NORTH AMERICAN TUNGSTEN CORPORATION LTD




North American Tungsten Corporation Ltd.

# MACTUNG PROJECT

# 2006 ENVIRONMENTAL BASELINE STUDIES VEGETATION AND ECOSYSTEM LAND CLASSIFICATION

12000163.007

April 2007

CREATING AND DELIVERING BETTER SOLUTIONS

eba

North American Tungsten Corporation Ltd.

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# 2006 ENVIRONMENTAL BASELINE STUDIES

# VEGETATION AND ECOSYSTEM LAND CLASSIFICATION

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## EXECUTIVE SUMMARY

North American Tungsten Corporation Ltd. (NATCL) retained EBA Engineering Consultants Ltd. (EBA) to update and supplement historic baseline vegetation information at the MacTung Project Property on both the Yukon and Northwest Territories sides of the study area. The objective was to document terrestrial ecosystems and vegetation within the MacTung Project Area for future regulatory submissions leading to MacTung Project approvals and implementation.

The MacTung Project Property is located in the Selwyn Mountain Range where the North Canol Road crosses the Yukon-Northwest Territories boundary. Field studies were undertaken within the MacTung Project Local Study Area (LSA), which covers an area of 225 km$^2$. Mapping of bioclimate zones for the LSA shows that the Alpine represents 65.5%, the Shrub Taiga represents 13.6%, and the Wooded Taiga represents 21.0% of the LSA. A total of 51 GIF plots and 26 visual plots were completed for a total of 77 sample plots. The 77 plots sampled within 324 polygons (including 24 polygons with no data) represent a sampling intensity of 23.8%. The average polygon size was determined to be 69.3 hectares. Thirteen distinct vegetation units/ map units and 10 complex polygon associations were mapped at a scale of 1:20,000 based on the 2006 field studies. The map units with the greatest percent cover of the LSA are: epilithic lichen 41.7%, heath-lichen 13.7%, fir-lichen: fir-moss 6.7%, birch-lichen 5.8%, fescue-willow 3.4%, and fescue-sedge 3.3%. One hundred twenty three different plants were recorded within the 51 ground inspection plots.

Initial reconnaissance indicates there is a potential for 26 rare plant species to occur within the LSA. Two rare species (*Rubus arcticus* and *Carex albo-nigra*) were observed in the LSA, but not in areas that historically have been proposed for the footprint of the mine. A list of rare plant communities potentially present does not currently exist for the MacTung Project LSA. In general, wetlands and arctic/ alpine communities are considered sensitive communities. There are no national parks, territorial parks, habitat protection, or wildlife management zones in the area of the MacTung Project LSA. Various wetlands and riparian areas have been identified in the LSA. Two areas that have the potential to be impacted by the project footprint area of the mine include a wetland area in the Upper Dale Valley, NWT and a small marsh and riparian area in the upper valley close to the mine site in Yukon Territory.

Once the MacTung Project footprint has been determined, the following studies are recommended:

- A site-specific rare plant survey in the area of the proposed MacTung Project infrastructure footprint;
- Baseline information regarding trace element concentrations in vegetation for cumulative effects and impact assessment purposes for the MacTung Project; and
- In field quality assurance/ quality control (QA/QC) of the ecosystem land classification (ELC) mapping be performed.

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# 1.0 INTRODUCTION

North American Tungsten Corporation Ltd. (NATCL) is considering development of a world-class tungsten deposit located near Macmillan Pass, on the border between the Northwest Territories and the Yukon (Figure 1). The mine site is located in the Selwyn Mountains at an elevation of 1,725-1,800 metres above sea level (m a.s.l.). The mine site is connected to the southern Yukon during summer months by the North Canol Road, and is 650 km (400 air km) northeast of Whitehorse. The mine site is linked to the North Canol Road just east of Macmillan pass by a 10 km-long access road.

NATCL retained EBA Engineering Consultants Ltd. (EBA) to update and supplement historic baseline vegetation information at the MacTung Project Property (MacTung Local Study Area), on both the Yukon and Northwest Territories sides of the study area. The survey objective was to document terrestrial ecosystems and vegetation within the Local Study Area for future regulatory submissions leading to MacTung Project approvals and implementation.

# 2.0 ENVIRONMENTAL SETTING

## 2.1 GENERAL DESCRIPTION

According to AMAX (1983), weather studies were first undertaken for the area in 1968 with environmental and socio-economic studies first conducted in 1973. There have been at least 87 studies conducted to date. For the purposes of the vegetation portion of this project report there are two studies of special interest which provide a detailed summary of the vegetation of the area. The vegetation portion of AMAX (1983) is based on information from Kershaw and Kershaw (1983). For this reason only one synopsis is presented below.

*AMAX Northwest Mining Company Limited. 1983. Initial Environmental Evaluation of the MacTung Project Yukon and Northwest Territories; and*

***Kershaw, G.P. and Kershaw, L.J. 1983. Geomorphology and Vegetation of the MacTung Study Area, Yukon/N.W.T. Prepared for AMAX Northwest Mining Co. Ltd., Vancouver. 85 p.***

These reports provide a detailed investigation into all physical, biological, and cultural aspects of their study area (500 $km^2$). The vegetation portion of the report presents a summary of both the existing vegetation and plant communities and potential environmental impacts associated with the construction of the proposed mine. A detailed plant species list from the Kershaw report is presented in Appendix A. The report identified 17 plant communities (Table 1) within their study area.

| TABLE 1: SUMMARY OF PLANT COMMUNITIES IDENTIFIED AND DELINEATED BY AMAX (1983). | |
|---|---|
| Tundra Plant Community Complexes | |
| Plant Community | Description |
| **Epilithic Lichen** | Lichen species colonized on exposed mineral substrates and cover more than 10% of the surface found at or near mountain tops on all slopes or aspects. |
| **Cushion Plant** | Dwarf shrub, graminoid, and mosses no greater than 30 cm in height on generally flat to gently sloping surfaces at high elevations where soil moisture is semiarid to xeric. |
| **Alpine meadow** | Alpine meadows dominated by dwarf shrubs such as *Salix arctica*, *S. reticulata* and *Dryas integrifolia* that are found in relatively moist areas at high elevations wit strong wind exposure. |
| **Alpine lichen-grass** | Same as alpine meadows, but found on drier sites where soils are freely drained giving rise to communities dominated graminoids with a lichen groundcover. |
| **Lichen-heath** | Communities have greater than 50% groundcover by *Cladina* and *Cetraria*. *Cassiope tetragona* is the dominant vascular plant. Sites are generally flat to gently sloping with a convex topography and soils that are freely to excessively drained. Wind exposure may be high. |
| **Birch-lichen** | Communities have greater than 50% groundcover by *Cladina* and *Cetraria*. *Betula glandulosa* is the dominant vascular plant. Sites are generally flat to gently sloping with a convex topography and soils that are freely to excessively drained. |
| **Birch-moss** | Groundcover is dominated by *Hylocomnium splendens* and *Polytrichum commune*. *Betula glandulosa* is the dominant vascular plant. Soils are relatively moist, and flat to gently sloping in valley bottoms. |
| **Willow-forb** | This is a highly diverse community dominate by *Salix* species with high bryophyte groundcover. Sites are generally moist to wet, concave and have poor drainage. The community is highly diverse. |
| **Riparian-willow** | Riparian willow communities are found in flooded areas with a high water table. Vegetation is dominated by *Salix* species. |
| **Sedge meadow** | Wet areas dominated by *Carex aquatilis* |
| **Forb meadow** | Wet and moist areas characterized by a diverse mix of forb species including *Mertensia*, *Artemesia*, *Senecio*, and *Petasites*. |
| **Lowland lichen-grass** | Dry, well drained sites dominated by rough fescue and various lichen species. |
| Sub-arctic Forest Community Complexes | |
| **Krummholz** | Krummholz communities are located at the upper treeline and consist of dwarf subalpine fir communities. Sites are sloping with well drained soils, often exposed to extreme cold and wind. |
| **Fir-lichen** | Communities have open canopies dominated by subalpine fir with an understory of lichens and some mosses. Soil is generally well drained and xeric. Species diversity is low. |
| **Fir-moss** | Canopy is dominated by subalpine fir with an understory of *Hylocomnium splendens* and *sphagnum* .Soils are generally well drained with, but may be |

| TABLE 1: SUMMARY OF PLANT COMMUNITIES IDENTIFIED AND DELINEATED BY AMAX (1983). | |
|---|---|
| | concave or associated with seeps and streams which increase soil moisture. Species diversity is low. |
| **Lowland white spruce** | Uncommon community found in lowland sheltered locations in the Hess tributary basin. |
| **Birch-spruce** | Community is dominated by *Betula glandulosa* with few conifers. Sites are found in valley bottoms of the Hess River Tributaries in generally flat areas with impeded soil drainage. |

The report also stated that upon review of rare species lists from the Yukon and NWT, four species were to be considered rare with a potential to occur in the area. None of the four plant species were identified or recorded in areas planned for construction.

