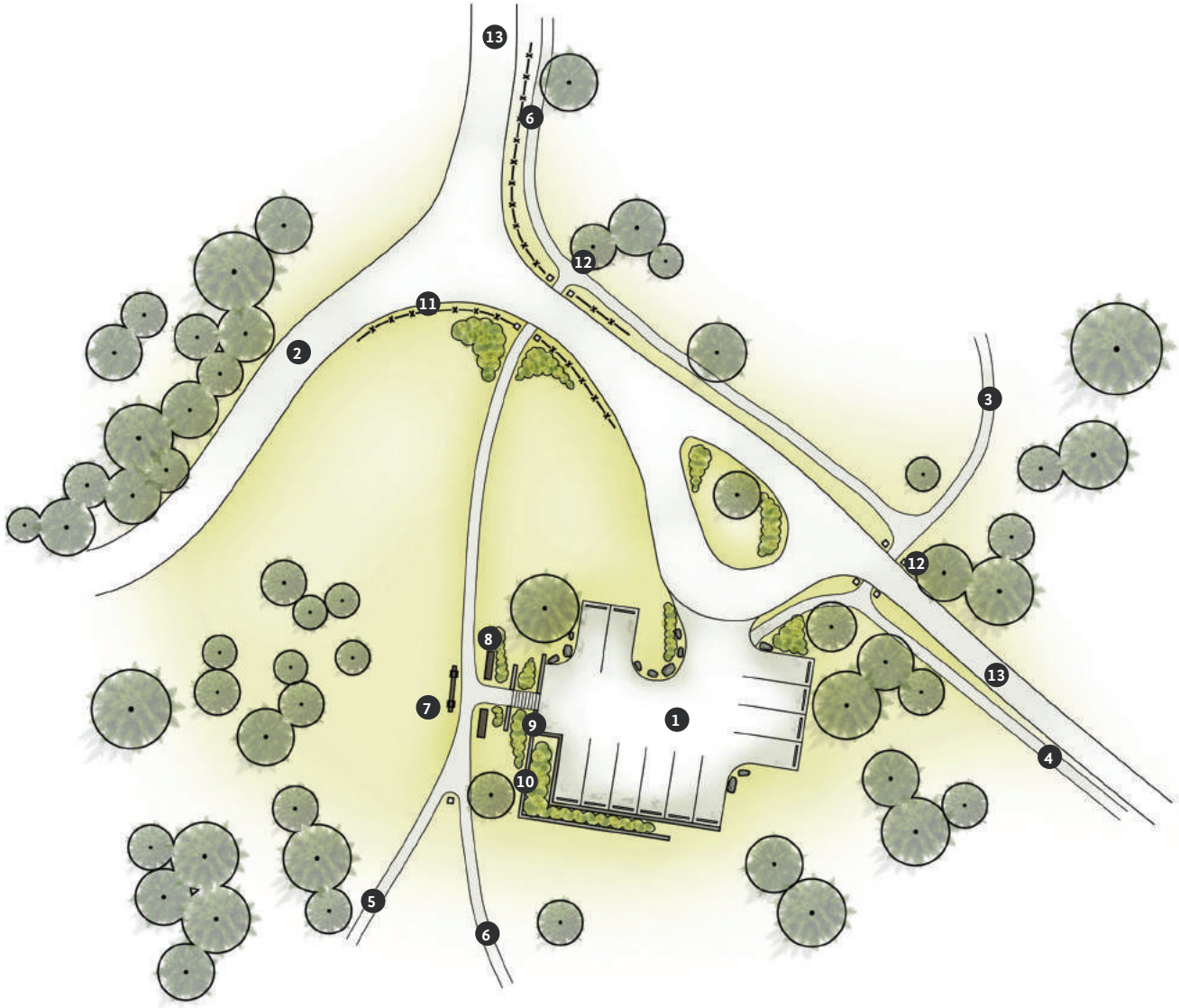
Top: Park entry sign & 'The Grind' wall precedent
Bottom: Gabion basket retaining wall

UPPER PARKING

GIANT'S HEAD MOUNTAIN PARK

NTS

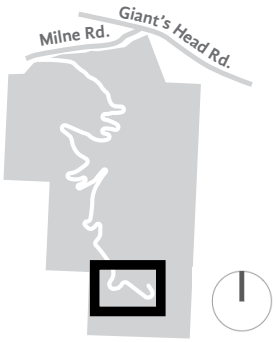
1. GRAVEL PARKING LOT (12 STALLS)
2. MAIN ROAD (TWO-WAY)
3. PATHWAY FROM OVERFLOW PARKING
4. PATHWAY TO WASHROOMS
5. PASSIVE HIKING TRAIL TO VIEWPOINT
6. "THE GRIND" TRAIL
7. PARK KIOSK
8. PARK BENCH
9. CONCRETE RETAINING WALL
10. GABION BASKET RETAINING WALL
11. GUARDRAIL
12. INTERSECTION MARKERS
13. LOOP ROAD (ONE-WAY)

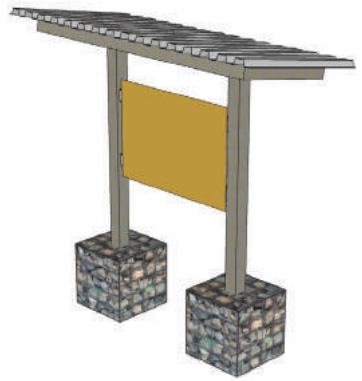


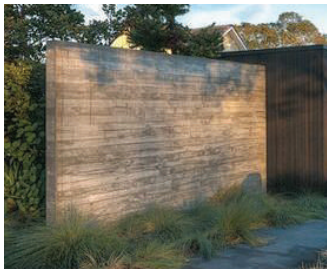
UPPER PARKING AREA

The expanded upper parking lot will include 12 stalls in a re-surfaced granular area with wheel stops and strategically-placed boulders to prevent parking outside of the lot. With improvements to the existing maintenance road creating a one-way vehicle access route, circulation will be well-marked and further delineated with guardrails to protect grassland areas and, where necessary, separate pedestrian trails and roadway. There will also be approximately 16 overflow parking stalls added on this one-way vehicle route.

As the main access point to the upper viewpoint, the intersection of The Grind trail and the parking lot will be marked with a small kiosk providing regulatory and wayfinding information. Minor improvements, such as concrete and gabion retaining walls, will also be included.







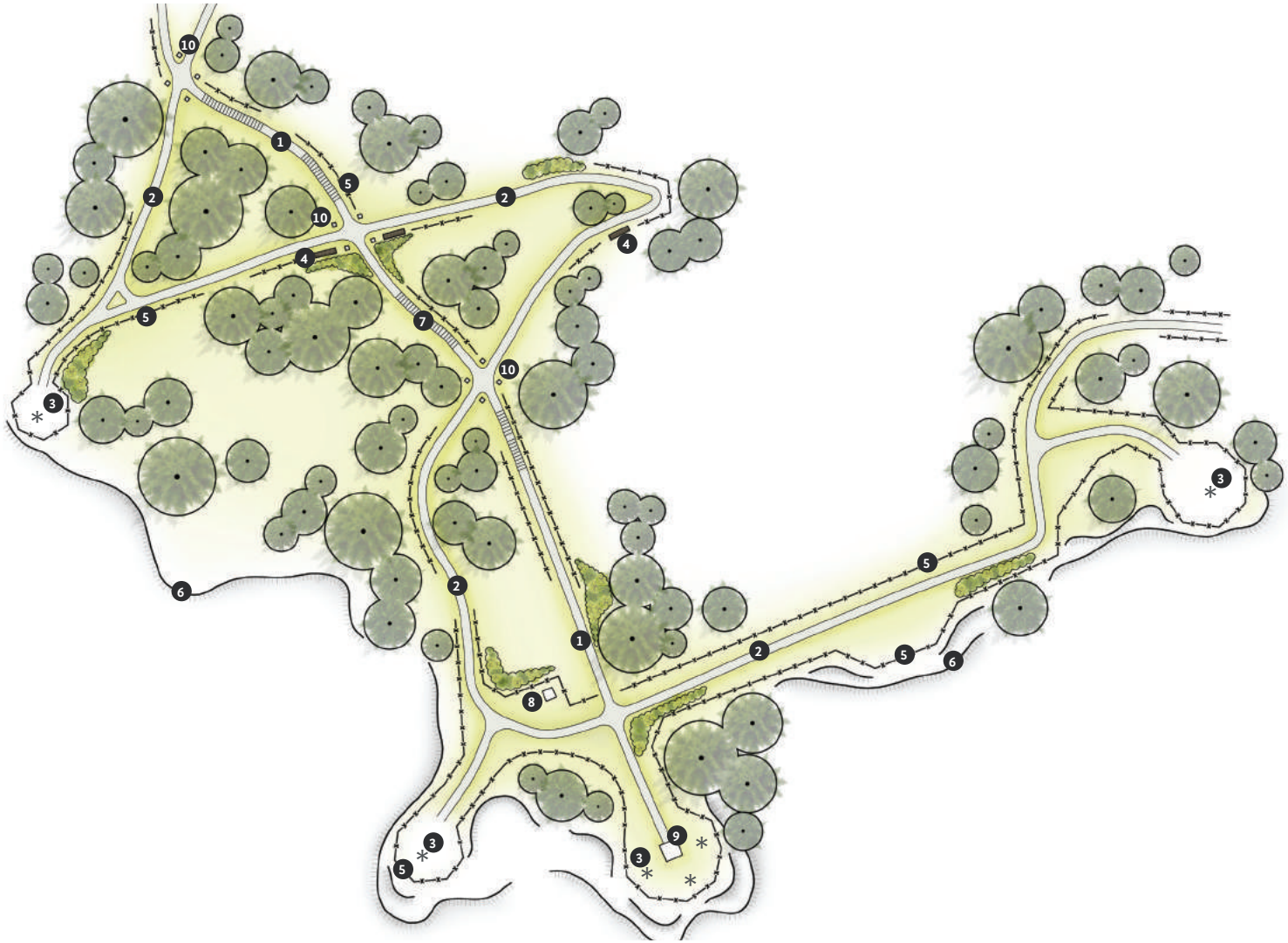
Top: Upper Parking Area location plan
Middle: Use of guardrails to mark trailheads
Bottom: Gravel parking lot
Upper right: Park kiosk precedent
Middle right: Boulders for vehicle control
Lower right: Gabion and concrete retaining walls

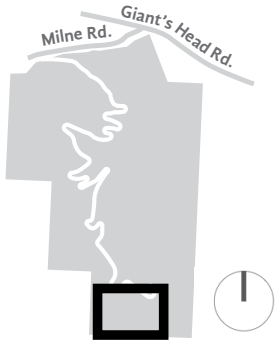
UPPER VIEWPOINT

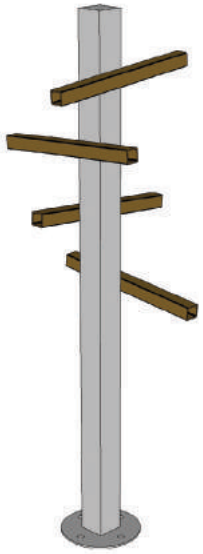
GIANT'S HEAD MOUNTAIN PARK

NTS

1. "THE GRIND" TRAIL
2. PASSIVE HIKING TRAIL TO VIEWPOINT
3. VIEWPOINT W/ VIEWTUBE FEATURE
4. PARK BENCH
5. GUARDRAIL
6. ROCK FACE
7. CRIB STAIRS / TIMBER STAIRCASE
8. EXISTING TIME CAPSULE
9. EXISTING MONUMENT & FLAGPOLE
10. INTERSECTION MARKERS





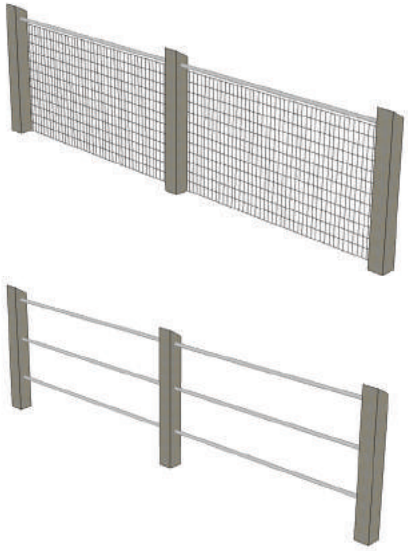


UPPER VIEWPOINT

The upper viewpoint is one of the most highly-used and, consequently, most damaged areas of the park. While the primary work will consist of extensive trail decommissioning, concurrent works will be necessary to encourage sustainable trail user habits, protect grassland and woodland undergoing restoration efforts, and address safety issues.

The Grind will continue to be the most direct route to the upper viewpoint. Because of the steep grade and severe erosion, crib steps and timber stairs will be necessary in certain locations to maintain restored trail conditions and provide a consistent surface for trail hikers.

A less steep secondary trail will wind its way to the summit and will offer a more leisurely and easier trail experience. The use of wayfinding devices, such as trail intersection markers, will be important to differentiate the trails and to discourage people from cutting their own trails to the summit. Likewise, the use of guardrails will be an important part of the trail work in this area to discourage people from deviating from the two main trails, as well as to improve safety conditions at steep locations along trails and at viewpoints.



Top: Upper Viewpoint location plan
Bottom: Proposed viewtube refurbishment
Right: Guardrail types for safety and habitat protection

Improvements for subsequent phases include replacing benches and refurbishing the view tubes at the upper viewpoint, a historic and well-loved feature that frames named viewpoints of Summerland and the surrounding valley.

Summit view of Trout Creek

4 IMPLEMENTATION STRATEGY

Park projects are often advanced in partnership with volunteers, agencies, institutions, and through grant programs to supplement core District budgeting. A planning-level cost estimate based on existing information is provided below, with suggested phasing to help prioritize works over several years.

4.1 COST ESTIMATE & PHASING

The work and associated costs identified on the following pages should be evaluated by staff and council relative to resource and budget requirements. Costs suggested here may vary depending on design and construction prices. The phases are ordered by priority, but this is subject to change dependent on available funding and funding conditions.

Phase 1 includes priority improvements to address immediate needs relating to trail usability, safety, and ecological sensitivity throughout the entire park. These include trail refurbishment and decommissioning to establish the overall park trail network, viewpoint improvements relating to safety and durability, and regulatory and wayfinding signage throughout the trail system.

Summary of Estimate of Probable Costs	
Phase 1	$344,900
Phase 2	$301,410
Phase 3	$278,315
Phase 4	$260,000

Subtotal	$1,184,625
15% Consultant Fees	$177,694
20% Contingency	$236,925
Total	**$1,599,244**

Phase 2 and 3 improvements build upon the Phase 1 work to further enhance functionality and user experience at key trail network locations. These include Milne Rd. entrance im-

provements, road upgrades, upper parking area upgrades, and furnishing upgrades.

Phase 4 improvements relate to the second washroom facility at the Milne Rd. entrance. This phase could be implemented at any time as it relates to user comfort and convenience and does not reflect an urgency in relation to trails restoration or user safety.

CLASS D COST ESTIMATE: PHASE 1

		Units	Qty.	Price	Item Total
1.0	**Park Trails**				
1.1	**New Trails**				
1.1.1	The Grind	l.m.	170	$15.00	$2,550.00
1.1.2	Multi-use Trails	l.m.	865	$15.00	$12,975.00
				1.1 Total	***$15,525.00***
1.2	**Existing Upgraded Trails**				
1.2.1	The Grind	l.m.	1502	$12.50	$18,775.00
1.2.2	Hiking Trails	l.m.	2533	$12.50	$31,662.50
1.2.3	Multi-use Trails	l.m.	2165	$12.50	$27,062.50
				1.2 Total	***$77,500.00***
1.3	**Decommissioned Trails**				
1.3.1	Trail Decommissioning (Restoration & Erosion Control)	l.m.	6390	$10.00	$63,900.00
				1.3 Total	***$63,900.00***
1.4	**Additional Trail Work**				
1.4.2	Crib Steps c/w Handrail on One Side	ea.	65	$300.00	$19,500.00
1.4.3	Timber Staircase c/w Handrail	ea.	65	$500.00	$32,500.00
				1.4 Total	***$52,000.00***
				1.0 Total	***$208,925.00***
2.0	**Viewpoint**				
2.1	**Road and Trail Work**				
2.1.1	Viewpoint Regrading & Surfacing w/ Compacted Granular	m^2	430	$45.00	$19,350.00
				2.1 Total	***$19,350.00***
2.2	**Furnishings and Features**				
2.2.1	Guardrail Type 1	l.m.	145	$175.00	$25,375.00
2.2.2	Guardrail Type 2	l.m.	420	$125.00	$52,500.00
2.2.3	Restoration Planting	m^2	450	$15.00	$6,750.00
				2.2 Total	***$84,625.00***
				2.0 Total	***$103,975.00***
3.0	**Signage**				
3.1	**Signage Types**				
3.1.1	Regulatory	ea.	16	$500.00	$8,000.00
3.1.2	Directional Signs	ea.	26	$750.00	$19,500.00
3.1.3	Trailhead Signs	ea.	3	$1,500.00	$4,500.00
				3.1 Total	***$32,000.00***
				3.0 Total	***$32,000.00***
				Subtotal	***$344,900.00***
				15% Consulting Fees	***$51,735.00***
				20% Contingency	***$68,980.00***
				Total	***$465,615.00***

CLASS D COST ESTIMATE: PHASE 2

1.0	**Road Upgrades**				
1.1	**Entry to Upper Parking Area**				
1.1.1	Vehicle Pull-offs (Incl. grading, surfacing, guardrail)	ea.	13	$5,000.00	$65,000.00
1.1.2	Pedestrian/Cyclist Pull-offs (Incl. grading, surfacing, guardrail)	ea.	26	$3,000.00	$78,000.00
				1.1 Total	***$143,000.00***
				1.0 Total	***$143,000.00***
2.0	**Park Entrance**				
2.1	**Road and Trail Work**				
2.1.1	Existing Entry Gate Removal	l.s.	1	$1,000.00	$1,000.00
2.1.2	Road Upgrades	l.s.	1	$20,000.00	$20,000.00
2.1.3	Crushed Granular Parking	m^2	421	$45.00	$18,945.00
2.1.4	Crushed Granular Trails	m^2	338	$45.00	$15,210.00
2.1.5	Crib Steps c/w Handrail on Two Sides	ea.	11	$350.00	$3,850.00
2.1.6	New Entry Gate	l.s.	1	$3,500.00	$3,500.00
				2.1 Total	***$62,505.00***
2.2	**Furnishings and Features**				
2.2.1	Kiosk	l.s.	1	$2,500.00	$2,500.00
2.2.2	Main Park Entry Feature / The Grind Entry	l.s.	1	$12,500.00	$12,500.00
2.2.3	Secondary Park Entry Sign	l.s.	1	$7,500.00	$7,500.00
2.2.4	Park Hours Sign	l.s.	1	$3,000.00	$3,000.00
2.2.5	Gabion Retaining Walls (1.2m Ht.)	face m.	108	$300.00	$32,400.00
2.2.6	Board Form Concrete Retaining Walls (1.2m Ht.)	face m.	38	$450.00	$17,280.00
2.2.7	Boulders	ea.	23	$75.00	$1,725.00
2.2.8	Restoration Planting	m^2	300	$15.00	$4,500.00
				2.2 Total	***$81,405.00***
				2.0 Total	***$143,910.00***
3.0	**Viewpoint**				
3.1	**Furnishings and Features**				
3.1.1	Benches	ea.	7	$1,000.00	$7,000.00
3.1.2	Viewtube Features	l.s.	1	$7,500.00	$7,500.00
				3.1 Total	***$14,500.00***
				3.0 Total	***$14,500.00***
				Subtotal	***$301,410.00***
				15% Consulting Fees	***$45,211.50***
				20% Contingency	***$60,282.00***
				Total	***$406,903.50***

CLASS D COST ESTIMATE: PHASE 3

1.0	**Upper Circulation**				
1.1	**Paving and Trails**				
1.1.1	Asphalt Paving	m^2	1340	$75.00	$100,500.00
1.1.2	Compacted Granular Paving (For Parking)	m^2	250	$45.00	$11,250.00
1.1.3	Connecting Pedestrian Trails	l.m.	170	$15.00	$2,550.00
				1.1 Total	***$114,300.00***
1.2	**Furnishings and Features**				
1.2.1	Upgrade Existing Washroom	ea.	1	$5,000.00	$5,000.00
				1.2 Total	***$5,000.00***
				1.0 Total	***$119,300.00***
2.0	**Upper Parking Area**				
2.1	**Road and Trail Work**				
2.1.1	Asphalt removal	l.s.	1	$1,250.00	$1,250.00
2.1.2	Compacted Granular Paving	m^2	327	$45.00	$14,715.00
2.1.3	Crib Steps c/w Handrail on Two Sides	ea.	9	$350.00	$3,150.00
				2.1 Total	***$19,115.00***
2.2	**Furnishings and Features**				
2.2.1	Kiosk	l.s.	1	$2,500.00	$2,500.00
2.2.2	Benches	ea.	2	$1,000.00	$2,000.00
2.2.3	Gabion Retaining Walls (1.2m Ht.)	face m.	56	$350.00	$19,600.00
2.2.4	Boulders	ea.	10	$75.00	$750.00
2.2.5	Restoration Planting	m^2	50	$15.00	$750.00
				2.2 Total	***$25,600.00***
				2.0 Total	***$44,715.00***
				Subtotal	***$278,315.00***
				15% Consulting Fees	***$41,747.25***
				20% Contingency	***$55,663.00***
				Total	***$375,725.25***

CLASS D COST ESTIMATE: PHASE 4

1.0 Park Entrance

1.1 Furnishings and Features

1.1.1	Washroom Building	l.s.	1	$225,000.00	$225,000.00
1.1.2	Washroom Servicing (Water, Elec., San.)	l.s.	1	$35,000.00	$35,000.00
				1.1 Total	***$260,000.00***
				1.0 Total	***$260,000.00***

Subtotal	***$260,000.00***
15% Consulting Fees	***$39,000.00***
20% Contingency	***$52,000.00***
Total	***$351,000.00***

APPENDIX A: RESOURCES & REFERENCES

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APPENDIX B: OPEN HOUSE FEEDBACK

APPENDIX B: OPEN HOUSE FEEDBACK

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

Don't think so.

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

The Grind, Hiking Trail.
I only use the road when the trails are too icy (spring). I do not mountain bike on G.H.

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

Appreciate the de-commissioning. We have the KVR Trail, Conkle Mtn, and other hiking areas outside of Dist. boundaries that are accessible.

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

road bikes

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

Hiking Trails.

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

Close ~~ther~~ road except Sundaay!

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

* Biggest concern address erosion from top parking lot to top of mountain. Stairs would be awesome!

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

- Road cyclists.
  - cyclists from all over the valley ride the road to train for races

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

I use the road for biking (mountain), running & hiking. I rarely use the trails because I prefer the road.

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

- I would like to see the road closed Mon - Fri, because more people use the road for non-vehicle uses than those who drive.

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

- Times when no vehicle access in park.
- I use the bottom of Milne Rd ~~access~~ pathway so I can walk from my house & avoid the road up.
- Love the grind trail

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

Would love to see more information along the trails the info about this unique environment

FEEDBACK QUESTIONNAIRE: Qe

GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.

Are there additional user groups in this park that have not already been identified?

- Bird watchers
- Wild flower photographers

QUESTION 2.

What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

Yes Yes Yes No

QUESTION 3.

Are there any additional comments or suggestions for the re-development of the trails in this park?

- Do not close/decommission the trail from the bottom of the Mine Rd.
- Do not overdo safety fences/rails. We do not want to feel "caged in"

MARTIN NISBET

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

THE COMMUNITY THAT ABUTS THE PARK (MILNE RD & TAYLOR PL).
HIKERS ARE #1 USERS AND FAR OUT NUMBER ALL OTHER USERS.
- PROBABLY ROAD BIKERS USE THE MOUNTAIN MORE THAN MOUNTAIN BIKERS ALTHOUGH, THEY ONLY USE THE ROAD FOR THE HILL CLIMB.
- SNOWBOARDERS ONLY USE THE MOUNTAIN FOR 3 DAYS A YEAR (BYE-LAWS FORBID THEM AT OTHER TIMES). BY FAR THEIR BIGGEST IMPACT IS PARKING ON MILNE ROAD & BUS TURN AROUND OUTSIDE GATE

MOUNTAIN BIKE TRAILS ON CONKLE, CARTWRIGHT, WILD HORSE & RATTLESNAKE MOUNTAINS ARE USED FAR MORE THAN GIANT'S HEAD. DON'T OVER ESTIMATE THEIR USE OF THIS PARK. *

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

GRIND & EASTSIDE TRAILS. TO BE HONEST, IF YOU MAKE THE EAST SIDE TRAILS "DOWN HILL MOUNTAIN BIKE TRAILS ONLY" I WILL STILL WALK THEM AS I HAVE NEVER SEEN A BIKE ON THEM SINCE GLENFIR SCHOOL CLOSED DOWN

THE ROUNDABOUT WILL GREATLY & ADVERSELY (NEGATIVELY) AFFECT THE LOCAL COMMUNITY BY INTERFERING WITH GARBAGE COLLECTION, SNOW CLEARANCE, ROAD CLEANING & GENERAL DELIVERIES — MUST NOT HAPPEN.
THE WASHROOM SHOULD BE A SMALL BUILDING - 1 MALE 1 FEMALE TOILET WITH HAND BASIN
- NO NEED FOR ANYTHING ELSE!

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

DE-COMMISSIONING TRAIL FROM BOTTOM OF MILNE ROAD WILL ONLY FORCE USERS OF MOUNTAIN TO PUT FURTHER PRESSURE ON GATE ACCESS BUT, WILL NOT DETER USERS FROM USING IT. "FIGHT THE BATTLES YOU CAN WIN!"
SAFE FENCING AT TOP ESSENTIAL.
THE GRIND TRAIL IS OK FOR FITNESS & TOUR MARKETING. DEAL WITH EROSION BUT, LEAVE THE MOUNTAIN AS THE NATURAL BEAUTY THAT IT IS. DO NOT OVER BUILD ON IT. * *

* MANY SCHOOL KIDS ARE WALKED-UP THIS MOUNTAIN & THEIR SAFETY IS AN ISSUE.

** PARKING ON MILNE ROAD HAS TO INCLUDE TOURISTS & LOCALS WITH LONG PICK-UPS, RV's, MOTOR HOMES.

CONGRATULATIONS TO ROTARY & COUNCIL FOR HOOKING INTO OPENING-UP THIS WONDERFUL LEE NATURAL RESOURCE

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

Dog TRAIL ??

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

Close road to cars (certain Hrs. / Days ???)

Dangerous as is with hair pin turns.

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

- I would like more consideration of youth for example - a time slot for Long Boarders 4 AM to 8 AM either Saturdays or Sundays -

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

- BIRDERS PERHAPS WALKERS
-

QUESTION 2.
What trail type that is ~~existing / proposed~~ are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

RESTORATION WAS MENTIONED, HOPEFULLY TO INCLUDE WEED CONTROL - INVASIVE SPECIES SUCH AS KNAPWEED IS BECOMING A PROBLEM AND WILL JUST GET WORSE YEAR OVER YEAR.

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

- Make it a teaching area for our kids
  - ▷ signs to explain plants / animals

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

Hiking Trail
Mountain Biking

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

Would like a trail to start up the mountain near Milne Rd / Giants Head Rd intersection
Otherwise have to walk up ~~Mt~~ Milne Rd — dangerous.

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

QUESTION 2.
What trail ~~type that is existing / proposed~~ are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

All of the above - mostly Grind Trail.

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

① Please consider limiting traffic.
② Timing stn (top & bottom) similar to Grouse Mtn.

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

Longboarders would love to use it (illegal now). Why not open the road to longboarders one day per week (close it to vehicles on that day)?

