District of Summerland
Giant's Head Mountain Trails Re-Development Plan: Biophysical Overview and Mitigation Strategy

Draft Project Report

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1 INTRODUCTION

1.1 Project Description

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 Project). The proposed trail network is designed to reduce disturbance to sensitive ecosystems within the subject property. Project design objectives further include reducing multi-use conflicts, erosion control, mechanical disturbance, wildlife habitat protection and human-wildlife interactions within Project boundaries.

In November 2016, Mountain Pacific Environmental Consultants Ltd. was retained by Bench Site Design Inc. to complete an environmental assessment overview of proposed Project works. The intention of this report is to characterize the terrestrial wildlife community, review Project design for potential effects to local wildlife populations, and provide mitigation recommendations to minimize and alleviate potential Project impacts.

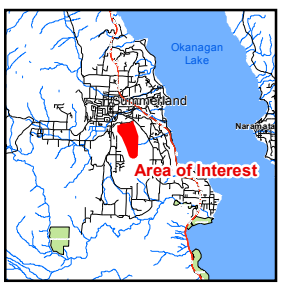
For the purpose of this effort, field investigations are limited to the proposed Project footprint while report recommendations address the Giant's Head Mountain Park boundary. Assessing the immediate Project footprint while inferring both impacts and protection options to the larger Park environment better accounts for effects to ecological function at the landscape scale.

1.2 Project Location

The Project is located in the District of Summerland, BC; within the Regional District of the Regional District of Okanagan-Similkameen. Giant's Head Mountain Park lies within the Thompson-Okanagan Plateau ecoregion. 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 307153.98 m E 5496552.43 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.

District of Summerland - Giants Head Mountain
Proposed Trails - Overview Location Map



Project Features

- Giants Head Project Boundary
- Giants Head Park Boundary

Road Class

- Highway
- Arterial
- Local
- Strata

Reference Data

- Provincial Park
- Lakes
- Streams

N
W E
S

1:20,000

210 105 0 210 420

Meters

Projection: NAD_1983_UTM_Zone_11

Cabin Forestry

Local Government Name: District of Summerland
Operational Consultant: Cabin Forestry
GIS Consulted: Aubin Dorion
Created On: 12/16/2016

Figure 1.1

1.3 Project Schedule

The Project was initiated in November 2016 with biophysical site visits completed on November 17th and 18th, 2016. Project ion construction is tentatively scheduled for 2017. Table 1.1 highlights significant tasks identified throughout the project period.

Table 1.1 Project Schedule and Identified Tasks

Task	Responsible Parties	Date of Completion
Project Initiation	District of Summerland Bench Site Design	October 24th, 2016
Biophysical Site Investigation	Mountain Pacific Environmental	November 17th & 18th, 2016
Biophysical Report Submission	Mountain Pacific Environmental	December 16th, 2016
Trail Master Plan Submission	Bench Site Design	Early 2017
Construction Start	District of Summerland	Date TBD, 2017

2 PROJECT SCOPE

The scope of this project is to provide a preliminary environmental assessment for the proposed Master Plan trail development in Giants Head Mountain Park. Considering this study was completed in November of 2016, a comprehensive environmental assessment was not completed because timing fell out of the wildlife and vegetation inventory timing windows. To support this preliminary study, vegetation and wildlife inventories should be collected during 2017, and an updated impact assessment (or addendum to this report) be completed utilizing information from this study and findings from primary and secondary vegetation and wildlife data collection.

2.1 Assessment Objectives

The objectives of prescribed biophysical overview constitutes a phased approach to ecosystem characterization and subsequently defining mitigation options. Toward the successful delivery of Project objectives the program address regulatory measures, captures documented material and field data, assess biophysical information and associated impacts, and delineates recommended mitigation strategies.

Project Objectives include, but are not limited to, the following identified tasks:

- Review of regulatory framework specific to the Project;
- compilation and review of existing literature;
- consultation with Bench Site Design Inc. staff
- identification of ecological communities, rare vegetation, noxious weeds, wildlife and wildlife habitat;
- analysis of trail disturbance conditions; and
- establish recommendations in support of Project delivery.

3 METHODS

Regulatory review requires engagement with a various federal, provincial, and regional, and municipal agencies. Included among the regulatory bodies specific to this Project were the Department of Fisheries and Oceans Canada (DFO), BC Ministry of Forests, Lands and Natural Resource Operations (FLNRO), Regional District of the North Okanagan (RDNO).

3.1 Review of Regulatory Framework

The proposed Project is under the jurisdiction of three levels of government requiring regulatory process. Jurisdictional supervision includes the District of the Regional District of Okanagan-Similkameen, the British Columbia provincial government, and the Canadian federal government. Regulatory statutes review provides an understanding of supporting measures for habitat and species protection. Relevant statues further provide guidance for development proposals and mitigation strategies.

3.1.1 Federal Regulation

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 the 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 species at risk is identified on private or provincial crown land, best management practices and good environmental stewardship are encouraged. In addition, environmental assessment must notify Environment Canada in writing of the project if it is likely to affect a listed wildlife species or its critical habitat (Section 79(1) of the Species at Risk Act. The species protected under the Act with the potential to be in the project area have been included in the environmental assessment of the Project (Government of Canada 2002).

Migratory Bird Convention Act

The Migratory Bird Convention Act protects migratory birds and nests from indiscriminate harvesting and destruction (Government of Canada 1994). Section 5.1 (1) of the Migratory Birds Convention Act, 1994,stipulate 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], Government of Canada 1994).

In addition, restrictions have been put in place during the migratory bird season (March 15 to August 15; CWS 2008) as well as the breeding bird season (April 1 to July 31; MOE 2007b). Given these requirements, the 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.

3.1.2 Provincial Regulation

B.C. Water Act

Any complex or complicated works in and about a water body requires 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 construction time frames.

B.C. Wildlife Act

The Wildlife Act of British Columbia protects vertebrate animals from direct harm, except as allowed by regulation (e.g., hunting or trapping; Government of British Columbia, 1996). The Minister may issue permits to authorize certain activities if they will not jeopardize the survival or recovery of that species. In 2004, the Wildlife Amendment Act was passed to protect and recover species at risk, making it an

offence to kill, harm, harass or capture identified species or their habitats (Government of British Columbia 2004).

B.C. Weed Control Act

The B.C. Weed Control Act designates provincially and regionally noxious weeds (Schedule A) and the associated regulations (B.C.MAL 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 the project area will occur. Additionally, weeds will be controlled throughout construction, when heavy machinery is moving on and off-site.

3.1.3 Municipal Regulation

Regional District of the Okanagan-Similkameen

Riparian Area Regulation Assessment

The 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 the District of Summerland, BC. While the Project study area is void of riparian and aquatic habitat. However, the south eastern extent of Giant's Head Mountain Park includes has implications regarding Project wildlife habitat management.

3.2 Assessing Vegetation and Vegetation Ecosystems

3.2.1 Terrestrial Ecosystem Mapping and Sensitive Ecosystem Inventories

A review was completed to gather background information regarding Giants Head Park and the surrounding area prior to planning the field assessment. The Project study area has been mapped following the Standard for Terrestrial Ecosystem Mapping (TEM) in British Columbia (RISC, 1998) and updated in 2012 (Iverson and Haney 2012). This included further analysis using the TEM mapping to develop a Sensitive Ecosystem Inventory within the Southern Okanagan including the Giants Head Park area. This work was completed at a broad scale of 1:20,000, so it was anticipated that during field surveys, differences would likely be encountered.

3.2.2 Terrestrial Ecosystems and Vegetation Field Investigations

Information from background review and ecosystem mapping was imported into QGIS software and overlaid on both orthophotos and terrain mapping to develop a digital terrain model that could be used to delineate terrain and vegetation features within the park.

During field studies, georeferenced maps produced from GIS and orthophotos were used on tablets to record data and take georeferenced photos. Key environmental attributes such as wildlife trees, rock outcrops, wet areas, small terrain features, and vegetation types were used to assess the polygons. Soil texture and coarse fragment content was examined throughout the area, including notes on bedrock outcrops and shallow soils. In addition, forest stand mensuration measurements were collected including dominant tree layer ages and diameters, and potential health concerns.