### 2.1.1 Fire History

The importance of fire to the structure and vegetation dynamics of forest ecosystems has long been recognized. Typical fire frequencies in the boreal forest are approximately every hundred years in areas dominated by white spruce, 75 years for black spruce and 50 years for trembling aspen (Larson 1997). The fire interval was found to increase at northern latitudes in the Yukon from 133 years to 234 years (Theberge 1972). Due to the moist and cold climate in the area of the MacTung LSA, the latter value is likely more accurate. Historical records indicate no major fire disturbance in the area of the proposed mine (Figure 2). This infers that late successional and/or mature communities are likely to be present in the Local Study Area

## 2.2 STUDY AREA

### 2.2.1 Local Study Area

The MacTung Local Study Area (LSA) is a 15 km by 15 km (225 $km^2$) area centred approximately on the proposed mine site (Figure 1). The LSA used to conduct ecosystem land classification is based upon the area associated with acquired Quickbird satellite imagery. The LSA occurs in both the Yukon and the Northwest Territories adjacent to where the North Canol Road crosses the border between the two Territories. The LSA includes the Dale Creek Valley and Tsichu River to the east; the Hess River Valley to the north with Keele Peak immediately outside the LSA; numerous tributary valleys to the west; and high elevation mountainous areas and the Macmillan River to the south-southeast. Within the LSA, valley bottoms measure between 1,160 m a.s.l. and 1,400 m a.s.l. and alpine peaks range from 1,800 m a.s.l. to 2,200 m a.s.l.

The Mactung LSA lies within the Selwyn Mountain Ecoregion of the Taiga Cordillera Ecozone of Canada. Ecodistricts for the LSA have not been formally defined. However, for the purposes of this report, a Selwyn-Yukon Ecodistrict (YN) and a Selwyn-NWT Ecodistrict (NT) have been designated. The Selwyn Mountain Ecoregion is characterized by high elevation mountain ranges that contain alpine glaciers such as those located on

nearby Keele Peak (2,970 m a.s.l.). Elevations range from 745 m a.s.l. to 2,970 m a.s.l. The Selwyn Mountains give rise to the highest levels of annual precipitation (600-700 mm) in Yukon outside the Coast Mountains (Smith *et al.* 2004). Mean annual temperatures for the region are -5 ºC to -8ºC, ranging from an average of -20 ºC in January to 8 ºC in July. The region lies in the discontinuous permafrost zone; however, the LSA is likely within the continuous permafrost zone due to its high elevation of between 1,300 m a.s.l. to 2,200 m a.s.l. Approximate land cover in the Selwyn Mountain Ecoregion is 65% boreal/subalpine coniferous forest, 20% alpine tundra, and 15% rockland (Smith *et al.* 2004).

Vegetation is highly variable in the LSA due to elevation, aspect, microtopography, and soil conditions. Valley bottoms tend to be vegetated by willow and scrub-birch thickets, wetlands, and sedge-forb meadows. Black and white spruce communities are rare in the Hess Tributary. Subalpine fir dominates the Wooded Taiga from 1,200 m a.s.l. to 1,550 m a.s.l. At higher elevations the canopy becomes sparse and is typically replaced by Krummholz and dwarf shrub communities in the Alpine. At elevations above 1,800 m a.s.l., vascular plants become rare and bare rock and epilithic lichen communities dominate.

### 2.2.2 Mine Footprint

The proposed Project Area/Mine Footprint is defined as the area in which construction of the mine will likely disturb vegetation and includes areas such as buildings, roads, mill site, and tailings ponds. The precise boundaries of the footprint remain to be defined.

## 2.3 2006 MACTUNG VEGETATION AND ECOSYSTEM LAND CLASSIFICATION SCOPE

The scope of work for the vegetation component of the biophysical assessment for the Mactung Project Local Study Area included:

1. Ecological land classification (ELC) for the LSA consistent with the evolving Yukon Ecosystem Classification and Mapping Framework (YCEMF Francis & Steffan 2003) and the Standard for Terrestrial Ecosystem Mapping in British Columbia (RIC 1998). The ELC includes presentation of Level 3 (Ecodistricts), Level 4 (Bio-Climate Zones), Level 5 (Landscape) and Level 6 (Vegetation) polygons;
2. An inventory of the vegetation and plant communities in the Local Study Area based on the 2006 field studies and historical work previously conducted in the area;
3. A reconnaissance level assessment of the potential for rare, sensitive and/or endangered plants to occur in the proposed footprint of the mine (a more detailed survey will be required upon determination of the footprint of the mine); and
4. Identification of any wetlands in the area.

# 3.0 METHODS

## 3.1 ECOLOGICAL LAND CLASSIFICATION AND VEGETATION INVENTORY

Ecological land classification (ELC) is an ecological mapping process which integrates site, soil, and vegetation characteristics in order to determine units that are repeatable and can be mapped for environmental land use planning and resource management. Currently, ecological land classification exists for many parts of Canada and provinces such as in British Columbia. An ecological land classification framework for Yukon is currently under development with a draft framework completed by Francis and Steffan (2003). This framework describes a hierarchical system incorporating ecoregional classification (Ecozone, Ecoregion and Ecodistrict) and ecosystems (Bioclimate Zones, Landscape units, Vegetation units and Ecosystem units).

Ecozone and Ecoregion mapping exists for all of the Yukon. Ecodistrict mapping and Bioclimate Zone mapping has been completed for many Ecoregions; however Ecodistricts for the Selwyn Mountain Ecoregion have not yet been determined. EBA (2003) completed Ecodistrict and Bioclimate Zone mapping for the Pelly Mountains and Yukon Southern Lakes Ecoregions and Zoladeski *et al.* (1996) completed a site classification guide for the southeast Yukon, but there are few projects that have used it as a basis for mapping ecosystems. Biophysical mapping was completed for the Watson Lake area by Lipovsky and McKenna (2005) using a new site classification system. Ecosystem mapping was also completed for the Wolverine Mine Project (YZC & Axys 2005). YZC and Axys (2005) described and developed new ecosystem classification units and cross-referenced these units to Zoladeski *et al.* (1996). This current report adheres to the framework in the Yukon Ecosystem Classification and Mapping Framework (YCEMF; Francis & Steffan 2003) and the Standard for Terrestrial Ecosystem Mapping in British Columbia (RIC 1998).

The general process for ecological land classification consists of project planning and initial classification, field sampling, imagery preparation, mapping, and quality assurance. The methods and approaches for each phase are discussed below.

Project planning and initial review included defining the objectives and the purpose of the work; conducting a detailed literature review of prior vegetation and ecosystem classification for the Local Study Area; and determining a sampling plan and survey intensity. The LSA is 22,500 hectares and review of AMAX (1983) indicates a potential for 17 plant communities to exist in the area. The size of the LSA and the project objectives suggests Level 4 survey intensity (RISC 1998). A Level 4 survey intensity protocol includes inspection of 15% to 25% of polygons at a ratio of 5 full plots, 20 ground inspections and 75 visual inspections. Suggested mapping scale is 1:20,000 to 1:50,000. Review of reports and maps for the area indicate that polygon size would be medium to large, therefore, it was estimated that there would be 375 polygons with an average size of 60 hectares. Typical range of polygon size for that scale of mapping is 2 to 80 ha. Based on this information it was estimated that 75 plots would be required at a sampling intensity of 20%. This extrapolates into 4 full plots, 15 GIF plots, and 56 visual plots.

Vegetation field sampling was conducted by vegetation ecologist Mr. Jamie Slogan M.Sc., R.P.Bio. (EBA), between July 4th and 10th 2006 with the assistance of Mr. Jeff Matheson M.Sc., R.P.Bio. (EBA), Mr. Glen Rudman M.Sc. (EBA), and Mr. Dave Langlois (Ross River First Nation). Sampling of vegetation was completed using ground inspection forms (GIF's) -FS 212-2 (1) and visual inspections according to methodology outlined in the *Field Manual for Describing Terrestrial Ecosystems* (MoF 1998). Field data were collected using methods consistent with the Yukon Environment Ecosystem Classification form. Mapping of vegetation adhered to the *Standard for Terrestrial Ecosystem Mapping in British Columbia* (RIC 1998). All plot positions were recorded using a Garmin 76 Global Positioning System with accuracy of between 6-8 m. Guidelines and nomenclature for ecosystem land classification are presented in Section 1.3.1.1 Defining Ecosystem Land Classification Hierarchy. Initial assessment and nomenclature of ecosystem units are based on the 17 plant communities identified by Kershaw and Kershaw (1983) listed in Table 1.