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

Summerland is full of engaged, caring, passionate citizens Council should form a Giants Head Committee enabling the many talented people to help form a more detailed plan.

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

Existing roadway, hiking trails

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

More consultation needed.

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

QUESTION 2.
What ~~trail type~~ that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

Leave Milne Road / @ Giant's Head Road open

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

"promote Giant's Hd as. The first Activity / Fitness / " self powered Mtn - no cars no vehicles

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

MOST LIKELY TO USE HIKING TRAILS. WOULD LIKE TO SEE NETWORK EXPANDED. - PARTICULARLY LESS RIGOUROUS ROUTES, AND ROUTES THAT COULD BE USABLE IN WINTER - LESS STEEPLINE.

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

- Youth. (not just longboarders → all youth).

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

- Hiking trail / existing roadway for hiking / cycling only

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

- Thank you for decommissioning some trails + rehabilitating sensitive areas.
- This planning exercise is valuable.

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

No.

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

* Close the road.
* Less consideration of moto. bikers. Already well served by Conkle/Cartwright with no vehicle conflict. Leave side views for hikers.

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail) Walking, Long boarding

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

we need a walking trail to the east side of the mountain. There is no point in having a park which no one (other than bikers) can see, or use. I am not sure of the current trail you propose to decommission

but we still need access to the East side

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

Hiking trail that is not as steep a grade as "The Grind"

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

Knox Mtn in Kelowna is a good example of a user-friendly grade that accommodates many abilities. The Grind is a great event ~~key~~ but the start of the grade of the trail is not serving the needs of the largest percentage of hikers.

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

NO

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

RESTORATION + CONSERVATION OF THE PARK IS MOST IMPORTANT.

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

Horseback riders? Don't know if that activity is allowed in the park.

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

Walking for exercise up the roadway. At times, using the trail that is parallel # to the E. of the Grind Trail. Sounds like that trail will be decommissioned. Else recommend the N. end of the grind trail be improved c/w low maintainence series of steps.

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

Don't decommission the trail that starts @ bottom of Mildred.

Board as an opportunity [illegible] expansion of the network
to Enhance / Improve, the trails in the
Park, ~~Until this evening I thought~~
Instead ~~[illegible]~~ [illegible] we stated that
Approx 50% of the trails will be
eliminated.

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

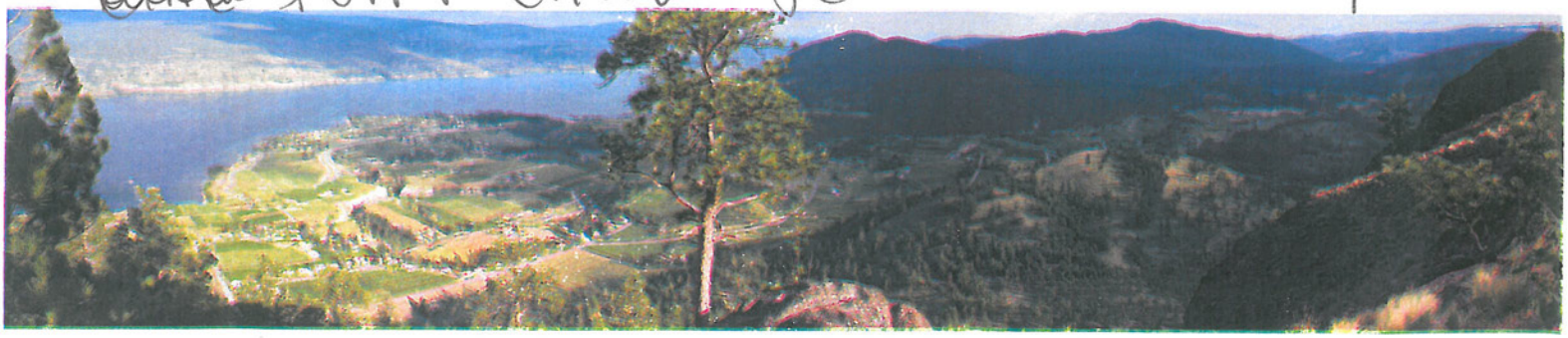
1. hikers
2.

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

Existing roadway
Hiking Trails - East Trail a fav.

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

Please close the road.
Don't put a bike washing station please.
No roundabout please.
Don't encourage mt. bikers please



TRAILS RE-DEVELOPMENT MASTER PLAN PUBLIC OPEN HOUSE
GIANTS HEAD MOUNTAIN PARK | SUMMERLAND BC | JUNE 15, 2017

DISTRICT OF SUMMERLAND

Love the idea of taking care of the trails.

over →

Need more than the road + designated trail up or it will be too busy. "Like a mall"

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

Not that I can think of!

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

I currently walk or run on almost all the existing trails and have observed that walkers/hikers are by far the biggest user group - very few mountain bikers.

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

I think the development of a proper trail along "The Grind" will be great as it is used year round and will prevent erosion.

The few bikers I have seen on Giants Head have been going up the road and coming down along roughly "The Grind" so to have a descent "mountain

P-T-O.

P-T-O. →

bikers only" route is unnecessary. That proposed route should be open to all users as that side of the mountain is used a lot by other people, the proposed hiking route does not go anywhere near that east edge and I think if you do not allow walkers, runners to use it they will make their own route in that side of the mountain and you will be back to square one! if you are trying to reduce the number of routes. On that note I think it is poor and I do not agree that 50% of the ~~trails~~ area we now have to walk on will no longer be available.

- I am sure a better balance between protecting the environment and trail use can be achieved. The presenters at the open house took pride in saying they had reduced available trails from 12km to 6km - sorry, but I don't want to be herded along a very limited amount of trail. I think long boarders should be better accommodated and would support closing the road to ~~vehicles~~ motorised traffic for part of the weekend to allow more access for them.

A trail from the Milne Road/Giants Head road to join the network would be great as many people to dot do not drive but walk to the park.

Thank you for your consideration of my thoughts.

FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

QUESTION 1.
Are there additional user groups in this park that have not already been identified?

You should seriously consider eliminating any motorized traffic from the park. It only contributes pollution, cigarette butts and empty beer cans - add an unnecessary hazard to recreational hikers.

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

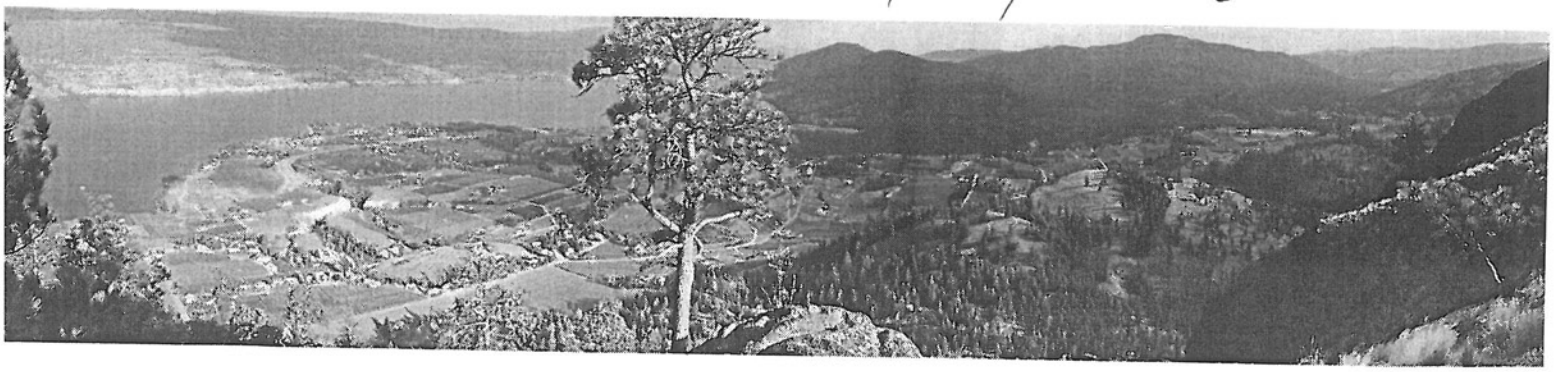
I use existing hiking trails on a daily basis.

No Grind Trail is too steep for most people. Half of the GH Grind participants used the next trail instead of the Grind Trail.!

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

Providing a bike wash facility + toilet is a really bad idea. It will only act as an additional noise generator in a residential neighborhood.

Walter Stein, Apples and Quails B+B, Trayler Place



FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

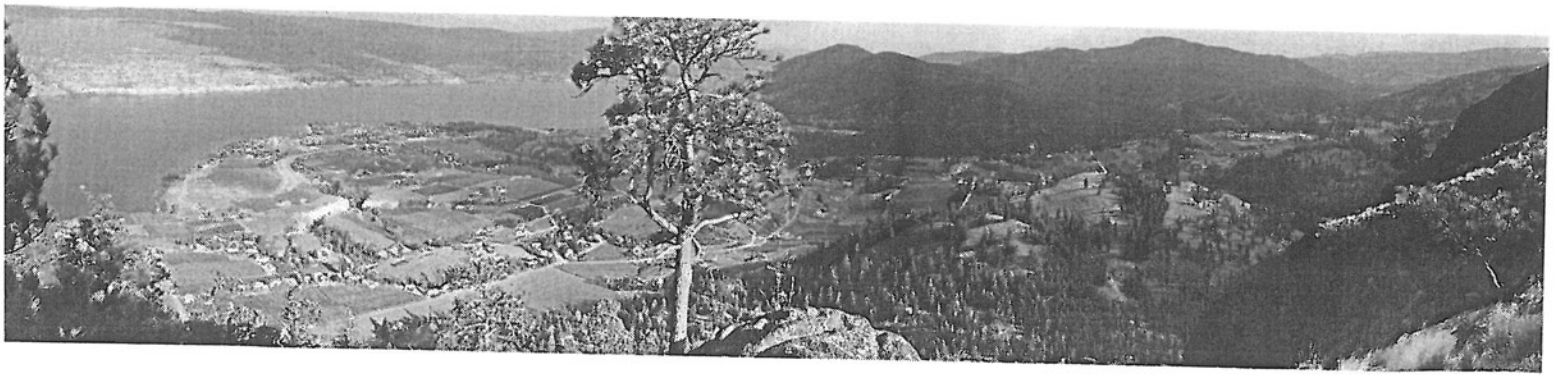
QUESTION 1.
Are there additional user groups in this park that have not already been identified?

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

(1) East trail to views of Lake-Shore Drive +
(2) Bottom of Milne Road.

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

no traffic please -
no round abouts
no trailers or campers



FEEDBACK QUESTIONNAIRE:
GIANT'S HEAD MOUNTAIN PARK TRAIL RE-DEVELOPMENT

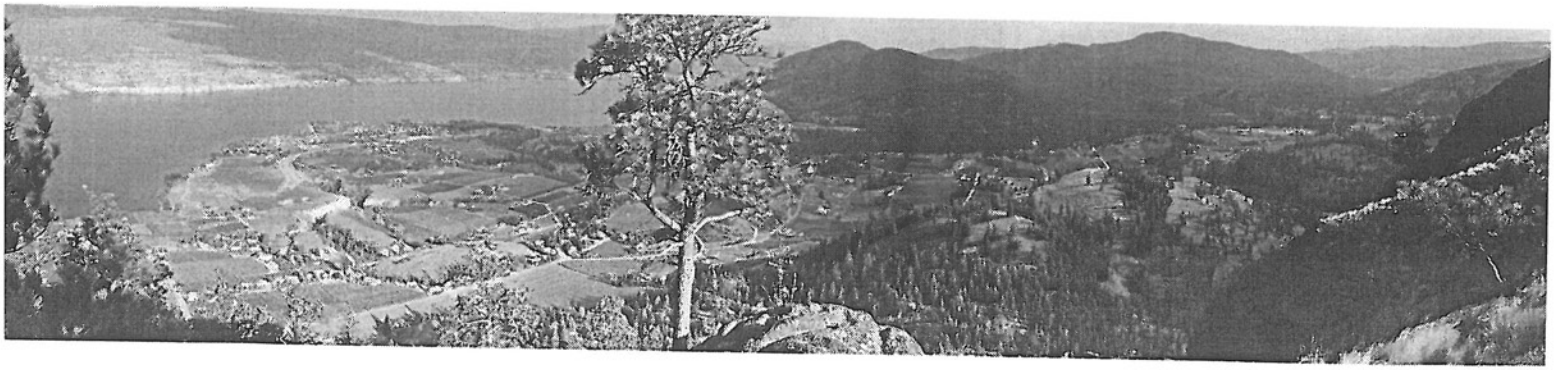
QUESTION 1.
Are there additional user groups in this park that have not already been identified?

QUESTION 2.
What trail type that is existing / proposed are you most likely to use? (Existing Roadway, The Grind Trail, Hiking Trail or Mountain Bike Trail)

walk way along Milne Road on Mtn side

QUESTION 3.
Are there any additional comments or suggestions for the re-development of the trails in this park?

no extra impact like Bike wash - not necessary!!!



APPENDIX C: ENVIRONMENTAL ASSESSMENT REPORT

District of Summerland
2018 Giant's Head Mountain Park Trails Redevelopment Plan
Environmental Assessment

Prepared for:

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Most importantly, we would like to thank the land and waters of the Okanagan-Similkameen that provide a lifestyle, preserve a culture and prepare a way forward.

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Environment and Climate Change Canada
Environnement et Changement climatique Canada

SOUTH OKANAGAN-SIMILKAMEEN CONSERVATION PROGRAM

DISTRICT OF SUMMERLAND

Recommended Citation: Arquilla, B. 2018. District of Summerland 2018 Giant's Head Mountain Park Trail Redevelopment Plan Environmental Assessment. Mountain Pacific Consultants Ltd. Technical Report: 2018.114.003.

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EXECUTIVE SUMMARY

On behalf of the Corporation of the District of Summerland and Bench Site Design Ltd., Mountain Pacific Environmental Consultants Ltd. completed a comprehensive 2018 Environmental Assessment (EA) in advance of a recreational trail development project on Giant's Head Mountain Park within the District's municipal boundary (the Project). Objectives of the report include characterization of the biophysical environment, review of park design for potential impacts and validation of delineated effects pathways. Project goals targeted mitigation recommendations that eliminate or minimize potential trail redevelopment impacts to biophysical resources. Towards this effort, the EA team completed baseline data capture, data analysis, effects pathway analysis and developed mitigation strategies for identified Valued Components.

Biophysical field investigations found the EA's Local Study Area were comprised of ponderosa pine (PPxh1) and interior Douglas-fir (IDFxh1) habitat. Ecosystem community observations were consistent with expected communities for the identified biogeoclimatic variants. Winter track count survey efforts produced 64 observations including ungulate, canine, mustelid and two domesticated species. Early season, distance based avian point count surveys produced 73 observations from 36 species. Incidental observations yielded an additional 8 avifauna species. Results from the entire EA Local Study Area found a Shannon Diversity Index of 4.19. Mean avian species richness for ages class found 7.80 ($\pm$0.85) species among overmature seral plots, 8.25 ($\pm$0.48) species among edaphic climax units and an overall men species richness of 7.89 ($\pm$0.54). Overall species richness was highest in overmature seral plots (22), followed by edaphic climax stands (22). Species Richness for all habitats may be skewed due to low habitat availability and subsequent sample size within the Project study area. No hibernacula or confirmed herptile use areas were identified through field investigations. Echolocation detection yielded two bat species occupying habitat along the park road access corridor. Inquiry through British Columbia Ministry of Environment produced no masked occurrences for Species at Risk on Project lands.

Species accumulation curves (with rarefaction) were used to compare an estimate of standardized species richness among habitats. Based on the species accumulation curves, the number of species continues to ascend, yet flatten, beyond the number of individuals sampled in all habitat types (i.e., the curves is approaching asymptote) indicating adequate data capture with the LSA avian community. This metric provides confidence that estimated species richness for the early breeding season period is accurate. However, it must be understood that early season breeding surveys may not fully capture the true species richness of the EA Local Study Area without comparative field surveys later into the breeding season.

A spatial assessment of impacts to wildlife used both GIS based polygon mapping and program FRAGSTATS to develop EA Local Study Area and Regional Study Area metrics examining edge effects including patch area, patch density and patch edge. Assessing comparative land use metrics, allows potential impacts (both physical and sensory) to be weighed against spatial attributes regarding loss of area, patch density,

patch edge, and ecosystem function. Assessments of land use metrics, habitat suitability and impact potential best ensures an understanding of ecosystem function and advances proactive protection of Project Valued Components. Examining both land use metrics and wildlife natal dispersal distances identified park constraints with respect to meta-population dispersal and immigration. Designing and mapping proposed trails with the intent of maximizing contiguous grassland habitat will assist in delivering both physical and sensory protection to local SAR (i.e. American badger, Nuttall's cottontail). Comparative winter and summer field investigations suggest GHMP offers important ungulate winter range. However, given deer natal dispersal distances, lack of movement corridors and significant cumulative effects within the RSA, Project lands may act as a population sink for local ungulate metapopulations. Sensitivity indexes were developed for local habitats within GHMP. Forested areas of the park were identified as District of Summerland Environmentally Sensitive Area (ESA) 3 due to adjacent road, trail and infrastructure disturbance. The park's northern grasslands, southern cliff faces and contiguous ponderosa pine and interior Douglas-fir forest are identified as ESA 2 and subject to minor invasive species colonization

Paired trails (hiking and mountain biking downtrack) may heighten recreational use on the east side of the park through winter. Winter tracking surveys yielded high winter use by deer and described avoidance of habitat along the park access road and neighbouring trails with high snowshoe activity. Given the importance of the park to local deer populations, it is further recommended that a study examine changes in use of ungulate winter range following trail implementation.

New trail development within GHMP has the potential to impact local snake populations through heighted collision mortality. Basking snakes are especially vulnerable to both the rapid speed of decent of bicycles on the downtrack and poor sight lines from narrow trails. As decommissioned trails grow over, snakes may be further drawn to the open, compact trails maintained by bicycle traffic. Compensation efforts targeting artificial hibernacula have the two-fold benefit of enhancing local Great Basin gophersnake (*Pituophis catenifer deserticola*) Critical Habitat and offsetting snake mortality. Strategically placed hibernacula along decommissioned trails at undisclosed locations provides secure and available denning and basking habitat for local Great Basin gophersnake populations and cohorts.

An Effects Analysis derived impact pathways for identified park trail redevelopment components. Assessments delineated residual impacts to Valued Components from the project's design, construction and operations phase. Our report recommends mitigation strategies for minimizing the trail design footprints, assessing ungulate winter range, protection of reptile and amphibian habitat, protection wildlife trees during trail routing, minimizing wildlife attractants, planting prescriptions and invasive species control, erosion and sediment control, wildlife collision deterrence, artificial hibernacula projects and environmental management planning. The trail redevelopment plan assists biophysical resources within Project lands by reducing recreational use impacts through footprint minimization, narrowed sensory disturbance and habitat management.

STATEMENT OF LIMITATIONS

This Traditional Environmental Overview Assessment has been prepared, and the work referred to in this report has been undertaken, by the Corporation of the District of Summerland in collaboration with Mountain Pacific Environmental Consultants Ltd. (Mountain Pacific). It is intended for the sole and exclusive use of the Corporation of the District of Summerland and its authorized agents for the purpose(s) set out in this report. Any use of, reliance on or decision made based on this plan by any person other than the Corporation of the District of Summerland and its authorized agents for any purpose, or by the Corporation of the District of Summerland and its authorized agents for a purpose other than the purpose(s) set out in this plan, is the sole responsibility of such other person or the Corporation of the District of Summerland and its authorized agents.

Any conclusions or recommendations made in this plan reflect the Corporation of the District of Summerland and Mountain Pacific's judgment based on the following: site investigation(s); literature review; and interviews with individuals having information about the project. Neither the Corporation of the District of Summerland nor Mountain Pacific make any representation or warranty as to its completeness or accuracy. If site conditions change or if any additional information becomes available at a future date, modifications to the findings, conclusions and recommendations in this plan may be necessary.

Nothing in this plan is intended to constitute or provide a legal opinion. Neither the Corporation of the District of Summerland nor Mountain Pacific make any representation as to the requirements of or compliance with environmental laws, rules, regulations or policies established by federal, provincial or local government bodies. Revisions to the regulatory standards referred to in this report may be expected over time. As a result, modifications to the findings, conclusions and recommendations in this report may be necessary.

Other than by the Corporation of the District of Summerland, and its authorized agents and as set out herein, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of the Corporation of the District of Summerland and Mountain Pacific, with the approval of the Corporation of the District of Summerland.

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ACRONYMS, ABBREVIATIONS and TERMS

BGC	Biogeoclimatic Zone
BEC	Biogeoclimatic Ecosystem Classification
BC	British Columbia
BC MFLNRO	British Columbia Ministry of Forests, Lands, Natural Resources and Rural Development
BC MOE	British Columbia Ministry of Environment
BCEAA	British Columbia Environmental Assessment Act
BG	Bunchgrass Zone
CEAA	Canadian Environmental Assessment Act
CWS	Canadian Wildlife Service
DFO	Fisheries and Oceans Canada
EAO	Environmental Assessment Office
EA	Environmental Assessment
EC	Environment Canada
ESA	Environmentally Sensitive Areas
ESC	Erosion and Sediment Control
FFD	Frost Free Days
GGD	Growing Degree Days
GPS	Global Positioning Unit
IDF	interior Douglas-fir Zone
HWY	Highway
km^2	square kilometres
LED	Linear Edge Density
LSA	Local Study Area
m	metres
MASL	meters above sea level
PP	Ponderosa Pine Zone
RDOS	Regional District of Okanagan-Similkameen
RSA	Regional Study Area
SEI	Sensitive Ecosystem Inventories
UTM	Universal Transverse Mercator
TCH	Trans-Canada Highway
VC	Valued Components

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1 INTRODUCTION

The Corporation of the District of Summerland is proposing a recreational trail development project on Giant's Head Mountain Park within the District's municipal boundary. The proposed trail network is designed to reduce disturbance to sensitive ecosystems within the subject property. Trail design objectives further include reducing multi-use conflicts, erosion control, mechanical disturbance, wildlife habitat protection and human-wildlife interactions within Project lands.

In November 2016, Mountain Pacific Environmental Consultants Ltd. was retained by Bench Site Design Inc. to complete a comprehensive Environmental Assessment (EA) of proposed park development works (the Project). The intention of this report is to characterize the biophysical environment, review park design for potential impacts and provide mitigation recommendations to minimize and alleviate potential park development impacts to biophysical resources. The EA is required to facilitate approval by the British Columbia Ministry of Forest, Lands and Natural Resource Operations and Rural Development (BC MFLNRORD) and subsequent Master Plan permitting. Specific to the EA, regulatory and community engagement will include Regional District of Okanagan-Similkameen (RDOS), Canadian Wildlife Service (CWS), Environment Canada (EC), and Fisheries and Oceans Canada (DFO).

1.1 PROJECT UNDERSTANDING

It is our understanding that the District of Summerland requires a comprehensive EA in advance of proposed trail development works and upgrades on GHMP. The EA report addresses recreational trail design and routing, park access road design and mapping in support of development works. Additional landscape design works will accompany primary Project upgrades.

Project requirements include the development of an Effect Analysis to assess impact potential form park development works and prescribe resulting mitigation measures. Impact mitigation will employ tangible actions in keeping with park requirements and trail design planning. Project components will include a systematic approach employing Study Design, Data Capture, Results Analysis, Results Interpretation, Mitigation Planning and Project Recommendations.

2 PROJECT SCOPE

2.1 PROJECT DESCRIPTION

The scope of the Project is to provide a comprehensive Environmental Assessment for the proposed Master Plan trail development in Giants Head Mountain Park. In preparation for comprehensive review, a preliminary overview study was completed to assess high level project impacts. This study did not

include primary biophysical data capture due to closures on standard wildlife and vegetation inventory timing windows. The 2018 impact assessment report uses information from primary and secondary biophysical data records. Towards this effort a vegetation and wildlife assessment were collected in winter and spring of 2018 and an updated impact assessment be completed utilizing information from this study and findings from primary and secondary vegetation and wildlife data collection.

In advance of construction, our EA examined potential impacts from aquatic and terrestrial biophysical resources including fisheries, vegetation and wildlife. Areas of concern include study design, spatial boundary delineation, habitat loss, population impacts, wildlife movement, sensory disturbance and cumulative effects.

Specifically, our Project's technical review addressed the following VCs:

- Rare and Sensitive Ecological Communities
- Wildlife Habitat
- Ungulates
- Carnivores
- Furbearers
- Rodents
- Bats
- Migratory Birds
- Non-migratory Birds
- Raptors
- Reptiles
- Amphibians

2.2 PROJECT OBJECTIVES

The following is a list of the Project Objectives that are to be addressed during the course of the study:

- Identification of VCs;
- Review of regulatory framework specific to the Project;
- Develop the EA's spatial and temporal boundaries;
- Conduct a preliminary baseline assessment of the Project area;
- Characterize the baseline environment and wildlife habitat quality in the Project Area;
- Identify rare and at risk vegetation, ecological communities, and wildlife;
- Conduct analysis and assessment of Project conditions;
- Identify the potential environmental effects of site preparation and construction, operation, and maintenance of the District of Summerland project;
- Identify and assess Cumulative Effects on Projects VCs;
- Consultation with the District of Summerland and Bench Site Design Inc. staff
- Determine mitigation strategies and procedures to avoid or reduce any identified effects;
- Determine residual environmental effects that cannot be reasonably mitigated; and
- Establish recommendations in support of Parks Master Plan project delivery.

Figure 2.1 Typical steppe/grassland vegetation along west facing cliffs within the Project LSA.

2.3 PROJECT LOCATION

The Project study area is located in the District of Summerland, BC; within the Regional District of the Regional District of Okanagan-Similkameen and entirely contained within the Okanagan Water Basin. Giant's Head Mountain Park lies within the Southern Interior Ecoprovince and the Northern Okanagan Basin Ecosection (Demarchi 2011, Figure 2.1). The remnant volcano dome is bordered by agricultural, residential, and industrial lands and lies approximately 1.01 km west of Okanagan Lake (Rossel 1999, Figure 1.1).

The proposed trail development is approximately centered on 11 U 307153 m E 5496552 m N. The legal description of the subject property is District Lot 2561 Except Plans 463, Except Plans M15186; PID 011 343 125 and PID 011 343 273. The park ranges in elevation from 487 m ASL to 778 m ASL. Located approximately 945 m west of Okanagan Lake, the Project area occupies a dominant feature above the valley floodplain and consists of gradual to steep slopes above the District of Summerland.

Figure 2.2 Giant's Head Mountain Park Project Location.

2.4 PROJECT CONTACT INFORMATION

Contact information pertaining to Project works is detailed in Table 2.1.

Table 2.1 EA Project Contact Information and Responsible Parties.

Role	Organization	Contact	Telephone	Email
Proponent	District of Summerland	Lori Mullin	250.404.4084	lmullin@summerland.ca
Proponent's Consultant	South Okanagan Similkameen Conservation Program	Alison Peatt	250.809.2609	alisonpeatt@shaw.ca
EA Project Consultant	Mountain Pacific Environmental	Brian Arquilla	250.540.4623	brian@mtn-pac.com
Landscape Architect	Bench Site Design	Keith Nyhof	250.470 2342	keith@benchsitedesign.com
Natural Resource	MFLNRO	Josie Symonds	250.490.2254	Josie.Symonds@gov.bc.ca
Local FN Lands Manager	Penticton Indian Band	Dan Sarazin	250.493.0048	lands.manager@pib.ca
BC Regional District	Similkameen Recreation Manager	Karl Donoghue	250.377.8673	simrec@rdos.bc.ca

2.5 PROJECT SCHEDULE

The Project was initiated on January 5th, 2018. Data capture occurred during mid-winter and early spring 2018. Table 2.2 highlights significant tasks and responsible parties identified throughout the Project period.