3.3 Assessing Wildlife and Wildlife Habitats

3.3.1 Field Investigations

Field investigations were organized by TEM polygons to assess habitat potential for identified wildlife species including species at risk. Assessed wildlife groups included:

- Class Aves (birds);
- Order Ungula (deer and sheep);
- Family Canidae (coyote and fox);
- Family Mustelidae (weasels);
- Order Rodentia (mice, vole, and squirrels);
- Order Chiroptera (bats);
- Class Amphibia (frogs and toads);
- Class Reptilla (snakes, lizards and skinks); and
- Order Lepidoptera (moths and butterflies).

Search efforts documented potential nest sites, roosting sites, den sites, hibernacula, movement corridors, basking sites, overwintering sites and foraging opportunities. Seasonal timing of the field investigation prevented winter track surveys, playback surveys or point count surveys (RIC 1999, RISC 1999, 2016, 2006a). Incidental observations of species or species sign were also recorded. Typical species sign may include nests, tree cavities, tracks, scat, trails, antler sheds, food caches, or mortalities.

A photo index of the study area was completed during field investigations. Several of the indexed photos have been included in this report. Presented photos describe representative habitat within TEM polygons and examples of trail disturbance within Giant's Head Mountain Park.

3.3.2 Potential Wildlife Habitat Impacts

Wildlife habitat and habitat associations within the Project study area were assessed through desktop review, mapping tools and field survey. Potential impacts and disturbance to local wildlife populations and were evaluated toward developing mitigation strategies. Impact assessment included effects derived from both the existing trail footprint and proposed trail development.

Impacts to wildlife habitat through trail development may include habitat loss, habitat degradation, movement corridor obstruction, invasive species colonization, predation efficacy, and noise and light sensory disturbance. Understanding project effects as they relate to habitat function and species life history characteristics is imperative to successful impact mitigation.

3.4 Mitigation and Mitigation Strategies

Proposed mitigation measures will address Project Design, Construction and Operation Phase impacts. Project-specific constraints will be adopted to develop targeted initiatives to eliminate or minimize impacts to local wildlife and wildlife habitat. Trail development recommendations will consider sensitive ecosystems unique to the Thompson-Okanagan Plateau ecoregion. The recreational objectives of the Project may require strategies that employ reducing disturbance rather than excluding mechanical and sensory impacts.

Mitigation planning has been developed according to current best practices. Mountain Pacific recognizes that recommended techniques and procedures will likely evolve through monitoring and adaptive Project management. Design mitigation and reclamation planning will target wildlife habitat capacity and diversity; identify appropriate wildlife habitat enhancement options; and describe an efficient monitoring program.

4 RESULTS

4.1 Terrestrial Ecosystem Mapping and Sensitive Ecosystem Inventories

The study area is classified as the Okanagan, Very Dry Hot Ponderosa Pine variant (PPxh1) within the provincial Bioegeoclimatic Ecosystem Classification (BEC) System (Lloyd et. al, 1990). 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*).

Based from the background review, TEM and SEI data and mapping was used as baseline information to focus field study efforts. Georeferenced maps were developed with TEM polygon line work and proposed trail locations throughout the Giants Head 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
- 1473 Py - bluebunch wheatgrass - cheatgrass (*Bromus tectorum*), Py - purple three-awn (*Aristida purpurea*)

Table 4.1 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	PPxh1/02		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	PPxh1/02 PPxh1/04	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 very dry hot biogeoclimatic unit.

4.2 Terrestrial Ecosystems and Vegetation Field Investigations

Field assessments were completed throughout the Giants Head Mountain Park on November 24 and 25th, 2016 by Eric Miller, RPF, RPBio. TEM and SEI map interpretations and rare and endangered plant species research was conducted by Derek Marcoux, RPBio. The site visit was conducted to give a preliminary examination of vegetation composition of each of the TEM polygons, verify TEM and SEI data, and locate and describe any other vegetative types that may not have been at the scale of mapping in the TEM or SEI inventory. Field efforts focused on following existing and proposed trails through the TEM polygons, along with observing non-disturbed areas between trails or where trails are not proposed. Given the time of year, accurate determination of rare and endangered plant species is not possible. These surveys should be conducted in the spring when the plant community is not dormant.

4.2.1 Vegetation Species at Risk

Several plant species at risk potentially occur within Giants Head Mountain Park. Prior to field investigations, a query of British Columbia Ministry of Environments BC Species & Ecosystem Explorer (Conservation Data Centre, 2016), SARA Registry (2016) and BC Habitat Wizard (2016) revealed the potential presence of 18 plant species at risk potentially occurring within or proximate to the park. At risk species were considered as being either red-listed (extirpated, endangered, or threatened) or blue-listed (special concern). From this list we assessed species-specific preferred habitat type conditions and area proximity to further delineate potentially occurring species. A total of 17 plant species potentially occur within the Project study area (Table 4.2). Two species (Grand Coulee owl clover and showy phlox) are federally listed on the SARA registry Schedule 1.

Table 4.2. Potential Plant Species at Risk in the Project Study Area (Provincial and Federal)

Scientific name	English name	Provincial	BC List	COSEWIC	SARA
Achnatherum thurberianum	Thurber's needlegrass	S2	Red	n/a	n/a
Agastache urticifolia	nettle-leaved giant-hyssop	S3 (2015)	Blue		
Brickellia oblongifolia var. oblongifolia	narrow-leaved brickellia	S3 (2015)	Blue	n/a	n/a
Carex hystericina	porcupine sedge	S2S3 (2016)	Blue	n/a	n/a

Gaura coccinea	scarlet gaura	S2 (2015)	**Red**	n/a	n/a
Gayophytum ramosissimum	hairstem groundsmoke	S2 (2015)	**Red**	n/a	n/a
Heterocodon rariflorum	heterocodon	S3 (2015)	**Blue**	n/a	n/a
Lathrocasis tenerrima	slender gilia	S1 (2015)	**Red**	n/a	n/a
Lupinus sulphureus	sulphur lupine	S1S2 (2015)	**Red**	n/a	n/a
Melica bulbosa	oniongrass	S3 (2011)	**Blue**	n/a	n/a
Oreocarya sheldonii	Snake River cryptantha	S2 (2015)	**Red**	n/a	n/a
Orobanche corymbosa ssp. mutabilis	flat-topped broomrape	S3 (2015)	**Blue**	n/a	n/a
Orthocarpus barbatus	Grand Coulee owl-clover	S2 (2015)	**Red**	Endangered	1-E
Pectocarya penicillata	winged combseed	S1 (2015)	**Red**	n/a	n/a
Phlox speciosa ssp. occidentalis	showy phlox	S2 (2015)	**Red**	Threatened	1-T
Ribes cognatum	northern gooseberry	S1S2 (2015)	**Red**	n/a	n/a
Trifolium cyathiferum	cup clover	S2	**Red**	n/a	n/a

Search Criteria: Search Type: Plant AND Species Groups: Vascular Plants AND BC Conservation Status:Red (Extirpated, Endangered, or Threatened) OR Blue (Special Concern) AND Forest Districts:Okanagan Shuswap Forest District (DOS) (Restricted to Red, Blue, and Legally designated species) AND Regional Districts: Okanagan-Similkameen (OSRD) (Restricted to Red, Blue, and Legally designated species) AND Habitat Types: Forest,Grassland/Shrub (Restricted to Red, Blue, and Legally designated species) AND BGC Zone:PP

4.2.2 TEM Polygon Vegetation Field Observations

A range of vegetative ecological communities within Giants Head Mountain Park were encountered during field assessments. Ecological types varied from mixed Ponderosa pine/Douglas-fir forest with bluebunch wheatgrass, open Ponderosa pine forests with bluebunch wheatgrass, and open grasslands of rough fescue and bluebunch wheatgrass. All of the conifer and grassland areas had arrowleaf balsamroot present at varying percentages. The west side of the park was characterised by bedrock outcrops overlain by thin soils, steep cliff areas and shrub steppe including common rabbitbush (*Ericameria nauseosa*) and big sagebrush (*Artemisia tridentata*).