The imagery used for the ELC mapping was created from one satellite image and the LSA for vegetation is based on the size of the image. The LSA consists of a tasked, ortho-rectified Quickbird image acquired August 21, 2006. The Quickbird satellite collects panchromatic imagery at 60-70 cm resolution and multi-spectral imagery at 2.4-2.8 m resolution. The acquired imagery has been shown in natural color and enhanced with panchromatic high resolution band to increase visual interpretation.

Identification and delineation of terrain and vegetation polygons was completed on-screen using ArcGIS version 9.1. All polygons were determined and mapped by Mr. Jamie Slogan, to ensure consistency with the field sampling program, with the help of Mr. Barry Pierce, Remote Sensing/GIS Specialist M.Sc., ADP (GIS). ELC was mapped at a nominal scale of 1:20,000 for the LSA. Ecosystem units were mapped according to best professional judgement based on clearly defined vegetation units at a resolution of 1:20,000. A quality assurance/quality control (QA/QC) review of the mapping was performed by comparing all ground data locations with mapped polygons. Each polygon was also checked after mapping to ensure all attributes met conditions for the classification hierarchy. In-field QA/QC of ELC will take place at a later date to be determined in tandem with a rare plant survey.

## 3.2 RARE PLANT SPECIES RECONNAISSANCE

An initial reconnaissance for rare plants was conducted on July 8th (Yukon) and July 9th (parts of NWT) 2006 in conjunction with the Ecosystem Land Classification field sampling. It is important to note that areas for development had not been determined at the time of the study and therefore, the purpose of this reconnaissance was to potentially supplement future rare plant surveys and determine potential for rare plants in the area.

Prior to conducting the rare plant reconnaissance, several sources (McJannet *et al.* 1995; Douglas *et al.* 1981) were used to compile a list of rare plants species for the Yukon and NWT the could potentially be present in the MacTung LSA. The reconnaissance included walking in a meandering fashion on foot through the area of interest. Sample plots were

established in areas historically planned for development (AMAX 1983) in order to map vegetation communities in the area and survey plants at a finer scale.

# 4.0 RESULTS

## 4.1 ECOSYSTEM LAND CLASSIFICATION AND VEGETATION INVENTORY

A total of 51 GIF plots and 26 visual plots were completed for a total of 77 sample plots with a sampling ratio of Full:GIF:Visual inspections of 0:66:34. The 77 plots sampled within 324 polygons (including 24 no data polygons) represent a sampling intensity of 23.8%. Average polygon size was determined to be 69.3 hectares. This meets the requirements for terrestrial ecosystem mapping (TEM) Level 4 survey. The sampling ratio was adjusted in the field to acquire the greatest amount of vegetation information as possible. There were less full plots recorded than initially planned because concurrent terrain and soils data were being collected by another team of scientists (see separate report on Terrain Mapping and Soils). In order to maximize field time, sampling concentrated on increasing the ratio of GIFs.

### 4.1.1 Defining Ecosystem Land Classification Hierarchy

Ecological land classification and mapping is based upon EBA (2003), Francis and Steffan (2003), Kershaw and Kershaw (1983) and Zoladeski *et al.* (1996). Table 2 shows the ecosystem land classification hierarchy for the MacTung LSA. As stated in the scope of work, Levels 1-3 (Figure 1), Level 4 (Figure 3), Level 5 (Figure 4) and Level 6 (Figures 5 and 6) were all defined (Table 2) and mapped.

TABLE 2: ECOSYSTEM CLASSIFICATION HEIRARCHY FOR THE MACTUNG LOCAL STUDY AREA

| Classification Level | | Unit Name | | Symbol |
|---|---|---|---|---|
| **1** | **Ecozone** | Taiga Cordillera | | TC |
| **2** | **Ecoregion** | Selwyn Mountains | | SM |
| **3** | **Ecodistrict** | Selwyn-Yukon | | YN |
| | | Selwyn-NWT | | NT |
| **4** | **Bioclimate** | Icefield | | ICF |
| | | Alpine | | ALP |
| | | Shrub Taiga | | STA |
| | | Wooded Taiga | | WTA |
| **5** | **Landscape** | Upland | Unclassified | -Uu |
| | | | Terrace | -Ut |
| | | | Depressional | -Ud |
| | | Lowland | Unclassified | -Lu |
| | | | Terrace | -Lt |
| | | | Riparian | -Lr |
| | | | Depressional | -Ld |

| TABLE 2: ECOSYSTEM CLASSIFICATION HEIRARCHY FOR THE MACTUNG LOCAL STUDY AREA | | | | |
|---|---|---|---|---|
| Classification Level | | Unit Name | | Symbol |
| | | | Braided | -Lb |
| **6** | **Vegetation** | **Plant Community** | **Notes** | **Unit Code** |
| | | Epilithic Lichen | Mainly bare rock/ lichen with spare dwarf shrub | EL |
| | | Fescue-Sedge (*Festuca-Carex*) | Dry alpine meadow | FC |
| | | Fescue –Willow (*Festuca-Salix*) | Moist alpine meadow | FS |
| | | Heath-Lichen (*Cassiope-Cladina*) | Dry, well drained heath/ dwarf shrub community | CC |
| | | Sedge –Bluebell (*Carex-Mertensia*) | Wet sedge meadow high in forbs and species richness | CM |
| | | Sedge –Cinquefoil (*Carex-Potentilla*) | Wetland in Dale Valley | CP |
| | | Willow – Sedge (*Salix-Carex*) | Dense willow riparian corridors | SC |
| | | Willow –Bluebell (*Salix-Mertensia*) | Open willow riparian corridors/ high elevation wet gentle slopes | SM |
| | | Willow (med/tall)-Slope (Salix-Slope) | Steep well drained slopes including avalanches chutes. | WS |
| | | Birch-Lichen (*Betula-Cladina*) | Dry, well drained, convex micro-topography | BC |
| | | Birch-Moss (*Betula*-Moss) | Moist, cool aspect, concave micro-topography | BM |
| | | Fir-Lichen (*Abies-Cladina*) | Dry, well drained, convex micro-topography | AC |
| | | Fir-Moss (*Abies*-Moss) | Moist, cool aspect, concave micro-topography | AM |
| | | Wetland | Unclassified wetland | WD |

### 4.1.2 Bioclimate Zones (Level 4)

There are four Bioclimate Zones in the Selwyn Mountains Ecoregion, but only three are present within the LSA. Icefields do not occur within the LSA, although this zone does occur immediately to the north at Keele Peak (Photo 1). All four Bioclimate Zones for the Taiga Cordillera are described here to help distinguish the characteristics of each Bioclimate

Zone. Characteristics of these Bioclimate Zones (Francis & Steffan 2003) are presented in Table 3.

***Icefield* (ICF):** *Highest elevations of mountain regions with extensive icefields. Most areas are covered by ice and bare rock: vegetated areas are limited. Due to regional precipitation regimes, the icefield bio-climate zone in Yukon is limited to the Kluane Region of southwest Yukon and isolated areas within major mountain ranges (Mackenzie and Selwyn Mountains).*

***Alpine* (ALP):** *High elevation mountain regions vegetated by dwarf shrubs, herb/cryptograms and low-growing and scattered krummholtz trees are the dominant vegetation condition. In high elevation areas, large areas may include bare rock, colluvium or ice/snow.*

***Shrub Taiga* (STA):** *High elevation Shrub Taiga replaces the term "Subalpine" in the northern Yukon. These areas are dominated by tall or low shrub vegetation or may have sparse or sporadic tree cover. These areas are generally influenced by arctic weather systems (ie. the east side of the Richardson Mountains).*

***Wooded Taiga* (WTA):** *Primarily coniferous forested areas with an open canopy. Wooded Taiga generally occurs in valley bottoms and lower slopes of mountain valleys or on plateaus and plains. The distribution and depth of permafrost is a major influence of vegetation distribution and dynamics. In steep terrain, slope processes help determine forested areas.*

TABLE 3: PERCENT COVER AND ELEVATION GUIDELINES FOR BIOCLIMATE ZONES WITHIN THE MACTUNG LOCAL STUDY AREA

| Bioclimate Zone | Percent Cover/ Area of LSA | Source | Upper Limit | | Lower Limit | |
|---|---|---|---|---|---|---|
| | | | Warm | Cool | Warm | Cool |
| **Alpine** | **65.5/ 14678.0 Ha** | Zoladeski *et al.* (1996) | x | x | 1650 | 1550 |
| | | Fieldwork (EBA 2006) | x | x | 1524 | 1450 (1405) |
| | | Final Elevation Used for Mapping | **x** | **x** | **1650** | **1550** |
| **Shrub Taiga** | **13.6/ 3045.5 Ha** | Zoladeski *et al.* (1996) | 1650 | 1550 | 1550 | 1450 |
| | | Fieldwork (EBA 2006) | 1616 | 1577 | 1372 | 1450 |
| | | Final Elevation Used for Mapping | **1650** | **1550** | **1500** | **1450** |
| **Wooded Taiga** | **21.0/ 4699.5 Ha** | Zoladeski *et al.* (1996) | 1550 | 1450 | x | x |
| | | Fieldwork (EBA 2006) | 1450 | 1450 | x | x |
| | | Final Elevation Used for Mapping | **1500** | **1450** | **x** | **x** |

Notes: cool aspect 285°-135°; warm aspect 135° -285°.