Table 2.2 EA Project Schedule and Identified Tasks.

Task	Responsible Parties	Date of Completion
Project Initiation	District of Summerland, Bench, Mountain Pacific	January 5th, 2018
Background Review	Mountain Pacific	January 15th to 19th, 2018
Winter Biophysical Field Investigation	Mountain Pacific	February 4th, 2018
Owling Survey	Mountain Pacific	April 21st, 2018
Spring Biophysical Investigation	Mountain Pacific	April 21st to May 14th, 2018
Result Assessment & Analysis	Mountain Pacific, Bench	Feb 12st to May 16th , 2018
Impact Mitigation	Mountain Pacific, Bench	May 3rd, to May 17th, 2018
Draft Report Submission	Mountain Pacific	May 28th, 2018
Draft Report Edits	District of Summerland and Bench	June 4th, 2018
Final Report Submission	Mountain Pacific	June 8th, 2018
Construction Initiation	District of Summerland and Construction Contractor	Summer 2018

2.6 PROJECT SCOPE

The spatial boundaries delineated are Project-specific and are based on the predicted spatial extent of work-related effects and the life history attributes of flora and fauna potentially influenced by both physical and sensory park development works. The Project's Regional Study Area (RSA) has been selected to capture any effect that may extend beyond the EA LSA and subsequently impact the abundance and distribution of floral and wildlife populations. The EA LSA has been selected to assess the immediate direct and indirect effects of park trail development options on ecological communities and wildlife.

GHMP lands comprise a mix of municipal park land bordered by both residential and agricultural lands which encompass the park boundary. Drainage of off GHMP feed a number of small creek systems including Eneas Creek, Trout Creek and Prairie Creek before dispensing into Okanagan Lake. The Project study area occurs completely within the RDOS and comprises portions of British Columbia's Great Basin Desert and interior plateau. Proximate to Summerland, the desert basin is dominated by ponderosa pine (*Pinus ponderosa*; PPxh1 - Okanagan Very Dry Hot), interior Douglas-fir (*Pseudotsuga menziesii glauca*; IDFxh1 - Okanagan Very Dry Hot) and interior Douglas-fir (IDFxh1 - Okanagan Very Dry Hot) subregions (British Columbia MFLNRO 2016).

2.6.1 Spatial and Temporal Project Boundaries

Completion of an EA requires the development of VC spatial and temporal boundaries defining the Project study area. These boundaries are specific to physical and sensory impacts to biophysical resources. Delineating spatial and temporal boundaries provides study design parameters for adequate investigation of VC.

Towards this effort map and landscape design products from Bench Site Design Inc. have been used to determine the Project scope and scale for preliminary investigation. Spatial boundaries for assessing VC consist of a polygon survey system within the proposed construction footprint and appropriate spatial buffers. Specific to the GHMP study area, the EA has identified appropriate temporal considerations for investigation. Further, the defining of temporal boundaries provides a working schedule for baseline data capture. Assessing the immediate Project footprint, while inferring both impacts and protection options to the larger GHMP environment, accounts for effects to ecological function at the landscape scale.

Table 2.3 Spatial and Temporal Boundaries for EA Valued Components.

Project VC	Spatial Boundaries	Temporal Boundaries	Data Capture Schedule
Ecological Communities	Project footprint polygons	Year-round	May 14th, 2018 to May 16th, 2018
Avifauna	Project footprint polygon surveys.	Year-round	May 14th, 2018 to May 16th, 2018
Regional owl species	GHMP and sensory disturbance thresholds	Year-round	April 21st, 2018
Mammals	GHMP and sensory disturbance thresholds	Year-round	February 4th, 2018 to May 14th, 2018
Regional bat species	GHMP and sensory disturbance thresholds	Year-round	February 4th, 2018 to May 14th, 2018

2.6.2 Local Study Area

The established Project LSA encompasses the GHMP boundary together with a 200 m buffer to account for sensory disturbance from operational phase activities (Figure 2.3). The 200 m LSA buffer is to be maintained as the park trail redevelopment project proceeds through construction and operation. Cumulative effects assessments for the Project beyond the 200 m safeguard. All sensory impacts within the delineated LSA are to be identified and subsequent mitigation applied to viable negative impacts. Landscape within the Project LSA constitutes primarily pristine habitat on steep and gradual slopes. The park maintains a moderate ascent from north to south with a steep vertical bluff on the south and east face. Adjacent to the LSA is a mix of residential, industrial and agricultural lands. A single access road and a developed trail network run throughout the study area. Native habitat within the EA LSA includes ponderosa pine forest, interior Douglas-fir forest and bunchgrass habitat. Small patches of native grasslands and meadow can be found within forest complexes.

1:10,000

Map 1 - LSA - Land Use Metrics

Project: 2018 Giant's Head Mountain Park Trails Redevelopment Plan
Client: Mountain Pacific Environmental Consultants Ltd.
GIS Consulted: Cabin Forestry Sevices Ltd.
Map Created: 5-20-2018
Data Sources: District of Summerland, Bench Site Design Inc., ESRI, Data BC

The data in this map was not created with survey grade GPS, and may be inaccurate with errors, omissions.

0 160 320 480 640 800 960 Metres

Coordinate System: NAD 1983 UTM Zone 11N

Legend

- Geographic Point
- Municipal Boundaries
- Local Roads
- Highways
- Lakes
- Watershed Boundary
- Index Contour
- Intermediate Contour
- Giants Head Trail Base
- Giants Head Park Boundary
- LSA Boundary

LSA - Land Use Metrics Type

- Agricultural/Rural
- Baseline (Undeveloped/Park)
- Rail Road
- Riparian
- Roads/Trails
- Urban

LOCATION INSET

1:2,000,000

Peachland
Summerland **Project Location**

MOUNTAIN PACIFIC ENVIRONMENTAL CONSULTANTS LIMITED

Cabin Forestry

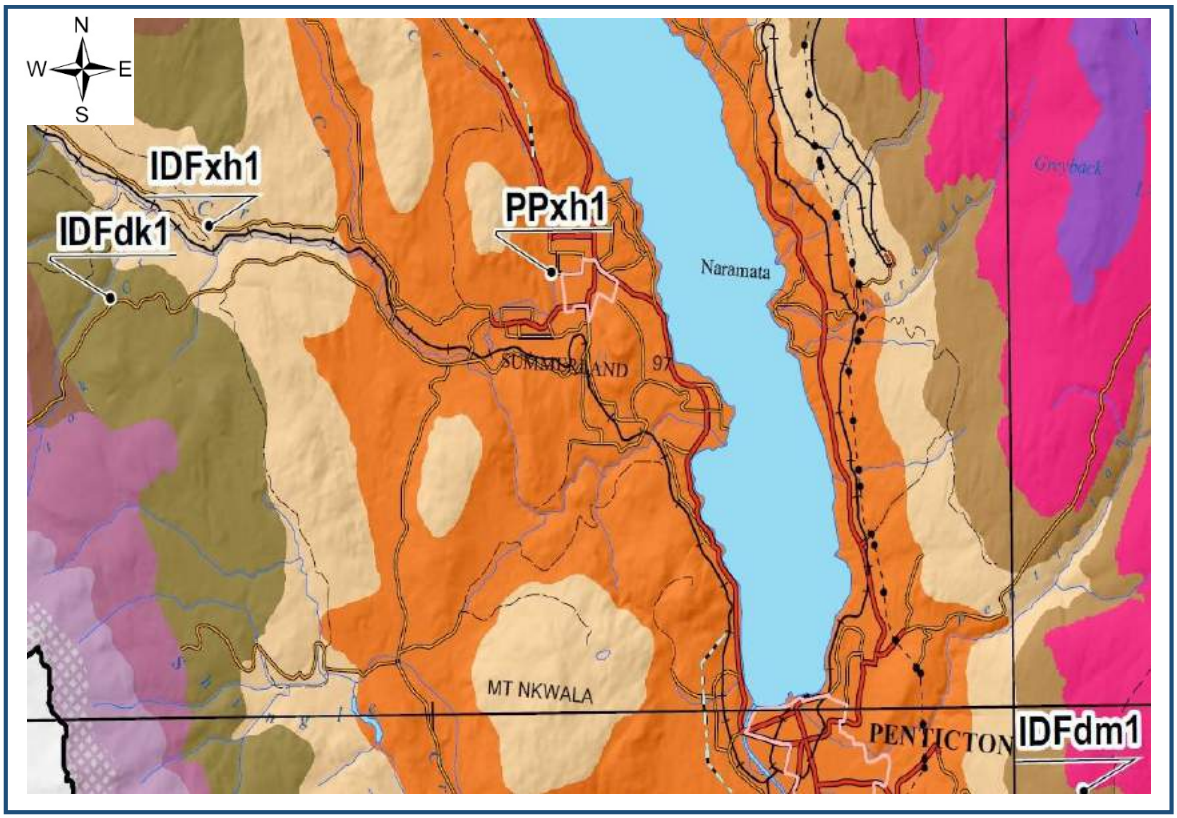


Figure 2.4 Biogeoclimatic Zone classification near Summerland, BC. (Source: BC MFLNRO 2016)

2.6.3 Regional Study Area

The Project RSA includes all minor GHMP drainages downstream to Okanagan Lake. The EA RSA was defined to capture the large-scale direct and indirect effects of the park trail redevelopment works on biotic and abiotic parameters (Figure 1.5). This study area further incorporates wildlife resources with wide population distributions. The study area is home to several wide-ranging wildlife species including ungulates, carnivores, passerines, and raptors; some of which are Species at Risk (SAR). The identified RSA polygon maintains a perimeter of 19.5 km and an area 19.2 km2.

The scale and boundaries of the EA RSA capture the diversity of habitats that support the seasonal requirements of wildlife resources. The boundary includes all of the downstream area expected to be affected by the park trail redevelopment project, so downstream effects on birds (e.g., relating to water flow changes), and regionally sensitive fish species can be appropriately assessed. Rare plants are expected to be impacted only by the actual footprint of the park trail redevelopment project; therefore, the EA RSA provides spatial boundaries that are appropriate for the assessment of floral SAR. The Regional Study Area comprises several drainages including Eneas Creek, Trout Creek and Prairie Creek.

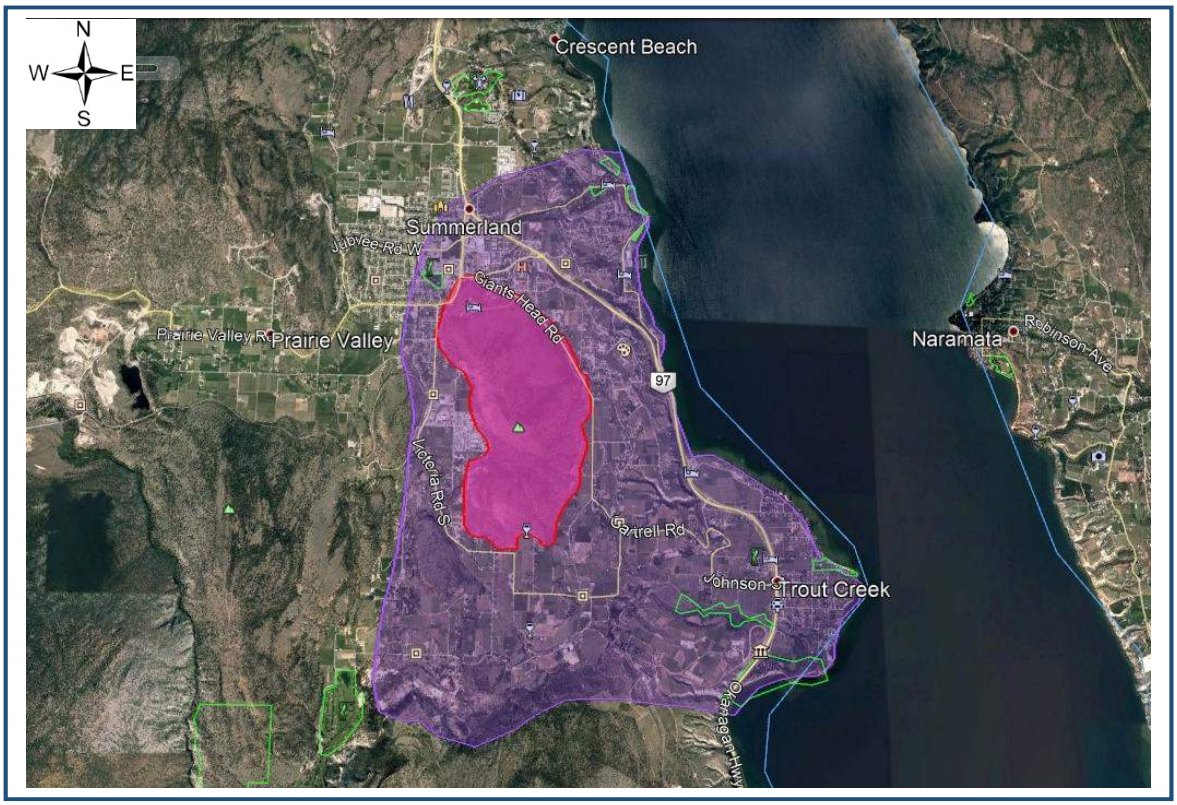


Figure 2.5 Project Regional Study Area.

Local Study Area
Regional Study Area

2.6.4 Project Components

Project components will include features addressed at both the Construction and Operation phase. Identified road and trail infrastructure and associated works will determine Project impact potential (Figure 2.6). Table 2.4 Identifies GHMP project components during respective phases.

Table 2.4 Park Trail Redevelopment Project Component Identification.

GHMP Project Phase	GHMP Project Components	Ancillary Works & Other Activities
Construction	• Road bed. • Parking lot. • Construction access roads. • Trail Construction.	• Waste and spill management. • Soil erosion and sedimentation. • Equipment and operation.
Operation	• Road maintenance • Parking Lot maintenance. • Trail maintenance.	• Waste and spill management. • Road and Parking Lot maintenance. • Signs/public management. • Lighting and electrical. • Equipment and operation.

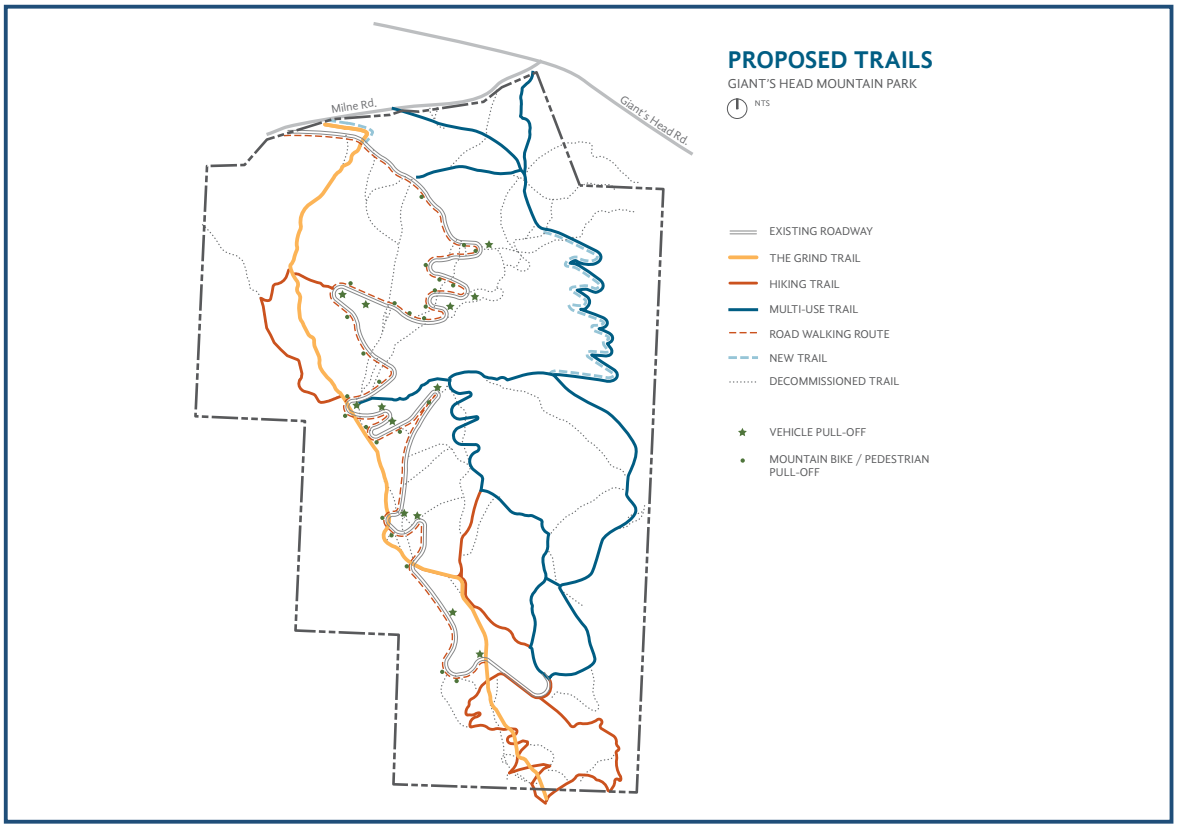


Figure 2.6 GHMP Hiking Trail, Road / Walking Route, and Mountain Bike Trail Design Plan.
(Source: Bench Site Design 2018)

Table 2.5 provides a list of proposed physical works and activities that may be associated with the construction, operation, modification, decommissioning, or abandonment of each project component. Subject to an Effects Analysis, GHMP Project components will be assessed for potential impacts to identified VCs.

Table 2.5 Park Trail Redevelopment Project Component Descriptions.

GHMP Project Components	Physical Works and Activities	Description of Equipment Used
Road Bed	• Rock cut • Drainage excavation • Subbase and base course construction • Concrete paving • Concrete footing	• Excavator • Gravel truck • Backhoe • Grader • Concrete pavers • Road Roller • Power tools

Construction staging areas	• Layout • Drainage excavation	• Excavator and Backhoe • Grader
Trail bed	• Brush clearing • Trail construction • Erosion and sediment control	• Power tools • Hand tools
Waste management and signage	• Waste disposal • Install signs • Remove construction waste	• Waste receptacles • Signs • Power tools • Spill response materials

3 EXISTING ENVIRONMENT

3.1 BIOGEOCLIMATIC ZONES AND CLIMATE

The Project site is primarily located within the ponderosa pine biogeoclimatic zone (PP), Okanagan Very Dry Hot variant (PPxh1) of the BC southern interior pavilion. The study area is classified as the Okanagan, Very Dry Hot ponderosa Pine variant (PPxh1) within the provincial Bioegeoclimatic Ecosystem Classification (BEC) System (BC MFLNRO 2016). The PPxh1 is typified by matures stands of ponderosa pine (*Pinus ponderosa*) with a dominant understory of bluebunch wheatgrass (*Pseudoroegneria spicata*), rough fescue (*Festuca campestris*), and arrow-leaved balsamroot (*Balsamorhiza sagittata*). This zone is characterized by a long, warm and dry summer season, and a cool winter (Meidinger and Pojar 1991).

Unique variants typical of the southern extent of the Okanagan Valley may include:

- PPxh1 WB / 00: Bluebunch wheatgrass – Balsamroot (Grassland)
- PPxh1 PC / 04: Ponderosa pine – Bluebunch wheatgrass – Cheatgrass
- IDFxh1 PS/ 02: (Douglas-fir - Ponderosa pine) - Bluebunch wheatgrass - Balsamroot
- PPxh1 CL / 00: Cliff (Rock)
- PPxh1 RZ / 00: Road and Right of Way (Grods 2006)

Recorded data from the Environment Canada climate station in Summerland (elevation 454.20 m ASL) between 1981 and 2010 determined that normal monthly average temperatures range from a July high of 24.4 ºC to a January low of -1.5 ºC with an average annual temperature of 9.6 ºC (Environment Canada 2018). Total annual precipitation for Summerland averages 6.18 mm, of which 0.0 mm falls as snow (water equivalent; Environment Canada 2018). The area experiences an average of 1311 Growing Degree Days (GDD, above 5 ºC) and 200 Frost Free Days (FFD, Bowen 2008).

Figure 3.1 Mature PPxh1 Forest within the Project LSA (view north).

The Project area is comprised of rolling and steep lands and gentle valley slopes that exhibit primarily open and discontiguous mature ponderosa pine and interior Douglas-fir on all aspects. Lower elevations of the park maintain open bunchgrass habitat while pronounced vertical cliffs dominate the south and southeast borders. Sub-dominant Douglas-fir is sporadically distributed throughout the study area. A mix of both conifers occupy the ridge between ephemeral drainages. The northern portion of the study site maintains anthropogenic disturbance from transportation corridors, agricultural and urban impacts.

Table 3.1 Summary of Climatological Data in Summerland, BC (nearest data station).

Station	Elev.	GDD	FFP	P_a	P_s	Snow	Temp Avg	Ext Min	Ext. Max.	Jan Min.	Jul Max
Summerland	454.2	2378*	331*	74.2	74.2	0.0	9.6	-26.8	38.5	-4.1	28.4

Sources: Environment Canada. Atmospheric Environment Service, 2017. Canadian Climate Normals: 1981-2010; Bowen 2010.

Elev. Elevation (m), **GDD** Growing Degree Day above 5°C, **FFP** Freeze free period (days), **P_A** Annual precipitation (mm), **P_S** May-September precipitation (mm), **Snow** Mean snowfall (cm), **T**avg, Average temperature (°C),, **Ext. Min.** Lowest minimum temperature ever recorded (°C), **Ext. Max.** Highest maximum temperature ever recorded (°C), **Jan. Min.** Average January minimum temperature (°C), **July Max.** Average July maximum temperature (°C)

3.2 HYDROLOGY

No permanent surface water wetlands are present in GHMP. Very shallow ephemeral habitat may occur seasonally but are desiccated prior to mid-summer. The study area hosts minor drainages emerging from GHM that contribute to several local watercourses emptying into nearby Okanagan Lake including Eneas Creek, Prairie Creek and Trout Creek. The topography of GHMP produces several acute and narrow drainages along its western flank. These drainages are ephemeral in nature and only hold consistent water during freshet. The Project RSA displays limited recharge potential though boasting an alluvial aquafer (Okanagan Basin Water Board 2010).

The largest of the three local creek systems, Eneas Creek is an urban watercourse located north of GHMP. From its source at Aeneas Lake the urban watercourse follows an eastern route through Summerland prior to discharging into Okanagan Lake. To the west of GHMP, Prairie Creek flows south forming a tributary to Trout Creek. Along its route, portions of Prairie Creek flow underground. Trout creek is a significant west-east watershed within the RSA located south of GHMP. The Summerland water system is supplied from two separate watersheds; Trout Creek Watershed and Eneas Creek Watershed. Trout Creek and Eneas Creek maintain reservoir with respective storage capacities of 14,635 ML and 148 ML.

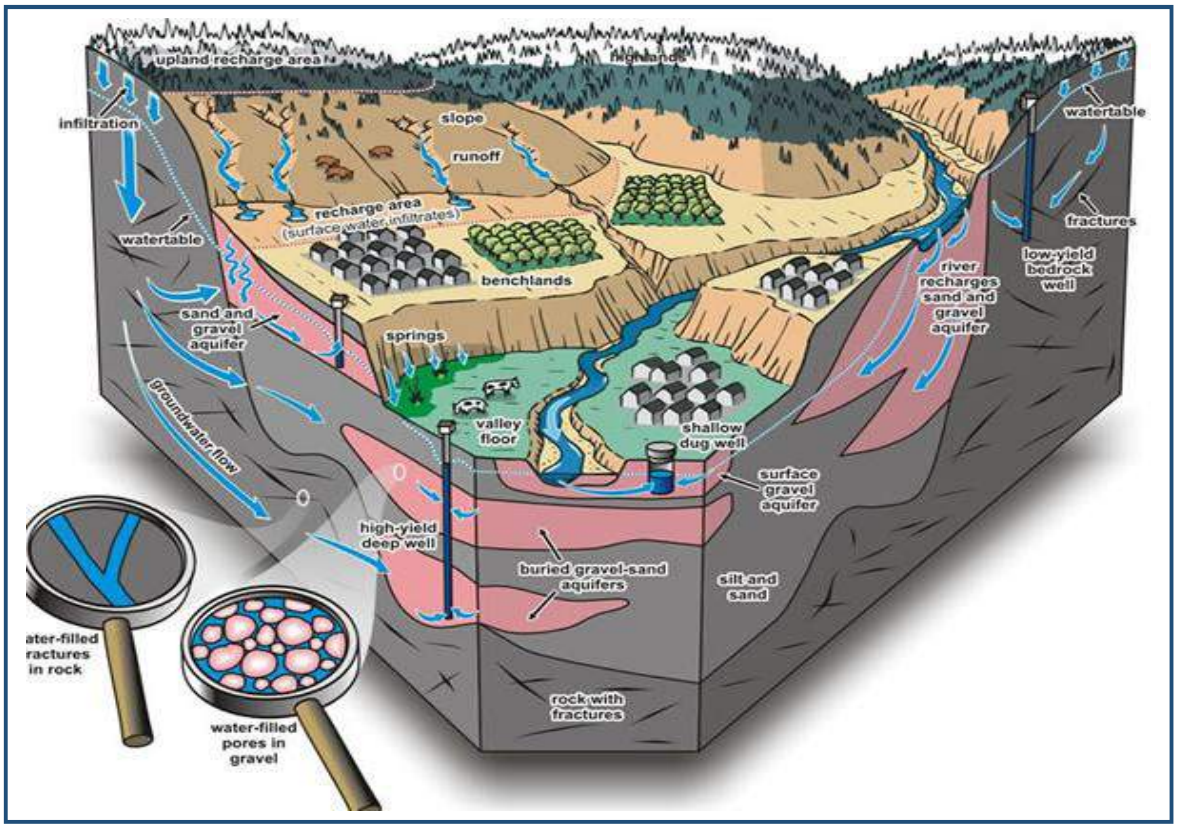


Figure 3.2 Okanagan Valley Hydrologic Cycles (Source: Okanagan Basin Water Board 2010).

3.3 GEOLOGY AND SOILS

Geology of the south Okanagan Valley was shaped by the retreat of the Cordilleran Ice Sheet during the Fraser Glaciation of the late Pleistocene Epoch leaving a varied mix of surficial materials (e.g. glacial, fluvioglacial, aeolian, fluvial, lacustrine) and bedrock. This glaciation event was subsequently modified through fluvial downcutting and erosion ((Road and Fulton 2011). Benches above the Valley floor have resided in moderately coarse to medium-textured, relatively stone-free glaciofluvial overlay underlain by sands and gravels.

Soils of the Summerland Soil Management Group are poorly drained with a high persistent ground water tables typically within 75 cm of the surface (Gough et al. 1994). Peak Evapotranspiration Rate for soils in the Summerland, BC area is 6.6 mm / day. (British Columbia Ministry of Agriculture, Food and Fisheries 2005). Compared with other soil management groups in the Okanagan Valley, the Summerland Soil Management Group has a relatively high Available Water Storage Capacity of 171 cm (Gough et al. 1994).

3.4 AQUATIC ECOSYSTEM

No waterbodies or permanent watercourses occur within the Project LSA. Several ephemeral drainages scattered throughout the park contribute to creek systems within the Project RSA. Prominent watercourses below GHMP include Eneas Creek, Trout Creek and Prairie Creek with Okanagan Lake as the eventual receiving body.

All three local watercourses are fish bearing. Kokanee, rainbow trout, mountain whitefish, prickly sculpin, peamouth chub, and longnose dace have been documented in Trout Creek. Eneas Creek has data records of kokanee, rainbow trout, brook trout, sucker spp. sculpin spp, redside shiner and longnose dace occurring in the system. Juvenile and adult rainbow trout along with adult brook trout are known to occur in Prairie Creek (BC Conservation Data Centre 2018). The District of Summerland (2010) notes that the Vivid Dancer, a provincial SAR damselfly, may be present in local creek systems.