TEM Polygon 1473

TEM Polygon 1473 consists of the southeast portion of Giants Head Mountain Park which ranges in elevation from 600 to 840 m, Giants Head Mountain summit. The west side of the polygon is adjacent to bedrock cliffs and is characterized by open Ponderosa pine with grasses over shallow soils. This portion of the polygon has some of the highest amount of disturbance from numerous trails, road access and invasive plant species. Percentage cover of invasive plant species ranged from 10% by the access road, summit

area and trails, to <5% for the rest of the polygon. Elevation within the polygon decreases eastward and forest cover becomes more dense. The Ponderosa pine forest typical of this polygon is blue listed by the CDC. Directly west of the mountain summit, a Douglas-fir leading stand (70%) is located on a short 80 m east facing 65 - 75% slope. This Douglas-fir type could be identified separately within the TEM if refinement is completed in the future.

The east and north portions of the polygon contains Ponderosa pine forest with Douglas-fir that is dense in the south and becomes more open moving east or north. Almost all of the area has an understory dominated by bluebunch wheatgrass, rough fescue and Saskatoon. Arrowleaf balsamroot is present in the open stands of forest on warmer aspects. The stand contained a number of large veteran trees and some standing snags.

Aged Douglas-fir stands ranged between 180 to over 200 years indicating old forest ocurance. Stand health was good; however, dwarf mistletoe was present in the Douglas-fir (<5%) and approximately 10% of the Ponderosa pine had been infested by pine beetle (grey and red attack). Soils ranged from a silt loam to loam texture and 30% to 50% coarse content.

Figure 4.2 Typical open conifer type on Polygon 1473.

Figure 4.3 Southwest portion of Polygon 1473 at summit.

TEM Polygon 1471

Polygon 1471 exhibited the most variability of vegetation types. Elevation ranged in between 700 to 785 m with slopes varying from flat to 40%. Vegetation types within the polygon include Ponderosa pine forest with a minor component of Douglas-fir, sparsely vegetated bedrock outcrops and cliffs, and open shrub steppe. This polygon is located on the west side of the park, which is bisected by the access road and the Giants Head Grind trail. Overall, there was over 5 - 10% invasive weed species adjacent to road, but less than 5% 10 m or more away from the road.

Areas of highest disturbance occurred from the access road and the Giants Head Grind Trail. The trail is not set on a defined path and splits into a number of trails running directly perpendicular to the contour causing significant erosion in areas. Soils within the polygon included shallow soils along the cliff area on the west side to deeper soils further to the east.

Forested sections of the polygon were comprised of smaller ingress growth under larger Ponderosa pine that were 180 to 200 years in age and an average diameter of 30 – 40 cm at 1.3 m height. The forest type also had Saskatoon (*Amelanchier alnifolia*), bluebunch wheatgrass, rough fescue, arrowleaf balsamroot, kinnikiknick (*Arctostaphylos uva-ursi*), and yarrow (*Achillea millefolium*) scattered throughout. The open shrub

steppe types were adjacent to the cliffs on the west side of the polygon and contained rabbitbush and big sagebrush along with scattered grasses.

Figure 4.4 Typical steppe/grassland vegetation near cliffs in Polygon 1471.

Figure 4.5 Conifer type with ingress tree growth in Polygon 1471.

TEM Polygon 1428

Polygon 1428 is where the majority of the new trails are proposed to be built. This area is dominated by open grassland with pockets of ingress conifer growth and some dispersed mature Ponderosa and Douglas-fir. Grasslands within Polygon 1428 were dominated by rough fescue and bluebunch wheatgrass. This ecosystem is red listed by the CDC. Elevations within this polygon ranges from 540 to 780 m and generally has a north to northeast aspect with the highest point in the southwest. Slopes range from 40 – 75% and are steepest where bedrock outcrops are present.

The grasslands in this area are in good condition regarding the level of invasive species established with the native species. Overall, this polygon averaged less than 5% at worst and often less than 2% invasive weed species. Toadflax (*Comandra umbellata*) was observed dispersed throughout the polygon, and some diffuse knapweed (*Centaurea diffusa*) was present near to rock outcrops. A couple of trails traverse across the area, but otherwise there is little disturbance. Soils were dark in colour and typically were loams with 30 to 50% coarse fragment content. Ponderosa pine located at the upper elevations of the polygon were over 180 years in age and 30 to 40 cm at 1.3 m height. At lower elevations, the north section of the polygon, the stand age decreased to 100 years with similar diameters. The proposed trail 5 will run through the east section of the polygon and cross a gully before descending down into TEM Polygon 1423. Trail 6 proposed location runs through the mid-section of the polygon and close to Trail 5.

Figure 4.6 Existing portion of downhill bike route within Polygon 1428.

Figure 4.7 Red-listed grassland within downhill bike route within Polygon 1428.

TEM Polygon 1423

Polygon 1423 consists of a mixed Ponderosa pine, Douglas-fir stand with significant ingress growth. This polygon shape is relatively narrow and runs from western higher elevations at 700 m to the lower elevations on the east side of the park at 520 m. Terrain is concave and wide draws are present at the eastern lower elevations of the polygon. If more detailed mapping is conducted, this section could be stratified into a different ecosystem type based from differing vegetation than what is typical throughout polygon 1423. Slopes ranged from 25 to 85%, with the steeper slopes at the higher western elevations (bedrock outcrops) and more gentle slopes in the eastern portions of the polygon. This polygon is red listed by the CDC.

Approximately 5 - 10% invasive species were estimated for this polygon, with the higher elevations having less and the lower elevations adjacent to Polygon 1416 having higher percentages. Invasive species observed included toadflax, diffuse knapweed (*Centaurea diffusa*) by bedrock outcrops or on lower eastern elevations where past anthropogenic disturbance was observed including old building foundations and roads.

Ponderosa pine was the dominant conifer, but Douglas-fir was more prevalent in some areas assessed. The stand age averaged around 100 years which is half the age of stands further up Giants Head Mountain. A mix of Ponderosa pine and Douglas-fir made up the composition of the understorey. Shrubs including Saskatoon were present throughout

the polygon, snowberry (*Symphoricarpos albus*), scattered willow and birch stems were present in the wide draws on the lower slopes. Grasses within the system include bluebunch wheatgrass and rough fescue.

Soils were observed to be loams in the western steeper sections where they were dark in colour with a fibrous humus layer. The soils changed to silt loams on the gentle slopes to the east, which had a brown colour. Coarse fragments ranged from 30 - 50% but averaged 40%.

Both Trails 5 and 6 will cross this polygon, however there are already trails existing throughout the area. Some of the trails split into several branches that rejoin, increasing disturbance in the area. It appeared a number of the trails run off the access road and down the hillside.

Figure 4.8 Lower east section of Polygon 1423 red-listed conifer type.

Figure 4.9 Existing user defined trails located within Polygon 1423.

TEM Polygon 1416

This polygon is dominated by open grassland consisting of bluebunch wheatgrass, and rough fescue. Ponderosa pine is dispersed throughout the polygon but mostly in close proximity to Polygon 1423 or at lower elevations. The southwest section of the polygon is the highest at 670 m along the access road, and the lowest elevations are located to the northeast at 500 m. Slopes are typically 20 - 40% and exposed bedrock is common at higher elevations.

The grasslands in this area are in the poorest condition observed in the Giants Head Mountain Park. Invasive species comprise 10 - 15% of total cover in 10 - 20 m diameter circular patterns (i.e. patches). Invasive species encountered included cheatgrass, diffuse knapweed, toadflax, and great mullein (*Verbascum thapsis*). Areas where invasive species were most abundant were along the access road (linear corridor) and old existing roads and trails within this portion of the park.

Ponderosa pine was the dominant conifer occurring within this polygon, particularly at lower elevations. Pine beetle attack was observed in the area at 5 - 10% incidence. Most of the conifer growth in this polygon is ingress growth, and ages ranged around 35 - 45 years with 20 - 30 cm diameters at 1.3 m height. Shrubs observed included rabbitbush, big sagebrush, and Saskatoon berry. Soils textures within the polygon were

loams and silt loams with a brown colour. Coarse fragments ranged from 25.-.40%, and in some areas regosols were present at or near bedrock outcrops.

