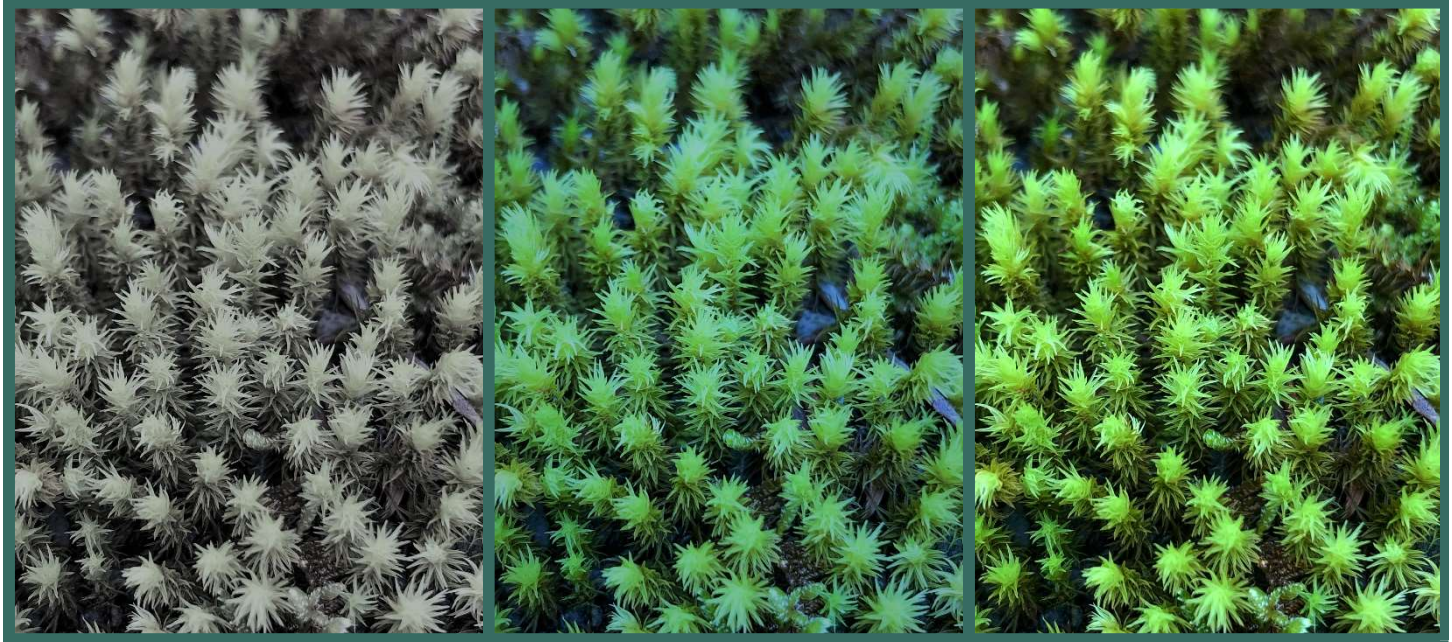

McKelvie Creek Ecosystems and Vegetation

Prepared for: Village of Tahsis
Prepared by: EcoLogic Consultants Ltd.

Project: 0056
January 14, 2020

McKelvie Creek
Ecosystems and Vegetation

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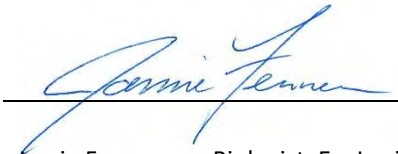

Jamie Fenneman, Biologist, EcoLogic

January 16, 2020

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GLOSSARY AND ABBREVIATIONS

B.C. CDC	BC Conservation Data Centre
CMAunp	Coastal Mountain-heather Alpine Undifferentiated Parkland
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWHvm1	Coastal Western Hemlock Submontane Very Wet Maritime Variant
CWHvm2	Coastal Western Hemlock Montane Very Wet Maritime Variant
ENV	BC Ministry of Environment; former acronyms include MOE and ECCS
MHmm1	Mountain Hemlock Moist Maritime Windward Variant
MBCA	*Migratory Bird Conventions Act*
TEM	Terrestrial Ecosystem Mapping
UWR	Ungulate Winter Range
WHA	Wildlife Habitat Area

1. INTRODUCTION

1.1 PROJECT UNDERSTANDING

The Village of Tahsis (hereafter, the Village) has requested a watershed assessment within McKelvie Creek Community Watershed (the Project). One of the goals of the assessment is to spatially identify ecological, economic, and cultural values within the watershed using a risk assessment approach. As the watershed is a source of drinking water or other values, the Village seeks to develop and implement a Watershed Protection Plan, similar to watershed protection plans established by other local governments. The watershed assessment is a key component of the Watershed Protection Plan as it will identify the risks of human-based activities such as timber harvesting. This watershed assessment will discuss aspects of the watershed's ecology (wildlife and wildlife habitat, vegetation and ecosystems, and species at risk) as well as the soils, terrain, and hydrology.

The reporting presented herein will encompass the vegetation and ecosystem classification elements of the watershed assessment; other aspects will be covered in separate reporting.

1.2 OBJECTIVES

The objective of this report is to describe and spatially identify ecological values, specifically plant diversity and sensitive ecosystems, within the McKelvie Creek Watershed (the Project area). This report comprises a component of a larger Project scope that includes wildlife and wildlife habitat, soils and geomorphology, and hydrology of the Project area, and is intended to supplement the information provided in these other components of the Watershed Assessment. This particular report aims to:

- identify sensitive ecosystems occurring within the Project area,
- describe and map the spatial extent of sensitive ecosystems within the Project area,
- identify known or potential rare and unusual plants within the Project area,
- identify exotic/invasive plant species within the Project area, and
- provide a comprehensive list of vascular plants and bryophytes documented within the Project area during the 2019 field surveys.

1.3 REGULATORY FRAMEWORK

Three pieces of legislation (two federal, one provincial) are identified as being relevant to the vegetation and ecosystems of the Project area (Table 1.3-1).

Table 1.3-1. Applicable Legislation for the Conservation of Vegetation and Ecosystems within the Project Area

Legislation Name	Year	Government Level	Description
Species at Risk Act	2002	Federal	The *Species at Risk Act* (SARA) provides for the legal protection of plant and wildlife species to conserve their biological diversity and prevent extirpation or extinction. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) identifies and assesses plant and wildlife species considered at risk, which may then qualify for legal protection and recovery under SARA. Once listed under SARA, species plans are legal requirements to secure the necessary actions for species recovery and management.
Forest and Range Practices Act	2002	Provincial	The *Forest and Range Practices Act* (FRPA) outlines standards and requirements for how forest and range practices and natural resource activities should be conducted on Crown land in BC in a manner that ensures protection of natural resources.
Weed Control Act	2011	Provincial	The British Columbia *Weed Control Act* requires all land occupiers to control the spread of provincial and/or regional noxious weeds on their land and premises, and specifies provisions for transportation, movement, and cleaning of machinery. The purpose of the *Act* is to protect the province's economy, natural resources, and society from the negative impacts of foreign weeds; the *Act* is administered by the Ministry of Forests, Lands and Natural Resource Operations.