Table 3.2 lists fish species potentially occurring and/or migrating in Summerland, BC creek systems.

Table 3.2 Fish Species Potentially Occurring in the Project RSA.

Scientific Name	Species Name	BC Species Status
Catostomus spp	sucker spp.	Yellow
Cottus spp.	sculpin spp.	Yellow
Cottus asper	prickly sculpin	Yellow
Hemerobius kokaneeanus	kokanee	No Status
Mylocheilus caurinus	peamouth chub	Yellow
Oncorhynchus mykiss	rainbow trout	Yellow

Prosopium williamsoni	mountain whitefish	Yellow
Richardsonius balteatus	redside shiner	Yellow
Rhinichthys cataractae	longnose dace	Yellow
Salvelinus fontinalis	brook trout	Yellow

3.5 VEGETATION REGIMES AND ECOLOGICAL COMMUNITIES

The Southern Interior Ecoprovince lies in the rain shadow of the Coast and Cascade mountains, and therefore contains areas that are very warm and dry in summer, with hot dry air entering the region from the Great Basin. Winter and early spring may be characterized by outbreaks of cold Arctic air. While climatic conditions vary according to a number of environmental factors. The area immediately around Summerland is characterized by semi-arid conditions characteristic of the ponderosa Pine very dry, hot, Okanagan variant (PPxh1), and the Interior Douglas-fir very dry, hot, Okanagan variant (IDFxh1) biogeoclimatic subzones. The ecotype variant is a mix of mature ponderosa pine and subdominant interior Douglas-fir.

Figure 3.3 Project study area wild flowers (clockwise from top left): *Balsamorhiza sagittata, Lewisia rediviva, Penstemon* fruticosus, *Zigadenus venenosus*, *Delphinium nuttallianum* and *Heuchera cylindrical*.

Typical understory consists of) Oregon grape (*Mahonia aquifolium*), nootka rose (*Rosa nutkana*), prickly rose (*Rosa acicularis*), Saskatoon (*Amelanchier alnifolia*), common snowberry (*Symphorocarpus albus*), kinnickinnick (*Arctostaphylos uva-ursi*), pinegrass (*Calamagrostis rubescens*), willow (*Salix* spp.) and

yarrow (*Achillea millefolium*); BC Ministry of Forests 1998). Associated and subdominant ecotypes occurring within the EA LSA include the Bunchgrass Biogeoclimatic Zone (BGxh1) where bluebunch wheatgrass (*Pseudoregneria spicatum*) formerly was dominant and big sagebrush is now common due largely to overgrazing in the area. Common grasses include bluebunch wheat grass (*Agropyron spicatum*), rough fescue (*Festuca scabrella*) and Idaho Fescue (*Festuca idahoensis*).

Figure 3.4 Project study area shrubs (clockwise from top left): *Ericameria nauseosa, Amelanchier alnifolia, Artemisia tridentate* and *Mahonia aquifolium*.

3.5.1 Rare and Endangered Flora

The British Columbia Conservation Data Centre rare plant list for the Okanagan Shuswap Forest District identifies nine potential rare or endangered vascular plant species. Field assessments in May 2018 detected no rare or endangered plants. Table 3.3 lists provincially listed vegetation species that may potentially occur within the LSA.

Table 3.3 Red and Blue Listed Plant Species Potentially Occurring in the LSA.

Scientific Name	Species Name	Provincial	BC List	COSEWIC
Chenopodium atrovirens	dark lamb's-quarters	S3? (2015)	Blue	na
Hesperostipa spartea	porcupinegrass	S2S3 (2015)	Blue	na
Impatiens aurella	orange touch-me-not	S3 (2015)	Blue	na
Oreocarya sheldonii	Snake River cryptantha	S3 (2013)	Red	na
Orobanche corymbosa ssp. mutabilis	flat-topped broomrape	S2 (2015)	Blue	na
Polygonum engelmannii	Engelmann's knotweed	S1 (2015)	Red	na
Salix tweedyi	Tweedy's willow	S3 (2015)	Blue	na
Stellaria obtusa	blunt-sepaled starwort	S3? (2015)	Blue	na
Verbena hastata var.scabra	blue vervain	S2S3 (2012)	Blue	na

Search Criteria Search Type: Plants OR Fungi (Lichens and Mushrooms) AND BC Conservation Status:Red (Extirpated, Endangered, or Threatened) OR Blue (Special Concern) OR Yellow (Not at Risk) AND Forest Districts:Okanagan Shuswap Forest District (DOS) (Restricted to Red, Blue, and Legally designated species) AND MOE Regions:8- Okanagan (Restricted to Red, Blue, and Legally designated species) AND Regional Districts: North Okanagan (NORD) AND Habitat Subtypes: Cliff,Conifer Forest - Dry,Grassland,Meadow,Mixed Forest (deciduous/coniferous mix),Rock/Sparsely Vegetated Rock,Sagebrush Steppe,Shrub - Logged,Shrub - Natural,Talus (Restricted to Red, Blue, and Legally designated species).

3.5.2 Sensitive Ecosystem Inventories

The unique ecology of the South Okanagan produces among the most threatened habitats within Canada and a comparatively high concentration of Species at Risk (RDOS 2018). Sensitive Ecosystem Inventories (SEI) capture information on rare and threatened ecosystems and provide tools for conservation and land use planning. Together with species specific data, information generated may be used to produce wildlife habitat ratings, wildlife suitability indexes, and species management plans (BC MOE 2014). At a regional context, the RDOS is increasingly subject to fragmentation, land use conversion, sedimentation and sensory disturbance. Cumulative effects assessments of biophysical resources within the LSA should evaluate both direct and indirect impacts from trail redevelopment works. SEI have been done from Vernon to Osoyoos from BGxh1 to ESSF (Iverson et al. 2000). South Okanagan Project area as well as the East Gate, Otter Lakes and Chain Lakes within the Town of Princeton, BC (Area H, Timberline Natural Resource Group Ltd. 2009).

Iverson et al. (2007) contends that wildlife suitability models can be used alone, or preferably in conjunction with Sensitive Ecosystem Mapping, to identify potential environmental values of areas for conservation purposes or to guide development proposals. Areas with High and Moderate habitat suitability should be used to identify where EAs should be conducted if the lands are proposed for development. Environmental assessments for development proposals, including on-site inventory, should be conducted to verify and revise the predictive mapping. The Project LSA is located within 30 km of the White Lake IBA (Important Bird Area) and Vaseaux Lake IBA and approximately 70 km from the Douglas Lake Plateau IBA. These three areas host a number of avian

and herptile species typical of the Southern Interior Ecoprovince. Herptiles occurring in the area include the Great Basin spadefoot (*Spea intermontana*), Great Basin gophersnake (*Pituophis catenifer deserticola*) and western rattlesnake (*Crotalus oreganus*), both restricted in Canada to the Okanagan and Thompson Valleys. Okanagan Lake is also a significant regional waterbody for spawning rainbow trout, lake trout and kokanee.

Based from the background review, TEM and SEI data and mapping was used as baseline information to focus field study efforts (Iverson et al. 2008). Georeferenced maps were developed with TEM polygon line work and proposed trail locations throughout the Giants Head Mountain Park area. Further to this, all pertinent TEM and SEI data was tabulated per polygon and used directly during field studies along with georeferenced mapping. Tabular information was developed that identified existing and proposed trail locations within specific TEM polygons along with corresponding BEC and SEI information. This table was directly used in reference with existing georeferenced maps. The following TEM polygons were identified for Project wildlife habitat assessments:

1416 Fescue (*Festuca* spp.) - bluebunch wheatgrass (*Pseudoroegneria spicata*);
1423 Py - bluebunch wheatgrass - rough fescue (*Festuca scabrella*);
1428 Fescue - bluebunch wheatgrass, Py - bluebunch wheatgrass - rough fescue;
21428 Py - Bluebunch wheatgrass-Idaho fescue;
1471 Selaginella spp. - bluebunch wheatgrass rock outcrop; and
1473 Py - bluebunch wheatgrass - cheatgrass (*Bromus tectorum*), Py - purple three-awn (*Aristida purpurea*).

Table 3.4 TEM Polygons and SEI Trail Interactions.

TEM Polygons	Dominant Species Composition	BEC* Units	Trail Identification	SEI Trail Interactions
1416	Fescue - bluebunch wheatgrass	PPxh1/00	Trail 5 Trail 8 Trail 11	Grassland: shrub steppe Woodland: coniferous Sparsely Vegetated: cliff
1423	Py-bluebunch wheatgrass-rough Fescue	PPxh1/05		Woodland: coniferous
1428	Py - bluebunch wheatgrass - rough fescue	PPxh1/05	Trail 5, 6 and 7	Grassland: shrub steppe Woodland: coniferous
21428	Py-bluebunch wheatgrass-Idaho fescue	PPxh1/05		Woodland: coniferous
1471	Selaginella spp. - bluebunch wheatgrass rock outcrop	PPxh1/00	Trail 7 Trail 9 Trail 11	Grassland: shrub steppe Woodland: coniferous Sparsely Vegetated: cliff
1473	Py - bluebunch wheatgrass - cheatgrass, Py - purple three-awn	PPxh1/04 PPxh1/0	Trail 2 and 7 Trail 9 and 11	Grassland: shrub steppe Woodland: coniferous Sparsely Vegetated: cliff

* Biogeoclimatic Ecosystem Classification; Provincially Red and Blue listed ecological communities.** PPxh1: ponderosa pine Okanagan very dry hot biogeoclimatic unit.

3.6 WILDLIFE AND WILDLIFE HABITAT

The Okanagan-Similkameen Regional District and its wild lands provide important habitat for a complex variety of resident, breeding, wintering, and migratory wildlife (MOE 2014). The area encompasses a complex of unique landscapes and in turn provides Critical Habitat for a diverse selection of rare and endemic wildlife species. The Okanagan-Similkameen region's composition of semi-arid and mesic systems, unique to western Canada, are high in both species diversity and richness (Hope at al. 1991 and 1991b). Wildlife habitat within the EA LSA supports a diverse concentration of species groups including ungulates, carnivores, mustelids, small mammals and bats, avifauna, reptiles, amphibians, and invertebrates.

As part of the Okanagan Lake watershed, the EA LSA area offers a mix of dry pine and fir forests, semi-arid grasslands, valley basin, and urban areas within a relatively small study area. This mix of habitat types within close proximity facilitates life history functions for both local and migratory wildlife. Multiple wildlife trees with prominent cavities with varying diameter at breast height (dbh) were identified during 2017 baseline overview assessments. Life history traits may include foraging, denning, hibernation, breeding, movement and staging opportunity. The prevalence of snags and deadfall may provide denning and foraging habitat for a variety of wildlife species within the Project area. Table 3.5 provides a list of mammal species with expected occurrence within the Project LSA.

Table 3.5 Potential Mammal Species and Expected Habitat Types in the Project LSA.

Scientific Name	Species	Provincial Status	COSEWIC Status
Antrozus pallidus	pallid bat	S2 (2015)	T (2010)
Canis latrans	coyote	S5 (2015)	No Status
Corynorhinus townsendii	Townsend's big-eared bat	S3S4 (2015)	No Status
Eptesicus fuscus	big brown bat	S5 (2015)	No Status
Erethizon dorsatum	North American porcupine	S5 (2015)	No Status
Euderma maculatum	spotted bat	S3S4 (2015)	No Status
Felis concolor	cougar	S4 (2015)	No Status
Lasionycteris nactivagans	silver-haired bat	S4S5 (2015)	No Status
Lasiurus blossevilli	western red bat	na	No Status
Lasiurus cinereus	hoary bat	S4S5 (2015)	No Status
Lepus americanus	Nuttall's cottontail	S3 (2015)	No Status
Lynx rufus	bobcat	S5 (2015)	No Status
Mephitus	striped skunk	S5 (2015)	No Status
Microtus pennsylvanicus	meadow vole	S5 (2015)	No Status
Mustela erminea	short-tailed weasel	S5 (2015)	No Status
Mustela frenata	long-tailed weasel	S5 (2015)	No Status
Myotis californicus	Californian myotis	S4S5 (2015)	No Status
Myotis ciliolabtum	western small footed myotis	S2S3 (2015)	No Status
Myotis evotis	long-eared myotis	S5 (2015)	No Status

Myotis lucifugus	little brown myotis	S4 (2015)	No Status
Myotis thysanodes	fringed myotis	S3 (2015)	No Status
Myotis volans	long-legged myotis	S4S5 (2015)	No Status
Myotis yumanensis	Yuma bat	S5 (2015)	No Status
Odocoileus hemionus	mule deer	S5 (2015)	No Status
Odocoileus virginianus	white-tailed deer	S5 (2015)	No Status
Parastrellus hesperus	canyon bat	SNA (2015)	No Status
Peromyscus maniculatus	North American deermouse	S5 (2015)	No Status
Procyon lotor	raccoon	S5 (2015)	No Status
Sorex cinerius	masked shrew	S5 (2015)	No Status
Tamias amoenus	yellow-pine chipmunk	S5 (2015)	No Status
Tamiasciurus hudsonicus	red squirrel	S5 (2015)	No Status
Taxidea taxus	American badger	S2 (2015)	E (2012)
Ursus Americanus	American black bear	S5 (2015)	NAR (1999)
Vulpes vulpes	red fox	S5 (2015)	NAR (1999)

Source: BC Habitat Wizard 2018

3.6.1 Local Wildlife

The unique habitat diversity of the Okanagan Valley supports abundant and varied ecological communities. This with community richness, the Project area provides niche opportunity for a variety of species unique to the Okanagan-Similkameen. The region provides amongst the highest diversity of avian species in the interior of British Columbia and among most avian breeding species of all of the twelve Ecoprovinces of the province (BC MOE 2017). Carnivores that potentially utilize the Project area include black bear (*Ursus americanus*), cougar (*Felis concolour*), coyote (*Canis latrans*), American badger (*Taxidea taxus*), bobcat (*Lynx rufus*), raccoon (*Procyon lotor*), red fox *(Vulpes vulpes*) and short-tailed weasel (*Mustela erinea)*. Mule deer (*Odocoileus hemionus*) is the most abundant ungulate in the area although the white-tailed deer (*Odocoileus virginianus*) has extended its range in the area. Small mammals in the Project area include American red squirrel (*Tamiasciurus hudsonicus)*, and Nuttall's cottontail (*Sylvilagus floridanus*).

A number of bat species, including big brown bat (*Eptesicus fuscus*), fringed mytosis (*Myotis thysanodes*) and hoary bat (*Lasiurus cinereus*) are found in this ponderosa pine system (Hope et al. 1991). The Project area also provides available habitat for several species of herptiles, specifically the Great Basin spadefoot, Great Basin gophersnake, western rattlesnake, common garter snake (*Thamnophis sirtalis*) and western garter snakes (*Thamnophis elegans*; Cal-Eco Consultants 2006).

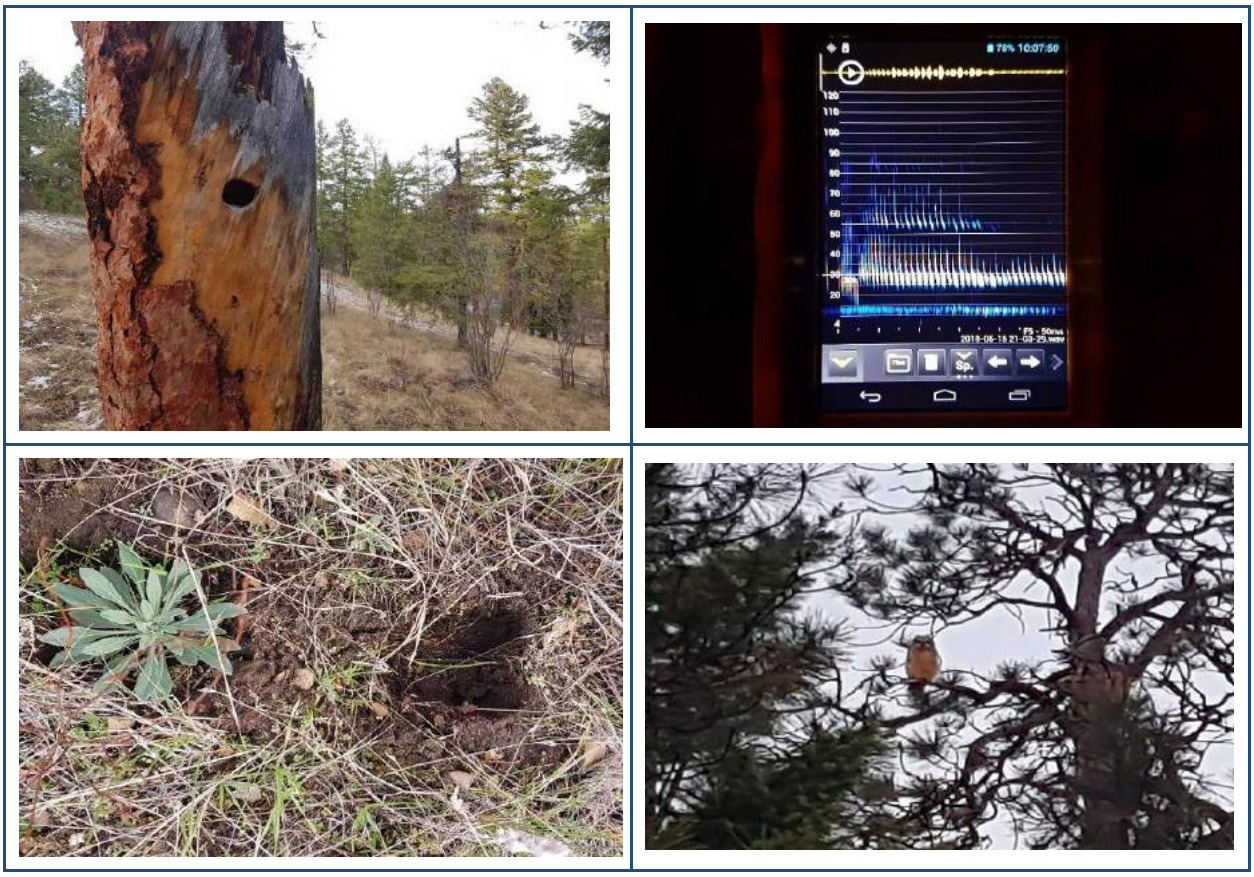


Figure 3.5 Clockwise from top left: Wildlife sign observed within the Project LSA included cavity nests, bat echolocation readings, juvenile great-horned owl and *Odocoileus* spp.

Dry upland forest, open grasslands and steep cliffs offer broad selection of niche opportunity for an assemblage of songbirds, corvids, raptors, woodpeckers and gallinaceous birds. Avian SAR potentially occurring within the EA LSA are identified in Table 3.6 include short-eared owl (*Asio flammeus*), burrowing owl (*Athene cunicularia*), common nighthawk (*Chordeiles minor*), evening grosbeak (*Coccothraustus vespertinus*), bobolink (*Dolichonyx oryzivorus*), barn swallow (*Hirundo rustica*), western screech-owl (*Megascops kennicottii macfarlanei*), Lewis's woodpecker (*Melanerpes lewis*), long-billed curlew (*Numenius americanus*), flammulated owl (*Psiloscops flammeolus*) and barn owl (*Tyto alba*). Insect infestation in the ponderosa pine has provided forage for woodpeckers and other insectivorous species.

3.6.1.1 Wildlife Species at Risk

The unique habitat diversity of the Okanagan Valley supports a number of SAR that potentially occupying habitat in the LSA. Provincially red- and blue-listed and federally listed wildlife species found in the Okanagan Shuswap Forest District and that may move

through the area or use it for foraging are listed in Table 2.5 (BC MOE 2017). Site-specific habitat features and species-specific life history traits further delineated the derived assessment of potentially occurring species.

Table 3.6 Red and Blue Listed Wildlife Species Potentially Occurring in the Project LSA.

Scientific Name	Species Name	Provincial	BC List	COSEWIC	SARA
Anaxyrus boreas	western toad	S3S4 (2010)	Blue	SC (2012)	1-SC (2005)
Antrozous pallidus	pallid bat	S2 (2015)	Red	T (2010)	T (2003)
Apodemia mormo	Mormon metalmark	S1(2014)	Red	E (2014)	1-E (2005)
Asio flammeus	short-eared owl	S3B,S2N (2015)	Blue	SC (2008)	1-SC (2012)
Athene cunicularia	burrowing owl	S1B (2015)	Red	E (2017)	1-E (2003)
Charina bottae	northern rubber boa	S4(2016)	Yellow	SC (2018)	1-SC (2005)
Chordeiles minor	common nighthawk	S4B (2015)	Yellow	SC (2016)	1-T (2010)
Coccothraustes vespertinus	evening grosbeak	S5 (2015)	Yellow	SC (2016)	No Status
Coluber constrictor	North American racer	S3 (2012)	Blue	T (2015)	1-SC (2016)
Crotalus oreganus	western rattlesnake	S3 (2012)	Blue	T (2015)	1-T (2005)
Corynorhinus townsendii	Townsend's Big-eared Bat	S3S4 (2015)	Blue	na	
Danaus plexippus	monarch	S3B (2013)	Blue	E (2016)	1-SC (2003)
Dolichonyx oryzivorus	bobolink	S3B (2015)	Blue	T (2010)	1-T (2017)
Euderma maculatum	spotted bat	S3S4 (2015)	Blue	SC (2014)	1-SC (2005)
Gulo gulo luscus	wolverine, *luscus* subspecies	S3 (2010)	Blue	SC (2014)	No Status
Hirundo rustica	barn swallow	S3S4B (2015)	Blue	T (2011)	1-T (2017)
Hypsiglena chlorophaea	desert nightsnake	S1 (2012)	Red	E (2011)	1-E(2003)
Icteria virens	yellow-breasted chat	S1S2B (2015)	Red	E (2011)	1-E (2011)
Lithobates pipiens	northern leopard frog	S1 (2016)	Red	E (2009)	1-E (2009)
Megascops kennicottii macfarlanei	western screech-owl	S2 (2009)	Red	T (2012)	1-T
Melanerpes lewis	Lewis's woodpecker	S2S3B (2015)	Blue	T (2010)	1-T (2012)
Myotis lucifugus	little brown myotis	S4	Yellow	E (2013)	1-E (2014)
Numenius americanus	long-billed curlew	S3B (2015)	Blue	SC (2011)	1-SC (2005)
Picoides albolarvatus	white-headed woodpecker	S1 (2015)	Red	E (2010)	1-E (2003)
Pituophis catenifer deserticola	gopher snake, *deserticola* subspecies	S2S3 (2012)	Blue	T (2013)	1-T (2005)
Plestiodon skiltonianus	western skink	S3 (2012)	Blue	SC (2014)	1-SC (2005)
Psiloscops flammeolus	flammulated owl	S3B (2015)	Blue	SC (2010)	1-SC (2003)
Reithrodontomys megalotis	western harvest mouse	S3 (2015)	Blue	SC (2007)	1-SC (2009)
Satyrium semiluna	half-moon hairstreak	S1 (2013)	Red	E (2006)	1-E (2009)
Spea intermontana	Great Basin spadefoot	S3 (2010)	Blue	T (2007)	1-T (2003)
Sphyrapicus thyroideus thyroideus	Williamson's sapsucker, *thyroideus* subspecies	SNRB (2012)	No Status	E (2017)	1-E (2006)
Sylvilagus nuttallii	Nuttall's cottontail	S3 (2015)	Blue	SC (2016)	1-SC (2007)
Taxidea taxus	American badger	S2 (2015)	Red	E (2012)	1-SC (2018)
Tyto alba	barn owl	S2? (2015)	Red	T (2010)	1-SC (2003)

Search Type: Animals AND BC Conservation Status:Red (Extirpated, Endangered, or Threatened) OR Blue (Special Concern) OR Yellow (Not at Risk) AND COSEWIC Status:Endangered OR Threatened OR Special Concern AND Forest Districts:Okanagan Shuswap Forest District (DOS) (Restricted to Red, Blue, and Legally designated species) AND MOE Regions:8- Okanagan (Restricted to Red, Blue, and Legally designated species) AND Regional Districts: North Okanagan (NORD) AND Habitat Subtypes: Antelope-brush Steppe,Cliff,Conifer Forest - Dry,Grassland,Meadow,Mixed Forest (deciduous/coniferous mix),Rock/Sparsely Vegetated Rock,Sagebrush Steppe,Shrub - Logged,Shrub - Natural,Talus (Restricted to Red, Blue, and Legally designated species)

The Project area represents an ecological island within Summerland urban centre. As such, consideration should be given to potential SAR metapopulations that may be lacking habitat connectivity options. Sensitive species occupying habitat within the project LSA may be subject to population sink dynamics due to low immigration and dispersal rates related to lack of movement corridor access (Hannson 1991, Baum et al. 2004).

4 METHODS

4.1 REVIEW OF REGULATORY FRAMEWORKS

The existing regulatory framework governs habitat protection and land use activities within federal, provincial and municipal jurisdiction. This framework provides legal context for potential VC protection on Project lands. Delivering EA strategies in conjunction with regulatory frameworks provides support for the development of protection measures. Toward this effort our team has referenced regulatory documents as they apply to both the EA and to the park trail redevelopment works.

Regulatory oversight for trail upgrades includes federal, provincial, regional and municipal statues that govern environmental regulations. The report identified the regulatory framework that park trail redevelopment works will be subject to. The EA also evaluated process risks and identified actions which could be taken to manage the risks. Review and application of the regulatory framework required for EA approval includes, but is not limited to:

4.1.1 Federal Regulation

- Fisheries Act (Government of Canada 1985);
- Species at Risk Act Schedule 1, Section 79(1); (Government of Canada 2002); and
- Migratory Bird Convention Act Section 5.1 (1), Section 6 [a], Section 35 [1] (Government of Canada 1994). Migratory Bird Convention Act defines migratory bird season (March 15 to August 15; CWS 2008), breeding bird season (April 1 to July 31; MOE 2007);

4.1.2 Provincial Regulation

- BC Water Sustainability Act Section 11 Authorization, (Government of British Columbia, 1996);
- BC Wildlife Act incl. Wildlife Amendment Act 2004 (Government of British Columbia, 1996);

- BC Riparian Areas Protection Act (Government of British Columbia, 2018); and
- BC Weed Control Act, (Government of British Columbia 2001).

4.1.3 District of Summerland

- BC Riparian Areas Protection Act (BC MOE 2012);
- District of Summerland Municipal Zoning;
- District of Summerland OCP 2014; and
- District of Summerland: A Guide to Development Guide in Sensitive Areas.

4.2 BACKGROUND INFORMATION REVIEW

A review of existing information relating to the Project spatial boundaries and/or proximate environment was completed. Data review examined information capture from federal, provincial, regional, municipal and private sources. This review included, but was not limited to:

- Environment Canada's SAR Public Registry;
- Environment Canada's Committee on the Status of Endangered Wildlife in Canada;
- BC Ministry of Forests Biogeoclimatic Zone maps;
- BC Ministry of Agriculture Soil Management Handbook;
- BC Conservation Data Centre (CDC) of rare and threatened species and ecosystems;
- BC Sensitive Ecosystem Inventories (SEI);
- The iMapBC (Province of BC 2018) for the study area;
- BC MFLNRO Wildlife Management Units;
- Terrestrial Ecosystem Mapping (TEM);
- BC RISC protocol;
- BC Protocol Guidelines;
- District of Summerland Official Community Plan;
- Aerial photographs of the study area;
- Previous governmental and peer reviewed studies from the District of Summerland area;
- General Nesting Periods of Migratory Birds in Canada;
- Bench Site Design ;
- Summerland Environmental Science Group. Review of Draft Project Report, Preliminary Environmental Assessment of Giant's Head Mountain Park Trail Master Plan;

Map products unique to park trail redevelopment works have proven useful as they have identified the extent of the project footprint potentially impacting VC spatial boundaries. In conjunction with park trail redevelopment map products, British Columbia's Habitat Wizard ™ and BC Species and Ecosystem Explorer ™ have provided summaries of species presence within the Project area. In turn, these databases

have allowed for the cataloguing and evaluation of the Project's ecological community prior to GHMP field investigations. Such tools have further assisted the EA team in understanding ecological community dynamics and in the preparation of field investigation studies. Once the approach to site-specific data capture has been established, the EA team may commence preparation of VC habitat assessment and suitability studies.