The distribution of Bioclimate Zones within the LSA is shown in Figure 2. The LSA is comprised of 65.5% Alpine, 13.6% Shrub Taiga, and 21.0% Wooded Taiga (Table 3).

### 4.1.3 Landscape Units (Level 5)

Landscape units (Level 5) of the Yukon framework are used to incorporate terrain/ landscape features into the mapping and classification framework (Figure 4). The first major division at the landscape level of the framework is defining Upland and Lowland areas. Upland is defined as *"any landform that is not influenced by the fluvial processes…"* (Francis & Steffan 2003) and includes depressional (d), terraced (t), and unclassified subtypes (u). Lowland is defined as *"any major lowland landform that is or has been influenced by active fluvial processes…"* (Francis & Steffan 2003) and includes braided (b), depressional (d), riparian (r), terraced (t), and unclassified subtypes (u). A summary of all landscape units is presented in Table 4 and 5.

TABLE 4: SUMMARY OF LANDSCAPE UNITS WITHIN THE LOCAL STUDY AREA

| Landscape Units | Polygons | Area (Ha) | Average Area (Ha) | Percent Cover |
|---|---|---|---|---|
| Upland unclassified | 9 | 19073.0 | 2119.2 | 84.9 |
| Lowland unclassified | 1 | 11.4 | 11.4 | 0.1 |
| Lowland terrace | 22 | 865.4 | 39.3 | 3.9 |
| Lowland riparian | 22 | 1168.7 | 53.1 | 5.2 |
| Lowland depressional | 12 | 187.0 | 15.6 | 0.8 |
| **Total** | **66** | **22467.8** | **340.4** | **94.9** |

| TABLE 5: SUMMARY OF LANDSCAPE UNITS WITHIN BIOCLIMATE ZONES OF THE LOCAL STUDY AREA | | | | |
|---|---|---|---|---|
| Landscape Units | Polygons | Area (Ha) | Average Area (Ha) | Percent Cover |
| Alpine | | | | |
| Upland unclassified | 12 | 13736.6 | 1144.7 | 61.1 |
| Lowland riparian | 20 | 301.0 | 15.0 | 1.3 |
| Shrub Taiga | | | | |
| Upland unclassified | 46 | 2392.5 | 52.0 | 10.6 |
| Lowland riparian | 16 | 484.4 | 30.3 | 2.2 |
| Lowland depressional | 1 | 45.8 | 45.8 | 0.2 |
| Wooded Taiga | | | | |
| Upland unclassified | 15 | 2944.0 | 196.3 | 13.1 |
| Lowland unclassified | 1 | 11.4 | 11.4 | 0.1 |
| Lowland terrace | 22 | 865.4 | 39.3 | 3.9 |
| Lowland riparian | 7 | 383.3 | 54.8 | 1.7 |
| Lowland depressional | 11 | 141.3 | 12.8 | 0.6 |
| Other | | | | |
| Water | 6 | 44.8 | 7.5 | 0.2 |
| No Data | 25 | 1117.3 | 44.7 | 5.0 |
| **Total** | **182** | **22467.8** | **123.4** | **100** |

Notes: * Average Area (Ha) and Percent Cover include No Data.

Alpine landscape units comprised 62.6% of the LSA, with 61.1% Upland unclassified (41.5% exposed rock), and 1.3% Lowland riparian (Tables 4 and 5). Exposed rock correlates with high elevation mountain peaks and epilithic lichen communities. The Alpine-Upland unclassified represents all vegetated terrains that are not glacial-fluvial terraces, or depressional areas such as lakes and wetlands. Alpine-Upland unclassified units generally consist of high elevation alpine meadows and dwarf shrub communities. Alpine-Lowland riparian areas occur adjacent to waterways and experience active flooding.

Shrub Taiga landscape units comprised 13.0% of the LSA., with 10.6% Upland unclassified (0.1% exposed rock), 2.2% Lowland riparian, and 0.2% Lowland depressional (Tables 4 and 5). Most of the Northwest Territories LSA appears limited to Shrub Taiga which is likely due to effects of cold air drainage and limited soil moisture from the local climatic impact of the surrounding high mountain peaks. Areas of exposed rock in the Shrub Taiga correlate with high elevation transition areas between the Alpine and Shrub Taiga along with rock slides. The Shrub-Upland unclassified represents all vegetated terrain types that are not glacial-fluvial terraces, or depressional areas such as lakes and wetlands. Shrub-upland unclassified units generally consist of scrub birch and willow dominated vegetation communities. Shrub-Lowland riparian areas occur adjacent to waterways and experience

active flooding. These plant communities are dominated by willows and have either a diverse forb understory, where soils are rich and canopy is open, or sedge dominated understory where the canopy is closed. Shrub depressional areas include graminoid dominated wetlands.

Wooded Taiga landscape units comprised 19.4% of the LSA., with 13.0% Upland unclassified (0.1% exposed rock), 3.9% Lowland terrace, 1.7% Lowland riparian, and 0.6% Lowland depressional (Tables 4 and 5). The Wooded Taiga is limited in the LSA to the Yukon Territory and low lying areas of the southeast Northwest Territories. Exposed rock correlates with rock slides. The Wooded-Upland unclassified represents all vegetated terrains that are not glacial-fluvial terraces, or depressional areas such lakes and wetlands. Wooded-upland unclassified units generally consist of alpine fir with a moss or lichen understory. Wooded-terraced areas are elevated benches within the lowland environment that are rarely flooded, if ever, but have been formed by glacial fluvial processes. Terraced area are well-drained and found in the Yukon LSA mainly vegetated by scrub birch-lichen communities. Wooded-lowland riparian areas occur adjacent to waterways and experience active flooding. These plant communities are dominated by willows and have either a diverse forb understory where soils are rich and canopy is open or sedge dominated understory where the canopy is closed. Areas in the Hess Tributary appear to have black spruce intermixed among the alpine fir (Photo 2). Wooded-Lowland depressional areas include wetlands consisting of swamps, fens, and bogs.

### 4.1.4 Vegetation (Level 6) and Ecosystem (Level 7) Units

Vegetation and ecosystem units are the most detailed levels of classification according to the YCEMF (2003). For the purposes of this report, vegetation units and map units are interchangeable, while ecosystem units incorporate details of stand composition, aspect, and soil drainage. Data on vegetation units (Level 6) and ecosystem units (Level 7) were collected for the MacTung LSA with vegetation units mapped and presented in Figure 5. A summary of the current and historical vegetation classification is presented in Table 6, with full descriptions presented below (Table 7). A summary of the results obtained from mapping vegetation units at a 1:20,000 scale are presented in Table 7, Figure 5, and Figure 6. Detailed analysis of ecosystem units (that include aspect and soil modifiers) are not discussed herein; however all plot data were classified to this level and results are presented in Appendix B.