2. STUDY AREA

2.1 PROJECT AREA

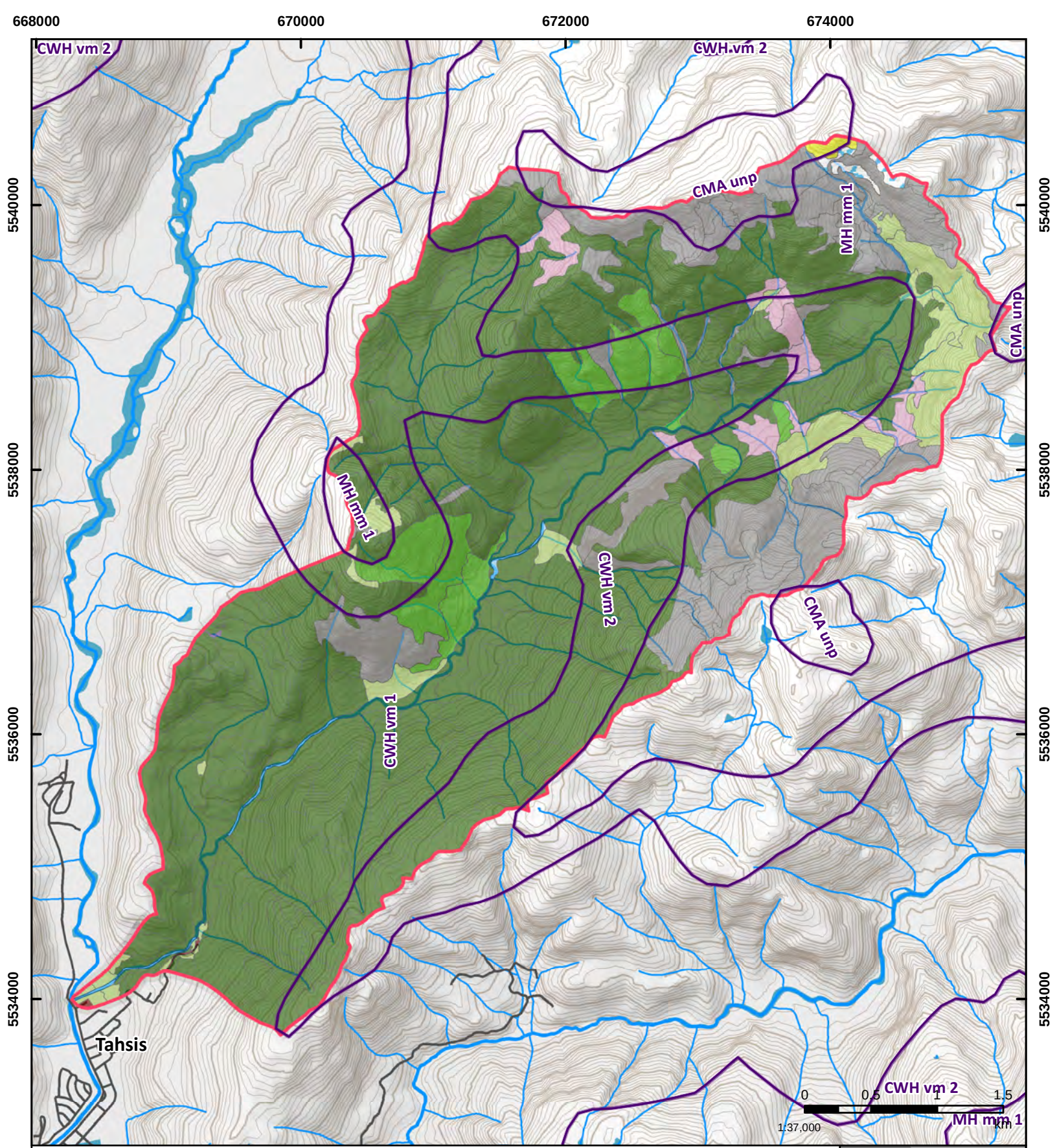
The Project area is defined as the extent of the McKelvie Creek Community Watershed (Figure 2.1-1), up to the height of land, and includes CWHvm1, CWHvm2, MHmm1, and CMAunp biogeoclimatic (BGC) variants. The lower elevation biogeoclimatic variants (CWHvm1 and CWHvm2) are characterized by dense conifer forests, typically less snow, and longer growing seasons. The higher elevation variant (MHmm1) forests are not quite as dense, and snow depth and duration increase. High elevation subalpine areas (CMAunp) are characterized by a diminishing tree cover and an increase of open meadows, tree islands, krummholz trees, rock outcrops, and talus slopes.

2.2 OVERVIEW OF LAND DESIGNATIONS

Many land designations are applicable to vegetation and ecosystems within the Project area (Table 2.1-1).

Table 2.1-1. Applicable Land Use Designations in the Project Area

Land Use Designation	Description
Tahsis Landscape Unit	The Project area is entirely located within the Tahsis Landscape Unit (LU). The Tahsis LU encompasses the Leiner, Little Zeballos, Perry, and Tahsis River drainages and is designated a Lower Biodiversity Emphasis Option (MFLNRORD 2019a).
Strategic Land and Resource Plans	The Project area is entirely located within the Vancouver Island Land Use Plan (MFLNRORD 2019b).
Old Growth Management Areas	There are no Old Growth Management Areas, either legal or non-legal, that occur in the Project area (MFLNRORD 2019c,d).
BC Parks, Ecological Reserves and Protected Areas	There are no parks, ecological reserves or protected areas within the Project area. Woss Lake Provincial Park is to the north and Weymer Creek Provincial Park is to the south (ENV 2019a).
Tree Farm Licence	The Project area is entirely within Tree Farm Licence 19 (MFLRORD 2019e).
Species and Ecosystems at Risk	There are no public occurrences of species at risk but there is a masked occurrence that overlaps with the southern portion of the Project area.



McKelvie Creek Watershed

Ecosystems and Biogeoclimatic (BGC) Variants in the Project Area

Figure 2.1-1

Legend

- BGC Variant

General Ecosystem Type

- Old Forest
- Mature Forest
- Forested
- Alpine
- Avalanche
- Sparsely Vegetated
- Wetland
- Anthropogenic
- Water
- Permanent Snow and/or Glacier
- Project Area
- Contour (100 m)

N

Date: 11/8/2019

Map Number: MKW-034

Coordinate System: NAD 1983 UTM Zone 9N

Projection: Transverse Mercator

Datum: North American 1983

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3. METHODS

3.1 TERRESTRIAL ECOSYSTEM MAPPING

Terrestrial Ecosystem Mapping (TEM) is a standardized method for ecological classification and mapping. TEM is used for project planning to assess and mitigate project impacts to rare and sensitive ecosystems and wildlife habitat. It uses the provincial Biogeoclimatic Ecosystem Classification (BEC) system to describe the type and extent of ecosystems within a defined study area. Ecosystems are classified at a local level (site series) that represent specific localized ecosystem units based on vegetation composition and soil characteristics, notably soil moisture and soil nutrients. Multiple site series are described for each regional subzone reflecting the landscape level distribution of ecosystems based on regional climate, elevation, and physiography. Ecosystem classification is based on climax and zonal theories, where the vegetation observed in a young or disturbed site may not necessarily reflect the species composition of a mature or old site (RIC 1998).

Bioterrain mapping is the first part of the TEM process, where mapped terrain polygons are used to identify areas of similar soils and topology. Bioterrain mapping describes terrain features based mainly on the type of surficial material (e.g., fluvial, glacial till, colluvium) and surficial expression (e.g., blanket, veneer, plain, steep slope, fan, or terrace). Additional information describing subsurface material (e.g., glacial till over bedrock), geomorphic processes (mass movement, inundation, permafrost, etc.), and soil drainage (e.g., well, imperfect, rapid) is also described for each polygon. The bioterrain mapping also delineates terrain units by vegetation features to separate areas of different productivity, water deficits, or those influenced by more saturated soils. Ecosystem mapping uses the bioterrain polygons (dividing them into smaller polygons as needed) to map and classify ecosystem types, along with additional descriptors that provide information on the current state and condition of each ecosystem.

Bioterrain mapping and TEM were conducted by qualified professionals in accordance with provincial methodologies. Mapping was completed on BC government digital air photos using the 3D stereo PurVIEW softcopy software and attribute data were recorded in a database linked to the ArcGIS terrain and ecosystem shapefiles. TEM was completed at a scale of 1: 5,000 for the Project area. This level of scale allows for site level planning, rather than landscape level planning associated with scales typically used for forest management planning (i.e., 1:20,000)

Ecosystem polygons may be a single ecosystem type or contain a complex unit that describes up to three ecosystem types. Each TEM polygon is attributed with ecosystem descriptions or, if it contains multiple ecosystem types, split into smaller ecosystem polygons which are attributed uniquely. Attributes include:

- ecosystem classification (i.e., site series) for up to three types per mapped polygon using deciles (10% increments describing the amount of a given ecosystem unit present in a polygon);
- structural stage, canopy composition, and modifiers (to describe the vegetation in terms of sparse, shrub, young forest, or old forest, as well as stand composition features such as conifer or mixed forest); and

- site modifiers (indicating conditions observed that differ from the expected for a given ecosystem unit).