4.3 DETERMINATION OF VALUED COMPONENTS

A VC is defined by the Canadian Environmental Assessment Agency (CEAA, 2006) as the environmental element of an ecosystem that is identified as having scientific, social, cultural, economic, historical, archaeological or aesthetic importance. Valued components that have the potential to interact with park trail redevelopment works are addressed in the assessment of environmental effects (CEAA, 2006). VC may comprise a variety of things including an abiotic parameter (e.g. water quality), a SAR (e.g. western rattlesnake), a population (e.g. Gerrard rainbow trout), or community (e.g. ponderosa pine ecosystem).

Factors considered when selecting VCs included the following (Salmo 2006):

- public concern;
- required by or compatible with regulatory requirements and existing initiatives;
- easily understood and known to be important to residents, managers, and regulators;
- when taken together, reflect overall environmental and social conditions;
- can be easily measured or described with one or more practical indicators; and
- allow cumulative effects pathways to be considered.

4.4 BASELINE DATA COLLECTION AND FIELD INVESTIGATIONS

The intent of the field investigation is to collect baseline data for the EA. Biophysical survey is required to assess the potential effects of the Project on traditionally important resources and SAR. Information on the distribution and abundance of resources is typically requested in the Terms of Reference for EA. Survey objectives will determine the composition, distribution, relative abundance and habitat use of biophysical resources within the study area. Obtained summer wildlife data will be complimented by winter data capture.

Since wildlife use of areas is related to habitat suitability, investigations are to maintain a geographic distribution of transects with proportional representation to each identified vegetation class. Habitat metrics including patch are size, patch perimeter length, patch density and edge density will be applied to wildlife observations in developing a community approach to Project lands.

4.4.1 Vegetation

Our team followed BC Ministry of Environment's Ecosystems Branch (Resources Inventory Standards Committee) Field Manual for Describing Terrestrial Ecosystems (Version 2.0). This guide provides detailed instruction for the assessment of animal abundance and habitat use. Winter field investigations were completed February 4th, 2018. Winter field investigations of the LSA were completed February 4th, 2018 by Mountain Pacific. Spring field investigations were completed between April 26th 2018 and May 15, 2018. Habitat assessments established study area boundaries, examined geology and soils, conducted completion of a high level habitat assessment and completed an assessment overview of potential impacts to traditional plant resources from highway development impacts. A further objective of this survey was to identify specific habitat features and floral species that may be subject to viable impacts. Habitat investigations included:

- delineating existing ecosystem communities;
- establishing ecosystem structural stage, identifying forest composition and forest health;
- identifying terrestrial and aquatic vegetation;
- assessing mammalian denning, movement, and foraging opportunities;
- assessing avian nesting and foraging potential; and
- identifying amphibian overwintering, basking, and foraging potential.

Figure 4.1 Wildlife Habitat Assessment studies within the Project LSA (view east).

4.4.2 Winter Tracking

Winter track count surveys were designed to document the relative abundance and habitat use of ungulates, carnivores, and furbearers within the LSA. Our team followed BC Ministry of Environment's Ecosystems Branch (Resources Inventory Standards Committee) Winter Tracking (1:20,000): Site Card Field Guide (Version 2.0). This guide provides detailed instruction for the assessment of animal abundance and habitat use. The location and number of incidental observations of other wildlife species were also recorded during the survey as complementary information. Global positioning units (GPS) were used to measure transect lengths, record changes in direction and capture data locations. Bearings were measured with a compass adjusted for declination (16° E). Transects were devised to provide both geographic and representative coverage of vegetation classes. Incidental information was used in subsequent reporting to direct or focus the need for any additional field surveys that may be required. Winter track count surveys were completed in February 2018. As Project lands may provide suitable habitat for several at risk species, a data records query of masked occurrences was solicited from BC MOE in May 2018. Inquiry through BC MOE produced no masked occurrences for Species at Risk on Project lands.

Figure 4.2 Winter Tracking Surveys (*Canis latrns*) within the Project LSA (view north).

Winter track counts occurred following snow accumulation on all habitat types within the EA RSA (i.e., snow accumulation on the ground will be different between open areas and areas with high percentage canopy cover. Surveys were completed following 12 hours from the last snowfall. Time since last snowfall was recorded to the nearest half day (e.g. 0.5 days). Prior to commencing the survey, the number of days since last snowfall within the EA RSA were documented.

Winter tracking survey transects were aligned to match habitat types within in the LSA. At the end of each day the distance surveyed in each habitat was updated and compared to totals in the EA LSA to ensure each habitat type received the appropriate coverage. Data collected included species, number of tracks, habitat type, and snow depth and condition. Wildlife tracks and sign of furbearers (i.e. coyote, fox, marten, short-tailed weasel, bobcat) and ungulates (i.e. deer, moose) encountered along each transect were recorded. Transects were surveyed as a 3 m wide corridor (1.5 m on each side of the survey transect) along the distance of the line of travel. All tracks observed within the corridor were recorded as either a track, trail, or network. With teams working 50 m apart, all wildlife sign within 5 m on either side of each transect was recorded (RISC 1998, RISC 1998b, RISC 1999, Murie 1974, Rezendes 1992). These observations included tracks, trails, network, beds, plunge holes, and roosting sites. A single track crossing or adjacent to the survey transect was recorded as one track. Multiple tracks from the same species that cross the survey transect at the same location were recorded as a "trail". Tracks that cross the transect many times over a short distance (e.g. 10 m) due to bedding, feeding or other activities were recorded as a "network". Beds, cratering, plunge holes, and grouse snow roosts were recorded as incidental observations. Results suggest the Project lands provide comparatively important ungulate winter range when weighed against summer usage.

4.4.3 Breeding Bird Survey

The objective of point count surveys is to determine presence, distribution and relative abundance during the breeding season. Our team followed BC MOE's Ecosystems Branch RISC (Resources Inventory Standards Committee) Inventory Methods for Forest and Grassland Songbirds (Version 2.0). This guide provides detailed instruction for the assessment of avian breeding.

We employed Distance Based Point Counts to compare both absolute and habitat-specific abundance within the EA LSA. Stations were surveyed once with no replication. Distance Based Point Counts are further recommended when site replication is not employed. All breeding bird surveys were conducted within the first three to four hours after sunrise.

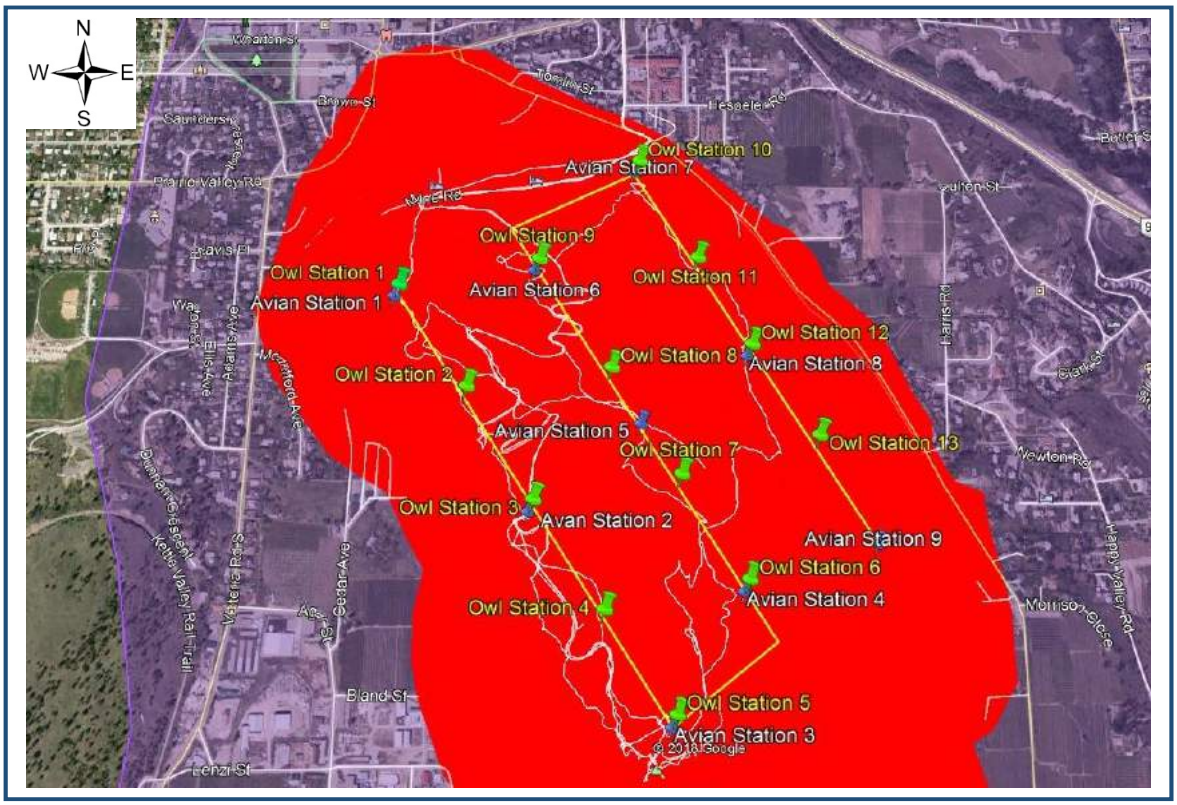


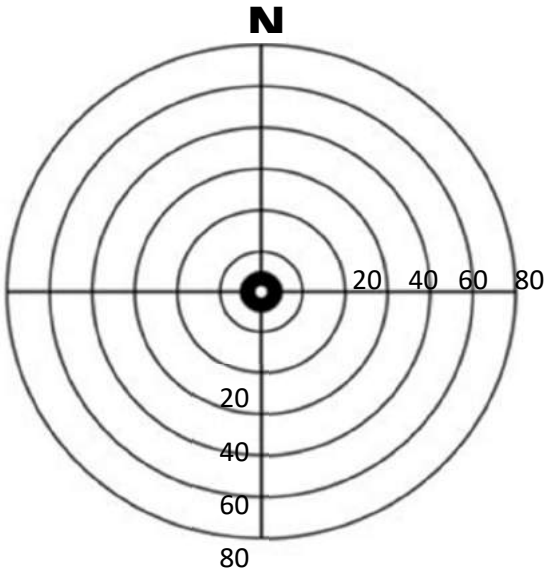
Figure 4.3 2018 Avian Point Count Survey Stations within the Project LSA.

Point count stations were established along transects a minimum of 200 m apart and within expected disturbance areas (Figure 3.3). A GPS was used to navigate along a pre-determined bearing and to record plot location. At each point count station the observer waited two minutes to allow the birds to adjust to the observer's presence. A five-minute survey period followed, and all species heard or observed within 100 m were recorded. Flyovers and birds observed outside the survey area were recorded as incidentals and used to provide a comprehensive species list, but they were excluded from the statistical analysis. Avian point count surveys collected the following data:

- GPS location of point count station number;
- date and time of observation;
- transect length and bearing;
- species; number of individuals; distance from observer(s);
- habitat (determined from vegetation classification); and
- behavioural activity (e.g. territorial calls or displays, nest or nest with eggs, and flyovers).

The survey was not conducted during periods of high winds (i.e., Beaufort Scale greater than 5 [trees and leaf sway]) or inclement weather that would reduce the likelihood of identifying species. EA LSA

terrestrial ecosystem data and Wildlife Habitat Assessments (WHA) were correlated with avian survey location to provide detailed habitat information. A systematic sampling program was employed across the centerline of the proposed footprint. Based on map and orthophoto data, the derived homogeneity of the relatively small EA LSA allowed a random distribution of survey stations throughout the Project's habitat types within the study area. An example of a Distance Based Point Count Data Form, including data collection parameters is detailed in Figure 3.4.



Project:	Start Time:
Survey:	End Time:
Study Area:	
Transect Length	Observation #
Transect Bearing:	Species:
Point Count station	Transect Distance
UTM: N E	Sex Age Class:
Date:	Activity:
Surveyors:	Nest Label:
Weather:	Comment:
Wind:	Incidental Observations:

Figure 4.4 2018 Avian Point Count Survey Data Form.

4.4.4 Herptile Surveys

Potential herptile use locations, including dens, basking, skin shedding areas and foraging areas were assessed using a 100 m grid pattern search method. The area was searched East to West, then North to South. All assessments were completed by individuals proficient in snake den location. Potential sites were assessed based on a total score of 10: 0-5 for fracturing, 0-3 for mass (of Rock), 0-1 for directional aspect, 0-0.5 for slope position and 0-0.5 for vertical slope.

Potential herptile use sites were then assessed for optimal search periods. Confirmation of a den would occur if multiple (more than one) snake was recorded within 50m of the den entrance. A single snake at a feature would warrant further searching of the area but would not confirm a hibernaculum unless accompanied by another snake. The second snake requirement is a way of avoiding false positive hibernaculum, if a single snake is still moving to its destination.

4.4.5 Bat Detection Surveys

Detection surveys were conducted along the park access road to assess bat presence and density of local bats. Biologists employed ultrasonic detectors that are sensitive to echolocation used by bats when flying to navigate and locate prey. Our study used an Anabat Walkabout™ device with omnidirectional microphones. Following dusk, a moving survey route followed the park access road from the gate at Giant's Head Mountain Park to the lookout atop the park.

Recorded calls were documented for time, location (UTM) and weather conditions. Captured data was uncompressed and sequence files were viewed using AnaLook™ software (Titley Electronics Inc.) for species identification.

4.4.6 Wildlife Habitat Assessment

Wildlife field data was collected during the reconnaissance Baseline Ecosystem Program using procedures and codes described in Describing Terrestrial Ecosystems (Province of British Columbia 2010). During terrestrial baseline field investigations, all members of the Project team collected data to describe and assess wildlife habitat within pre-determined plots.

Wildlife Habitat Assessments examined habitat potential and constraints as it applies to the identified wildlife VCs. Representative species groups were selected based on niche opportunity, habitat function or SAR status.

Field investigations recorded unique wildlife habitat features such as wildlife trees, coarse woody debris, migration corridors, birthing areas, raptor nesting areas, old growth attributes, mineral licks and denning sites. Examples of special features and animal sightings were also photographed. This additional information was collected within each visited polygon as well as during the traverses to and from each of the visited polygons. The most recent versions of the Wildlife Habitat Assessment Form was used to record the wildlife habitat data.

Habitat suitability for each Project indicator species were developed through terrestrial ecosystem assessments and baseline data capture. Seasonal and year-round habitat ratings for VCs were developed using core polygon attributes including:

- Biogeoclimatic Zone
- Ecotype
- Forest Type
- Successional Status
- Structural Stage
- Canopy Cover
- Elevation
- Slope
- Surface Shape
- Mesoslope Position
- Moisture Regime
- Nutrient Regime
- Surface Substrate
- Site Disturbance

Density estimates were developed where available. Species' accumulation curves will assess comparative species richness among identified habitat types and relate this to key habitat attributes.

4.5 CUMMULATIVE EFFECTS AND LANDSCAPE LEVEL ATTRIBUTES

Cumulative effects represent the sum of all natural and human-induced influences on the physical, biological, cultural, and economic influences on targeted systems. Identification and data capture of both historic and proposed activities comprise the extent, duration, and severity of cumulative effects on identified VC. Information obtained through the assessment of unique effects can be compiled in both quantitative and GIS based spatial platforms to yield effects analysis tools. In assessing the impact to municipal park lands, it is imperative to weigh the influence of cumulative effects on VCs.

Evaluation of park trail redevelopment impacts to wildlife resources requires an assessment of VC. Consideration of cumulative impacts to selected VCs requires an understanding of all historic and existing project activities as well as incremental effects of current or proposed development projects. Quantifying the measure of this impact is achieved by assessing the cumulative land use impacts to species-specific habitat. These influences include direct impacts and impacts defined via zones-of-influence.

Identifying habitat or behavioural constraints as a result of natural or anthropological influences allow researchers predictive tools in assessing impacts and preparing mitigation strategies. Constraints effecting wildlife populations may include habitat loss or disturbance resulting in population reduction or emigration. Quantifying the extent of such impacts is aided by spatial analysis tools including Geographic information Systems (GIS).

Characterizing the spatial extent of cumulative impacts provides researchers both analytical and mapping tools in assessing impact effects. Map products and visual assessment tools can in-turn further provide statistical assessment of land use impacts. Applying a spatial component to identified historic, current, and park trail redevelopment effects on selected VCs delivers layered and comprehensive cumulative assessment tool to the effects study area. Assessment for impacts of wildlife resources within the Project area includes detailed evaluation of cumulative effects.

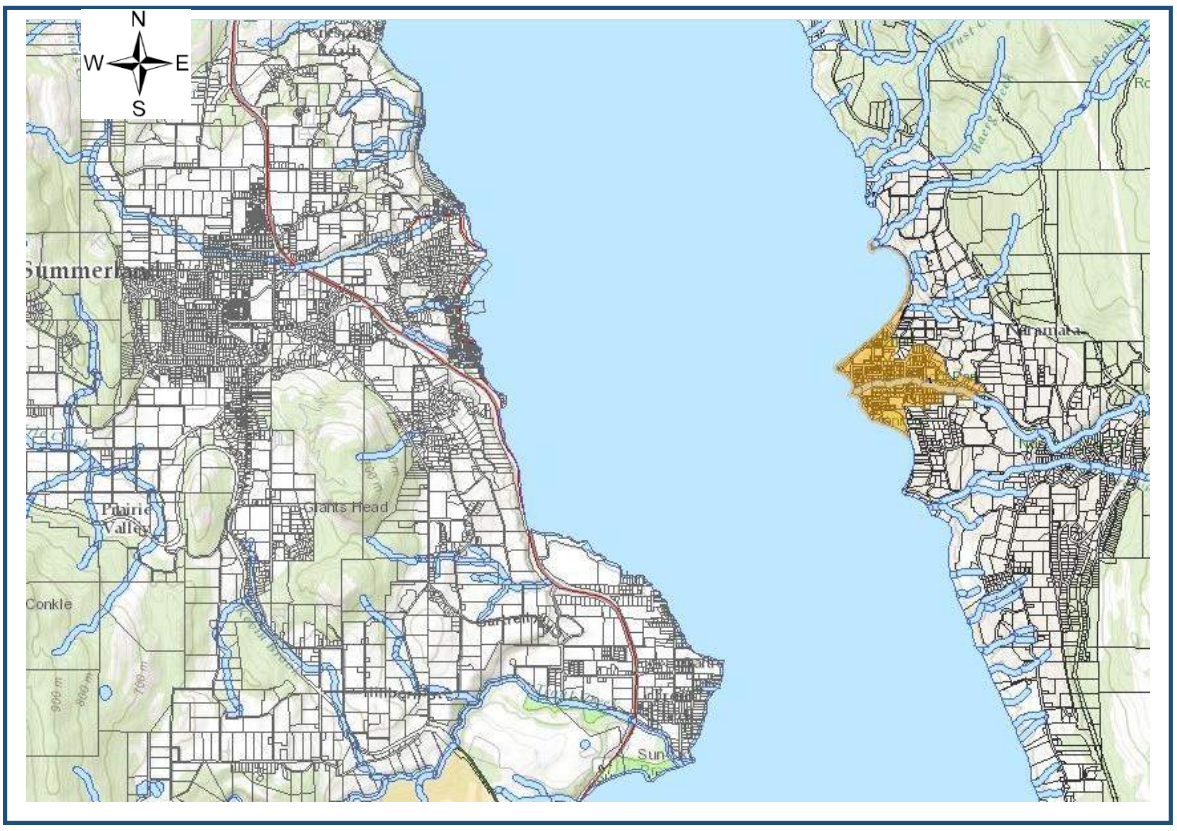


Figure 4.5 Landscape level attributes contributing to Cumulative Effects Assessment within the Project RSA.

4.5.1 Cumulative Impact Spatial Tool Process for Wildlife Resources

In developing an application of spatial tools in assessing cumulative GHMP trail impacts to wildlife resources, we employed the following process:

1. Identify and map Project footprint.
2. Identify and map spatial boundaries at both the EA LSA and EA RSA scales.
3. Identify Project VCs.
4. Identify spatial extent of VC (e.g. wildlife species' range and natal dispersal distance)
5. Identify species-specific habitat and within the natal dispersal boundary
6. Identify and map historic and proposed cumulative impacts.
7. Assess spatial and temporal constraints to impacts, as required.

4.6 EFFECTS ANALYSIS

The strength of an Effects Analysis lies in the ability of the process to identify and assesses impact viability between GHMP Project components or activities and the potential effects on VCs. The Effects Analysis

uses a vetting process to screen the impact of GHMP Project components on identified VC. Through this process, potential pathways are identified and validated. By assessing the interaction of GHMP Project components and ecological pathways, valid, minor, and invalid pathways are delineated. Subsequent examination of minor and valid pathways yields impact mitigation measures to address potential park trail redevelopment impacts. Pathway validity may result in the following characterizations:

- a valid pathway that could result in residual effects;
- a minor pathway that would involve measurable change, but have a negligible effect; and
- an invalid pathway that will not result in residual effects.

Determination of the legitimacy of an assessed pathway is dependent on a variety of factors including qualitative measure, qualitative comparison, gap analysis, traditional knowledge and professional judgment. Impacts occurring during the breeding season may negate temporal constraints of assessment if impacts affect overall population health or status, which in-turn effect harvest. For example, seasonal trail operations providing sensory disturbance to year-round ungulate habitat provides only a temporal constraint. In comparison, road development leading to habitat loss, habitat fragmentation, and collision mortality are permanent in duration.

Table 4.1 Definitions of Criteria Used in the Residual Impact Classification of Valid Pathways Effects.

Direction	Magnitude[a]	Geographic Extent	Duration	Frequency	Reversibility	Likelihood
Negative: a decrease relative to baseline values **Positive:** an increase relative to baseline values	**Negligible:** no predicted detectable change from baseline values **Low:** impact is predicted to be within the range of baseline values **Moderate:** impact is predicted exceeds the limits of baseline values **High:** impact is predicted to likely change the state from baseline conditions	**Local:** small-scale direct and indirect GHMP Project impacts (e.g., footprint, physical hazards) **Regional:** direct and indirect GHMP Project impacts that exceed local-scale effects (can include cumulative, direct and indirect impacts) **Beyond Regional:** cumulative local and regional GHMP project impacts and other developments extend beyond the regional scale	**Short-term:** impact is reversible at end of construction **Medium-term:** impact is reversible at end of closure **Long-term:** impact is reversible within a defined length of time (e.g., animal life spans) beyond closure	**Isolated:** impact confined to a specific discrete period **Periodic:** impact occurs intermittently but repeatedly over the assessment period **Continuous:** impact will occur continually over the assessment period	**Reversible:** impact will not result in a permanent change of state of the population compared to "similar" environments not influenced by the GHMP trail works **Irreversible:** impact is not reversible (i.e., duration of impact is unknown or permanent)	**Unlikely:** the impact is likely to occur less than one in 100 years **Possible:** the impact will have at least one chance of occurring in the next 100 years **Likely:** the impact will have at least one chance of occurring in the next 10 years **Highly Likely:** the impact is very probable (100% chance) within a year

(a) baseline includes range of expected values from reference conditions (no development) through 2017 and 2018 baseline conditions.
(b) similar" implies an environment of the same type, region, and time period

5 RESULTS

5.1 REVIEW OF REGULATORY FRAMEWORKS

The proposed Project is under the jurisdiction of three levels of government requiring regulatory process. Jurisdictional supervision includes the District of Summerland, RDOS, the Province of British Columbia and the Government of Canada. Regulatory review provides an understanding of supporting measures for habitat and species protection. Relevant statues further provide guidance for restoration proposals and mitigation strategies. Mountain Pacific reviewed relevant regulation to ensure Project compatibility and authorization.

5.1.1 Federal Regulation

5.1.1.1 Fisheries Act

Under proper Project Management and environmental controls, including erosion and sediment there is no anticipated impacts to local fisheries from trail redevelopment impacts. The objective of the *Fisheries Act* is to "manage threats to fish that are part of or support commercial, recreational or Aboriginal fisheries with the goal of ensuring their productivity and ongoing sustainability" (Government of Canada 2012).

• Section 35 (1) of the Act states "No person shall carry on any work, undertaking or activity that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery."; and

• In addition, Section 36 (3-4) states "no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water." The *Fisheries Act* applies to this Project since Okanagan Lake and several tributaries are located within the Project RSA likely provides fish habitat that directly or supports fish habitat for a recreational, commercial or aboriginal fishery. The Fisheries Act defines RDOS fish work windows (Section 42:1) between July 22nd to Sept 15th.

5.1.1.2 Species at Risk Act

The *Species at Risk Act* (SARA) is federal legislation that provides legal protection to "At Risk" wildlife and their habitats on SARA Schedule 1. Habitats include "residences" and "Critical Habitat", for which the definitions are currently being drafted. At-Risk wildlife and plants are listed in Schedule 1 of SARA (Government of Canada 2002).

The purposes of SARA is to prevent Canadian indigenous species, subspecies and distinct populations from becoming extirpated or extinct, and to encourage the management of other species to prevent them from becoming at risk. This protection applies to all federal lands in Canada. If a SAR is identified on private or provincial crown land, best management practices and good environmental stewardship are encouraged. In addition, GHMP project proponents must notify Environment Canada in writing if the project is likely to affect a listed wildlife species or it's Critical Habitat (Section 79(1) of SARA).

Protection options and associated environmental controls for species identified under SARA with the potential to occur within Project study area have been included in the EA report (Environment Canada 2018b). No vertebrate SAR or their residences were identified during Project assessments.

5.1.1.3 Migratory Bird Convention Act

The *Migratory Bird Convention Act* (MBCA) protects migratory birds and nests from indiscriminate harvesting and destruction (Government of Canada 1994). Section 5.1 (1) of MBCA 1994, stipulates that "no person shall disturb, destroy or take a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird" (Section 6 [a]). The Act further states that, "no person shall deposit or permit to be deposited oil, oil wastes or any other substance harmful to migratory birds in any waters or any area frequented by migratory birds (Section 35 [1]). In addition, restrictions have been put in place during the migratory bird season (March 15 to August 15) as well as the breeding bird season (April 1 to July 31; BC MOE 2014b).

Given these requirements, the District of Summerland, as the park trail redevelopment project proponent, is compelled to implement an acceptable degree of due diligence to ensure migratory birds are protected from the risk of harm or mortality created by the operation of the development project.

5.1.2 Provincial Regulation

5.1.2.1 BC Water Sustainability Act

No instream works are anticipated under the current Project scope. Any complex or complicated works in and about a water body require a Section 9 approval under the Water Act by FLNRO, while simple works near a water body require a Section 7 notification. These regulations were designed to protect water resources and aquatic environments, and they are subject to specific terms, conditions and time frames (BC MOE 1996).

5.1.2.2 BC Wildlife Act

The *B.C. Wildlife Act* of British Columbia protects vertebrate animals from direct harm, except as allowed by regulation (e.g., hunting or trapping; BC MOE 1996b). The Minister may issue permits to authorize certain activities if they will not jeopardize the survival or recovery of that species. In 2004, the *B.C. Wildlife Amendment Act* was passed to protect and recover SAR, making it an offence to kill, harm, harass or capture identified species or their habitats (British Columbia MOE 1996b).

5.1.2.3 BC Weed Control Act

Ensuring adequate protection to the threat of noxious weed colonization is a critical component of the trail redevelopment plan. The *B.C. Weed Control Act* designates provincially and regionally noxious weeds (Schedule A) and the associated regulations (British Columbia Ministry of Agriculture and Lands 2001). The Act provides guidelines for noxious weed prevention and management.