TABLE 6: SUMMARY OF HISTORICAL CLASSIFICATION FOR VEGETATION UNITS OF THE MACTUNG AREA

| Vegetation Unit (EBA 2006) | Unit Code | Notes | Kershaw and Kershaw 1983 | Zoladeski *et al*. (1996) |
|---|---|---|---|---|
| Alpine | | | | |
| Epilithic Lichen | EL | Mainly bare rock/ lichen with spare dwarf shrub | Epilithic Lichen | V301 Crustose lichen |
| Fescue-Sedge (*Festuca-Carex*) | FC | Dry alpine meadow | Alpine lichen grass | V201 Dry grass Herb |
| Fescue –Willow (*Festuca-Salix*) | FS | Moist alpine meadow | Alpine meadow | V202 Mesic grass herb |
| Heath-Lichen (*Cassiope-Cladina*) | CC | Dry, well drained heath/ dwarf shrub community | Cushion plant<br>Heath-Lichen | V115 White heather/ dwarf shrub |
| Shrub Taiga | | | | |
| Sedge –Bluebell (*Carex-Mertensia*) | CM | Wet sedge meadow high in forbs and species richness | Forb meadow | V208 Mesic forb |
| Sedge – Cinquefoil (*Carex-Potentilla*) | CP | Wetland in Dale Valley | Sedge meadow | V206 Wet sedge Herb |
| Willow – Sedge (*Salix-Carex*) | SC | Dense willow riparian corridors | Riparian willow | NA |
| Willow – Bluebell (*Salix-Mertensia*) | SM | Open willow riparian corridors/ high elevation wet gentle slopes | Willow forb | V104 Willow medium/ tall shrub |
| Birch-Lichen (*Betula-Cladina*) | BC | Dry, well drained, convex micro-topography | Birch-Lichen | V101 shrub birch medium/ tall |
| Birch-Moss (*Betula*-Moss) | BM | Moist, cool aspect, concave micro-topography<br>Wet, riparian areas intermixed with black spruce | Birch-Moss<br>Birch-Spruce | V101 shrub birch medium/ tall |
| Wooded Taiga | | | | |
| Fir-Lichen (*Abies-Cladina*) | AC | Dry, well drained, convex micro-topography<br>In high elevation transition area between STA and WTA | Fir-Lichen<br>Krummholz | V16 Open alpine fir<br>V109 V16 alpine fir medium/ tall shrub |
| Fir-Moss (*Abies*-Moss) | AM | Moist, cool aspect, concave micro-topography | Fir-Moss | V16 Open Alpine fir |
| Willow (med/tall)-Slope | WS | Steep well drained slopes including avalanches chutes. | Willow forb | V104 Willow medium/ tall shrub: Avalanche chute |

Thirteen distinct vegetation units/ map units and 10 complex polygon associations were mapped based on sampling performed by EBA in 2006. Complex polygons were used when distinct vegetation units were not mappable with confidence at a 1:20,000 level. Complex polygons are limited to two map units and are assumed to occur as 50% Map Unit 1:50% Map Unit 2. Complex polygons are not described in Table 7 as they are formed as a result of small-scale changes in microtopography, aspect, soil conditions and slope which create a patchwork of the broader vegetation units explained below. The map units with the greatest percent cover of the LSA are: epilithic lichen 41.7%, heath-lichen 13.7%, fir-lichen: fir-moss 6.7%, birch-lichen 5.8%, fescue-willow 3.4%, and fescue-sedge 3.3%.

TABLE 7: DESCRIPTION OF MAPPED VEGETATION UNITS WITHIN THE MACTUNG LOCAL STUDY AREA

| Vegetation Unit | Unit Code | Description |
|---|---|---|
| Alpine | | |
| Epilithic Lichen | EL | The epilithic lichen vegetation unit (Photo 3) represents 41.7% or 9,275.5 Ha of the LSA with an average polygon size of 371 Ha. These areas are mainly exposed bare rock or talus covered with crustose lichen communities that occur above 1,650 m a.s.l.. At lower elevations, dwarf shrub species and graminoid species may be observed sporadically. |
| Fescue-Sedge | FC | The fescue-sedge vegetation unit (Photo 4) represents 3.3% or 734.1 Ha of the LSA with an average polygon size of 18.4 Ha. These areas are dry alpine meadows observed in the alpine between 1,870 m a.s.l. and 1,515 m a.s.l. in Yukon and at lower elevations in the NWT. The vegetation unit is dominated by Festuca altaica and Cladina species, although, Carex and Poa species may occur in high abundance on moister soils. These sites are generally on exposed, well drained soils, convex micro-topography and/or warm aspects. |
| Fescue –Willow | FS | The Fescue-Salix vegetation unit (Photo 5) represents 3.4% or 752.9 Ha of the LSA with an average polygon size of 26.9 Ha. These areas are moist alpine meadows observed in the alpine between 1,780 and 1,590 m a.s.l. in Yukon and 1,650-1,600 m a.s.l. in the NWT. The vegetation unit is dominated by fescue (Festuca altaica) and moss species, although, sedge (Carex), hairgrass (Deschampsia), and rush (Luzula) species may occur in high abundance. These sites are characterized by the occurrence of dwarf shrub species such as Salix arctica, Salix reticulata, and Salix barrattianna. Fescue-Salix vegetation units are generally less exposed than Fescue-Sedge and occur on well drained soils, concave micro-topography and cool aspects. |
| Heath-Lichen | CC | The Heath-Lichen vegetation unit (Photo 6) represents 13.7% or 3052.9 Ha of the LSA with an average polygon size of 40.2 Ha. These areas are dwarf shrub communities observed in the alpine of the Yukon and the NWT between 1,760 m a.s.l. and 1405 m a.s.l.. The vegetation unit is dominated by dwarf shrub species mountain heather (Cassiope tetragona, Phyllodoce species), crowberry (Empetrum nigrum), Lingonberry (Vaccinium vitis idea), and lichen species. Few plants grow taller than 20 cm high. These sites are generally on exposed and well drained soils. |

| TABLE 7: DESCRIPTION OF MAPPED VEGETATION UNITS WITHIN THE MACTUNG LOCAL STUDY AREA | | |
|---|---|---|
| Vegetation Unit | Unit Code | Description |
| Shrub Taiga | | |
| Sedge–Bluebell | CM | The Sedge-Mertensia vegetation (Photo 7) unit represents 0.8% or 173.8 Ha of the LSA with an average polygon size of 13.4 Ha. These areas were observed in the lower Alpine and Shrub Taiga of the Yukon and the NWT between 1,620 m a.s.l. and 1,370 m a.s.l.. The vegetation unit is dominated by Carex podocarpa and a diverse mix of forbs including Mertensia paniculata, Senecio triangularis, Artemesia arctica, and Polemonium acutiflorum. These sites are generally gentle sloping, with moderately drained submesic to mesic soils, in sheltered valleys. This unit is similar to Willow-Mertensia and may occur at higher elevations with submesic soils. |
| Birch-Lichen | BC | The Birch-Lichen vegetation unit (Photo 11) represents 5.8% or 1,289.4 Ha of the LSA with an average polygon size of 22.2 Ha. These areas were observed in the Shrub Taiga of the Yukon and the NWT between 1,530 m a.s.l. and 1,350 m a.s.l. and in the Wooded Taiga mainly on upland terraces in the Yukon between 1,406 and 1,175 m a.s.l.. The vegetation unit is dominated by scrub birch (Betula nana) and lichen species (Cladina, Cetraria, and Cladonia). On upland terraces in the Yukon *Ledum decumbens* occurred with high abundance. These sites are generally on exposed well drained soils, convex micro-topography and/or warm aspects. |
| Birch-Moss | BM | The Birch-Moss vegetation unit (Photo 12) represents 2.8% or 622.8 Ha of the LSA with an average polygon size of 32.8 Ha. These areas were observed in the Shrub Taiga of the Yukon and the NWT between 1,420 m a.s.l. and 1,385 m a.s.l. The vegetation unit is dominated by scrub birch (Betula nana) and a moss understory (Hylocomnium splendens and Polytrichum commune). Birch-Moss is generally favoured on sheltered, moist, well drained soils, concave micro-topography and/or cool aspects. |
| Sedge –Cinquefoil | CP | The Sedge-Potentilla vegetation unit (Photo 8) represents 0.1% or 16.4 Ha of the LSA with an average polygon size of 16.4 Ha. This area was observed in the Shrub Taiga of the NWT at 1,482 m a.s.l. The vegetation unit is dominated by Carex aquatilis with a minor component of Carex podocarpa and Potentilla palustris. These sites are generally depressional to flat areas with poorly drained, subhygric soils in valleys bottoms. The groundcover was mainly Sphagnum species. |
| Willow – Sedge | SC | The Willow-Sedge vegetation unit (Photo 9) represents 1.5% or 324.1 Ha of the LSA with an average polygon size of 15.4 Ha. The Willow-Sedge unit occurs adjacent to streams and rivers in floodplains. These areas were observed in the Shrub Taiga of the NWT between 1,500 m a.s.l. and 1,450 m a.s.l. and the Wooded Taiga of the Yukon between 1,300 and 1,150 m a.s.l. The dense canopy is dominated by medium to tall willow species Salix alaxensis, Salix planifolia, and Salix glauca. The understory is characterized by sedge species (Carex aquatilis and C. podocarpa), Equisetum species, and moss species. These sites are generally flat, |