3.2 PLANT DIVERSITY

Plant diversity within the Project area was documented through collections of vascular plants and bryophytes, as well as through incidental observations of both of these taxonomic groups, made during field surveys on July 3–4, 2019. Although few vascular plants were collected (most species were common, easily identifiable, and did not require collections for verification), most species of bryophyte were documented through collection; only the most common and easily identifiable bryophyte species were not collected. These collections were processed following standard protocols for the collection of plants (see Brayshaw 1996), and all specimens will ultimately be submitted to the collections of the University of British Columbia herbarium in Vancouver. Some species were further documented through photographic voucher.

4. RESULTS

4.1 TERRESTRIAL ECOSYSTEM MAPPING

Results in this section are confined to a discussion regarding sensitive ecosystems. Sensitive ecosystems identified within the Project area include wetlands, old-growth forests, and at-risk (provincially Red- or Blue-listed) ecological communities.

4.1.1 Wetlands

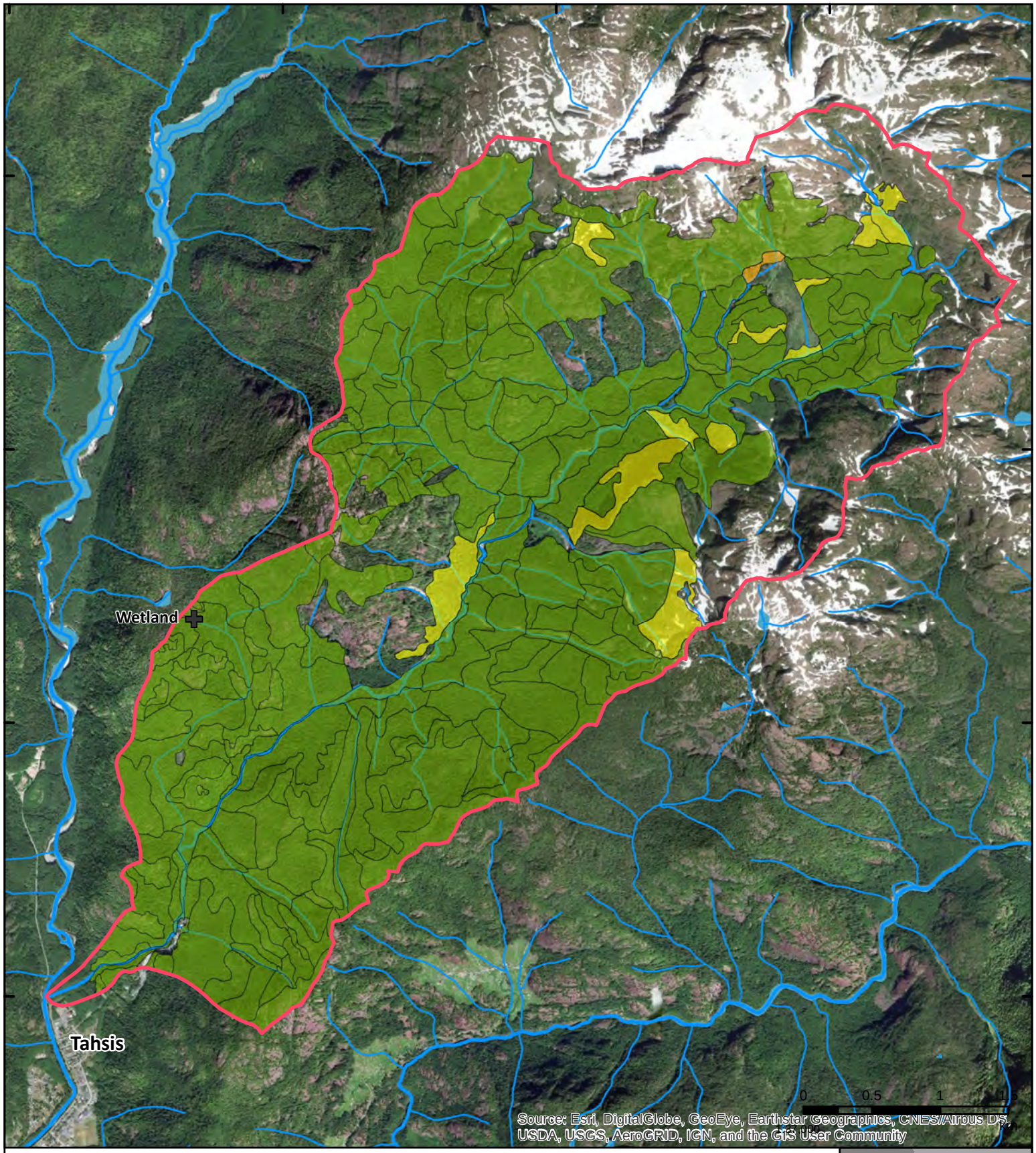
Wetlands occur over an extremely small portion (0.018%) of the Project area, and are restricted to the low-elevation CWHvm1 subzone (Figure 2.1-1). Two wetland communities were documented within a single TEM polygon, which included 0.2 ha of Wf (fen wetland, unspecified) and 0.2 ha of Ws (swamp wetland, unspecified). Given their limited distribution and very small size, wetland ecosystems are not considered a major ecological component of the Project area, although the single site may provide local breeding opportunities for pond-breeding amphibians such as northwestern salamander (*Ambystoma gracile*) and long-toed salamander (*A. macrodactylum*).

4.1.2 Old-growth Forests

Old-growth forests (structural stage 7) occur widely throughout the Project area (Figure 4.1-1, Plate 4.1-1). Old-growth forests are considered an important component of the ecology of the watershed, particularly in the BGC units present at lower elevations (i.e., 86.3% of CWHvm1, 70.7% of CWHvm2; Table 4.1-1). Higher-elevations supported a lower proportion of old-growth habitats (i.e., 27.8% of MHmm1) relative to lower elevations, and no old-growth habitats were mapped for the highest elevations (i.e., CMAun) as this BGC unit is largely treeless.

Table 4.1-1. Distribution of Old-growth Forests among the Four BGC Variants within the Project Area

BGC Unit	Old-growth Area (ha)	Old-growth % (BGC unit)	Old-growth % (Total Watershed)
CWHvm1	734	86.3	33.9
CWHvm2	515.2	70.7	23.8
MHmm1	144.2	27.8	6.7
CMAun	0	0	0
TOTAL	**1393.4**	**-**	**64.4**



McKelvie Creek Watershed

Distribution of Old-growth Forests and Wetlands within the Project Area

Figure 4.1-1

Date: 11/8/2019
Map Number: MKW-052
Coordinate System: NAD 1983 UTM Zone 9N
Projection: Transverse Mercator
Datum: North American 1983

Legend

- Old-Growth Forest (Leading Community)
- Old-Growth Forest (Secondary Community)
- Old-Growth Forest (Tertiary Community)
- Project Area
- Wetland

N

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Plate 4.1-1. Examples of old-growth forests in the McKelvie Creek Watershed. Left: higher elevation Amabilis Fir-Western Hemlock stand; Right: lower elevation Western Redcedar-Western Hemlock stand.

4.1.3 Ecological Communities at Risk

Five ecological communities at risk were mapped as occurring within the Project area (Table 4.1-2, Figure 4.1-2), including one Red-listed ecosystem and four Blue-listed ecosystems. These at-risk plant communities are entirely confined to the two lower-elevation BGC variants (CWHvm1, CWHvm2). The Western-Hemlock – Western Redcedar / Salal Very Wet Maritime community was found to be the most extensively distributed ecological community at risk within the watershed. It occurs in both the CWHvm1 and CWHvm2 variants, with a combined spatial extent of 333 ha within the watershed (which is 15.4% of the total spatial extent of the watershed).