Figure 4.10 Southern portion of Polygon 1416 with a patch of invasive weed species.

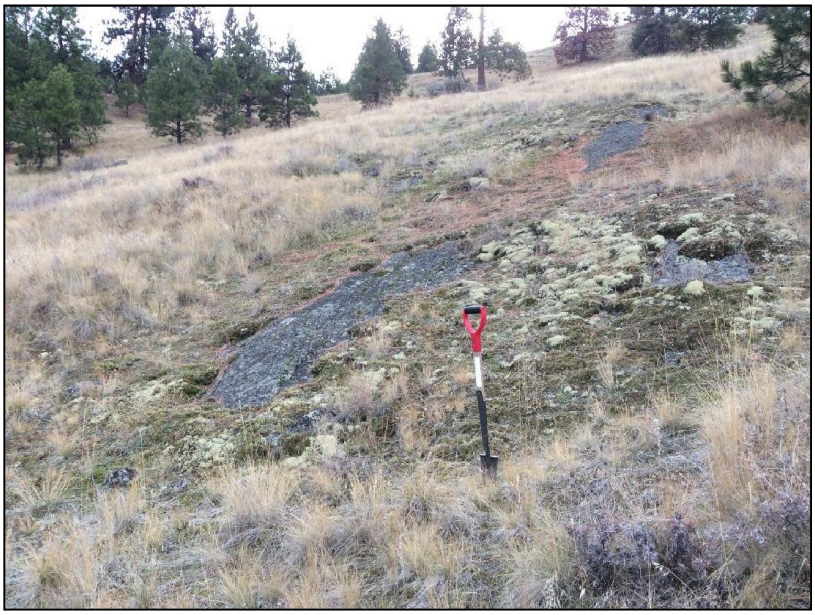


Figure 4.11 Polygon 1416 showing representative exposed bedrock in area.

4.3 Assessing Wildlife and Wildlife Habitats

The southern interior of British Columbia, including the South Okanagan and Similkameen region, have one of the highest levels of biodiversity and concentrations of species at risk in Canada (Bezener et al. 2004). The Regional District of the Okanagan-Similkameen and its wild lands provide important habitat for a wide variety of resident, breeding, wintering, and migratory wildlife. The District encompasses a complex of unique landscapes and in turn provides critical habitat for a variety rare and endemic wildlife species. The Okanagan's composition of semi-arid and mesic systems, unique to western Canada, are high in both species diversity and richness (British Columbia Ministry of Environment 2014).

The District of Summerland offers a unique mix of lake water, river valley, agricultural, and urban areas within a relatively small municipal region. This mix of habitat types within close proximity facilitates life history functions for both local and migratory wildlife. Life history traits may include foraging, denning, hibernation, breeding, movement and staging opportunity (BC Environmental Protection & Sustainability 2016). Wildlife habitat within the District of Summerland supports a diverse concentration of species groups including ungulates, carnivores, mustelids, aquatic rodents, small mammals and bats, avifauna, reptiles, amphibians, and invertebrates (BC Environmental Protection & Sustainability 2016).

4.3.1 Wildlife and Wildlife Habitat Field Investigations

A preliminary field assessment of the property was completed on November 24, 2016 by Brian Arquilla MSc. RPBio. This initial assessment established property boundaries, examined adjacent property interactions, assessed wildlife habitat community composition and completed an impact assessment overview of the Project study area. Site investigations followed existing trails, proposed trails and off-trail reached within prescribed TEM polygons. Site searches along various intensities of disturbance provided comparative assessment of habitat potential.

4.3.2 Wildlife Species at Risk

Several species at risk potentially occupy habitat within Giant's Head Mountain Park. Prior to field investigations, a query of British Columbia Ministry of Environments Ecosystem Explorer (2016), SARA Registry (2016) and BC Habitat Wizard (2016) revealed the potential presence of 106 species at risk potentially occurring within or proximate to Project lands. From this list we assessed species-specific life history traits in accordance with site-specific habitat features to further delineate potentially occurring species. Our vetted list produced 48 species at risk potentially occurring within the Project study area consisting of 18 red and 26 blue provincially listed species. Among the expected species includes 25 SARA Schedule 1 listed species lending to the unique importance of the South Okanagan's ecological diversity (Table 4.3).

Table 4.3 Potential Avian Species at Risk in the Project Study Area (Provincial and Federal)

Scientific Name	English Name	Provincial	BC List	COSEWIC	SARA
Ammodramus savannarum	Grasshopper Sparrow	S1S2B (2015)	Red	No Status	No Status
Asio flammeus	Short-eared Owl	S3B,S2N(2015)	Blue	SC(2008)	1-SC (2012)
Catherpes mexicanus	Canyon Wren	S3? (2015)	Blue	N(1992)	No Status
Chondestes grammacus	Lark Sparrow	S3S4B (2015)	Blue	No Status	No Status
Chordeiles minor	Common Nighthawk	S4B (2015)	Yellow	T(2010)	1-T (2010)
Buteo swainsoni	Swainson's Hawk	S2B (2015	Red	No Status	No Status
Falco peregrinus	Peregrine Falcon anatum	S2?B (2010)	Red	SC (2007)	1-SC (2012)
Hirundo rustica	Barn Swallow	S3S4B (2015)	Blue	T (2011)	No Status
Empidonax wrightii	Gray Flycatcher	S3B (2015)	Blue	N(1992)	No Status
Eremophila alpestris	Horned Lark merrilli	S3S4B (2009)	Blue	No Status	No Status
Falco mexicanus	Prairie Falcon	S2 (2015)	Red	N(1996)	No Status
Melanerpes lewis	Lewis's Woodpecker	S2S3B (2015)	Blue	T(2010)	1-T (2012)
Sphyrapicus thyroideus	Williamson's Sapsucker thyroideus	SNRB (2012)	No Status	E(2005)	1-E (2006)
Spizella breweri	Brewer's Sparrow breweri	S2B (2005)	Red	No Status	No Status
Tyto alba	Barn Owl	S2 (2015)	Red	T(2010)	1-SC (2003)

Table 4.4 Potential Mammal Species at Risk in the Project Study Area (Provincial and Federal)

Scientific Name	English Name	Provincial	BC List	COSEWIC	SARA
Antrozous pallidus	Pallid Bat	S2 (2015)	Red	T(2010)	1-T (2003)
Euderma maculatum	Spotted Bat	S3S4 (2015)	Blue	SC(2014)	1-SC (2005)
Myotis ciliolabrum	Western Small-footed Myotis	S2S3 (2013)	Blue	No Status	No Status
Myotis thysanodes	Fringed Myotis	S3 (2013)	Blue	DD(2004)	3 (2005)
Perognathus parvus	Columbia Plateau Pocket Mouse	S3 (2015)	Blue	No Status	No Status
Reithrodontomys megalotis	Western Harvest Mouse	S2S3 (2006)	Blue	SC(2007)	1-SC (2009)
Sorex merriami	Merriam's Shrew	S1 (2015)	Red	No Status	No Status
Sorex prebleii	Preble's Shrew	S1S2 (2010)	Red	No Status	No Status
Taxidea taxus	American Badger	S1 (2011)	Red	E(2012)	1-E (2003)
Myotis lucifugus	Little Brown Myotis	S4 (2015)	Yellow	E(2013)	1-E (2014)
Sylvilagus nuttallii	Nuttall's Cottontail	S3 (2015)	Blue	SC(2006)	1-SC (2007)

Table 4.5 Potential Herptiles Species at Risk in the Project Study Area (Provincial and Federal)