The *B.C. Weed Control Act* imposes a duty on all land occupiers to control designated noxious plants. Weed control can be conducted during site-preparation where major clearing and grubbing of the land within GHMP will occur. Additionally, weeds will be controlled throughout construction, when heavy machinery is moving on and off-site.

When the project proceeds to tender, it is required that trail development applicants address noxious weed management as instructed in the GHMP Project's Environmental Management Plan.

5.1.3 Municipal Regulation

5.1.3.1 Riparian Area Protection Act

No direct threats to local riparian systems are expected to result from Project works and no Riparian Area Regulation application submission is warranted. The *B.C. Fish Protection Act* empowers municipal and provincial law to protect riparian and aquatic habitat. All works within 30 m of the high-water mark of aquatic environments (lake or stream) require a Riparian Area Regulation Assessment. This act applies to all works on both public and private lands within District of Summerland.

5.1.3.2 District of Summerland Municipal Zoning

An examination of zoning constraints and land ownership issues will be applied to the District of Summerland. Understanding stakeholder coordination and partnership opportunities will be imperative to land access and development planning.

5.2 VALUED COMPONENT SELECTION

Project VCs were selected by Project biologists based on representative species vulnerability ecological community resilience and SAR status. Within the Project LSA, biophysical resources provide a fundamental subsistence resource and identify cultural values. Factors considered when selecting Project VCs included the following (Salmo 2006):

- identified VC species status;
- required by or compatible with regulatory requirements and existing initiatives;
- easily understood and known to be important to residents, managers, and regulators;
- when taken together, reflect overall environmental and social conditions;
- can be easily measured or described with one or more practical indicators;
- allow cumulative effects pathways to be considered; and
- public concern.

5.2.1 Addressing Potential Valued Component Impacts

Of primary concern to District of Summerland is the addressing of information on faunal and flora species and associated species' habitat. Several potential impacts were identified as important with respect to development assessment. In assessing potential Project impacts it is important that representative species do not included SAR are not due to inherent detection bias
A list of concerns addressing potential impacts to Project VC included:

- SARA species in the LSA and RDOS;

- access roads (forestry and subsequent road construction);
- soil and water contamination;
- potential erosion (i.e. wind, rain);
- potential group impacts as identified by represented by species-specific habitat requirements
  - ungulates (mule deer);
  - carnivores (black bear);
  - mustelid (short-tailed weasel);
  - passerines (winter and breeding season habitat use; dark-eyed junco);
  - raptors (red-tailed hawk); and
  - herptiles (Great Basin gophersnake).

5.3 BASELINE DATA COLLECTION AND FIELD INVESTIGATIONS

5.3.1 Vegetation

The property is comprised of medium to steep sloping terrain, gradual ridges, and mid-elevational bench lands exhibiting primarily open, late successional ponderosa pine and interior Douglas-fir on both north and northwest facing aspects. Sub-dominant Douglas-fir is sporadic throughout the study area. A mix of both conifers occupy the ridge between drainages. The northern portion of the study site maintains open grasslands dominated by bluebunch wheatgrass and pine grass. Identified shrubs and plants includes prickly rose, Saskatoon, Oregon grape, arrowleaf balsam root aster *spp*., alumroot (*Heuchera cylindrica*) and yarrow (*Achillea millefolium*). Successional stages ranged from overmature seral to edaphic climax while structural stage included shrub, sapling, young and mature forest stages. Forests were primarily coniferous with some early successional, mixed forest adjacent to LSA boundaries. Percent cover ranged from 10% in young forest environments to 80% in mature climax systems.

Forest structure and stand age were influence due to proximity to the District of Summerland. The variety in forest composition is primarily due to prominent disturbance and fire suppression within the Project study area. Site investigations were consistent in mesoslope and surface shape as the study area transected the gradual slopes between the Okanagan valley floor and benches below the Interior Plateau. Elevation between sites was relatively consistent with a small rise in the northern terminus of the LSA. Moisture and nutrient scores are confined to assessed plots and not representative of the valley floor and riparian areas along Okanagan Lake. Table 5.1 details baseline ecosystem assessment for thirty four plots within the Project LSA. Sensitivity indexes were developed for local habitats within GHMP. Forested areas of the park were identified as District of Summerland Environmentally Sensitive Area (ESA) 3 due to adjacent road and trail disturbance. The park's northern grasslands, southern cliff faces and contiguous ponderosa pine and interior Douglas-fir forest are identified as ESA 2 and subject to minor invasive species colonization.

Table 5.1 2018 Terrestrial Ecosystem Assessments within the Project LSA.

Plot	Date	UTM Easting	UTM Northing	Ecosection	BGC Zone	Successional Status	Structural Stage	Stand Age (y)	Canopy % Cover	Composite
1	May 15	0306562	5497069	NOB Basin	BGxh1	Overmature Seral	Herb	60	15	Grassland
2	May 15	0306861	5496567	NOB Basin	PPxh1	Edaphic Climax	Young Forest	80-120	20	Coniferous
3	May 15	0307162	5496099	NOB Basin	PPxh1	Edaphic Climax	Young Forest	80-120	20	Coniferous
4	May 15	0307328	5496377	NOB Basin	PPxh1	Edaphic Climax	Young Forest	80-120	40	Coniferous
5	May 15	0307114	5496754	NOB Basin	PPxh1	Edaphic Climax	Young Forest	80-120	40	Coniferous
6	May 15	0306880	5497118	NOB Basin	BGxh1	Overmature Seral	Herb	60	35	Grassland
7	May 15	0307114	5497347	NOB Basin	BGxh1	Overmature Seral	Herb	60	30	Grassland
8	May 15	0307356	5496900	NOB Basin	BGxh1	Overmature Seral	Herb	60	25	Grassland
9	May 15	0307623	5496470	NOB Basin	BGxh1	Overmature Seral	Herb	60	80	Grassland

Figure 5.1 Representative habitat within the Project LSA comprising ponderosa pine, interior Douglas-fir, mixed forest and grassland systems.

The proximity of the District of Summerland urban centre relative to the Project LSA incurs heightened colonization and abundance of invasive plants. Invasive species identified during field

observations include sulphur cinquefoil (*Potentilla recta*), knapweed (*Centaurea* sp.) and dandelion (*Taraxacum officinale*).

Table 5.1b 2017 Terrestrial Ecosystem Assessments within the Project LSA.

Plot	Date	Aspect	Slope (%)	Surface Shape	Mesoslope	Moisture Regime	Nutrient Regime	Surface Substrate	Disturbance
1	May 15	N	58	Concave	Low	Xeric	Poor	Organic	I, S, R, Tr,U, I
2	May 15	N	59	Concave	Middle	Xeric	Poor	Organic	I, S, R, Tr
3	May 15	N	20	Concave	Upper	Xeric	Poor	Organic	I, S, R, Tr
4	May 15	N	50	Concave	Upper	Xeric	Poor	Organic	I, Tr
5	May 15	N	60	Concave	Middle	Xeric	Poor	Organic	I, Tr
6	May 15	N	62	Concave	Low	Xeric	Poor	Organic	S, H, T, R, S
7	May 15	E	59	Concave	Low	Xeric	Poor	Organic	S, H, T, R, S
8	May 15	E	68	Convex	Middle	Xeric	Poor	Organic	I, Tr
9	May 15	E	77	Concave	Upper	Xeric	Poor	Organic	I, Tr

Disturbance Codes: **I** - Invasive Plants, **R** - Road, **S** - sensory, **Tr** - Trails, **U** - Urban.

5.3.2 Winter Track Survey Results

Winter track survey baseline data collection occurred within the Project LSA on February 4th 2018. Transect surveys were employed to assess proportionally representative habitat within the Project LSA. Total transect length for the survey was 4.8 km. Proportional habitat representation was estimated at 45 % ponderosa pine, 35% IDF and 25 % grassland. Anthropogenic areas comprised the remaining < 5 %. Habitat metrics were used to further delineate wildlife habitat assessment and ecosystem mapping during the spring survey period.

Winter track count surveys revealed 64 observations including ungulate, canine, mustelid and two domesticated species. Observed tracks and sign included carnivores consisting of coyote and bobcat. Ungulate consisted of undifferentiated *Odocoileus* (i.e. mule deer and white-tailed deer). Short-tailed weasel represented the lone mustelid observed during winter survey efforts. Small rodent sign (*Rodentia* spp.), quite possibly that of deer mouse (*Urocitellus columbianus*), was further observed during field efforts. No herptiles were observed during site investigations. Deer and coyote represented the mammals most commonly observed during site investigations. Bed sites belonging to both large mammals were identified on Project lands. Deer and coyote were most active in grassland habitat and open ponderosa pine habitat while bobcat was confined to closed forests. Throughout both winter and summer field investigations within the Project's LSA, no significant wildlife habitat features, including active den sites, caves, hibernacula or permanent wetlands were observed (Figure 5.2). However, it is important to note that caves have previously been identified within the larger GHMP (Bryn White, pers. comm).

Table 5.2 2018 Winter Track Count Survey Results.

2018 Date	Species Name	Track Type	UTM * Easting	UTM Northing	2018 Date	Species Name	Track Type	UTM * Easting	UTM Northing
Feb 04	*Felis silvestris catus*	track	306563	5497378	Feb 04	*Odocoileus spp.*	trail	307110	5496469
Feb 04	*Odocoileus spp.*	track	306704	5497262	Feb 04	*Odocoileus spp.*	trail	306901	5496699
Feb 04	*Canis latrans*	track	306700	5497151	Feb 04	*Canis lupus familiaris*	trail	306833	5496812
Feb 04	*Odocoileus spp.*	track	306479	5497048	Feb 04	*Canis lupus familiaris*	trail	306833	5496812
Feb 04	*Canis lupus familiaris*	track	306764	5496926	Feb 04	*Canis lupus familiaris*	track	306841	5497035
Feb 04	*Canis latrans*	track	307049	5496805	Feb 04	*Odocoileus spp.*	track	306917	5497143
Feb 04	*Odocoileus spp.*	trail	307266	5496797	Feb 04	*Canis lupus familiaris*	track	306917	5497143
Feb 04	*Odocoileus spp.*	trail	307266	5496797	Feb 04	rodentia spp.	track	306989	5497141
Feb 04	*Odocoileus spp.*	track	307411	5496792	Feb 04	rodentia spp.	track	306993	5497252
Feb 04	*Odocoileus spp.*	track	307403	5496570	Feb 04	*Canis latrans*	track	306993	5497252
Feb 04	*Odocoileus spp.*	track	307399	5496458	Feb 04	*Odocoileus spp.*	track	307065	5497249
Feb 04	*Canis latrans*	track	307399	5496458	Feb 04	daybed/ small den	track	307065	5497249
Feb 04	*Odocoileus spp.*	track	307327	5496461	Feb 04	*Odocoileus spp.*	track	307134	5497136
Feb 04	*Odocoileus spp.*	trail	307327	5496461	Feb 04	*Canis latrans*	track	307134	5497136
Feb 04	*Odocoileus spp.*	trail	307250	5496352	Feb 04	*Odocoileus spp.*	track	307130	5497024
Feb 04	*Odocoileus spp.*	trail	307250	5496352	Feb 04	*Canis latrans*	track	307198	5496911
Feb 04	*Odocoileus spp.*	track	307250	5496352	Feb 04	*Odocoileus spp.*	trail	307270	5496908
Feb 04	*Mustela erminea*	track	307250	5496352	Feb 04	*Odocoileus spp.*	trail	307270	5496908
Feb 04	*Odocoileus spp.*	track	307250	5496352	Feb 04	*Odocoileus spp.*	trail	307270	5496908
Feb 04	*Odocoileus spp.*	visual	307250	5496352	Feb 04	*Odocoileus spp.*	track	307266	5496797
Feb 04	*Odocoileus spp.*	visual	307247	5496241	Feb 04	*Odocoileus spp.*	trail	307338	5496794
Feb 04	*Odocoileus spp.*	track	307247	5496241	Feb 04	*Odocoileus spp.*	track	307335	5496683
Feb 04	*Odocoileus spp.*	trail	307247	5496241	Feb 04	*Odocoileus spp.*	track	307262	5496686
Feb 04	*Odocoileus spp.*	trail	307247	5496241	Feb 04	*Lynx rufus*	track	307186	5496577
Feb 04	*Odocoileus spp.*	trail	307247	5496241	Feb 04	*Odocoileus spp.*	track	307186	5496577
Feb 04	*Tamiasciurus hudsonicus*	trail	307315	5496127	Feb 04	*Odocoileus spp.*	track	307182	5496466
Feb 04	*Mustela erminea*	trail	307315	5496127	Feb 04	*Odocoileus spp.*	track	307254	5496464
Feb 04	*Odocoileus spp.*	trail	307315	5496127	Feb 04	*Odocoileus spp.*	track	307254	5496464
Feb 04	*Mustela erminea*	trail	307243	5496130	Feb 04	*Odocoileus spp.*	track	307254	5496464
Feb 04	*Odocoileus spp.*	trail	307247	5496241	Feb 04	*Odocoileus spp.*	track	307254	5496464
Feb 04	*Odocoileus spp.*	trail	307247	5496241	Feb 04	*Canis latrans*	track	306696	5497040
Feb 04	*Canis lupus familiaris*	trail	307250	5496352	Feb 04	*Odocoileus spp.*	trail	307110	5496469

* Universal Transverse Mercator (UTM) Zone 11U; *Canis latrans:* coyote. *Canis lupus familiaris:* domestic dog, *Mustela ermine, Felis silvestris catus*: domestic cat, *Lynx rufus:* bobcat, *Odocoileus spp:* mule deer or white-tailed deer, *rodentia* spp: small rodents, *Tamiasciurus hudsonicus:* American red squirrel.

1:6,000

LOCATION INSET
1:2,000,000

Peachland
Summerland **Project Location**

Map 3 - Winter Tracking Data

Project: 2018 Giant's Head Mountain Park Trails Redevelopment Plan
Client: Mountain Pacific Environmental Consultants Ltd.
GIS Consulted: Cabin Forestry Sevices Ltd.
Map Created: 5-20-2018
Data Sources: District of Summerland, Bench Site Design Inc., ESRI, Data BC

The data in this map was not created with survey grade GPS, and may be inaccurate with errors, omissions.

0 110 220 330 440 550 Metres

Coordinate System: NAD 1983 UTM Zone 11N

Legend

- Geographic Point
- Municipal Boundaries
- Lakes
- Index Contour
- Intermediate Contour
- Local Roads
- Highways
- Watershed Boundary
- Giants Head Trail Base
- Giants Head Park Boundary
- LSA Boundary

GHMP - Winter Track Data
Species - Observation Type

- Deer - visual
- Deer - trail
- Deer - Track
- American red squirrel - trail
- bobcat - track
- coyote - track
- den - track
- domestic cat - track
- domestic dog - trail
- domestic dog - track
- rodent - track
- short-tailed weasel - trail
- short-tailed weasel - track
- snowshoe - trail
- snowshoe - track

MOUNTAIN PACIFIC ENVIRONMENTAL CONSULTANTS LIMITED

Cabin Forestry

5.3.3 Breeding Bird Survey Results

Spring point counts occurred on May 15th and May 16th yielding avian species consistent with PPxh1 and IDFxh1 of the Southern Interior Ecoprovince. Avian species observed typified woodland and grassland ecological communities within the Project LSA. The complex of habitat communities occurring on the Project LSA, including conifer forests, forested savannah, open grasslands, dense and narrow drainages mixed wood forests provide habitat suitability for a broad variety of avifauna.

During the spring breeding surveys, a total of 36 avian species were identified during upland breeding bird survey plots. An additional eight species were observed incidentally during survey works including included an adult saw-whet owl, two juvenile great horned owls and one juvenile long-eared owl. Owl playback calls on April 21st, 2018 produced three independent response from adult great-horned owl while incidental observations of a saw-whet owl and long-eared owl were further recorded. Despite the high species abundance, the late spring experienced in the region may have deterred early avian migration and territoriality. In turn, a late start to the avian breeding season may have potentially impacted observed species richness. Species richness within the LSA was potentially underestimated due to lack of replication as reflected in the trajectory of the Species Accumulation Curve for observed avifauna on Project lands (Figure 5.3).

Open grassland and shrub habitat provided associations with California quail (*Callipepla californica*), American goldfinch (*Spinus tristis*), Savannah sparrow (*Passerculus sandwichensis*), vesper sparrow (*Pooecetes gramineus*), and mourning dove (*Zenaida macroura*). The mountain park's transition habitat provides an important resource for a variety of local breeding birds. Transition habitat offers nesting opportunity, thermal protection and foraging along the interface between coniferous woodland and open grassland. Grassland systems provide foraging options for predatory, insectivorous and seed eating avifauna. Species finding important niche opportunity along these transition areas include great-horned owl, dark-eyed junco, western bluebird (*Sialia Mexicana*), violet-green swallow (*Tachycineta thalassina*), The diversity in habitat, yielding high avian diversity, results in providing excellent hunting opportunity for predatory species including Cooper's hawk (*Accipiter cooperii*). Within both the park's upper forests an open grasslands, common raven (*Corvus corax*), American crow (*Corvus brachyrhynchos*) and black-billed magpie (*Pica hudsonia*) represented several of the generalist foraging corvids that use the study area.

Table 5.3 Avian Species Observed during 2018 Spring Field Investigations.

Scientific Name	Species Name	Provincial	BC List	COSEWIC
Aeronautes saxatalis	white-throated swift	S3S4B (2015)	Blue	No Status
Aegolius acadicus	northern saw-whet owl	S5B,S5N (2009)	Yellow	No Status
Ammodramus savannarum	grasshopper sparrow	S1S2B (2015)	Red	No Status
Asio otus	long-eared owl	S4B (2015)	Yellow	No Status
Bubo virginianus	great horned owl	S5 (2015)	Yellow	No Status

Buteo jamaicensis	Cooper's hawk	S5B (2015)	Yellow	NAR (1995)
Callipepla californica	California quail	SNA (2015)	Exotic	No Status
Colaptes auratus	northern flicker	S5 (2015)	Yellow	No Status
Contopus sordidulus	western wood-peewee	S5B (2015)	Yellow	No Status
Corvus brachyrhynchos	American crow	S5 (2015)	Yellow	No Status
Corvus corax	common raven	S5B (2015)	Yellow	No Status
Empidonax oberholseri	dusky flycatcher	S5B (2015)	Yellow	No Status
Empidonax traillii	willow flycatcher	S5B (2015)	Yellow	No Status
Falcipennis canadensis	spruce grouse	S5 (2015)	Yellow	No Status
Icterus bullockii	Bullock's oriole	S5B (2015)	Yellow	No Status
Junco hyemalis	dark-eyed junco	S5B (2015)	Yellow	No Status
Melospiza lincolnii	Lincoln's sparrow	S5B (2015)	Yellow	No Status
Melospiza melodia	song sparrow	S5B (2015)	Yellow	No Status
Myadestes townsendi	Townsend's solitaire	S5B (2015)	Yellow	No Status
Oreothlypis ruficapilla	Nashville warbler	S5B (2015)	Yellow	No Status
Passerculus sandwichensis	savannah sparrow	S5B (2015)	Yellow	No Status
Passerella iliaca	fox sparrow	S5B (2015)	Yellow	No Status
Petrochelidon pyrrhonota	cliff swallow	S4S5B (2015)	Yellow	No Status
Pica hudsonia	Black-billed magpie	S5B (2015	Yellow	No Status
Pipilo maculatus	spotted towhee	S5 (2015)	Yellow	No Status
Poecile atricapilla	black-capped chickadee	S5B (2015)	Yellow	No Status
Pooecetes gramineus	vesper sparrow	S5B (2015)	Yellow	No Status
Regulus calendula	ruby-crowned kinglet	S5B (2015)	Yellow	No Status
Selasphorus calliope	calliope hummingbird	S5B (2015)	Yellow	No Status
Setophaga coronata	yellow-rumped warbler	S5B (2015)	Yellow	No Status
Setophaga townsendi	Townsend's warbler	S5B (2015)	Yellow	No Status
Sialia mexicana	western bluebird	S4B (2015)	Yellow	No Status
Sitta canadensis	red-breasted nuthatch	S5B (2015)	Yellow	No Status
Sitta carlinensis	white-breasted nuthatch	S5 (2015)	Yellow	No Status
Sitta pygmaea	pygmy nuthatch	S4 (2015)	Yellow	No Status
Spinus tristis	American goldfinch	S4B (2015)	Yellow	No Status
Spizella passerina	chipping sparrow	S5B (2015)	Yellow	No Status
Tachycineta bicolor	tree swallow	S4S5B (2015)	Yellow	No Status
Tachycineta thalassina	Violet-green swallow	S4S5B (2015)	Yellow	No Status
Troglodytes aedon	house wren	S5B (2015)	Yellow	No Status
Turdus migratorius	American robin	S5B (2015)	Yellow	No Status
Vireo cassinii	Cassin's vireo	S5B (2015)	Yellow	No Status
Zenaida macroura	mourning dove	S4?B (2015)	Yellow	No Status
Zonitrichia atricapilla	white-crowned sparrow	S5B (2011)	Yellow	No Status

Blue List: List of ecological communities, and indigenous species and subspecies of special concern (formerly vulnerable) in British Columbia. **Yellow List:** List of ecological communities and indigenous species that are not at risk in British Columbia. **Special Concern:** Particularly sensitive to human activities or natural events but not endangered or threatened [as used by COSEWIC - A wildlife

species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.] Special Concern was formerly referred to as Vulnerable. **Threatened:** Likely to become endangered if limiting factors are not reversed.

Diversity indexing and habitat mapping yielded expectedly strong associations with cavity nesting species in the in park's higher elevation conifer forests. Primary and secondary excavators, including northern flicker (*Colaptes auratus*), were prevalent in ponderosa pine and interior Douglas-fir complexes. Cavity nesters relying on secondary use opportunities in the climax forests resulted in broad and varied species observations including black-capped chickadee *(Poecile gambeli*), tree swallow (*Tachycineta bicolor*) and red-breasted nuthatch (*Sitta canadensis*). The parks higher elevation closed forests yielded two observations of spruce grouse (*Falcipennis canadensis*).

5.3.3.1 Avian Species Richness

A total of 33 bird species were identified during upland breeding bird survey plots within the EA LSA, species richness differed among habitat types with the highest species richness in overmature seral systems (25) followed by edaphic climax systems (22). The LSA for the Project is equally weighted between both grassland and forest. Species accumulation curves (with rarefaction) were used to compare an estimate of standardized species richness among habitats (Table 5.4). Species Richness provides a simple and established measure of community diversity. Comparative estimates of species diversity within a community is a fundamental tool in modeling community structure (MacArthur & Wilson 1967; Connell 1978, Magurran 1988). Attempts at maximizing species richness are inherent goals in both conservation and community resilience efforts (May 1988; Gotelli and Colwell 2001). Based on the species accumulation curves, the number of species continues to plateau beyond the number of individuals sampled in all habitat types (i.e., the curves is approaching asymptote). The curve indicates that no more sampling is required to accurately estimate species richness, and species richness reported is representative of the LSA. However, it is important to note that early season breeding surveys may not fully capture the true species richness of the EA LSA without comparative field surveys later into the breeding season.

Overall avian species richness for the LSA was 7.89 +/- 0.54. Mean avian species richness for forest ages class found 7.80 ($\pm$0.85) species among overmature seral plots and 8.25 ($\pm$0.48) among edaphic climax stands. Species Richness for both Overmature Seral (25) and Edaphic Climax (22) habitats may be skewed due to lack of replication and subsequent sample size within the Project study area.

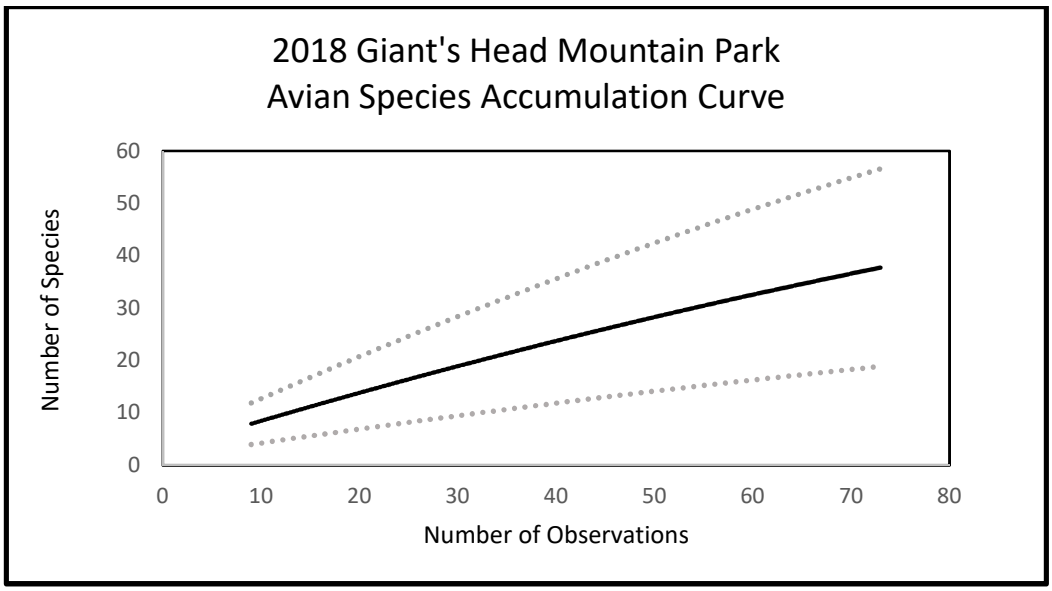


Figure 5.3 EA LSA Species Accumulation Curve with Rarefaction.

Table 5.4 Avian Species Richness per Habitat Type in the EA LSA.

Habitat	N of plots	Total Individuals	S_{obs}	Mean Richness +/- SE
Overmature Seral	5	46	25	7.70 +/- 0.85
Edaphic Climax	4	35	22	8.25 +/- 0.48
Total Plots	9	73	36	7.89 +/- 0.54

*Note: Sobs is the maximum observed number of species for each habitat

5.3.3.2 Avian Species Diversity

A Species Diversity Index provides more information than simple richness as the function takes species evenness into account. Species evenness compares the number of individuals between species in an environment. The Shannon Diversity Index increases as both the richness and the evenness of the community increase. When comparing communities, the community with the higher Shannon Diversity Index is the more diverse community. We used the following equation to determine avian diversity within the LSA:

$$H' = -\sum_{i=1}^{S} p_i \ln p_i$$

H = Shannon Diversity Index,
S = total number of species in the community (species richness)
p = proportion of S made up of the *i*th specie

Field investigation results yielded 44 avian species within the Project LSA yielding a Shannon Diversity Index of 4.19. The resulting Index score is high relative to other systems

in the Southern Interior Ecoprovince reflecting the varied niche opportunity prevalent in the municipal park.

5.3.4 Bat Survey Results

Acoustic detection surveys were completed on May 15th, 2018 at 15 stations within the Project LSA. Transects were confined to the parks primary access road and parking areas where construction and operational phase disturbance may incur potential impacts to habitat and behaviour. Temperature at the time of survey was between 8 and 10 C. Winds ranged from Beaufort Scale of 2 with gusts to 3.

Two bat species were detected along the survey route at an elevation of 789 m. The observation occurred in a clearing along the road corridor which provides excellent foraging habitat within the park's higher elevation mixed coniferous forest. AnaLook™ software was used to determine the identification of silver haired bat (*Lasionycteris noctivagans*) and long-legged myotis (*Myotis volans*) at 11 U 307030 E 5496223 N. Both species may be found in low to mid-slope elevations in dry coniferous forests (Adams 2003).

Table 5.5 Bat species potentially occurring in the Project LSA.