Table 4.1-2. Spatial Extent of Ecological Communities at Risk within the Project Area

Ecosystem Name	Site Series	Map Code	BC Rank	BGC Unit	Area (ha)
Sitka spruce -Salmonberry	09	SS	Red	CWHvm1	0.7
Western redcedar - Western hemlock - Sword fern	04	RS	Blue	CWHvm1	0.3
Western hemlock - Western redcedar - Salal	03	HS	Blue	CWHvm1	137.0
				CWHvm2	196.0
Amabilis fir - Sitka spruce - Devil's-club	08	AD	Blue	CWHvm1	30.4

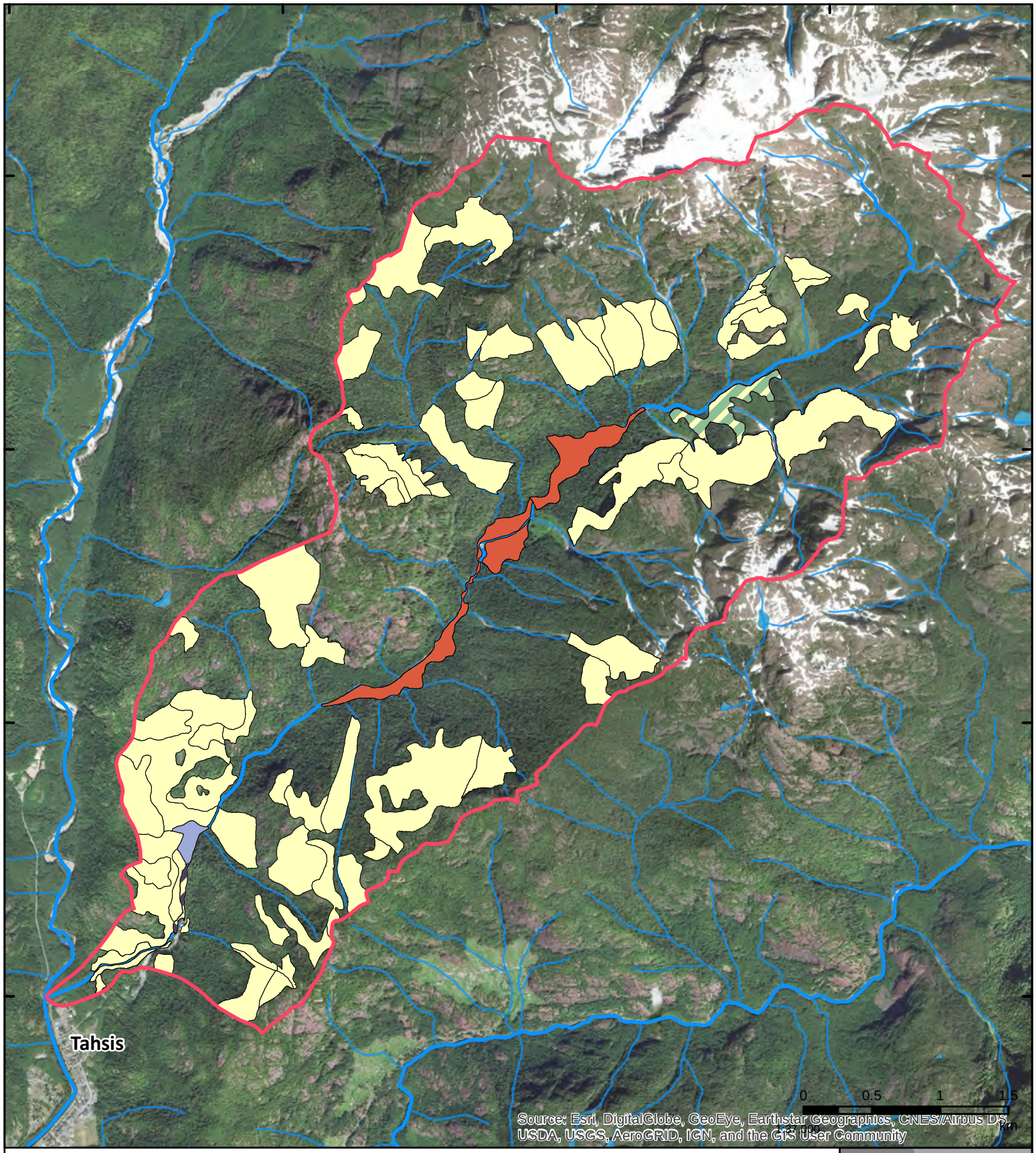
Ecosystem Name	Site Series	Map Code	BC Rank	BGC Unit	Area (ha)
Western hemlock - Amabilis fir - Deer fern	06	HD	Blue	CWHvm2	5.7
				Total	**370.1**

4.2 PLANT DIVERSITY

A total of 172 species of vascular plants (Appendix A) and 64 species of bryophytes, including 16 species of liverworts and 48 species of mosses (Appendix B), were detected within the Project area during the July 2019 surveys.

4.2.1 Species at Risk

Thirteen plant species at risk were identified during the pre-field desktop review as having the potential to occur within the Project area based on their known distributions and habitat preferences (Table 4.2-1). None of these species were detected during the July 2019 surveys. However, only a small portion of the watershed was surveyed and it is considered likely that rare species (particularly bryophytes) occur within the Project area, especially in areas of limestone influence.



McKelvie Creek Watershed

Distribution of Ecological Communities at Risk in the Project Area

Figure 4.1-2

Legend

- Project Area

Rare Ecosystem

- CWHvm1 - SS
- CWHvm1 - RS
- CWHvm1|2 - HS
- CWHvm1 - AD
- CWHvm2 - HD
- CWHvm2 - HD/HS
- CWHvm1 - HS/RS

N

Date: 11/8/2019
Map Number: MKW-053
Coordinate System: NAD 1983 UTM Zone 9N
Projection: Transverse Mercator
Datum: North American 1983

ECOLOGIC environmental consulting

Table 4.2-1. Plant Species at Risk with the Potential to Occur within the Project Area

Species	Species Group	BC Rank[1]	COSEWIC Status[2]	Habitat
Andreaea schofieldiana	Moss	Red (S2)		Dry, acidic (siliceous) rock outcrops and rock faces in the montane zone.
Ditrichum schimperi	Moss	Blue (S2S3)		Moist to wet mineral soil, humus, cliff bases, and disturbed sites in the lowland zone.
Grimmia anomala	Moss	Blue (S3)		Moist, acidic (siliceous) boulders, rock outcrops, ledges, crevices, and rock faces in the montane and subalpine zones.
Hymenostylium recurvirostre var. *insigne*	Moss	Blue (S2S3)		Wet, seepy, calcareous (limestone) rock outcrops, ledges, crevices, and rock faces, especially around mineral springs, in the lowland and montane zones.
Imbribryum gemmiparum	Moss	Blue (S3)		Moist to wet, calcareous (limestone) mineral soil, rock outcrops, ledges, crevices, and streambanks in the lowland, montane, and subalpine zones.
Philonotis yezoana	Moss	Blue (S2S3)		Moist to wet, shady, often seepy mineral soil, humus, rock outcrops, ledges, crevices, rock faces, and streambanks in the lowland and montane zones.
Platyhypnidium riparioides	Moss	Blue (S3?)		Wet, often submerged, mineral soil, boulders, rock outcrops, streambanks, waterfall spray zones, and seepage slopes in the lowland and montane zones.
Ptychostomum schleicheri	Moss	Blue (S2S3)		Moist to wet, calcareous (limestone) mineral soil, streambanks, seepage areas, snowbeds, and tundra in the upper montane, subalpine zones, and alpine zones.
Schistidium trichodon	Moss	Blue (S3)		Dry to moist, calcareous (limestone) boulders, rock outcrops, ledges, crevices, and rock faces, often along rivers and streams, in the lowland, montane, subalpine, and alpine zones.
Seligeria acutifolia	Moss	Red (S1)	E	Moist, shady calcareous (limestone) rock faces around waterfall spray zones in the lowland zone.
Sphagnum quinquefarium	Moss	Blue (S3)		Wet mineral soil, rock outcrops, humus, bogs, fens, wet depressions, streambanks, and seepage slopes, especially where forested, in the lowland and lower montane zones.
Warnstorfia pseudostraminea	Moss	Blue (S3)		Mineral-poor, acidic wetlands (esp. poor fens, bogs), wet logs, shorelines, seepage sites, wet depressions, and streambanks, often submerged or floating, in the upper montane, subalpine, and alpine zones.
Claytonia washingtoniana	Vascular Plant	Red (S2)		Moist to dry rock outcrops, coastal bluffs, open forests, and disturbed areas in the lowland zone.