Scientific Name	English Name	Provincial	BC List	COSEWIC	SARA
Anaxyrus boreas	Western Toad	S3S4 (2010)	Blue	SC(2012)	1-SC (2005)
Charina bottae	Northern Rubber Boa	S4 (2012)	Yellow	SC(2003)	1-SC (2005)
Coluber constrictor	North American Racer	S3 (2012)	Blue	SC(2004)	1-SC (2006)
Crotalus oreganus	Western Rattlesnake	S3 (2012)	Blue	T(2004)	1-T (2005)
Pituophis caternife	Gopher Snake deserticola	S2S3 (2012)	Red	T(2013)	1-T (2005)
Spea intermontana	Great Basin Spadefoot	S3 (2010)	Blue	T(2007)	1-T (2003)
Hypsiglena chlorophaea	Desert Nightsnake	S1 (2012)	Red	E(2011)	1-E (2011)
Plestiodon skiltonianus	Western Skink	S3 (2012)	Blue	SC(2014)	1-SC (20015)

Table 4.6 Potential Lepidoptera Species at Risk in the Project Study Area (Provincial and Federal)

Scientific Name	English Name	Provincial	BC List	COSEWIC	SARA
Apodemia mormo	Mormon Metalmark	S1 (2013)	Red	E(2014)	1-E (2005)
Hesperia nevada	Nevada Skipper	S3S4 (2013)	Blue	No Status	No Status
Danaus plexippus	Monarch	S3B (2013)	Blue	SC(2010)	1-SC (2003)
Lycaena nivalis	Lilac-bordered Copper	S3 (2013)	Blue	No Status	No Status
Polites sabuleti	Sandhill Skipper	S2 (2013)	Red	No Status	No Status
Callophrys affinis	Immaculate Green Hairstreak	S3 (2013)	Blue	No Status	No Status
Cicindela pugetana	Sagebrush Tiger Beetle	S3? (2015)	Blue	No Status	No Status
Cicindela decemnotata	Badlands Tiger Beetle	S1S3 (2015)	Red	No Status	No Status
Pyrgus communis	Checkered Skipper	S3 (2013)	Blue	No Status	No Status
Satyrium behrii	Behr's Hairstreak	S1 (2013)	Red	E(2012)	1-T (2003)
Satyrium californica	California Hairstreak	S3 (2013)	Blue	No Status	No Status
Satyrium semiluna	Half-moon Hairstreak	S1 (2013)	Red	E(2006)	1-E (2007)
Speyeria mormonia	Mormon Fritillary erinna	S1S2 (2013)	Red	No Status	No Status

Search Criteria: Plants & Animals AND Species Subgroups: Amphibians (Frogs, Toads, Newts & Salamanders) OR Reptiles & Turtles (Lizards, Skinks, Snakes, & Turtles) OR Fish, Freshwater OR Fish, Marine OR Birds, All Species OR Birds, Species Breeding in BC OR Mammals OR Beetles (Tiger Beetles only) OR Butterflies OR Dragonflies & Damselflies OR Grasshoppers and Related Insects OR Molluscs, Freshwater (Snails, Mussels & Clams) OR Molluscs, Terrestrial (Snails & Slugs) OR Other Invertebrates OR Spiders (Partial List) OR Flowering Plants (Monocots & Dicots) OR Conifers (Cone-bearing Woody Plants) OR Ferns (Includes Horsetails and Club-mosses) OR Hornworts OR Liverworts OR Mosses OR Lichens (Macrolichens & COSEWIC-listed)AND BC Conservation Status: Red (Extirpated, Endangered, or Threatened) OR Blue (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 Municipalities: Lake Country Restricted to Red, Blue, and Legally designated species AND Habitat Subtypes: Conifer Forest-Dry, Conifer Forest-Mesic (average),Deciduous/Broadleaf Forest, Grassland, Meadow, Mixed Forest (deciduous/coniferous mix),Shrub-Natural Restricted to Red, Blue, and Legally designated species)AND BGC Zone: IDF

Within Giant's Head Mountain Park, ecological communities included open Ponderosa Pine forests, mixed conifer forests, mixed conifer deciduous forests, open grassland, shrub, sagebrush steppe, rocky outcrops, cliffs, and anthropogenic road/trail systems. The diverse array of ecological communities within the park provide a relatively complex wildlife habitat assemblage within a limited spatial boundary (Figure X-X). Giant's Head Mountain Park represents a unique ecological island within the constraints of the District of Summerland's agricultural, residential, and commercial development

Giant's Head Mountain Park acts as both a population source and sink depending on species-specific life history characteristics. Terrestrial mammal populations may be supplemented by source populations from large undisturbed lands located west of the park. While limited, the open grasslands of the northern extent of the park provide den and burrow opportunity for a number of mammal species including Columbia Plateau pocket mouse, western harvest mouse, Merriam's shrew, Preble's shrew, and Nuttall's cottontail (*Sylvilagus nuttallii*)

Though present, mustelids (weasels) and medium sized carnivore (i.e. coyote and red fox) populations are limited due to disturbance and confinement concerns. Large mammal is limited throughout the study area due to spatial constraints and sensory disturbance. In contract the cliff walls and rocky outcrops available in the Project property may provide important local breeding opportunity for avifauna, bats and herptiles.

4.3.3 TEM Polygon Wildlife Field Investigations

TEM Polygon 1473

TEM Polygon 1473 occupies the high elevation habitat within Giant's Head Mountain Park. The area's relatively high density of mixed conifer and shrub layer decreases from southwest to southeast as the polygon transitions to open grasslands. Available habitat provides good cavity nesting, tree nesting, and bat roosting opportunity. Wildlife trees and snags (ex. 11 U 0307400 E 5496144 N) allow avian nesting opportunity for primary cavity nesters (i.e. woodpeckers, sapsuckers) and secondary cavity nesters (i.e. owls, kestrels, swallows, swifts, bluebirds, nuthatches, creepers and chickadees).

Adjacent rock outcrops and bluffs (225 m - 175 m) along the polygon's southern extent offer hibernacula (i.e. snakes. lizards, skinks) and cliff nesting opportunities (i.e. falcons, swallows, swifts). Proximate grassland and agricultural lands further contribute to the attraction of cliff nesting species to the unique landscape feature. East of the cliffs and outside of the Project study area, the terrain gradually levels toward watercourses and drainage ditches empting into Okanagan Lake. Existing rock outcrops offer good hibernaculum with access to breeding and foraging habitat.

Figure 4.12 Cavity nest in Ponderosa Pine snag in TEM Polygon 1473.

Figure 4.13 Mixed conifer forest with bunchgrass understory in TEM Polygon 1473.

The modest plateau maintains the area's highest density of trail disturbance due to viewscape, relative gradient and the proximity to vehicle parking. Heightened trail densities may contribute to increased habitat fragmentation and sensory disturbance. Design objectives should target minimizing Project footprint and address considerations to critical wildlife habitat outside of the Project study area.

TEM Polygon 1471

Located along the Project study area's southwestern boundary, TEM Polygon 1471 comprises mixed conifer and rock outcrops above west facing cliffs (225 m - 200 m). Toward the polygons western extent, tree and shrub communities give way to single, scattered specimens of Douglas fir amid sparse tufts of bunchgrass.

Cliff features and rock outcrops within the polygon provides burrows and hibernacula for local wildlife. Access to forage opportunities in proximate grasslands heighten the importance of these features to local mammal and reptile species. Cliff faces further provide nesting operating to several species of avifauna, and a number of species at risk, including peregrine falcon (*Falco peregrinus*), prairie falcon (*Falco mexicanus*), barn swallow (*Hirundo rustica*), bank swallow (*Riparia riparia*), white-throated swift (*Aeronautes saxatalis*) and canyon wren (*Catherpes mexicanus*).

Critical wildlife habitat concerns as well as human safety issues advise the avoidance of the western extent of the TEM Polygon 1471 boundary immediately above the considerable cliff face. Developing trail design that avoids fragile habitats assists breeding and juvenile rearing for a wide variety of local species including a number of species at risk.

Figure 4.14 Rock Outcrop along steep west facing cliff walls TEM Polygon 1471.

Figure 4.15 Rock Outcrop along steep west facing cliff walls TEM Polygon 1471.