| TABLE 7: DESCRIPTION OF MAPPED VEGETATION UNITS WITHIN THE MACTUNG LOCAL STUDY AREA | | |
|---|---|---|
| Vegetation Unit | Unit Code | Description |
| | | moderately to well drained, with submesic to mesic soils. |
| Willow –Bluebell | SM | The Willow-Mertensia vegetation unit (Photo 10) represents 2.3% or 516.0 Ha of the LSA with an average polygon size of 17.2 Ha. The Willow-Mertensia unit occurs adjacent to streams and seepage areas. These areas were observed in the lower Alpine and Shrub Taiga of the Yukon and the NWT between 1,525 m a.s.l. and 1,455 m a.s.l. and in the Wooded Taiga at 1,400 m a.s.l.. The dense canopy is dominated by medium to tall willow species Salix planifolia, Salix glauca, Salix alaxensis, and Salix barrattianna. The understory is a diverse mix of forbs including Mertensia paniculata, Senecio triangularis, Artemesia arctica, and Polemonium acutiflorum. These sites are generally gentle sloping, moderately drained, with moist to wet soils, in sheltered valleys. |
| Wetland | WD | The Wetland vegetation units (Photo 17) represent 0.8% or 180.9 Ha of the LSA with an average polygon size of 12.9 Ha. In the southeast LSA along the North Canol Road graminoid and shrubby fens were observed in the Wooded Taiga along the Macmillan River at elevations of 1,300 m a.s.l.. These fens were observed to be dominated by willow and Sphagnum species. Other wetland areas include low-lying depressions along the Hess River where poor drained soils support shrubby fens and intermixed with black spruce |
| Wooded Taiga | | |
| Fir-Lichen | AC | The Fir-Lichen vegetation unit (Photo 13) represents 2.1% or 471 Ha of the LSA with an average polygon size of 52.3 Ha. These areas were observed in the Wooded Taiga of the Yukon and the NWT between 1,445 m a.s.l. and 1,370 m a.s.l. The vegetation unit is dominated by alpine fir (Abies lasiocarpa) and lichen species. The canopy is usually open and may a have Scrub birch B2 layer. These sites are generally on exposed, well drained soils, convex micro-topography and/or warm aspects. |
| Fir-Moss | AM | The Fir-Moss vegetation unit (Photo 14) represents 1.8% or 394.3 Ha of the LSA with an average polygon size of 78.9 Ha. These areas were observed in the Wooded Taiga of the Yukon between 1,450 m a.s.l. and 1,200 m a.s.l. The vegetation unit is dominated by alpine fir (Abies lasiocarpa) and a moss understory (Hylocomnium splendens and Polytrichum commune). Percent canopy cover is higher than in the Fir-Lichen vegetation unit. Fir-Moss is generally favoured on sheltered, moist, well drained soils, concave micro-topography and/or cool aspects. This community also occurs adjacent to seeps streams. |
| Willow (med/tall)-Slope | WS | The Willow-Slope vegetation unit (Photo 15) represents 0.8% or 179.0 Ha of the LSA with an average polygon size of 8.9 Ha. These areas were observed on steep slopes such as avalanche chutes (Photo 16) in the Wooded Taiga of the Yukon between 1,450 m a.s.l. and 1,250 m a.s.l. The dense canopy is dominated by medium to tall willow species Salix planifolia, Salix alaxensis, and Salix glauca. An understory alpine fir was |

| TABLE 7: DESCRIPTION OF MAPPED VEGETATION UNITS WITHIN THE MACTUNG LOCAL STUDY AREA | | |
|---|---|---|
| Vegetation Unit | Unit Code | Description |
| | | observed in the NWT along the Canol Road in the southeast portion of the LSA. The herbaceous (c) layer is characterized by sedge species (Carex aquatilis and C. podocarpa), Salix reticulata, and/ or a mix of forbs. These sites are steep slopes, with well drained, with submesic to xeric soils. |
| Other | | |
| Water | WR | At least six small lakes were identified throughout the LSA including Cirque Lake to the north of the mine site. Lakes accounted for 0.2% of the LSA or 44.8 Ha with an average size 7.5 Ha. |
| No Data | ND | No data includes 16 areas which were unmappable due to cloud cover and shadow effects. A total of 3.6% or 793.3 Ha of the LSA was classified as no data with an average polygon size of 0.2 Ha. |

| TABLE 8: SUMMARY OF MAPPED VEGETATION UNITS WITHIN THE MACTUNG LOCAL STUDY AREA | | | | | |
|---|---|---|---|---|---|
| Vegetation Unit | Unit Code | Polygons | Area (Ha) | Average Area (Ha) | Percent Cover |
| Alpine | | | | | |
| Epilithic Lichen | EL | 12 | 9243.0 | 770.3 | 41.1 |
| Fescue-Sedge | FC | 24 | 734.0 | 30.6 | 3.3 |
| Fescue-Sedge: Birch-Lichen | FC:BC | 2 | 76.4 | 38.2 | 0.3 |
| Fescue-Sedge: Fescue –Willow | FC:FS | 4 | 142.3 | 35.6 | 0.6 |
| Fescue –Willow | FS | 23 | 750.3 | 32.6 | 3.3 |
| Fescue –Willow: Willow – Slope | FS:WS | 1 | 45.0 | 45.0 | 0.2 |
| Heath-Lichen | CC | 61 | 3052.0 | 50.0 | 13.6 |
| Heath-Lichen: Fescue-Sedge | CC:FC | 11 | 550.7 | 50.1 | 2.5 |
| Shrub Taiga | | | | | |
| Sedge–Bluebell | CM | 11 | 173.8 | 15.8 | 0.8 |
| Sedge–Bluebell: Birch-Moss | CM:BM | 2 | 61.1 | 30.5 | 0.3 |
| Birch-Lichen | BC | 45 | 1277.5 | 28.4 | 5.7 |
| Birch-Lichen: Fir-Lichen | BC:AC | 7 | 343.6 | 49.1 | 1.5 |
| Birch-Lichen: Fir-Moss | BC:AM | 1 | 365.0 | 365.0 | 1.6 |
| Birch-Lichen: Birch- | BC:BM | 10 | 232.7 | 23.3 | 1.0 |

TABLE 8: SUMMARY OF MAPPED VEGETATION UNITS WITHIN THE MACTUNG LOCAL STUDY AREA

| Vegetation Unit | Unit Code | Polygons | Area (Ha) | Average Area (Ha) | Percent Cover |
|---|---|---|---|---|---|
| Moss | | | | | |
| Birch-Moss | BM | 13 | 619.8 | 47.7 | 2.8 |
| Birch-Moss: Fir-Moss | BM:AM | 1 | 101.1 | 101.1 | 0.4 |
| Sedge –Cinquefoil | CP | 1 | 16.4 | 16.4 | 0.1 |
| Willow – Sedge | SC | 8 | 324.1 | 40.5 | 1.4 |
| Willow –Bluebell | SM | 15 | 515.0 | 34.3 | 2.3 |
| Marsh/ Fen | WD | 14 | 180.9 | 12.9 | 0.8 |
| Wooded Taiga | | | | | |
| Fir-Lichen | AC | 10 | 468.4 | 46.8 | 2.1 |
| Fir-Lichen: Fir-Moss | AC:AM | 4 | 1475.0 | 368.8 | 6.6 |
| Fir-Moss | AM | 4 | 379.8 | 94.9 | 1.7 |
| Willow (med/tall)-Slope | WS | 10 | 178.0 | 17.8 | 0.8 |
| **Total** | | **294** | **21305.7** | **72.5** | **94.8** |
| Other | | | | | |
| Water | WR | 6 | 44.8 | 7.5 | 0.2 |
| No Data | ND | 24 | 1117.3 | 46.6 | 5.0 |
| **Total** | | **324** | **22467.9** | **69.3** | **100** |

### 4.1.5 Plant Species

Species observed during the 2006 field season are listed in Table 9. A list of plant species expected from historical studies is presented in Appendix B with nomenclature according to Cody (1996). A summary of all vegetation data recorded is presented in Appendix C. One hundred twenty three different plants were recorded within the 51 ground inspection plots. Twenty-nine of these recorded plants were identified only to genus and are assumed to be different than those identified to species.