[1] *BC Rank: ranges from S1 (most endangered) to S5 (least endangered); Red-listed = S1, S1S2, S2; Blue-listed = S2S3, S3; Yellow-listed = S3S4, S4, S4S5, S5*

[2] *COSEWIC Status: E = Endangered*

Although no plant species at risk were documented during the July 2019 field surveys, several species were detected that are considered important given their infrequent occurrence in British Columbia and/or their rarity on Vancouver Island. These uncommon species were detected exclusively in higher-elevation portions of the watershed, near the interface between high montane and subalpine ecosystems of the CWHvm2 and MHmm1 BGC units, and are considered unusual components of the biodiversity of the watershed. All species listed here were documented by collection and, in one case, by photographic voucher as well.

Vascular Plants

***Arnica gracilis* (Tall Mountain Arnica)**

This member of the sunflower family (Asteraceae) is primarily a species of the southern portion of mainland British Columbia, from the Coast-Cascade Mountains east to the Rocky Mountains, and prior to this survey was known from only two sites on Vancouver Island (eFlora BC 2019). The species was found to be locally frequent in the high montane/subalpine habitats in upper portions of the watershed that were visited on July 4, 2019, where it grew on humus around boulders on a vegetated talus slope. The early-flowering phenology of the species meant that almost all individuals detected had completed their flowering and were producing seeds.

***Carex preslii* (Presl's Sedge)**

This species of sedge (family Cyperaceae) occurs widely throughout the mainland of British Columbia, particularly in southern portions of the province, but is uncommon on Vancouver Island (eFlora BC 2019). It was collected from high montane/subalpine habitats in upper portions of the watershed that were visited on July 4, 2019, where it grew on humus around boulders on a vegetated talus slope.

***Phacelia sericea* subsp. *sericea* (Silky Phacelia)**

This member of the waterleaf family (Hydrophyllaceae) is a common species across the southern mainland of British Columbia, occurring widely from the Coast-Cascade Mountains east to the Rocky Mountains. It is rare at high elevations of central Vancouver Island, where it has been collected as far north on the island as Merry Widow Mountain near Port Alice (eFlora BC 2019). It was collected from a single location on a dried, rocky riverbed near the upper reaches of McKelvie Creek on July 4, 2019, where several non-flowering clumps were observed.

***Douglasia laevigata* (Smooth Douglasia)**

This member of the primrose family (Primulaceae) is uncommon throughout its Canadian range, which is restricted to central Vancouver Island and Haida Gwaii (eFlora BC 2019). It was formerly ranked as Blue-listed by the BC Conservation Data Centre; it is now ranked as Yellow-listed (S3S4), but remains a scarce and infrequently observed species in the province. A single clump was detected on rocky outcrops in high montane/subalpine habitats in the upper portions of the watershed on July 4, 2019 (Plates 4.2-1 and 4.2-2). This individual had already flowered and was producing fruit. The species likely occurs more widely

at high elevations of the Project area, as the single location was at the lower elevation limits for the species.

Plate 4.2-1. Smooth Douglasia (*Douglasia laevigata*) in upper McKelvie Creek Watershed (July 4, 2019).

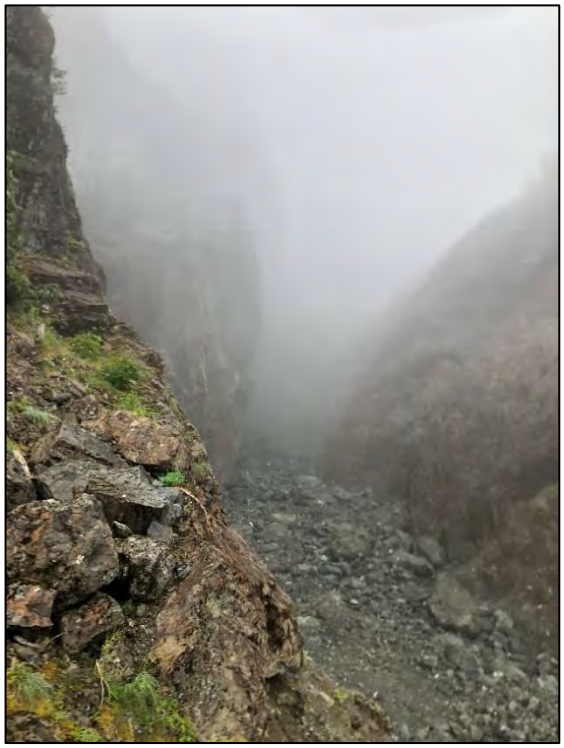


Plate 4.2-2. Location of Smooth Douglasia population on rock walls of upper montane canyon.

Liverworts

Anastrophyllum assimile

This leafy liverwort occurs sporadically in coastal, northern, and southeastern British Columbia, and is known from Vancouver Island from only a handful of collections along the west coast of the island (Brooks Peninsula, Tofino; eFlora BC 2019). This species was collected growing on boulders on a high montane/subalpine talus slope in the upper portions of the Project area on July 4, 2019.

Gymnomitrion brevissimum

This species is known in British Columbia primarily from the southern Coast Mountains, Cascade Mountains, and Kootenay region; the only known collections from Vancouver Island are from the Schoen Lake/Mount Cain areas (eFlora BC 2019). It was collected growing on boulders on a high montane/subalpine talus slope in the upper portions of the Project area on July 4, 2019.

Mosses

Dicranodontium denudatum

This moss is infrequently reported along the south coast of British Columbia, but is considerably more common along the coast north of Vancouver Island (eFlora BC 2019). On Vancouver Island, it has been collected sporadically around Barkley Sound, as well as on the Brooks Peninsula. The species was collected on July 4, 2019, from humus surrounding boulders on a high montane/subalpine talus slope in the upper portions of the Project area.

Isothecium cristatum

This moss is occasional in the Georgia Depression of southwestern British Columbia, but is not known from elsewhere on Vancouver Island (eFlora BC 2019). It was found at several locations within the upper Project area on July 4, 2019, where it grew in mats on shady, moist boulders along the sides of a dry, rocky creek in mature western hemlock-amabilis fir forests.

Pseudoleskea stenophylla

This moss occurs in British Columbia primarily in the southern Coast Mountains, Cascade Mountains, and Kootenay region; it is only occasionally encountered elsewhere in the province, including at two locations on Vancouver Island (eFlora BC 2019). The species was collected on July 4, 2019, from humus surrounding boulders on a high montane/subalpine talus slope in the upper portions of the Project area.

4.2.2 Exotic and Invasive Plants

The term 'exotic plants' refers to all non-native species, irrespective of their impact to either natural ecosystems or agricultural areas. Invasive species, however, are defined by the Invasive Species Council of British Columbia (ISCBC) as "*any non-native organism that cause economic or environmental harm and can spread quickly to new areas of B.C.*" These species can establish quickly and easily on both disturbed and undisturbed sites, and cause widespread negative impacts (ISCBC 2019). They are often referred to as 'noxious weeds.'

Of the 172 species of vascular plants detected during the July 2019 field surveys, 29 species of exotic plants were detected (Table 4.2-1). All but one of these species were restricted to disturbed habitats (mainly roadsides) in the lowermost reaches of the Project area, between the community of Tahsis and the location of the water intake structure. The single introduced species that was found away from these habitats, wall lettuce (*Mycelis muralis*), was found widely but sporadically throughout all areas of the Project area that were visited, including uppermost portions of the watershed that were far from anthropogenic disturbance. This species is not considered to be invasive by the ISCBC. Two species that are listed as provincially 'noxious' weeds by the ISCBC (2019), but remain unregulated, were documented from the Project area. These two species, creeping buttercup (*Ranunculus repens*) and bull thistle (*Cirsium vulgare*), occurred along roadsides near the water intake structure but were not found to be impacting natural habitats of the watershed.