TEM Polygon 1428

The north facing polygon's composition of sandy soils and sparse, low growing vegetation provides habitat for four mammalian SAR potentially occurring in the region. Habitat potential exists for four mammal species comprised of three rodents and one mustelid. The American badger (*Taxidea taxus jeffersonii*) is the largest of these four mammals and occupies open valley bottoms and open canopied forests (SARA 2014). Small areas of open canopied forests exist at the Project site and immediately proximate areas. However, surrounding areas of closed forest bottomlands may isolate movements for any potentially occurring individual animals. No potential den sites or sign of American badger activity were identified during field investigations.

Avifauna observed during site assessment include bald eagle (*Haliaeetus leucocephalus*), common raven (*Corvus corax*), dark-eyed juncos (*Junco hyemalis*) and northern flicker (*Colaptes auratus*). The polygon maintained a high density of deer sightings, tracks, and trails lending to the assessment of key winter ungulate habitat in the immediate area. white-tailed deer (*Odocoileus virginianus*), Douglas squirrel (*Tamiasciurus douglasii*) and an unknown vole species represented the lone mammal species (or sign) observed during site investigations. No herptiles were observed during site investigations. Recommendation for the polygon include decommissioning two recreational trails immediately east of the primary trail to reduce sensory disturbance and provide a movement corridor to wintering ungulates.

Figure 4.16 East facing open bunchgrass and pine habitat in TEM Polygon 1428.

Figure 4.17 North facing bunchgrass and pine habitat in TEM Polygon 1428.

TEM Polygon 1423

The southwestern extent of Polygon 1423 represents the most critical wildlife habitat within the polygon boundary. The area's composition of sandy soils and sparse, low growing vegetation provides habitat for four mammalian SAR potentially occurring in the region. Habitat potential exists for four mammal species comprised of three rodents and one mustelid. The American badger is the largest of these four mammals and

occupies open valley bottoms and open canopied forests (SARA 2014). Small areas of open canopied forests exist at the Project site and immediately proximate areas. However, surrounding areas of closed forest bottomlands may isolate movements for any potentially occurring individual animals. No potential den sites or sign of American badger activity were identified during field investigations.

Figure 4.18 Rock Outcrop along steep west facing cliff walls TEM Polygon 1428.

Nuttall's cottontail occupy brushy, rocky areas; found in dense sagebrush, streamside thickets and brushy forest edges (Verts et al. 1984). In British Columbia this species is associated with shrub-steppe with Antelope-Bush and Big Sage. Sagebrush and the presence of rocky outcrops are important habitat attributes. The species is uncommon in old fields and grassland habitats (Sullivan et al. 1989). Nuttall's cottontail also appears to be rare in cultivated orchards (Sullivan 1985; Sullivan et al. 1989, Carter et al. 1993). In British Columbia most occurrences are below 700 m elevation.

The common checkered-skipper (*Pyrgus communis*) is generally transient species in a great variety of dry disturbed situations and some more natural ones such as short grass prairies. Low vegetation, flowers, and patches of bare ground are probably important. Strays can turn up in almost any open situation. A lack of wetted sites on the Project study area reduce the potential for available habitat for the Great Basin spadefoot (*Spea intermontana*). Existing low areas and drainage channels are ephemeral at best and marginal given the dry grasslands and Ponderosa Pine forest of the region. Existing cavity trees may provide roosting and hibernating opportunity for the Western small-footed myotis (*Myotis ciliolabrum*) and fringed myotis (*Myotis thysanodes*).

5 PRELIMINARY ASSESSMENT OF POTENTIAL IMPACTS AND MITIGATION MEASURES

5.1 Potential Impact Identification

Potential effects to vegetation, wildlife and wildlife habitat were assessed at a preliminary level to determine any significant issues that may exist with the proposed trail development plan. This preliminary environmental study is limited in detail and scope because it was conducted during the late fall (November) which is outside the suitable timing windows for vegetation and wildlife inventory.

Prior to trail network construction and operation, vegetation and wildlife inventories should be completed along with a finalized impact assessment and mitigation plan based on the results of those inventories and findings within this study. The optimum time of year for vegetation and avian and surveys is in May and June 2017 while winter conditions are preferred for mammal investigations are

Potential impacts from the trail development can be reduced through various mitigation activities, starting with the Design and continuing through Construction and Operation phases. Both ecosystem restoration and invasive plant management plans are detailed in Section 5.5.

5.2 Design Phase Potential Impacts

Design considerations of the development footprint should aim to retain native vegetation where possible and minimize impacts to undisturbed ecosystems. In addition, proposed trails should be located far enough apart so that users will not cross between different trails and cause impacts to undisturbed ecosystems. 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 recommended compensation plans and replacement ratios.

Figure 5.1 Examples of Habitat Disturbance in Giant's Head Mountain Park (November 2016).

5.2.1 Trail Design and Project Footprint

Vegetation and Vegetation Communities

Existing Trail Footprint

Impact: Current impacts include significant areas of trail erosion, trail braiding and 'user-defined' trails not in the Project master plan.

Significant trail braiding occurs on the Giant Heads Mountain grind along with areas of erosion. Trail erosion is significant where it is located perpendicular to the elevation contour and collects and directs drainage straight down the slope. In some areas, trails may climb steeply across the slope and intercept drainage from the hillside and divert it

from its natural drainage path, thus magnifying erosion problems on the trail and potential impacts to ecosystems. Trail braiding results in a larger footprint and impact on the native grasslands, and widens the corridor of exposed soils potentially leading to more invasive plant establishment and erosion problems.

Mitigation:

- During planning, develop erosion and sediment control measures for existing trails, and reroute severely impacted or high risk trails if necessary;
- Where braiding occurs, one desired trail route should be established. All braids should then be restored as part of the trail rehabilitation / restoration plan; and
- Trails that are not part of the master plan (user defined trails) should be closed and restored back to surrounding ecological conditions.

Land disturbance will decrease overall species diversity through habitat loss, reduced ecosystem function, and reduced ecological community interactions (Walker 1995). Impacts to local wildlife resulting from trail development 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 disturbance include minimizing the overall development footprint, retaining habitat where possible, observing work windows for breeding avifauna, active weed management through project duration, landscape exposed soils with native trees and shrubs, and revegetate exposed soils with native seed mix.

Proposed Trail Footprint

Impact: Design and layout of new trails within sensitive grassland and forest ecosystems can result in impacts to vegetation and vegetation ecosystems.

Impacts at the design stage include locating trails in sensitive areas or features, concentrating trails in one area. The design may also enable unauthorized building of trails to link to each other. Additional trails proposed within the park will add additional linear corridors in sensitive ecosystems that could result in degradation of relatively intact grassland ecosystems through the introduction of invasive weed species.

Mitigation:

Separate the proposed mountain bike climb trail and the mountain bike downhill trail. The original plan was to place both trails close to each other within TEM Polygon 1428.

It is recommended to move the climb trail into TEM Polygon 1423 (conifer type) close to access road. Mitigation will accomplish the following objectives:

- Separate trails further apart so that there is minimal temptation to construct an unauthorized trail link between the two trails.
- Reduced impact on a red-listed grassland ecosystem that is intact and in good condition.
- Moves the climb trail into the conifer type that already has a number of existing bike trails. This trail will replace the current user defined trails, and effectively shut them down in preparation for restoration or vegetation recovery.

5.3 Construction Phase Potential Impacts

Potential impacts from trail construction may be minimized or eliminated via prescribed mitigation practices. Mitigation may be adopted at all Project phases including design, construction, and operations. Mitigation measures will be subject to review and revision throughout the Project process. A qualified professional, on-site during construction works, will facilitate the communication and delivery of best practices during this phase of the Project.

5.3.1 Construction Management

Specific mitigation measures that will minimize the effects of Project construction include:

- Using existing trails and roads wherever possible;
- Restricting the trail development areas to a minimum size;
- Leaving existing grassland and forested areas undisturbed, where possible;
- End-haul trail excavation material. Do not side cast excavated material as this will increase the potential for invasive/noxious week invasion;
- Avoid constructing trails that run perpendicular to the terrain contour as this will increase erosion problems and potentially impact red-listed ecosystems;
- During trail construction, if user defined trails are present, complete deactivation/rehabilitation measures when possible;
- Conducting trail construction and decommissioning during the winter (i.e., not clearing between April 1st and August 31st) to avoid regional breeding bird and ungulate calving seasons;
- Adhere to the Ecosystem Restoration Program and Invasive Plant Management Plan located in Section 5.5 where possible; and

- Follow Erosion and Sediment control measures for trails and access points during construction (i.e. Erosion and Sediment Control Plan).