Scientific Name	Species	Expected Habitat Types	SAR
Antrozus pallidus	pallid bat	Mountainous areas, arid deserts and grasslands near rocky outcrops and water	T[2] (COSEWIC), Red (BC)
Corynorhinus townsendii	Townsend's big-eared bat	rocky outcrop / riparian	Blue (BC)
Eptesicus fuscus	big brown bat	Range from high mountains to low deserts – rosst in buildings, bridges, hollow trees, rock crevices, tunnels, cliffs	Not at Risk
Euderma maculatum	spotted bat	Varied – montane coniferous stands to desert, open ponderosa pine, riparian, open pasture and meadow – roost in cracks and crevices in cliffs	SC[2]; Blue (BC)
Lasionycteris nactivagans	silver-haired bat	Coniferous forests adjacent to lakes, ponds, or streams	Not at Risk
Lasiurus blossevilli	western red bat	broadleaf riparian	Red (BC)
Lasiurus cinereus	hoary bat	Deciduous or coniferous forests and woodlands, riparian corridors – roost in foliage of large trees	Not at Risk
Myotis californicus	Californian myotis	Varied – sea costs, desert scrub, montane forest, mountain meadows, riparian woodlands and grasslands – roost in rock crevices and tree cavities	Not at Risk
Myotis ciliolabtum	western small footed myotis	Desert, semiarid, woodlands, riparian zones, near cliffs and outcrops	Blue (BC)

Myotis evotis	long-eared myotis	Varied – lowland, montane, subalpine woodlands, forests, shrubland	Not at Risk
Myotis lucifugus	little brown bat	riparian / rural	E[1]
Myotis thysanodes	fringed myotis	open Douglas fir – roost in caves	Blue (BC)
Myotis volans	long-legged myotis	Mountainous wooded areas	Not at Risk
Myotis yumanensis	Yuma bat	na	Not at Risk
Parastrellus hesperus	canyon bat	Canyon desert mountain ranges, desert scrub flats, shrub-steppe, rocky canyons and riparian zones	??[3]

Source: Craig et al. 2014.

5.3.5 Herptile Surveys Results

Sparsely vegetated rocky ecosystems have the potential to provide a large variety of specialized habitats that many SAR depend on for survival. The project area includes many small, sparsely spaced openings of rock outcrop; however, the deep crevices and talus slopes required for high value roosting and hibernacula sites for herptiles were not present. Snakes and other reptiles will likely use these areas as basking sites for thermo-regulation. Otherwise, these areas provide moderate-value escape terrain for ungulates and other terrestrial mammals.

No snakes or snake dens were found in the project area; however, the park location is within 5 km of known snake dens and juvenile Great Basin gophersnakes have been recorded within the park (Alison Peatt pers. comm.). It is possible that snakes denning outside the park forage within the project area during their main activity period, (late April to late September). It is expected that construction is scheduled to occur within this window; therefore, it is possible that snakes will be encountered within the project footprint. Records from iMapBC (2018) identify tiger salamander (*Ambystoma tigrinum,* Southern Mountain population), Great Basin spadefoot and Great Basin gophersnake occurrences within the Project LSA.

5.3.6 Wildlife Habitat Assessment Results

The objective of wildlife habitat assessment (WHA) data is to assist effects analysis and direct residual effects mitigation for group-specific Project impacts. Species groups selected for wildlife habitat assessment are based on VC priority, species group characteristics, and existing knowledge of species. Spatial models derived from wildlife habitat assessment may be used to guide development planning and mitigation options.

Wildlife habitat assessment scores for both growing (i.e. spring, summer, fall) and winter (including den and hibernacula) were determined for indicator species representing ungulate, bear, canine, mustelid, passerine, raptor and snake. Wildlife Habitat Assessment scores were given percentage scores compared with provincial benchmarks for species-specific habitat. The data was binned into the following classes:

Comparative Habitat Score (%)	Habitat Class
100 to 81	High
80 to 61	Moderate High
60 to 41	Moderate
40 to 21	Low
20 to 1	Very Low
0	Nil

Table 5.6 and Table 5.6b detail Wildlife Habitat Assessment scoring for the EA LSA.

Table 5.6 Wildlife Habitat Assessment Scores for Species Groups in the EA LSA.

Plot	Date	UTM E	UTM N	Ungulate Growing	Ungulate Winter	Carnivore Growing	Carnivore Winter	Mustelid Growing	Mustelid Winter
1	April 26, 2017	341125	5751110	moderate	mod high	moderate	mod high	moderate	low
2	April 26, 2017	310216	5631961	moderate	moderate	mod high	low	moderate	moderate
3	April 26, 2017	310297	5632033	mod high	mod high	moderate	low	mod high	mod high
4	April 26, 2017	310379	5632148	mod high	mod high	moderate	moderate	mod high	mod high
5	April 26, 2017	310441	5632227	mod high	mod high	moderate	moderate	mod high	mod high
6	April 26, 2017	310473	5632233	mod high	mod high	mod high	mod high	mod high	mod high
7	April 26, 2017	310607	5632315	moderate	mod high	moderate	mod high	moderate	low
8	April 26, 2017	310696	5632390	moderate	mod high	moderate	mod high	moderate	low
9	April 26, 2017	310795	5632463	moderate	mod high	moderate	mod high	moderate	low

* Representative VC species. ungulate (mule deer), carnivore (coyote) and mustelid (short-tailed weasel).

Table 5.6b Wildlife Habitat Assessment Scores for Species Groups in the EA LSA.

Plot	Date	UTM E	UTM N	Passerine Growing	Passerine Winter	Raptor Growing	Raptor Winter	Herptile Growing	Herptile Winter
1	April 26, 2017	341125	5751110	moderate	low	mod high	moderate	mod high	low
2	April 26, 2017	310216	5631961	moderate	moderate	mod high	moderate	moderate	moderate
3	April 26, 2017	310297	5632033	mod high	mod high	moderate	mod high	moderate	moderate
4	April 26, 2017	310379	5632148	high	mod high	mod high	mod high	mod high	moderate
5	April 26, 2017	310441	5632227	high	mod high	mod high	mod high	mod high	moderate
6	April 26, 2017	310473	5632233	high	mod high	mod high	moderate	mod high	low
7	April 26, 2017	310607	5632315	moderate	mod high	mod high	moderate	mod high	low
8	April 26, 2017	310696	5632390	low	low	moderate	moderate	mod high	low
9	April 26, 2017	310795	5632463	low	low	moderate	moderate	mod high	low

* Representative VC species. passerine (northern flicker), raptor (great-horned owl) and herptile (Great Basin gophersnake).

5.4 CUMULATIVE EFFECTS

It is imperative that Cumulative Effects assessment only examined potential overlapping impacts between current and immediately proposed projects. Due to inherent limitations of cumulative effects modeling, the tool should never be employed to forecast predictive measures beyond immediately expected impacts. At all scales, models simply demonstrate proposed outcomes of the trends employed by the user. The predictive nature of models is static and highly subject to changes in policy, management and environmental variability. As such, it is imperative that models be employed in an adaptive management framework. Allowing accommodations for land use management options provides flexibility in the decision making process (Walters and Holling 1990, Schneiber et al. 2003).

5.4.1 Edge Effects and FRAGSTATS Analysis

Specific to the goal of this assessment is to identify the impact of cumulative effects on habitat for identified Project VC. The potential for cumulative impacts may arise from a variety of anthropogenic sources and their corresponding zones of influence including, paved roads, trails, cut blocks, transmission lines, pipelines, agricultural lands, and developed areas. Table 5.7 provides land use metrics for both the Project LSA and RSA. Table 5.7 and 5.7b provides land use metrics for the Project RSA.

Table 5.7 Land Use Metrics for EA LSA.

Parameters	Baseline	Agri and Rural	Forestry	Industrial	Rail
Area (km2)	1.705328	0.932923	0.00	0.006074	0.00
Average Area (km2)	0.033438	0.021696	0.00	0.002025	0.00
Total Patch Perimeter (km)	38.457525	28.926627	0.00	0.699038	0.00
Patch Density (count / km)	16.12072208	13.59198136	0.00	0.94827777	0.00
Patch Edge Density (km/km2)	12.15613868	9.143492444	0.00	0.220960732	0.00
Count (reference)	51	43	0	3	0

Table 5.7b Land Use Metrics for EA LSA.

Parameters	Riparian	Road	Urban	IR Lands	Open Water
Area (km2)	0.013394	0.269908	0.236002	0.00	0.00
Average Area (km2)	0.002679	0.010381	0.018154	0.00	0.00
Total Patch Perimeter (km)	2.779793	44.46009	7.946954	0.00	0.00
Patch Density (count / km)	0	8.218407	4.109204	0.00	0.00

Patch Edge Density (km/km2)	0.878671969	14.05351	2.511973	0.00	0.00
Count (reference)	0	26	13	0	0

Within the Project LSA, baseline conditions expectedly maintain the largest land use type by Area (1.71 km^2) followed by agricultural and rural lands (0.93 km^2). Similarly, the two systems maintain the highest average patch area within the study area. However, both baseline conditions and agricultural lands fall short of roads with respect to Total Patch Perimeter (44.46 km) and Patch Edge Density (14.05 km/km^2) though maintaining significantly higher Patch Counts.

When compared to both baseline and both agricultural and rural land use types, the high patch edge density of roads suggests that undeveloped area within the LSA are potentially sensitive to edge effects from road features. In an attempt to reduce edge effects from Project development, caution should be advised with respect to road and trail access with a focus on minimizing road and parking lot footprints within the park.

5.4.2 Spatial Assessment of Impacts to Wildlife

Defining the study area for cumulative effects on wildlife resources requires species-specific natal dispersal distances as spatial boundary widths around development project footprints. Natal dispersal distance has strong implications for survivorship, immigration, and habitat for identified and wildlife VC.

Dispersal by immature animals is important for colonization and the maintenance of metapopulation connectivity (D'Eon et al. 2002). Natal dispersal distances are defined here as distances beyond which 90% of dispersing females will not travel. Literature values for the estimated maximum natal dispersal distance for dark-eyed junco was used as a representative examples for passerines. These two species provide representative indices as allometric equations for juvenile dispersal distances were not used due to the very poor explanatory power of the models for herbivorous and omnivorous birds (adjusted r_2 of 0.02 for maximum dispersal distances, Sutherland et al. 2000). Table 5.8 lists the natal dispersal distances for key harvest species potentially found in the Project LSA.

Table 5.8 Natal Dispersal Distances for EA LSA Indicator Wildlife Vectors.

Species/Species Group	Estimated Natal Dispersal Distance (km)	Source
Ungulate (mule deer)	females: 8.22, males:7.34	Robinette (1966)
Carnivore (coyote)	females: 232.20; males: 176.00	Andrews and Boggess (1978)

Carnivore (bobcat)	females: 56.00; males:182.00	Robinson and Grant (1958))
Mustelid (short-tailed weasel)	Females: 1.65 ; males: 4	Linnel, et. al (2017)
Raptor (great-horned owl)	Females and males: 4.92	Sutherland, et. al (2000)
passerines (dark-eyed junco)	Females: 0.5; males: 1.17	Liebgold, et. al (2013)
Herptile (Great Basin gophersnake)	Females and males: 520	Williams et al 2012

Natal dispersal distances were estimated using the allometric equations of Sutherland et al. (2000). Using the 'corrected' negative exponential functions of Sutherland et al (2000), estimates represent 90% of expected dispersal distances.

Wildlife harvest information notes deer are important game resource within the region (BC MOE 2018). Delineating spatial boundary data for wildlife resources within the Project study area will consider conifer and mixed forest habitat. Additional temporal delineation may further introduce seasonal constraints to species movements. However, impacts occurring during the breeding season may negate temporal constraints of assessment if impacts affect overall population health or status, which in-turn effect harvest. For example, seasonal construction operations providing sensory disturbance in year-round ungulate habitat provides only a temporal constraint. In comparison, road development, habitat fragmentation, and collision mortality are permanent in duration.

5.5 EFFECTS ANALYSIS

Assessment endpoints for fish and wildlife VCs included the preservation of abundance and distribution. Changes to abundance may result from hydrological regime changes, sedimentation, habitat loss and wildlife mortality. Vegetation loss and hydrological regime changes may affect the long-term carrying capacity of the environment, leading to reduced fish and wildlife recruitment and population change. Changes to wildlife distribution may occur if populations display avoidance of noise and activity which occurs particularly during construction, and from behavioural changes in response to vegetation removal (for example, passerine diversity is often observed to change across linear developments (Jalkotzy et al. 1997).

Table 5.9 identifies assessment endpoints employed in the Project Effects Analysis.

Table 5.9 Project Valued Components and Assessment Endpoints.

Valued Components	Representative Species	Assessment Endpoint
Ecological Community	PPxh1 PC / 04: Ponderosa pine – Bluebunch wheatgrass – Cheatgrass	preservation of native vegetation abundance preservation of native vegetation distribution

Ungulate	mule deer	preservation of ungulate abundance preservation of ungulate distribution
Carnivores	coyote	preservation of carnivores abundance preservation of carnivores distribution
Mustelid	short-tailed weasel	preservation of furbearers abundance preservation of furbearers distribution
Passerines	dark eyed junco	preservation of passerine abundance preservation of passerine distribution
Raptors	great-horned owl	preservation of raptors abundance preservation of raptors distribution
Herptile	Great Basin gophersnake	preservation of snake abundance preservation of snake distribution

5.5.1 Potential Pathways

The objective of pathway analysis is to identify and assesses impact viability between GHMP Project components or activities and the potential effects VC. Pathway analysis employs a vetting process to screen the impact of GHMP Project components on identified VC. Through this process, GHMP Project-related pathways are identified.

By assessing the interaction of GHMP Project components and ecological pathways, valid, minor, and invalid pathways are delineated. Subsequent examination of minor and valid pathways yields impact mitigation measures to address potential GHMP Project impacts.
Pathway validity may result in the following characterizations:

- A valid pathway that could result in residual effects;
- a minor pathway that would involve measurable change, but have a negligible effect; and
- an invalid pathway that will not result in residual effects.

Determination of the legitimacy of an assessed pathway is dependent on a variety of factors including qualitative measure, qualitative comparison, gap analysis, traditional knowledge and professional judgement. Table 5.10 examines potential Project component impact pathways, impact duration and delineated validation.

Table 5.10 Project Component Pathway Validation.

GHMP Project Components	Pathway	Pathway Duration	Valued Components	Pathway Validation
Access Road Bed Parking Lot	• Physical disturbance impacting abundance • Physical disturbance impacting distribution	• Construction • Operations • Construction • Operations	• Vegetation • Wildlife • Vegetation • Wildlife	• Valid • Valid

Infrastructure	• Sensory disturbance impacting abundance	• Construction • Operations	• Wildlife	• Minor
	• Sensory disturbance impacting distribution	• Construction • Operations	• Wildlife	• Valid
	• Edge effects impacting habitat quality	• Operations	• Vegetation • Wildlife	• Valid
Hiking Tails Biking Trails	• Physical disturbance impacting abundance	• Construction • Operations	• Vegetation • Wildlife	• Minor
	• Physical disturbance impacting distribution	• Construction • Operations	• Vegetation • Wildlife	• Minor
	• Sensory disturbance impacting abundance	• Construction • Operations	• Vegetation • Wildlife	• Minor
	• Physical disturbance impacting distribution	• Construction • Operations	• Vegetation • Wildlife	• Valid
	• Edge effects impacting habitat quality	• Operations	• Vegetation • Wildlife	• Minor
Signage Waste Disposal	• Sensory disturbance impacting abundance	• Operations	• Wildlife	• Valid
	• Sensory disturbance impacting distribution	• Operations	• Wildlife	• Minor

6 DISCUSSION and RECOMMENDATIONS

6.1 PROJECT IMPACT IDENTIFICATION

The Effects Analysis is used by investigators to validate potential impacts to Project VCs. Once impacts have been identified a pathway analysis may be used to determine impact validity. Valid impacts will then be subject to residual impact mitigation to best alleviate or minimize potential impact.

6.1.1 Impact Occurrence

Identified Impacts may occur at the Project's design, construction or operation phases. Impacts may further entail combinations of multiple phases. Assessing occurrence and duration of identified impact allows investigators to judge temporal intervals and constraints. The temporal period that an impact occupies may conceal or mask resulting consequences. While the occurrence of an impact may be brief in duration, acute effects may have extensive and severe outcomes on Project VCs.

6.1.1.1 Design Phase Impacts

Design phase impacts primarily address the need for access road and trail routing, minimizing development footprint, and erosion and control design on Project lands. Road and infrastructure design will best attempt to minimize additional runoff from the GHMP Project footprint over existing slopes. Design considerations of the road footprint should aim to retain native vegetation where possible.

Minimizing fragmentation through design best ensures and promotes the preservation of contiguous habitat. Adjacent habitat systems provide corridors for local animal movement and migration. Once design considerations have been exhausted, revegetation guidelines will follow accepted replacement ratios from the District of Summerland or proximate municipalities (i.e. District of Lake Country Official Community Plan 2010).

6.1.1.2 Construction Phase Impacts

During the park trail redevelopment's construction phase, the potential for impacts exist through land clearing, soil disturbance, spill potential and sensory disturbance to terrestrial wildlife. Potential threats to the integrity of terrestrial habitat includes invasive species introduction, soil loss, soil degradation and soil channelization. Resulting impacts may include reduced native species diversity and richness, non-native and invasive species propagation, soil erosion, wildlife habitat loss and possibly wildlife extirpation.

6.1.1.3 Operation Phase Impacts

Park trail redevelopment operations may incur potential impacts including habitat fragmentation, invasive species introduction, soil channelization on steep slopes and sensory disturbance to terrestrial wildlife. Potential impacts during GHMP project operations may include deteriorated quality of surface and ground water, invasive species propagation, collision mortality and sensory disturbance to local wildlife.

6.2 PROJECT IMPACT MITIGATION

6.2.1 Species Diversity and Habitat Loss

Land clearing and associated disturbance decreases overall species diversity through habitat loss, reduced ecosystem function, and reduced ecological community interactions (Walker 1995). Impacts to local wildlife resulting from parks trail redevelopment may include loss of wildlife habitat including fragmented corridor connectivity, loss of den and nest sites, reduced thermal cover, decreased grazing and browse opportunity for large ungulates, decreased foraging habitat and prey

availability for carnivores, and loss of both cover and foraging opportunity for small mammals and insects. Mitigation measures to minimize the effects of land clearing include minimizing the overall development footprint, retaining habitat where possible, observing work windows for breeding avifauna, active weed management through construction, landscape exposed soils with native trees and shrubs, and revegetate exposed soils with native seed mix.

Weed management may be accomplished through mowing, pulling, chemical application (in accordance with municipal and provincial guidelines), or biological controls. Limiting development encroachment during construction may be aided by delineating the limits of the clearing and grubbing area with flagging. Any non-footprint areas that are disturbed will be planted or hydro-seeded as soon as possible. Sandy soils typical of the PPxh1 and IDFxh1 zones may be subject to channelization and trenching from heightened erosion potential from potential development impacts. Plant all exposed soils immediately after construction to prevent erosion of the fill slope during rain and snow melt. Erosion control matting or mulch may be considered if vegetation cannot be established prior. A native seed mix will be used to re-seed disturbed areas. Planted areas should be covered with mulch to prevent erosion and to help seeds germinate.

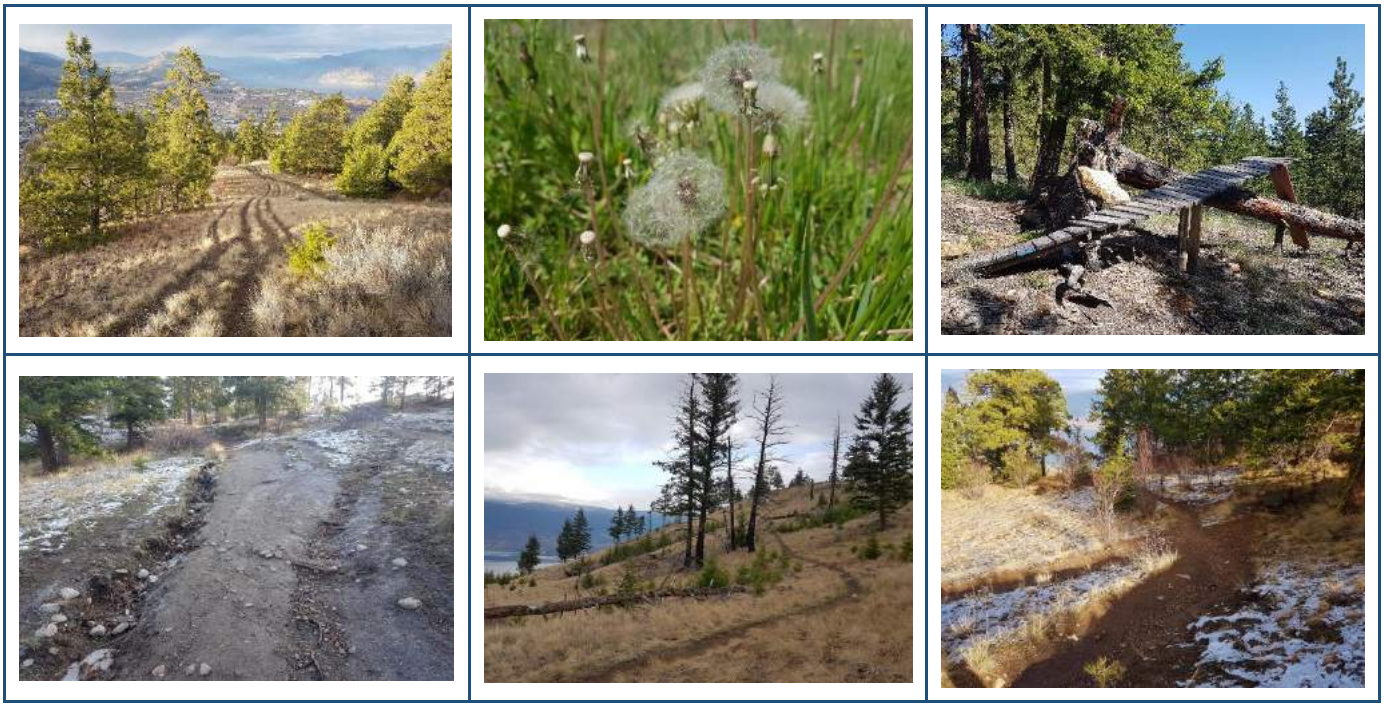


Figure 6.1 Observed disturbance features within the Project LSA include (clockwise from top left): trail widening, invasive weed species, illegal construction, fragmentation, contiguous habitat disruption and soils erosion.

6.2.1.1 Construction Work Windows

All active bird nests are fully protected under the *BC Wildlife Act* and it is an offence to destroy nests occupied by a bird, its eggs or its young (Government of British Columbia 1996). In accordance with the *Migratory Bird Act* (Government of Canada 1994), land clearing may occur outside of the sensitive nesting period. Work windows for land clearing in the Okanagan-Similkameen Region are as follows:

Nesting Birds:

- Raptors August 15th to January 30th;
- Herons: August 15th to January 30th; and
- other birds August 1st to March 31st

Amphibians and Turtles:

"Amphibians and turtles can be vulnerable to works in and around water, especially in temporary and permanent ponds or wetlands. In this region many of these features occur in grassland areas. The general least risk period for these species varies according to species and geographic location. If amphibians or turtles are known to use the area, operations are not to occur if species are hibernating, breeding or migrating."

Source: BC MOE 2018c. Okanagan Region. Timing Windows

Construction impacts to soil systems may be best mitigated via planting of exposed soil and slopes upon completion of construction works. Delineating construction boundaries prior to construction initiation will best ensure footprint minimization. Flagging or fencing of site boundaries will best mitigate potential encroachment on undisturbed lands. Further demarcation of marked wildlife trees will best protect existing habitat.

6.2.2 Sensory Disturbance

Sensory disturbances from operations, which may affect local and migratory wildlife, stem from both lighting and noise. Noise will be continuous throughout the duration of operations and may eradicate sensitive wildlife from the area (Dafour 1980, Schmiegelow and Monkkonen 2002). Lights might disrupt bird navigation and lead to circling flights, sometimes to the point of exhaustion (Kingsley and Whittam 2003).

During migration, birds use a variety of navigational cues including celestial, sunrise orientation, and internal magnetic compass. Artificial light pollution may impact avian navigation through reduced visibility of the night sky, disrupting orientation, disrupting light-dependant magnetoreception, and increases attraction to infrastructure. Artificial light may both over

stimulate and attract nocturnally migrating birds. Findings have concluded that lighting away from the yellow and white spectrum may have reduced attenuation, reduced disorientation, and reduced collision probability (Emlen 1975, Ogden and Evans 1996, Wiltschko and Wiltschko 2000, Wiltschko and Wiltschko 2001).

6.2.3 Linear Disturbance

Linear developments include a wide variety of infrastructure processes which have varied effects on wildlife populations. Examples of linear features include roads, transmission lines, phone lines, seismic lines, and Right-of-Ways (Harron 2003). Much information currently exists on the effect and impacts of linear developments on North American wildlife, especially the interaction of avifauna and both transmission and tele-communication lines (Arend 1970, Avery 1978, Rusz et al. 1986, Brown and Drewien 1995, Saverwno et al. 1996, Bevanger and Broseth 2004, Beckmann 2010). These studies contend that linear features may negatively impact avian populations via collision mortalities, disrupting contiguous habitat, limit distributions, reduce nest densities, decrease nest success, and impact both dispersal and recruitment.
While species specific responses to breeding habitat disturbances may be variable, the habitat requirements, behaviour, morphology and biomechanics of waterfowl may make this group vulnerable to heightened mortality rates through linear feature interactions in BC interior forests and grasslands.

Lastly, there is concern that edge effects may create “ecological traps” for forest breeding avifauna, particularly ground nesting species (Flaspohler et al. 2001). A multi-species examination on edge effect on forest breeding species revealed ground nesters were more likely to nest in higher densities close to forest edges while also experiencing higher rates of nest failure due to predation (Flashpohler et al. 2001). These results suggest attractive transition habitats may lure breeding adults that result in “ecological sinks” through decreased nest success.

6.2.4 Fragmentation and Edge Effect

Linear infrastructure, including transportation corridors, have the potential to adversely affect wildlife by causing habitat avoidance, acting as barriers to movement, and increasing wildlife-vehicle interactions (Opdam 1997, Rondinini and Doncaster 2002, Clevenger et al. 2003). Studies have shown that ungulates and large carnivores are particularly susceptible to the effects of linear corridor development (Woods 1990, Evink 1996, Parks and Harcourt 2002). In North America, wildlife crossing structure have been widely used to prevent collision mortalities along highway corridors (Singer and Doherty 1985, Paquet et al.;. 1996, Beckmann et al. 2010).

Fragmentation and edge effect may have negative implications on avian populations due to increased potential for predation, parasitism, habitat reduction and habitat isolation (Yahner 1988,

Paton 1994, Baynes et al. 2005). Recent studies have revealed the impact of roads on bear mortality and population segregation (Mace and Waller, 1998f). Understanding the vulnerability of this species to increasing development pressures within the TCH area is vital to species viability in the region. Development pressures will also heighten bear-human encounters and attractants. Management plans that minimize these interactions will prove increasingly important to the viability of this species.

Baynes et al. (2005) suggests that the rapid development of energy reserves in Canada's western boreal forests contributes directly to forest fragmentation due to seismic line intensification. The authors work on the response of passerines to conventional seismic lines determined that forest fragmentation due to conventional linear features may have strong impacts on avian population densities and movements (Baynes et al. 2005). Kroodsma's (1982) study on the effect of edge on breeding forest birds along power line corridors identified variability in nest densities between species. Paton (1994) notes that increased avian nest predation and parasitism have been linked to the effect of edge between adjacent habitats.