Table 4.2-2. Exotic Plants detected in the Project Area during Field Surveys on July 3-4, 2019

Species	Common Name	Species	Common Name
Agrostis capillaris	Colonial Bentgrass	*Leucanthemum vulgare*	Oxeye Daisy
Agrostis gigantean	Redtop	*Medicago lupulina*	Black Medic
Aira caryophyllea	Silver Hairgrass	*Mycelis muralis*	Wall Lettuce
Anthoxanthum odoratum	Sweet Vernalgrass	*Plantago lanceolata*	English Plantain
Cerastium fontanum	Mouse-ear Chickweed	*Plantago major*	Common Plantain
Cirsium vulgare	Bull Thistle	*Prunella vulgaris* ssp. *vulgaris*	Self-heal
Cotoneaster horizontalis	Rock Cotoneaster	*Ranunculus repens*	Creeping Buttercup
Crepis capillaris	Smooth Hawksbeard	*Rubus armeniacus*	Himalayan Blackberry
Dianthus armeria	Deptford Pink	*Sagina procumbens*	Bird's-eye Pearlwort
Digitalis purpurea	Purple Foxglove	*Sonchus asper*	Prickly Sow-thistle
Euphrasia nemorosa	Eastern Eyebright	*Symphytum officinale*	Common Comfrey
Holcus lanatus	Common Velvetgrass	*Taraxacum officinale*	Common Dandelion
Hypericum perforatum	Common St. John's-wort	*Trifolium dubium*	Small Hop-clover
Hypochaeris radicata	Hairy Cat's-ear	*Trifolium repens*	White Clover
Lapsana communis	Nipplewort		

5. SUMMARY

A total of 236 species of plants, including 64 species of bryophytes and 172 species of vascular plants, were documented in the Project area during the field surveys on July 3–4, 2019. No at-risk species of plants were documented during these surveys, although a number of locally or regionally uncommon species were collected. Twenty-nine species of exotic plants were documented in the Project area, and only one of these species (*Mycelis muralis*) was found to occur within undisturbed ecosystems.

Sensitive ecosystems identified within the Project area included wetlands, old-growth forests, and ecological communities at risk. Wetlands were not found to be a major component of the ecology of the Project area (comprising only 0.4 ha). Old-growth forests were found to occupy 1,393.4 ha (64.4%) of the watershed. Five ecological communities at risk were documented within the Project area, including one Red-listed community and four Blue-listed communities. These ecological communities at risk occupy 370.1 ha (17.1%) of the Project area. In total, 1,445.4 ha (66.8%) of the Project area supports sensitive ecosystems.

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APPENDIX A. COMPREHENSIVE LIST OF VASCULAR PLANT SPECIES DETECTED IN THE PROJECT AREA, JULY 3–4, 2019

BC Status: S1, S2 = Red-listed (Endangered/Threatened); S2S3, S3 = Blue-listed (Special Concern); S3S4, S4. S4S5, S5 = Yellow-listed (Secure); SNA = Not Assessed; SNR = Not Ranked.

Species	Common Name	Family	BC Status	BC Rank
Abies amabilis	Amabilis Fir	Pinaceae	S5	Yellow
Acer glabrum var. *douglasii*	Douglas Maple	Sapindaceae	S5	Yellow
Achillea borealis	Woolly Yarrow	Asteraceae	S5	Yellow
Adiantum aleuticum var. *aleuticum*	Western Maidenhair-fern	Pteridaceae	S4	Yellow
Agrostis capillaris	Colonial Bentgrass	Poaceae	SNA	Exotic
Agrostis gigantea	Redtop	Poaceae	SNA	Exotic
Agrostis scabra	Hair Bentgrass	Poaceae	S5	Yellow
Aira caryophyllea	Silver Hairgrass	Poaceae	SNA	Exotic
Alnus rubra	Red Alder	Betulaceae	S5	Yellow
Alnus viridis subsp. *sinuata*	Sitka Alder	Betulaceae	S5	Yellow
Amelanchier alnifolia var. *semiintegrifolia*	Saskatoon	Rosaceae	S4S5	Yellow
Anaphalis margaritacea	Pearly Everlasting	Asteraceae	S5	Yellow
Anemone parviflora	Northern Anemone	Ranunculaceae	S5	Yellow
Anthoxanthum odoratum	Sweet Vernalgrass	Poaceae	SNA	Exotic
Anticlea occidentalis	Western Mountainbells	Melanthiaceae	S4S5	Yellow
Aquilegia formosa var. *formosa*	Sitka Columbine	Ranunculaceae	S5	Yellow
Arnica gracilis	Tall Mountain Arnica	Asteraceae	S5	Yellow
Arnica lanceolata subsp. *prima*	Streambank Arnica	Asteraceae	S5	Yellow
Arnica latifolia	Mountain Arnica	Asteraceae	S5	Yellow
Aruncus dioicus var. *acuminatus*	Goatsbeard	Rosaceae	S5	Yellow
Athyrium filix-femina var. *cyclosorum*	Lady Fern	Athyriaceae	S5	Yellow
Boykinia occidentalis	Coast Boykinia	Saxifragaceae	S5	Yellow
Bromus vulgaris	Columbia Brome	Poaceae	S5	Yellow
Calamagrostis canadensis var. *canadensis*	Bluejoint Reedgrass	Poaceae	S5	Yellow

Species	Common Name	Family	BC Status	BC Rank
Campanula rotundifolia	Common Harebell	Campanulaceae	S5	Yellow
Carex bolanderi	Bolander's Sedge	Cyperaceae	S5	Yellow
Carex interior	Inland Sedge	Cyperaceae	S5	Yellow
Carex laeviculmis	Smooth-stemmed Sedge	Cyperaceae	S5	Yellow
Carex leptalea	Bristle-stalked Sedge	Cyperaceae	S5	Yellow
Carex mertensii	Mertens' Sedge	Cyperaceae	S5	Yellow
Carex preslii	Presl's Sedge	Cyperaceae	S5	Yellow
Carex spectabilis	Showy Sedge	Cyperaceae	S5	Yellow
Cassiope mertensiana subsp. *mertensiana*	White Mountain-heather	Ericaceae	S5	Yellow
Castilleja hispida var. *hispida*	Harsh Paintbrush	Orobanchaceae	S5	Yellow
Castilleja miniata var. *miniata*	Scarlet Paintbrush	Orobanchaceae	S5	Yellow
Cerastium fontanum subsp. *vulgare*	Mouse-ear Chickweed	Caryophyllaceae	SNA	Exotic
Chamaenerion angustifolium	Fireweed	Onagraceae	S5	Yellow
Cirsium vulgare	Bull Thistle	Asteraceae	SNA	Yellow
Claytonia sibirica	Siberian Miner's-lettuce	Montiaceae	S5	Yellow
Coptis aspleniifolia	Fern-leaved Goldthread	Ranunculaceae	S5	Yellow
Corallorhiza maculata var. *occidentalis*	Spotted Coralroot	Orchidaceae	SU	Unknown
Cornus sericea	Red-osier Dogwood	Cornaceae	S5	Yellow
Cornus unalaschkensis	Alaskan Bunchberry	Cornaceae	S5	Yellow
Cotoneaster horizontalis	Rock Cotoneaster	Rosaceae	SNA	Exotic
Crepis capillaris	Smooth Hawksbeard	Asteraceae	SNA	Exotic
Cryptogramma acrostichoides	Parsley Fern	Pteridaceae	S5	Yellow
Danthonia spicata	Poverty Oatgrass	Poaceae	S5	Yellow
Deschampsia elongata	Slender Hairgrass	Poaceae	S5	Yellow
Dianthus armeria subsp. *armeria*	Deptford Pink	Caryophyllaceae	SNA	Exotic
Digitalis purpurea	Common Foxglove	Plantaginaceae	SNA	Exotic
Douglasia laevigata	Smooth Douglasia	Primulaceae	S3S4	Yellow
Dryopteris expansa	Spiny Wood Fern	Dryopteridaceae	S5	Yellow
Elliottia pyroliflora	Copperbush	Ericaceae	S5	Yellow
Elymus glaucus subsp. *glaucus*	Blue Wildrye	Poaceae	S5	Yellow