Trail Construction Works

Impact: Proposed Trail Construction.

- Trail construction has the potential to impact red-listed grassland and red-listed conifer ecosystems within Giants Head Mountain Park (TEM Polygons 1416, 1423 and 1428);
- Potential to spread of invasive plant species into these intact ecosystems through construction of linear corridors, exposed soils, and side cast soils (TEM Polygon 1423, 1428);
- Directly impact a habitat feature such as sensitive soils near rock outcrops, wildlife trees, den location;
- Increase sediment and erosion potential; and
- Wildlife sensory disturbance.

Mitigation:

- Trail construction will remove some areas within red-listed ecosystems, however through proper construction management practices (detailed below), minimizing the trail footprint and disturbance, and rehabilitating user defined trails within Polygon 1423 and other areas will likely offset those impacts.
- Through proper construction management practices, invasive week species spread can be minimized by end-hauling excess soil, minimizing vegetation removal, rehabilitating any exposed soils using the ecosystem restoration program and invasive plant management plan described in Section 5.5.
- Prior to construction of trails, follow-up vegetation and wildlife inventory surveys should be completed during proper timing windows to determine if there are any additional impacts based off the surveys. This would also include on site inventory for any listed vegetation or wildlife species both provincially and federally.
- Existing impacts to the park and its ecosystem are already occurring at current trail locations. A significant amount of mitigation can be completed by carrying out the mitigation options noted in the design phase impacts “Existing Trail Impacts”. This will further offset impacts from the construction of the new trail footprint.
- Prior to construction, develop a comprehensive Erosion and Sediment Control Plan that covers both construction and operational phases of trail development.

5.3.2 Construction Work Windows

All active bird nests are fully protected under the B.C. 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 of birds between April 1st and July 31st. Development can only proceed within this period if a nest survey by a qualified environmental professional has concluded that no nests are present. Preserve as many large-diameter trees as possible as they provide potential habitat for avian cavity-nesters and denning mammals.

5.3.3 Construction Crew Awareness

Awareness campaigns for construction crews and on-site personnel are an essential and invaluable tool for increasing the potential efficiency of crossing structures and for assessing mitigation efficacy. A wildlife awareness program can be incorporated into the general site orientation that all personnel attend prior to working on-site. Personnel would be informed of the location and purpose of on-site wildlife crossing structures and/or elevated pipes and instructed to avoid them where possible. This could help prevent damage to the structures that could result from workers using the approach ramps of wildlife crossing structures to turn their vehicles around.

5.4 Operations Phase Potential Impacts

Use of the trail system post-construction (Operations Phase) may incur potential impacts including invasive species introduction, sensory disturbance to wildlife, and surface runoff channelization and erosion on steep slopes. In order to mitigate some operational effects, both an Ecosystem Restoration Program and an Invasive Plant Management Plan have been developed to help guide operations (Section 5.5). In addition, a comprehensive Erosion and Sediment Control Plan should be developed for park operations specific to trail maintenance and operations.

5.4.1 Public Education and Signage

Education and awareness for all trail users is an essential tool critical in preventing impacts to local vegetation and wildlife. Mortality events and habitat loss may result from human - wildlife interactions. Further, the effects of human activities with the park may result in wildlife abandoning local habitat in favor of areas of less disturbance. Appropriately placed signage indicating the existing wildlife corridors, road crossings, and critical habitat may reduce potential impacts to local fauna within the park. Sensory disturbance resulting from increased traffic along proposed trails is expected as a result of the project. Most disturbance is anticipated during the construction phase of the Project.

Minimizing sensory disturbance may be accomplished by a variety of methods. Local wildlife will be aided by the maintenance and revegetation of native flora regimes that provide visual and sound barriers from development operations. Observation of work windows during species-specific periods of sensitivity or vulnerability further reduces disturbance impacts. There is potential for the presence of several species of rare or threatened cold-blooded species on

Project lands. As a precaution to vehicular mortality, strategic fencing may be installed to direct reptiles and amphibians seeking basking opportunity away from proximate roads and parking lots.

5.4.2 Wildlife Habitat Enhancement and Impact Mitigation Monitoring

The efficacy of disturbance mitigation for select wildlife species can be evaluated by monitoring through snow tracking and remote camera surveys. Modifications can be made if monitoring determines that trail design is not providing sufficient protection or movement for wildlife species. Monitoring will also determine any maintenance issues related to the trail structures and passageways (e.g., loss of soil/vegetation surface over time, damage to vegetation from unsuccessful trail construction).

The development of a wildlife monitoring program will best assess potential effects and impact mitigation to local wildlife populations. Monitoring techniques may include a variety of protocol including mammal surveys, snow tracking remote cameras, breeding bird surveys, amphibian surveys, nest boxes and bat houses.

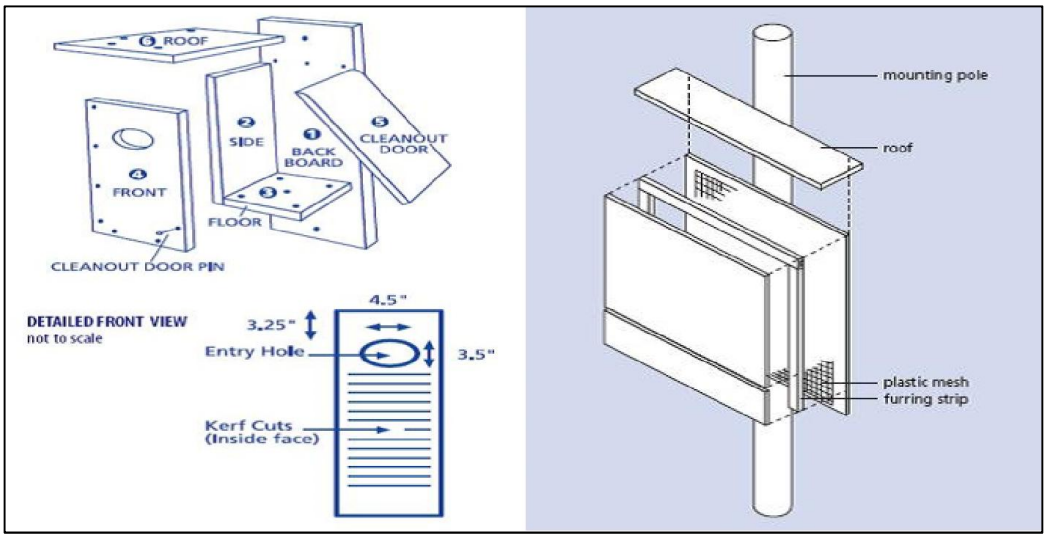


Figure 5.2 Diagram of a Nest Box and Bat House

From: http://www.ducks.ca/resource/general/wetland/pdf/batbox.pdf

5.5 Restoration and Invasive Plant Management Plans

5.5.1 Ecosystem Restoration Program

Ecosystem restoration will be completed based on the naturally occurring landscape components occurring in Giants Head Park. Terrestrial Ecosystem Mapping and Sensitive Ecosystem Inventory descriptions (Iverson and Haney, 2012) will be used as a baseline regarding appropriate restoration techniques and plant species that should be utilized.

The ecosystem restoration plan will include adding biotic and abiotic components to provide suitable vertical and horizontal structure that aligns with existing site conditions. Existing site conditions will be determined using undisturbed 'reference' ecosystem survey plots. These plots will be located in Giants Head Park by field crews and used to record the native species and densities of vegetation naturally occurring in the area. Horizontal and vertical diversity will be created through spacing of native plants and placements of abiotic structures.