TABLE 9: LIST OF PLANT SPECIES RECORDED BY EBA DURING THE 2006 FIELD SEASON IN THE MACTUNG LOCAL STUDY AREA

| Latin Name | Common Name | Latin Name | Common Name | Latin Name | Common Name |
|---|---|---|---|---|---|
| *Abies lasiocarpa* | subalpine fir | *Festuca altaica* | Altai fescue | *Rhizocarpon sp.* | N/A |
| *Aconitum delphiniifolium* | mountain monkshood | *Gentiana glauca* | glaucous gentian | *Rhodobryum roseum* | rose-moss |
| *Agoseris* | orange agoseris | *Geum* | large-leaved | *Ribes sp.* | currant or |

TABLE 9: LIST OF PLANT SPECIES RECORDED BY EBA DURING THE 2006 FIELD SEASON IN THE MACTUNG LOCAL STUDY AREA

| Latin Name | Common Name | Latin Name | Common Name | Latin Name | Common Name |
|---|---|---|---|---|---|
| *aurantiaca* | | *macrophyllum* | avens | | gooseberry |
| *Agoseris sp.* | N/A | *Hedysarum alpinum* | alpine hedysarum | *Rosa acicularis* | prickly rose |
| *Alopecurus alpinus* | alpine meadow-foxtail | *Hierochloë alpina* | alpine sweetgrass | *Rubus arcticus* | nagoonberry |
| *Anemone cylindrical* | long-headed anemone | *Hylocomium sp.* | wood-moss | *Rubus chamaemorus* | cloudberry |
| *Anemone narcissiflora* | narcissus anemone | *Hylocomium splendens* | step moss | *Rumex sp.* | Dock |
| *Anemone parviflora* | northern anemone | *Juniperus communis* | common juniper | *Salix alaxensis* | Alaska willow |
| *Arctostaphylos alpine* | alpine bearberry | *Linnaea borealis* | twinflower | *Salix arctica* | arctic willow |
| *Artemisia norvegica* | mountain sagewort | *Lupinus arcticus* | arctic lupine | *Salix barrattiana* | Barratt's willow |
| *Astragalus sp.* | N/A | *Lycopodiaceae* | Club moss | *Salix glauca* | grey-leaved willow |
| *Aulacomnium acuminatum* | N/A | *Lycopodium sp.* | clubmoss | *Salix planifolia* | plane-leaved willow |
| *Aulacomnium sp.* | groove-moss | *Mertensia paniculata* | tall bluebells | *Salix reticulata* | net-veined willow |
| *Betula nana* | scrub birch | *Myosotis asiatica* | mountain forget-me-not | *Salix sp.* | willow |
| *Calamagrostis Canadensis* | bluejoint reedgrass | *Myosotis sp.* | N/A | *Saxifraga sp.* | saxifrage |
| *Campanula rotundifolia* | common harebell | *Oryzopsis sp.* | N/A | *Saxifraga lyallii* | red-stemmed saxifrage |
| *Carex albo-nigra* | two-toned sedge | *Oxyria digyna* | mountain sorrel | *Saxifraga nelsoniana* | dotted saxifrage |
| *Carex aquatilis* | water sedge | *Parnassia fimbriata* | fringed grass-of-Parnassus | *Selaginella sp.* | N/A |
| *Carex podocarpa* | graceful mountain sedge | *Pedicularis bracteosa* | bracted lousewort | *Senecio lugens* | black-tipped groundsel |
| *Carex sp.* | sedge | *Pedicularis sp.* | lousewort | *Senecio triangularis* | arrow-leaved groundsel |
| *Cassiope mertensiana* | white mountain-heather | *Pedicularis labradorica* | Labrador lousewort | *Senecio vulgaris* | common groundsel |
| *Cassiope tetragona* | four-angled mountain-heather | *Peltigera sp.* | pelt lichens | *Shepherdia canadensis* | soopolallie |

TABLE 9: LIST OF PLANT SPECIES RECORDED BY EBA DURING THE 2006 FIELD SEASON IN THE MACTUNG LOCAL STUDY AREA

| Latin Name | Common Name | Latin Name | Common Name | Latin Name | Common Name |
|---|---|---|---|---|---|
| *Cerastium sp.* | chickweed | *Petasites frigidus* | sweet coltsfoot | *Silene acaulis* | moss campion |
| *Cetrariella sp.* | N/A | *Phyllodoce empetriformis* | pink mountain-heather | *Solidago sp.* | goldenrod |
| *Cetraria sp.* | Iceland moss lichens | *Pleurozia sp.* | N/A | *Sonchus sp.* | N/A |
| *Cladonia bellidiflora* | toy soldiers | *Pleurozium sp.* | feathermoss | *Sphagnum sp.* | peat-moss |
| *Cladina sp.* | reindeer lichens | *Pleurozium schreberi* | red-stemmed feathermoss | *Spiraea sp.* | |
| *Cladina mitis* | lesser green reindeer | *Poa sp.* | bluegrass | *Spiraea betulifolia* | birch-leaved spirea |
| *Cladonia sp.* | clad lichens | *Polemonium acutiflorum* | tall Jacob's-ladder | *Stellaria longipes* | long-stalked starwort |
| *Cladina stellaris* | star-tipped reindeer | *Polytrichum sphaerothecium* | Star moss | *Stellaria longifolia* | long-leaved starwort |
| *Danthonia spicata* | poverty oatgrass | *Polytrichum sp.* | haircap moss | *Stereocaulon condensatum* | granular soil-foam |
| *Delphinium glaucum* | tall larkspur | *Polygonum viviparum* | alpine bistort | *Stereocaulon depressum* | creeping foam |
| *Deschampsia cespitosa* | tufted hairgrass | *Potentilla anserina* | common silverweed | *Stereocaulon sp.* | foam lichens |
| *Dryas integrifolia* | entire-leaved mountain-avens | *Potentilla sp.* | N/A | *Thalictrum occidentale* | western meadow rue |
| *Dryas octopetala* | white mountain-avens | *Pyrola sp.* | Wintergreen | *Vaccinium uliginosum* | bog blueberry |
| *Empetrum nigrum* | crowberry | *Pyrola minor* | lesser wintergreen | *Vaccinium vitis-idaea* | Lingonberry |
| *Epilobium angustifolium* | fireweed | *Ranunculus eschscholtzii* | subalpine buttercup | *Vahlodea atropurpurea* | mountain hairgrass |
| *Epilobium latifolium* | broad-leaved willowherb | *Ranunculus sp.* | buttercup | *Valeriana sitchensis* | Sitka valerian |
| *Equisetum arvense* | common horsetail | *Rhizocarpon atroflavescens* | N/A | *Veratrum viride* | Indian hellebore |
| *Equisetum pretense* | meadow horsetail | *Rhizocarpon obscuratum* | N/A | *Viola sp.* | violet |
| | | | | *Zigadenus elegans* | mountain death-camas |

## 4.2 RARE PLANTS AND RARE PLANT COMMUNITIES

A literature search and field reconnaissance for protected areas and rare, sensitive, and/or endangered species plant species was conducted for the study (Table 10). There are no national parks, territorial parks, habitat protection or wildlife management zones in the area of the MacTung Project LSA. EBA consulted the *Species at Risk Act* (SARA) database, *The Rare and Vascular Plants of the Yukon*. (Douglas *et al.* 1981) and *Rare Vascular Plants in the Northwest Territories* (McJannet *et. al.* 1995) as part of a search for rare vascular plants. A list of potential rare plant species with species observed is presented in Table 10.

TABLE 10: LIST OF POTENTIAL RARE PLANT SPECIES FOR THE MACTUNG LOCAL STUDY AREA

| Yukon | | | |
|---|---|---|---|
| Species | Habitat | Location[1] | Observed |
| *Angelica lucida* | sub-alpine meadow | YT | |
| *Arnica parryi* | alpine, steep ravines, ledges | YT | |
| *Carex albo nigra* | dry alpine tundra | YT | ✓ |
| *Carex arcta* | woodland bogs, marshes | YT | |
| *Listera cordata* | alpine meadows near timberline | YT | |
| *Phylodoce glanduliflora* | alpine/sub-alpine slopes-moist | YT | |
| *Poa porsildii* | alpine/sub-alpine slopes-moist | YT/NWT[2] | |
| *Polystichum lonchitis* | limestone cliffs, rocky/talus slopes | YT | |
| *Rubus arcticus* | alpine and sub-alpine meadows | YT | ✓ |
| *Salix arctophila* | wet/dry mossy tundra | YT | |
| *Saxifraga aizoides* | Moist calcareous. and gravel | YT | |
| *Phegopteris connectilis* | alpine cliff ledges/rocky slopes | YT/NWT[2] | |
| *Woodsia ilvensis* | dry cliffs/talus slopes | YT | |
| Northwest Territories | | | |
| *Species* | Habitat | Location[2] | Observed |
| *Antennaria friesiana ssp. Alaskana* | Arctic-alpine | YT/NWT | |
| *Arnica mollis* | alpine meadows and slopes | YT/NWT | |
| *Draba ogilviensis* | Montane/alpine meadows | YT/NWT | |
| *Draba porsildii* | Montane/alpine meadows/scree | YT/NWT | |
| *Minuartia macrocarpa* | Arctic - alpine | NWT | |
| *Podisteva macounii* | ridgetops/rock | YT/NWT | |
| *Ranunculus turneri* | sub-alpine meadows | YT/NWT | |
| *Rumex acetosa* | Arctic-alpine moist meadows | YT/NWT | |
| *Viola selkirkii* | alpine tundra | YT/NWT | |
| *Eritrichium slendons* | arctic-alpine scree slopes ledges | YT/NWT | |
| *Festuca lenensis (ovina ssp alaskana)* | dry tundra | YT/NWT | |

| TABLE 10: LIST OF POTENTIAL RARE PLANT SPECIES FOR THE MACTUNG LOCAL STUDY AREA | | | |
|---|---|---|---|
| Yukon | | | |
| Species | Habitat | Location[1] | Observed |
| *Koeleria astiatica* | Shale scree/dry tundra | YT/NWT | |
| *Minuartia yukonensis* | arctic-alpine scree slopes ledges | YT/NWT | |

Notes: [1] from Douglas *et. al.* 1981.