Species	Common Name	Family	BC Status	BC Rank
Elymus hirsutus	Hairy Wildrye	Poaceae	S5	Yellow
Epilobium anagallidifolium	Alpine Willowherb	Onagraceae	S5	Yellow
Epilobium ciliatum subsp. *ciliatum*	Purple-leaved Willowherb	Onagraceae	S5	Yellow
Epilobium hornemannii subsp. *hornemannii*	Hornemann's Willowherb	Onagraceae	S4	Yellow
Epilobium minutum	Small-flowered Willowherb	Onagraceae	S5	Yellow
Erigeron glacialis var. *glacialis*	Subalpine Daisy	Asteraceae	S5	Yellow
Erigeron philadelphicus var. *philadelphicus*	Philadelphia Fleabane	Asteraceae	S4	Yellow
Erythranthe guttata	Yellow Monkey-flower	Phrymaceae	S5	Yellow
Erythranthe lewisii	Pink Monkey-flower	Phrymaceae	S5	Yellow
Euphrasia nemorosa	Common Eyebright	Orobanchaceae	SU	Unknown
Festuca occidentalis	Western Fescue	Poaceae	S5	Yellow
Festuca subulata	Bearded Fescue	Poaceae	S5	Yellow
Galium triflorum	Sweet-scented Bedstraw	Rubiaceae	S5	Yellow
Gaultheria shallon	Salal	Ericaceae	S5	Yellow
Geum macrophyllum var. *macrophyllum*	Large-leaved Avens	Rosaceae	S5	Yellow
Gymnocarpium disjunctum	Western Oak Fern	Cystopteridaceae	S5	Yellow
Heracleum maximum	Cow-parsnip	Apiaceae	S5	Yellow
Heuchera glabra	Smooth Alumroot	Saxifragaceae	S5	Yellow
Heuchera micrantha var. *diversifolia*	Small-flowered Alumroot	Saxifragaceae	S5	Yellow
Hieracium albiflorum	White Hawksbeard	Asteraceae	S5	Yellow
Holcus lanatus	Common Velvetgrass	Poaceae	SNA	Exotic
Holodiscus discolor var. *discolor*	Oceanspray	Rosaceae	S5	Yellow
Hypericum perforatum subsp. *perforatum*	Common St. John's-wort	Hypericaceae	SNA	Exotic
Hypochaeris radicata	Hairy Cat's-ear	Asteraceae	SNA	Exotic
Juncus articulatus	Jointed Rush	Juncaceae	S5	Yellow
Juncus effusus subsp. *pacificus*	Common Rush	Juncaceae	S5	Yellow
Juncus ensifolius	Dagger-leaved Rush	Juncaceae	S5	Yellow
Kopsiopsis hookeri	Vancouver Groundcone	Orobanchaceae	S4S5	Yellow

Species	Common Name	Family	BC Status	BC Rank
Lapsana communis	Nipplewort	Asteraceae	SNA	Exotic
Leucanthemum vulgare	Oxeye Daisy	Asteraceae	SNA	Exotic
Linnaea borealis subsp. *longiflora*	Twinflower	Caprifoliaceae	S5	Yellow
Luetkea pectinata	Partridge-foot	Rosaceae	S5	Yellow
Luina hypoleuca	Silverback Luina	Asteraceae	S5	Yellow
Luzula piperi	Piper's Wood-rush	Juncaceae	S5	Yellow
Luzula subsessilis	Short-stalked Wood-rush	Juncaceae	S5	Yellow
Lycopodium clavatum	Running Clubmoss	Lycopodiaceae	S5	Yellow
Lysichiton americanus	Skunk Cabbage	Araceae	S5	Yellow
Maianthemum dilatatum	False Lily-of-the-valley	Asparagaceae	S5	Yellow
Medicago lupulina	Black Medic	Fabaceae	SNA	Exotic
Melica subulata	Alaska Oniongrass	Poaceae	S5	Yellow
Menziesia ferruginea	False-azalea	Ericaceae	S5	Yellow
Micranthes ferruginea	Alaska Saxifrage	Saxifragaceae	S5	Yellow
Micranthes nelsoniana var. *cascadensis*	Dotted Saxifrage	Saxifragaceae	S5	Yellow
Montia parvifolia	Small-leaved Montia	Montiaceae	S5	Yellow
Mycelis muralis	Wall Lettuce	Asteraceae	SNA	Exotic
Neottia banksiana	Northwestern Twayblade	Orchidaceae	S5	Yellow
Oplopanax horridus	Devil's-club	Araliaceae	S5	Yellow
Orthilia secunda	One-sided Wintergreen	Ericaceae	S5	Yellow
Oxyria digyna	Mountain Sorrel	Polygonaceae	S5	Yellow
Parnassia fimbriata	Fringed Grass-of-Parnassus	Celastraceae	S5	Yellow
Penstemon davidsonii var. *menziesii*	Davidson's Penstemon	Plantaginaceae	S4	Yellow
Penstemon serrulatus	Coast Penstemon	Plantaginaceae	S5	Yellow
Persicaria lapathifolia	Willow-weed	Polygonaceae	S5	Yellow
Phacelia leptosepala	Narrow-sepaled Phacelia	Hydrophyllaceae	S5?	Yellow
Phacelia sericea subsp. *sericea*	Silky Phacelia	Hydrophyllaceae	S5	Yellow
Phegopteris connectilis	Narrow Beech Fern	Thelypteridaceae	S5	Yellow
Phleum alpinum	Alpine Timothy	Poaceae	S5	Yellow
Physocarpus capitatus	Pacific Ninebark	Rosaceae	S5	Yellow

Species	Common Name	Family	BC Status	BC Rank
Picea sitchensis	Sitka Spruce	Pinaceae	S5	Yellow
Pinus contorta var. *contorta*	Shore Pine	Pinaceae	S5	Yellow
Pinus monticola	Western White Pine	Pinaceae	S4	Yellow
Plantago lanceolata	Ribwort Plantain	Plantaginaceae	SNA	Exotic
Plantago major	Common Plantain	Plantaginaceae	SNA	Exotic
Platanthera stricta	Slender Bog-orchid	Orchidaceae	S5	Yellow
Poa palustris	Fowl Bluegrass	Poaceae	S5	Yellow
Poa stenantha var. *stenantha*	Narrow-flowered Bluegrass	Poaceae	S5	Yellow
Polypodium glycyrrhiza	Licorice Fern	Polypodiaceae	S5	Yellow
Polystichum munitum	Sword Fern	Dryopteridaceae	S5	Yellow
Prenanthes alata	Western Rattlesnake-root	Asteraceae	S5	Yellow
Prosartes hookeri	Hooker's Fairybells	Liliaceae	S5	Yellow
Prunella vulgaris subsp. *vulgaris*	Self-heal	Lamiaceae	SNA	Exotic
Prunus emarginata	Bitter Cherry	Rosaceae	S5	Yellow
Pseudotsuga menziesii var. *menziesii*	Douglas-fir	Pinaceae	S5	Yellow
Pteridium aquilinum var. *pubescens*	Bracken Fern	Dennstaedtiaceae	S5	Yellow
Ranunculus repens	Creeping Buttercup	Ranunculaceae	SNA	Exotic
Ranunculus uncinatus	Little Buttercup	Ranunculaceae	S5	Yellow
Ribes bracteosum	Stink Currant	Grossulariaceae	S5	Yellow
Ribes laxiflorum	Trailing Black Currant	Grossulariaceae	S5	Yellow
Rosa gymnocarpa var. *gymnocarpa*	Baldhip Rose	Rosaceae	S5	Yellow
Rubus armeniacus	Himalayan Blackberry	Rosaceae	SNA	Exotic
Rubus parviflorus	Thimbleberry	Rosaceae	S5	Yellow
Rubus pedatus	Five-leaved Bramble	Rosaceae	S5	Yellow
Rubus spectabilis	Salmonberry	Rosaceae	S5	Yellow
Rubus ursinus	Trailing Blackberry	Rosaceae	S5	Yellow
Sagina procumbens	Bird's-eye Pearlwort	Caryophyllaceae	SNA	Exotic
Salix sitchensis	Sitka Sedge	Salicaceae	S5	Yellow
Saxifraga mertensiana	Wood Saxifrage	Saxifragaceae	S5	Yellow
Sceptridium multifidum	Leathery Grape Fern	Ophioglossaceae	S5	Yellow