Biotic components will include the application of a native grass seed mix suitable to the PPxh1 biogeoclimatic zone. Seed selection will include suitable species for erosion control as well as sod-forming species that will inhibit colonization by invasive plants. Grass seed mixes should be applied according to the application rates provided by the supplier. It is important that a non-native seed mixture is not used as many species in these grass mixes are invasive and will displace native grasses and forbs.

In addition, containerized native plant species may be planted in heavily disturbed sites where appropriate. Native plants used for planting will include herbs and shrubs that will enhance the vertical structure in the ecosystem. Native plants can be obtained from nurseries in the Okanagan valley (e.g. Sagebrush Nurseries, Oliver, BC). Planting prescriptions by TEM and SEI ecosystem type will be used as a basis for this Project.
The following protocol will be used for ecosystem restoration following trail construction for the Project:

1. Establish reference ecosystem survey plots in one of each ecosystem type that will be disturbed by trail construction.
2. Ecosystem types will align with the Terrestrial Ecosystem Mapping and Sensitive Ecosystem Inventory for the Giants Head Park area.
3. Within each reference plot, survey the species present and density (e.g. plants/m2)
4. Develop planting prescriptions by ecosystem type that align with reference plot data.
5. Locate a suitable supplier for native plants within the Okanagan valley area and estimate the inventory needed for the restoration plan. (Sagebrush Nurseries in Oliver, B.C. provides native plant container stock)
6. Survey exposed soil by ecosystem type following trail construction and calculate the specific number of native plants required. Submit a purchase request to native plant supplier.
7. Plant native plants within 30 days of trail construction or before May 1 to take advantage of the growing season.
8. Establish monitoring plots in each ecosystem type to determine survival rates and survey for a minimum of two years post trail construction.

5.5.2 Wildlife Habitat Enhancement

Landscape restoration is the key initiative for alleviating the effects of habitat loss. The objective of the program is to progressively restore disturbed soils with native vegetation in areas targeted for restoration. Mountain Pacific has committed to a number of construction and operation mitigation measures as described below. Many of the available habitat enhancement options will benefit ecosystem components including soils, vegetation and wildlife. Landscape restoration will allow for soil reclamation and in turn establish vegetation communities and associated wildlife habitat.

The planting prescriptions for revegetation of target ecological communities will be designed to maximize the potential for these areas to reach desired end uses. Wildlife habitat value is optimized by considering techniques and procedures that provide movement corridors, enhance recolonization and increase habitat diversity on the restored areas. Habitat enhancement can be furthered through the retention and creation of the following habitat features:

- Brush and Rock Piles
- Coarse Woody Debris
- Snags
- Connectivity
- Habitat Diversity

Irregularity and undulation within reclaimed trails will result in the creation of a greater diversity of microsites. Differences in aspect, soil moisture regime and water or snow accumulation between microsites will result in improved vegetation diversity. This will subsequently benefit wildlife by providing a greater diversity of browse and forage species. A variety of trees and shrubs are used to provide a more structurally complex habitat and help promote community diversity during the period of successional development. Selected species also include important wildlife food plants (e.g. shrubs).

Many wildlife species depend on snags (i.e. dead standing trees) and coarse woody debris for cover, as nesting or denning sites and as feeding substrates. Some of these wildlife benefits will be achieved by distributing coarse woody debris and installing snags from newly cleared development areas within areas undergoing reclamation. This practice will also result in nutrient enrichment of these reclamation areas, thus facilitating natural regeneration of trees and other native vegetation. Coarse woody debris can also aid in erosion control on slopes.

5.5.3 Invasive Plant Management Plan

Invasive plant management will be completed by following a prompt revegetation protocol followed by monitoring and spot treatment of newly developed invasive plant infestation centres. Native grass seed suitable for erosion control will be applied immediately following trail construction following the protocol for ecosystem restoration. Ideally this will occur before May to ensure the seed is able to germinate following snow melt and take advantage of the growing season. In heavily disturbed sites, mulch may be applied (straw or Rolled Erosion Control Blanket - RECP) to enhance seed germination, reduce surface erosion, and reduce seed removal by birds and small mammals.

The following protocol will be established for invasive plant management for the Project:

1. Grass seed disturbed soil within 30 days after disturbance or before May 1 to take advantage of the growing season.
2. Use erosion control products (mulch or RECP) in disturbed sites greater than 10m2
3. Survey disturbed sites two months after grass seeding to monitor invasive plant infestation centres. Map all centres using a handheld GPS for future reference.
4. Hand pull or mechanically treat infestation centres to control invasive plant areas once per year in late June prior to seed dispersal.
5. Establish monitoring plots for invasive plant infestations and survey for a minimum of two years post trail construction.

6 RECOMMENDATIONS AND CONCLUSIONS

6.1 General Recommendations

A summary table describing mitigation of ecosystem components with respect to Project design, construction, and operation is provided below (Table 5-1). This evaluation considers Project impacts, applied mitigation, and resultant effects following mitigation.

6.1.1 Management Strategy

Management strategy objectives are to include the following recommended tasks:

- Objectives should address reducing human wildlife conflicts;
- Trail routing and access allowances should be designed in the interest of maintaining or developing wildlife movement corridors;
- Examine options for trail footprint minimization and decommissioning;
- Post construction mitigation to focus on planting and recolonizing wildlife habitat; and
- Minimize invasive weed encroachment on existing and new trails.

6.1.2 Management Controls

Recommended management control items are to address the following responsibilities:

- Park managers to examine off leash restrictions within park boundaries to reduce wildlife and wildlife habitat disturbance ;
- Reduce speed limit on park road;
- Examine temporal closures to specific park areas with known hibernacula during key periods of seasonal reptile migration ;
- Define Trail 9 across on east side of plateau (11 u 03072115 5496065) to reduce trail footprint and deviations;
- Rudimentary trails east of TEM Polygon 1428 to be deactivated through open grassland areas and protect important winter ungulate habitat; and
- Assess routing options and implications for trail design with respect to rare gully at 11U 0307201 5496904.

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Table 6-1 Mitigation Summary Table Arranged by Ecosystem Component and Project Phase

Ecosystem Component	Design Phase	Construction Phase	Operation Phase
Surface Water Quality	• Heightened Communication with Report personnel. • Design planning to minimize exposed soils and vegetation removal.	• Work to be completed during low water levels. • Minimize exposure of mineral soil. • EMP with Sediment and Erosion Control Plan. • Spill response planning.	• Monitor replanting, and slope erosion and sediment issues related to foot traffic. • Establish methods to deter public from going off path and using other areas to launch. • Water quality monitoring.
Soils	• Heightened Communication with Report personnel. • Soil retention design.	• EMP with Sediment and Erosion Control Plan. • Vegetate/plant riparian vegetation onsite and directly upstream during or post construction.	• Sediment and Erosion Control Plan. • Maintain vegetation on slopes. • Post public educational signage.
Vegetation	• Heightened Communication with Report personnel.	• Accommodate seasonal flooding. • Retention and improvement of vegetation communities by adding structural complexity through planting.	• Retention of aquatic and riparian vegetation. • Monitor and maintain any planting completed. • Post public educational signage.
Fisheries	• Discussion with the Department of Fisheries and Oceans, and Ministry of Environment (FLNRO). • Design Project and pathways in accordance with Best Management Practices (DFO, MOE), mitigation options provided in this report.	• Minimize disturbance within in-stream areas including substrate and aquatic vegetation. • Construct Project in accordance with BMP mitigation options provided in this report (including fisheries work windows). • Adhere to BMP (DFO, MOE)	• Minimize disturbance within the in-stream area including substrate and aquatic vegetation. • Limit access to the shallow water area with anchored logs or another deterrent. • Adhere to BMP (DFO, MOE) • Post public educational signage.
Wildlife	• Heightened Communication with Report personnel. • Routing away from critical habitat. • Maintain wildlife movement corridors. • Protect key winter ungulate habitat.	• Observe avian breeding work windows. • Observe reptile migration windows. • Include mitigation planning for construction around herptile habitat using BMP's. • Assess and develop wildlife habitat enhancement options.	• Maintain habitat for herptiles. Look at habitat enhancement options and keeping recreational vehicles out of shallow water areas. • Monitor wildlife habitat associations and movements. • Post public educational signage.

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