Several studies have found that avian nest success declines with proximity to habitat edge and transition areas (Kroodsma 1982, Kroodsma 1987, Flaspohler 2001). In turn, increased nest success has been correlated with increased patch size in several studies. Complimenting these studies, Knight and Kawashima's (1993) work observed the increased density of avian nest predators (i.e. ravens) along linear right-of-way in California forests. The presence and foraging success of nest predators in transition areas and right-of ways lends to studies documenting decreased nest success proximate to linear features.

6.2.5 Wildlife Collision Mortality

Motor vehicles and bicycles remain the primary form of direct mortality to local fauna. Wildlife movements between seasonal foraging and bedding areas heightens the vulnerability of animals to vehicular mortality. Appropriately placed signage may reduce potential mortality to local fauna from vehicles using the park access road. Human-wildlife interactions may result in wildlife abandoning local habitat in favor of areas of less disturbance. Sensory disturbance resulting from increased vehicular traffic is expected as a result of the parks trails project.

Most wildlife collision mortality is anticipated during the operations phase of the park trails project. Reducing wildlife-motor vehicle collisions may accomplished by reducing vehicle speed at problem areas and the installation of overpasses, underpasses and fencing. (Clevenger and Ford 2010). Reducing snake mortality from bicycle encounters first requires obtaining information on areas of high centration or risk.

Figure 6.2 2018 juvenile Great Basin gophersnake mortality by motor vehicle within the Project LSA (Photo credit: Alan Peatt).

6.3 SIGNIFICANCE DETERMINATION

The following information was used in the evaluation of the significance of impacts from the GHMP park trails redevelopment project on identified biophysical VCs:

- Results from the residual impact classification of valid pathways;
- Subsequent classification of environmental consequence on assessment endpoints, which uses ecological context, frequency, and likelihood of the impact as modifiers that may increase or decrease environmental consequence;
- Application of professional judgment and ecological principals, such as resilience, to predict the duration and associated reversibility of impacts; and
- Application of additional adaptive management and mitigation measures that may increase resilience, and decrease the significance of impacts.

Table 6.1 outlines residual impact criteria classification for valid pathway effects.

Table 6.1 Residual Impact Criteria Classification for Valid Pathway Effects.

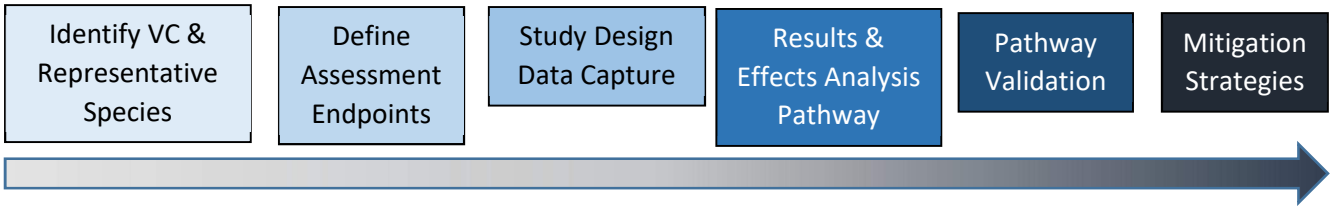
Residual Impact	Direction	Magnitude (a)	Geographic Extent	Duration	Frequency	Reversibility	Likelihood
Road, Parking and Infrastructure: Physical disturbance impacting vegetation & wildlife abundance	Negative	Moderate	Local	Long-term	Continuous	Irreversible	Likely
Road, Parking and Infrastructure: Physical disturbance impacting vegetation & wildlife distribution	Negative	Moderate	Local	Long-term	Continuous	Irreversible	Likely
Road, Parking and Infrastructure: Sensory disturbance impacting wildlife distribution	Negative	Moderate	Local	Long-term	Isolated	Irreversible	Likely
Road, Parking and Infrastructure: Edge Effects impacting habitat quality	Negative	Moderate	Local	Long - term	Isolated	Reversible	Likely
Recreational Trails: Physical disturbance impacting vegetation & wildlife distribution	Negative	Low	Local	Long-term	Continuous	Irreversible	Low
Lighting: Sensory disturbance impacting wildlife	Negative	Low	Local	Long-term	Continuous	Irreversible	Moderate

(a) baseline includes range of expected values from reference conditions (no development) through 2008 baseline conditions.

6.4 PROJECT MITIGATION OPTIONS

The trail redevelopment plan assists biophysical resources within Project lands by reducing recreational use impacts through footprint minimization, narrowed sensory disturbance and habitat management. Resulting residual impacts from the Project Effects Analysis highlights physical disturbance from contruction and operations as well as sensory disturbance form project operations. Mitigation options will employ a variety of measure at the trail redevelopment Design, Construction and Operations phases. These options will address residual impacts delineated through the Effects Analysis (below) for identified GHMP Project components. By addressing GHMP Project component impacts with tangible mitigation measures, the Project will best ensure minimizing or alleviating impact potential.

Table 6.2 Effects Analsysis Pathway Process.



Mitigation measures include minimizing the trail design footprints, assessing ungulate winter range, protection of reptile and amphibian habitat, protection wildlife trees during trail routing, minimizing

wildlife attractants, planting prescriptions and invasive species control, erosion and sediment control, wildlife collision deterrence, artificial hibernacula projects, and environmental management planning, Mitigation options derived through the Project's Effects Analysis are provided in Table 6.2.

Table 6.3 Effects Analysis Mitigation.

GHMP Project Components	Pathway	Pathway Duration	Valued Components	Mitigation
• Access Road Bed • Parking Lot • Infrastructure	• Physical disturbance impacting abundance.	• Construction • Operations	• Vegetation • Wildlife	• Minimize access road footprint. • Selective brushing & clearing. • Observe avian work windows. • Follow construction EMP[1]. • Conduct cavity tree assessments.
	• Collision mortality impacting abundance.	• Operations	• Wildlife	• Assess areas of high risk. • Install deterrents as required. • Hibernaculum compensation plan to offset mortality risk.
	• Physical disturbance impacting distribution.	• Construction • Operations	• Vegetation • Wildlife	• Minimize access road footprint. • Selective brushing & clearing. • Observe avian work windows, • Follow GHMP Project EMP. • Conduct cavity tree assessments.
	• Sensory disturbance impacting distribution.	• Construction • Operations	• Wildlife	• Employ prescriptive revegetation. • Observe avian work windows.
	• Edge effects impacting habitat quality.	• Operations	• Vegetation • Wildlife	• Minimize access road footprint. • Conduct invasive species control. • Employ prescriptive revegetation.
• Recreational Hiking and Biking Trails	• Physical disturbance impacting distribution.	• Construction • Operations	• Vegetation	• Minimize Project footprint and ESC[2] • Selective brushing & clearing. • Follow Construction EMP. • Conduct cavity tree assessments. • Conduct invasive species control.
• Waste • Signs	• Sensory disturbance impacting abundance	• Operations	• Wildlife	• Reduce noise pollution and wildlife attractants through infrastructure design and installation.

EMP[1]: Environmental Management Plan, ESC[2] Erosion and Sediment Control

6.4.1 Retention of Sensitive Grassland and Cliff Faces through Footprint Minimization

New construction of the park access road may potentially impact the study area's PPxh1 and BGxh1 biogeoclimatic zones through loss of vegetation and wildlife habitat. These areas may provide habitat to a variety of identified SAR given the unique ecosystem of the RDOS and Okanagan Valley basin. Minimizing the overall parks trail redevelopment footprint and retaining attributes of the

existing environment will result in fewer impacts. Design phase considerations will address options to reducing the trail redevelopment Project footprint while completing successful park trail redevelopment. It is recommended that Design and Construction phase efforts focus on minimizing cut and fill, clearing and grubbing while aiming for the retention of vegetation, coarse woody debris and wildlife trees (i.e. snags). Soil preservation may be encouraged by removing vegetation without disturbing root and soil systems. Such efforts will deter habitat disturbance, prevent erosion and allow quick regrowth to targeted areas. The construction of steep sloped ditches will reduce surface area and minimize potential disturbance by the road width.

6.4.2 Ungulate Winter Range Study

Designing and mapping proposed trails with the intent of maximizing contiguous grassland habitat will assist in delivering both physical and sensory protection to local SAR (i.e. American badger, Nuttall's cottontail). Comparative winter and summer field investigations suggest GHMP offers important ungulate winter range. However, given deer natal dispersal distances, lack of movement corridors and significant cumulative effects within the RSA, Project lands may act as a population sink for local ungulate metapopulations. In the same way, avoidance of disturbance to cliff faces through routing options will best protect potential nest and roosting habitat for avian and bat species using the unique regional feature.

Paired trails (hiking and mountain biking downtrack) may heighten recreational use on the east side of the park through winter. Winter tracking surveys yielded high winter use by deer and described avoidance of habitat along the park access road and neighbouring trails with high snowshoe activity (Figure 5.2). Given the importance of the park to local deer populations, it is further recommended that a study examine changes in use of ungulate winter range following trail implementation.

6.4.3 Protection of Reptile and Amphibian Habitat including Species at Risk

Tiger salamander, Great Basin gophersnake and Great Basin spadefoot share low-elevation grasslands, shrub-steppe, and open forest woodlands as both core and connectivity Critical Habitat. Easily crumbled soils, fine gravel, clay, and sandy soils that permit burrowing or denning along with surface cover (e.g. rocks, coarse woody debris) provide both forage and refuge opportunity (Environment and Climate Change Canada. 2017, 2017b, Southern Interior Reptile and Amphibian Recovery Team. 2008). These common Critical Habitat attributes for all three herptiles are prevalent throughout large portions of the LSA including grasslands and adjacent transition areas with closed forest. Tiger salamander and Great Basin gophersnake Critical Habitat is available throughout the Project LSA while Great Basin spadefoot Critical Habitat is confined to the northwest corner of the park. Potential habitat disturbance to at risk critical habitat requires proactive mitigation towards minimizing risk to local Great Basin gophersnake and Lewis's woodpecker populations.

Potential impacts to GHMP herptiles and herptile habitat includes:

- Disruption or destruction of temporary basking and denning habitat;
- Harm or injury sustained from encountering heavy machinery; and
- Reduced access to foraging habitats resulting from site-preparation and construction activities.

Minimizing potential impacts to herptiles encountered in the Project LSA is best achieved by employing the following prescriptions during park access road and trail construction:

- Do not disturb rocky slopes used by snakes as basking, hibernation, or nursery sites;
- Retain talus, rock outcrops with fissures, and coarse woody debris, which provide shelter for reptiles;
- Retain an Environmental Monitor or other qualified environmental professional to conduct a pre-construction survey for snakes in the project footprint; and
- Install temporary fencing upslope of the reservoir location to discourage snakes (i.e. western rattlesnakes) from entering the work area. Inspect the area thoroughly prior to starting work each morning for snakes that have moved in overnight. Contact the Project Environmental Monitor if snakes are encountered;
- Inform the construction crews of the value of snakes and discourage harm if encountered during project activities (BC MWLAP 2004);
- Reduce the potential for excessive fugitive dust generated from site preparation and construction by watering exposed and denuded soils until revegetation and restoration activities are complete;
- Examine coupling motor vehicle closures with seasonal snake dispersal to minimize vulnerability of migrating snakes to collision mortality; and
- Install filter or silt fences along the construction site boundaries to contain sediment on-site and prevent sediment from being carried in runoff toward any drainage ditches during site-preparation and construction.

To avoid reptile mortalities during site-preparation and construction, due diligence requires that relocation efforts be conducted to remove native reptiles occurring in the alignment prior to ground-disturbing construction activities. This will involve the detection, capture and relocation of reptiles currently residing within the alignment footprint, immediately prior to construction. Assessments of Critical Habitat for identified herptile SAR were conducted for Great Basin gophersnake, Great Basin spadefoot and tiger salamander (Table 6.3).

PPxh1 and BGxh1 habitat at the north end of the park provides contiguous grassland and associated habitat attributes common to all three identified herptiles. Trail development has the potential to fragment grassland complexes as well as heightened collision mortality risk to tiger salamander,

Great Basin gophersnake and Great Basin spadefoot. Subsequent mitigation strategies targets recommendations to minimize risk. An assessment of potential project risks to species-specific Critical Habitat were based on the Project's Effects Analysis. Resulting validations of effects pathways yielded the mitigation resolutions for Great Basin spadefoot and Lewis's woodpecker.

Table 6.4 SAR Critical Habitat Assessment Process on Project Lands

	Step One	Step Two	Step Three	Step Four
Species	Critical Habitat Present	CH Attributes Present	CH Risk Present	Project Mitigation
Great Basin gophersnake	✓	✓	✓	✓
Great Basin spadefoot	✓	✓	X	
Lewis's woodpecker	✓	✓	✓	✓
tiger salamander	✓	✓	X	

CH* Critical Habitat

6.4.4 Protection of Identified Wildlife Trees during Trail Routing

Lewis's woodpecker Critical Habitat includes nest sites in 5 cm or greater cavities in well decaying trees of >30 cm dbh.in open ponderosa pine and IDF forests. Nest sites feature canopy closures no exceeding 35% with understories comprising fruit bearing shrubs and perennial grass cover of 20% or greater (Environment and Climate Change Canada. 2017d). These Critical Habitat attributes are prevalent along the northern and eastern extent of the LSA and adjacent transition areas with closed forest. Potential habitat disturbance to at risk critical habitat requires proactive mitigation towards minimizing risk to local Lewis's woodpecker populations.

Trail design and routing efforts are to attempt to preserve as many large-diameter trees as possible as they provide potential habitat for avian cavity-nesters and denning mammals. Standing dead and dying trees (snags) provide important nesting and roost sites for cavity nesters such as Lewis's woodpecker and bats. The project is located in a region with expected occurrences of Lewis' woodpecker and three at-risk bat species.

Prioritization for retention should be provided to wildlife trees consistent with attributes for Lewis's woodpecker. The woodpecker's occurrences within the LSA coupled with exiting Critical Habitat that may be at risk to trail development requires active mitigation. Prior to brush clearing, all trees selected for clearing should be inspected by qualified biologist to assess habitat potential, specifically those with cavities that may provide nesting and roosting opportunity for avifauna and bats. It is the objective of the assessment to protecting all areas with identified attributes specific to Lewis's woodpecker suitability. Secondary considerations are to include trees of larger diameter (dbh) and shading attributes consistent with species-specific requirements.

6.4.5 Minimize Sensory Disturbance along Park Access Road

Sensory disturbance remains a pressing impact of road and highway systems on local wildlife populations. While habitat disturbances will occur during construction, effects of habitat alteration on wildlife will be most evident during park trail operations. Effects during the construction and operation phases are considered to be significant, given the long duration of the operation phase. Wildlife response to sensory disturbances, including public waste and heightened noise, has the potential to affect a variety of ungulates, carnivores, mustelids, rodents, avifauna and herptiles. The park trail redevelopment project is predicted to contribute to regional cumulative effects of sensory disruption. Mitigation to minimize sensory disturbance from traffic noise is primarily completed through the implementation of sound barriers through prescription planting. Well-designed waste receptacles along the park access road assist in reducing problem wildlife encounters and collision mortality.

6.4.6 Planting Prescriptions and Invasive Species Control on Access Road and Trails

Planting prescriptions in compensation for vegetation clearing are assigned with the following assumptions:

- Ecosystem establishment starts with the appropriate choice of landscape position, moisture regime and nutrient regime. If soil chemistry is appropriate, trees and shrub of the PPxh1 and IDFxh1 ecosystem may then be established;
- Species stocking is naturally variable in community structure. A recommended convention is to allow variation of species stocking by 10% of regionally recommended numbers;
- Shrub species will be recommended based on prominence identified through site-specific investigations; and
- The application of planting prescriptions for wildlife habitat is determined by the following landscape characteristics:

    - nature and type of reclaimed landform structures;
    - slope;
    - aspect;
    - soil type (capability class); and
    - soil drainage conditions and plant succession.

Establishing restoration efforts may involve the direct planting of materials, such as containerized or bare root seedlings, cuttings, root fragments and/or seed into the target site. One advantage of this method is that a more diverse mix of species can be introduced to the site at the time of planting, relative to depending upon native recolonization. For plant species with low dispersal distances, such as gravity dispersed seeds, natural colonization may be impeded in a disturbed landscape (Lane

et al. 2003). Revegetation replacement ratios are designed to compensate for habitat lost due to development impacts. Compensation allocation exists for both shrub and tree species (Table 6.4). Management plans can be built to incorporate replacement prescriptions.

Table 6.5 Recommended Landscape Guidelines for Habitat Compensation.

Removal	Replacement
1 Shrub	2 Shrub
0mm – 151mm dbh	2 replacement trees or 4 shrubs for up to 50% of trees being replaced in this range)
152mm – 304mm dbh	3 replacement trees (minimum height 1.5m)
305mm – 456mm dbh	4 replacement trees (minimum height 1.5m)
457mm – 609mm dbh	6 replacement trees (minimum height 1.5m)
610mm + dbh	8 replacement trees (minimum height 1.5m)
20% of trees > 304mm dbh shall be retained as wildlife snags at a minimum height of 3m. dbh = diameter at breast height	

Source: District of Lake Country 2010

During the park trail's Construction Phase, the potential for invasive plant colonization is available through land clearing, soil disturbance, transportation, and infrastructure works. Weed management may be accomplished through mowing, pulling, chemical application (in accordance with municipal and provincial guidelines), or biological controls. Limiting access road and trail development encroachment during construction may be aided by delineating the limits of the clearing and grubbing area with flagging. Any non-footprint areas that are disturbed will be hydro-seeded as soon as possible.

The potential presence of SAR within the Project area may require that a SARA permit be compulsory for the GHMP Project. The use of pesticides (including herbicides, rodenticides, and insecticides) should be avoided. If pesticide use is required, a qualified applicator should be retained. Use of pesticides is regulated by the Integrated *Pest Management Act* and the *Pesticide Control Act Regulation*. This Act includes provisions to protect water quality, fish and wildlife where use of pesticides is required.

6.4.7 Erosion and Sediment Control

Erosion control efforts primarily address the need for minimizing development footprint, soil retention and water runoff mitigation on Project lands. Design planning will best attempt to minimize additional runoff from the GHMP Project footprint over existing steep slopes. GHMP Project design considerations for erosion control will best protect terrestrial and downstream habitats from impacts during construction. Sand and silt soils (loam) typical of the PPxh1 or IDFxh1 zone may be subject to channelization and trenching from heightened erosion potential from potential development impacts. Hydro seed or plant all exposed soils immediately after construction

is completed to prevent erosion of the fill slope during fall rains and following winter snow melt. Erosion control matting or mulch may be considered if vegetation cannot be established prior. A native seed mix, approved by the District of Summerland, will be used to re-seed disturbed areas. Planted areas should be covered with mulch to prevent erosion and to help seeds germinate.

Best management practices encourage conducting GHMP Project works during dry periods when there is no ephemeral flow. If GHMP Project timing requires construction activities during periods of high seasonal flow, route water drainage around the construction site so as not to increase sediment transfer downslope. Without inclusive containment, road construction operations may deliver overland flow, runoff, and sedimentation to aquatic systems and negatively impact water quality. Downstream impacts to the South Thompson River may affect aquatic impacts including periphyton, benthic invertebrate communities and fish populations. Proven management considerations for water containment and treatment are important to the health of both the immediate and downstream aquatic environment.

The design and construction of appropriate ESC measures is vital to seasonal life history requirements of aquatic life within the South Thompson River. Developing site specific environmental management strategies will include employing ESC protection options, minimizing sedimentation and monitoring water quality through the operations phase. Active monitoring and adaptive management throughout the duration of the operations is recommended.

Erosion control efforts primarily address the need for minimizing development footprint, soil retention and water runoff mitigation on GHMP Project lands. Design planning will best attempt to minimize additional runoff from the GHMP Project footprint over existing steep slopes. GHMP Project design considerations for erosion control will best protect terrestrial and downstream habitats from impacts during construction.

6.4.8 Wildlife Collision Deterrence Strategies and Artificial Hibernacula

In reducing the probability of wildlife collision events, deterrence may be applied at both the park trail project's design and operations phase. Motorist awareness will be completed through a combination of speed restrictions and signage. In areas of high risk, design controls and strategic fencing will assist in minimizing accident probability. Assessing areas of high risk, or if risk is heightened through access road operations, adopting mitigation measures through design measures or physical deterrence (i.e. wildlife fencing, underpass and overpass options).

Minimizing the attraction of access road features to wildlife is perhaps the most successful tool in reducing collision probability. Ungulates will often find salt licks and mineral deposits attractive as they provide supplemental sources of nutrition, especially during summer months. Reducing waste along roads, trails, and pull-offs will deter problem wildlife encounters. Winter tracking data and

habitat mapping illustrated a strong association with coyote in areas of human activity (Figure 4.2). Carnivores may be attracted to either material or prey resources that feed on human waste products. Proactive maintenance and removal of attractants best deters wildlife encounter and collision risk.

New trail development within GHMP has the potential to impact local snake populations through heighted collision mortality. Basking snakes are especially vulnerable to both the rapid speed of decent of bicycles on the downtrack and poor sight lines from narrow trails. As decommissioned trails grow over, snakes may be further drawn to the open, compact trails maintained by bicycle traffic. Compensation efforts targeting artificial hibernacula have the two-fold benefit of enhancing local Great Basin gophersnake Critical Habitat and offsetting snake mortality. Strategically placed hibernacula along decommissioned trails at undisclosed locations provides secure and available denning and basking habitat for local Great Basin gophersnake populations and cohorts. Figure 6.3 provides a general schematic of a snake hibernaculum including materials, form and relation to both frost line and water table.

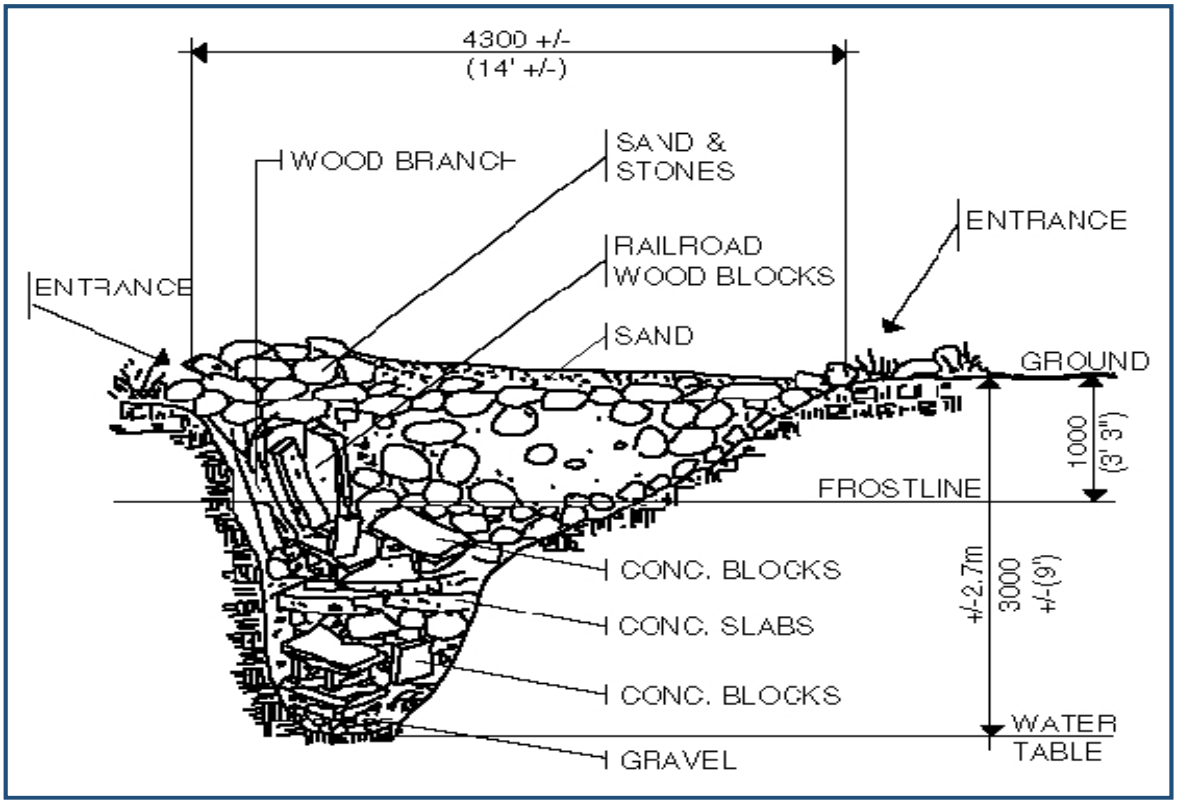


Figure 6.3 Hibernaculum Schematic Design. (Source: Toronto Zoo).

6.4.9 Park Trail Redevelopment Environmental Management Plan

Assessment and mitigation of potential impacts is best approached with a structured Environmental Management Plan specific to resource sectors. Addressing management plans to sector demands serves both proponents and land managers.

Mitigation to potential impacts may be addressed at each phase of the GHMP Project including:

- Design Phase Impacts;
- Construction Phase Impacts; and
- Operation Phase Impacts.

Environmental safeguards enhance current planning objectives while facilitating the meeting of GHMP project targets. Environmental protection options should include spill contingency planning, ESC options, shoreline management, and sensory disturbance management. Environmental Planning targets may be specific to regulatory requirements, safety protocols, and habitat or species conservation. Potential impacts to wildlife are summarized as follows:

- direct and indirect effects to wildlife health;
- habitat change and fragmentation through remediation works;
- vegetation change through dust fall and emissions from onsite activities;
- direct and indirect wildlife mortality;
- alterations in behaviour from attraction of wildlife to area;
- impediment, disruption, and reduction of movement of wildlife through access road and trail routing; and
- sensory disturbance altering wildlife behavior.

Due to the site conditions and the typically dry nature of the LSA, controlling drainage will also provide mitigation for any erosion or sedimentation issues. Other areas of concern include dust suppression, and stockpiles on site. Upon completion of excavations on site and any other site construction activities, successful re-vegetation of the site will be a priority to improve the existing drainage and potential for erosion and sedimentation on site. Resulting residual impacts assist in directing land use managers toward mitigation options at the LSA scales.

The communication and delivery of environmental management plans throughout the duration of GHMP Project delivery will best ensure impact mitigation. Table 6.5 provides a summary of Project recommendations based on validated effects pathways and mitigation options.

Table 6.6 EA Summary Table and Recommendations.

Pathway	Valued Components	Project Mitigation	EA LSA Recommendations
Access Road, Parking Lot and Infrastructure • Physical disturbance impacting abundance • Physical disturbance impacting distribution • Sensory disturbance impacting abundance • Sensory disturbance impacting distribution • Collision mortality impacting distribution	• Wildlife • Vegetation	• Minimize Road Access Footprint • Selective Brushing and Clearing • Observe Wildlife Work windows • Follow Construction EMP • Assess areas of high risk to wildlife • Employ fencing & deterrents as required • Observe Wildlife Work windows • Conduct cavity tree assessments • Employ prescriptive revegetation	• Retention of Sensitive Grassland and Cliffs Faces through Footprint Minimization • Ungulate Winter Range Study. • Protection of Reptile and Amphibian Habitat. • Protection of Identified Wildlife Trees during Trail Routing • Minimize Wildlife Attractants along Park Access Road • Planting Prescriptions and Invasive Plant Control on Access Road and Trails • Erosion and Sediment Control • Wildlife Collision Deterrence Strategies and Artificial Hibernacula • Park Trail Redevelopment Environmental Management Plan
Recreational Hiking And Biking Trails • Physical disturbance impacting abundance	• Wildlife • Vegetation	• Minimize Rec Trail Footprint • Selective Brushing and Clearing • Invasive Plant Management Plans • Employ prescriptive revegetation • Conduct cavity tree assessment • Conduct invasive species control	
Waste and Signage • Sensory disturbance impacting abundance	• Wildlife • Vegetation	• Reduce noise pollution and wildlife attractants through infrastructure design and installation.	

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