Species	Common Name	Family	BC Status	BC Rank
Selaginella wallacei	Wallace's Selaginella	Selaginellaceae	S5	Yellow
Solidago multiradiata	Northern Goldenrod	Asteraceae	S5	Yellow
Sonchus asper	Prickly Sow-thistle	Asteraceae	SNA	Yellow
Sorbus sitchensis var. *sitchensis*	Sitka Mountain-ash	Rosaceae	S5	Yellow
Stachys chamissonis var. *cooleyae*	Cooley's Hedge-nettle	Lamiaceae	S5	Yellow
Streptopus amplexifolius	Clasping Twistedstalk	Liliaceae	S5	Yellow
Streptopus lanceolatus var. *curvipes*	Rosy Twistedstalk	Liliaceae	S5	Yellow
Struthiopteris spicant	Deer Fern	Blechnaceae	S5	Yellow
Symphytum officinale	Common Comfrey	Boraginaceae	SNA	Exotic
Taraxacum officinale	Common Dandelion	Asteraceae	SNA	Exotic
Taxus brevifolia	Western Yew	Taxaceae	S5	Yellow
Tellima grandiflora	Fringecup	Saxifragaceae	S5	Yellow
Thuja plicata	Western Redcedar	Cupressaceae	S5	Yellow
Tiarella trifoliata var. *trifoliata*	Three-leaved Foamflower	Saxifragaceae	S5	Yellow
Tolmiea menziesii	Piggy-back Plant	Saxifragaceae	S5	Yellow
Trautvetteria caroliniensis	False Bugbane	Ranunculaceae	S5	Yellow
Trifolium dubium	Low Hop-clover	Fabaceae	SNA	Exotic
Trifolium repens	White Clover	Fabaceae	SNA	Exotic
Tsuga heterophylla	Western Hemlock	Pinaceae	S5	Yellow
Tsuga mertensiana	Mountain Hemlock	Pinaceae	S5	Yellow
Vaccinium alaskaense	Alaskan Blueberry	Ericaceae	S5	Yellow
Vaccinium ovalifolium	Oval-leaved Blueberry	Ericaceae	S5	Yellow
Vaccinium parvifolium	Red Huckleberry	Ericaceae	S5	Yellow
Valeriana sitchensis	Sitka Valerian	Caprifoliaceae	S5	Yellow
Veratrum viride var. *eschscholzianum*	Green False-hellebore	Melanthiaceae	S5	Yellow
Veronica nutans	Alpine Speedwell	Plantaginaceae	S5	Yellow
Veronica serpyllifolia var. *humifusa*	Thyme-leaved Speedwell	Plantaginaceae	S5	Yellow
Viola glabella	Stream Violet	Violaceae	S5	Yellow
Viola sempervirens	Trailing Yellow Violet	Violaceae	S5	Yellow
Xanthocyparis nootkatensis	Yellow-cedar	Cupressaceae	S4	Yellow

APPENDIX B. COMPREHENSIVE LIST OF BRYOPHYTE SPECIES DETECTED IN THE PROJECT AREA, JULY 3–4, 2019

BC Status: S1, S2 = Red-listed (Endangered/Threatened); S2S3, S3 = Blue-listed (Special Concern); S3S4, S4. S4S5, S5 = Yellow-listed (Secure); SNA = Not Assessed; SNR = Not Ranked.

Species	Taxonomic Group	BC Status	BC Rank
Anastrophyllum assimile	Liverwort	S4	Yellow
Blepharostoma trichophyllum	Liverwort	SNR	N/A
Diplophyllum albicans	Liverwort	SNR	N/A
Diplophyllum taxifolium var. *taxifolium*	Liverwort	S4	Yellow
Frullania nisquallensis	Liverwort	S5	Yellow
Gymnomitrion brevissimum	Liverwort	S3S4	Yellow
Herbertus aduncus	Liverwort	S4S5	Yellow
Lepidozia reptans	Liverwort	SNR	N/A
Marsupella emarginata	Liverwort	SNR	N/A
Metzgeria conjugata var. *japonica*	Liverwort	S4	Yellow
Pellia neesiana	Liverwort	SNR	N/A
Porella navicularis	Liverwort	S5	Yellow
Scapania americana	Liverwort	SNR	N/A
Scapania bolanderi	Liverwort	S5	Yellow
Scapania undulata var. *undulata*	Liverwort	SNR	N/A
Schistochilopsis incisa var. *incisa*	Liverwort	SNR	N/A
Andreaea blyttii	Moss	S4	Yellow
Antitrichia curtipendula	Moss	S5	Yellow
Buckiella undulata	Moss	S4	Yellow
Bucklandiella heterosticha	Moss	S4S5	Yellow
Bucklandiella lawtoniae	Moss	S4?	Yellow
Claopodium bolanderi	Moss	S4S5	Yellow
Codriophorus aciculare	Moss	S4S5	Yellow
Codriophorus fasciculare	Moss	S4S5	Yellow
Codriophorus varius	Moss	S4S5	Yellow
Dicranella heteromalla	Moss	S4	Yellow
Dicranodontium denudatum	Moss	S4	Yellow

Species	Taxonomic Group	BC Status	BC Rank
Dicranum fuscescens var. *fuscescens*	Moss	S5	Yellow
Dicranum scoparium	Moss	S5	Yellow
Drepanocladus aduncus	Moss	S5?	Yellow
Grimmia torquata	Moss	S4S5	Yellow
Grimmia trichophylla	Moss	S4S5	Yellow
Heterocladium macounii	Moss	S4S5	Yellow
Hylocomium splendens	Moss	S5	Yellow
Hypnum circinale	Moss	S5	Yellow
Hypnum cupressiforme var. *cupressiforme*	Moss	S4S5	Yellow
Hypnum dieckei	Moss	S4S5	Yellow
Isothecium cristatum	Moss	S4?	Yellow
Isothecium stoloniferum	Moss	S4S5	Yellow
Kiaeria starkei	Moss	S4S5	Yellow
Kindbergia oregana	Moss	S5	Yellow
Kindbergia praelonga	Moss	S5	Yellow
Leucolepis acanthoneuron	Moss	S5?	Yellow
Neckera douglasii	Moss	S4S5	Yellow
Niphotrichum elongatum	Moss	S4S5	Yellow
Orthotrichum lyellii	Moss	S4S5	Yellow
Pleurozium schreberi	Moss	S5	Yellow
Pogonatum contortum	Moss	S4S5	Yellow
Pogonatum urnigerum	Moss	S4S5	Yellow
Polytrichastrum alpinum var. *alpinum*	Moss	S4S5	Yellow
Polytrichum commune var. *commune*	Moss	S4S5	Yellow
Pseudoleskea stenophylla	Moss	S4	Yellow
Pseudotaxiphyllum elegans	Moss	S4S5	Yellow
Ptychostomum pseudotriquetrum	Moss	S5	Yellow
Rhizomnium glabrescens	Moss	S4S5	Yellow
Rhytidiadelphus loreus	Moss	S5	Yellow
Rhytidiadelphus triquetrus	Moss	S5	Yellow
Rhytidiopsis robusta	Moss	S5	Yellow
Scleropodium obtusifolium	Moss	S4S5	Yellow

Species	Taxonomic Group	BC Status	BC Rank
Scleropodium touretii var. *touretii*	Moss	S3S4	Yellow
Scouleria aquatica	Moss	S4S5	Yellow
Sphagnum girghensonii	Moss	S4S5	Yellow
Sphagnum palustre	Moss	S4S5	Yellow
Tortella tortuosa var. *tortuosa*	Moss	S4S5	Yellow