[2] from McJannet *et. al.*1995.

A list of rare plant communities does not currently exist for the MacTung LSA. In general, wetlands and arctic/alpine communities are considered sensitive communities. Wetlands and riparian areas have a higher potential for rare plants, high wildlife habitat value, are sensitive to potential contamination drainage, are very sensitive to disturbance and may take above average lengths of time to reclaim. Alpine plant communities also have a higher potential for rare plants, are very sensitive to disturbance and may take above average lengths of time to reclaim. Wetland and riparian areas in the Local Study Area should be considered as sensitive plant communities.

## 5.0 SUMMARY

The following is a summary of the Vegetation and Ecosystem Land Classification conducted for the 2006 Environmental Baseline Studies for the MacTung Project.

- The MacTung Project Local Study Area is located in the Selwyn Mountain Range where the Canol Road crosses the Yukon Northwest Territories boundary. Mapping of bioclimate zones for the LSA show that the Alpine represents 65.5%, the Shrub Taiga represents 13.6% and the Wooded Taiga represents 21.0% of the LSA;
- A total of 51 GIF plots and 26 visual plots were completed for a total of 77 sample plots. The 77 plots sampled within 324 polygons (including 24 no data polygons) represent a sampling intensity of 23.8%. Average polygon size was determined to be 69.3 hectares;
- Thirteen distinct vegetation units/map units and 10 complex polygon associations were mapped at a scale of 1:20,000 based on sampling performed by EBA in 2006. The map units with the greatest percent cover of the LSA are: epilithic lichen 41.7%, heath-lichen 13.7%, fir-lichen:fir-moss 6.7%, birch-lichen 5.8%, fescue-willow 3.4%, and fescue-sedge 3.3%;
- One hundred twenty three different plants were recorded within the 51 ground inspection plots. Twenty-nine of these recorded plants were identified only to genus and are assumed to be different than those identified to species.
- Initial reconnaissance indicates there is a potential for 26 rare plant species to occur in the LSA. Two rare species (*Rubus arcticus* and *Carex albo-nigra*) were observed in the LSA,

but not in areas that historically have been considered for the proposed footprint of the mine. A list of rare plant communities does not currently exist for the MacTung Project LSA. In general, wetlands and arctic/ alpine communities are considered sensitive communities;

- There are no national parks, territorial parks, habitat protection or wildlife management zones in the area of the MacTung Project LSA.; and
- Various wetlands and riparian areas have been identified in the LSA. Two areas may be potentially impacted by the proposed project footprint area of the mine include the wetlands in the Upper Dale Valley, NWT and a small marsh and riparian area in the upper valley in the Yukon Territory.

Once the MacTung Project footprint has been determined, EBA recommends the following studies be performed:

- A site-specific rare plant survey be conducted in the area of the proposed MacTung Project infrastructure footprint;
- Baseline information be collected relating to trace element concentrations in vegetation in order to supplement cumulative effects modelling and any impact assessments of the MacTung Project; and
- In field Quality assurance/ Quality control (QA/QC) of the ELC mapping be performed.

## 6.0 CLOSURE

EBA is pleased to present the North American Tungsten Corporation Ltd. with this 2006 Vegetation and Ecosystem Land Classification Report for the MacTung Project. The survey objective was to conduct Ecological Land Classification, inventory vegetation and plant communities, assess the potential for rare plants and identify any wetlands within the Local Study Area. We are confident the information presented here will support future regulatory submissions leading to project approvals and production.

Respectfully submitted,
EBA Engineering Consultants Ltd.

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Intermediate Environmental Scientist

Reviewed by:

Jeff Matheson, M.Sc. R.P.Bio
Senior Environmental Scientist

Richard Hoos, M.Sc., R.P.Bio.
Principal Consultant

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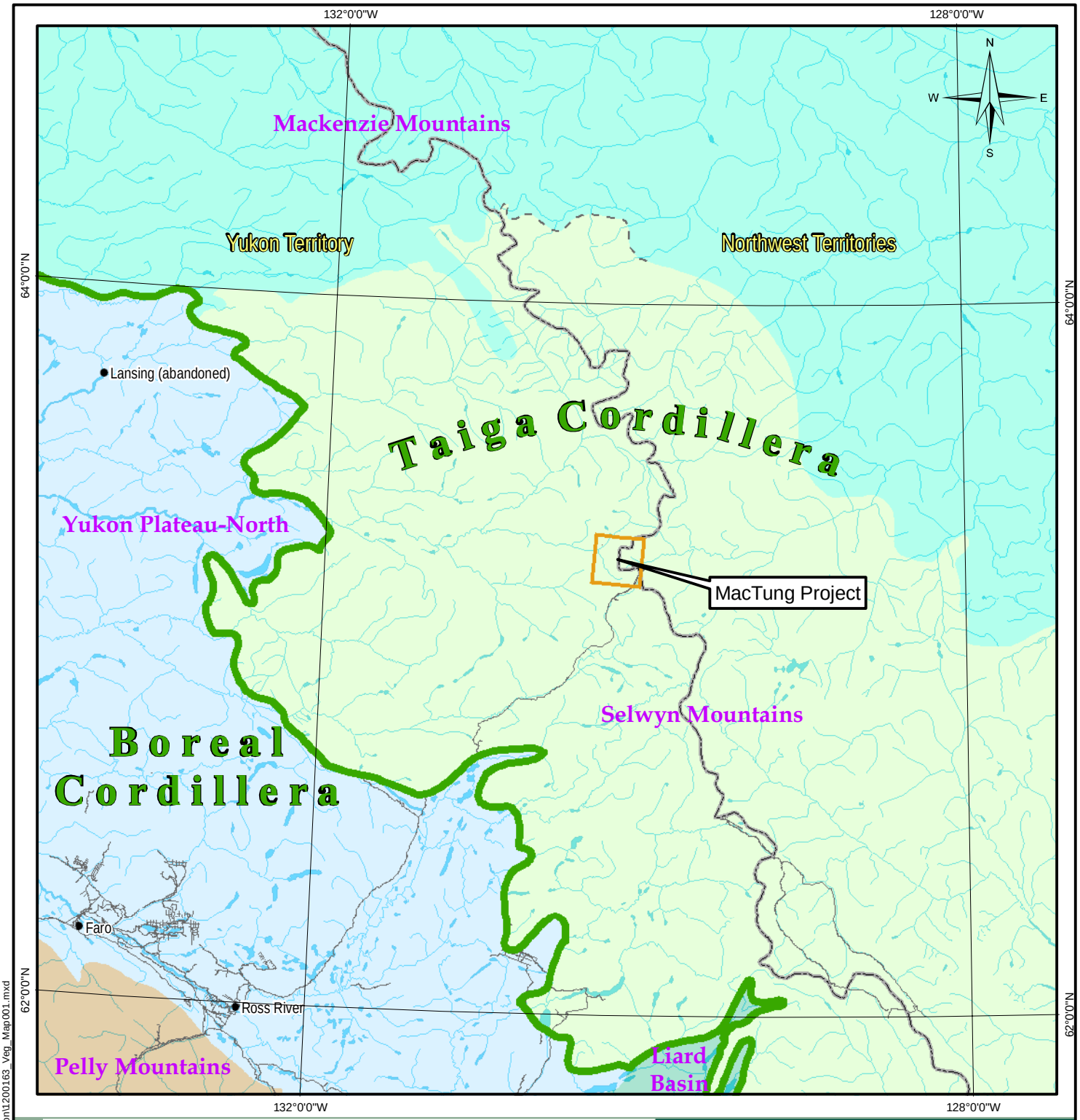
# FIGURES




LEGEND

- Local Study Area
- NWT - Yukon Border
- Roads
- Watercourse
- Waterbody
- Place Names
- Ecozones
- Extrapolated Ecoregion Boundary

Ecoregions

- Selwyn Mountains
- Mackenzie Mountains
- Pelly Mountains
- Liard Basin
- Yukon Plateau-North

NOTES

Base data source:
Yukon, Northwest Territories Governments, NTS

MACTUNG PROJECT
2006 Environmental Baseline Studies
Vegetation and Ecosystem Land Classification

# Ecozones and Ecoregions

| PROJECTION | DATUM |
|---|---|
| UTM Zone 9 | NAD83 |

Scale: 1:1,725,000
20 10 0 20 40
Kilometres

EBA Engineering Consultants Ltd.

FILE NO.
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| PROJECT NO. | DWN | CKD | REV |
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Figure 1

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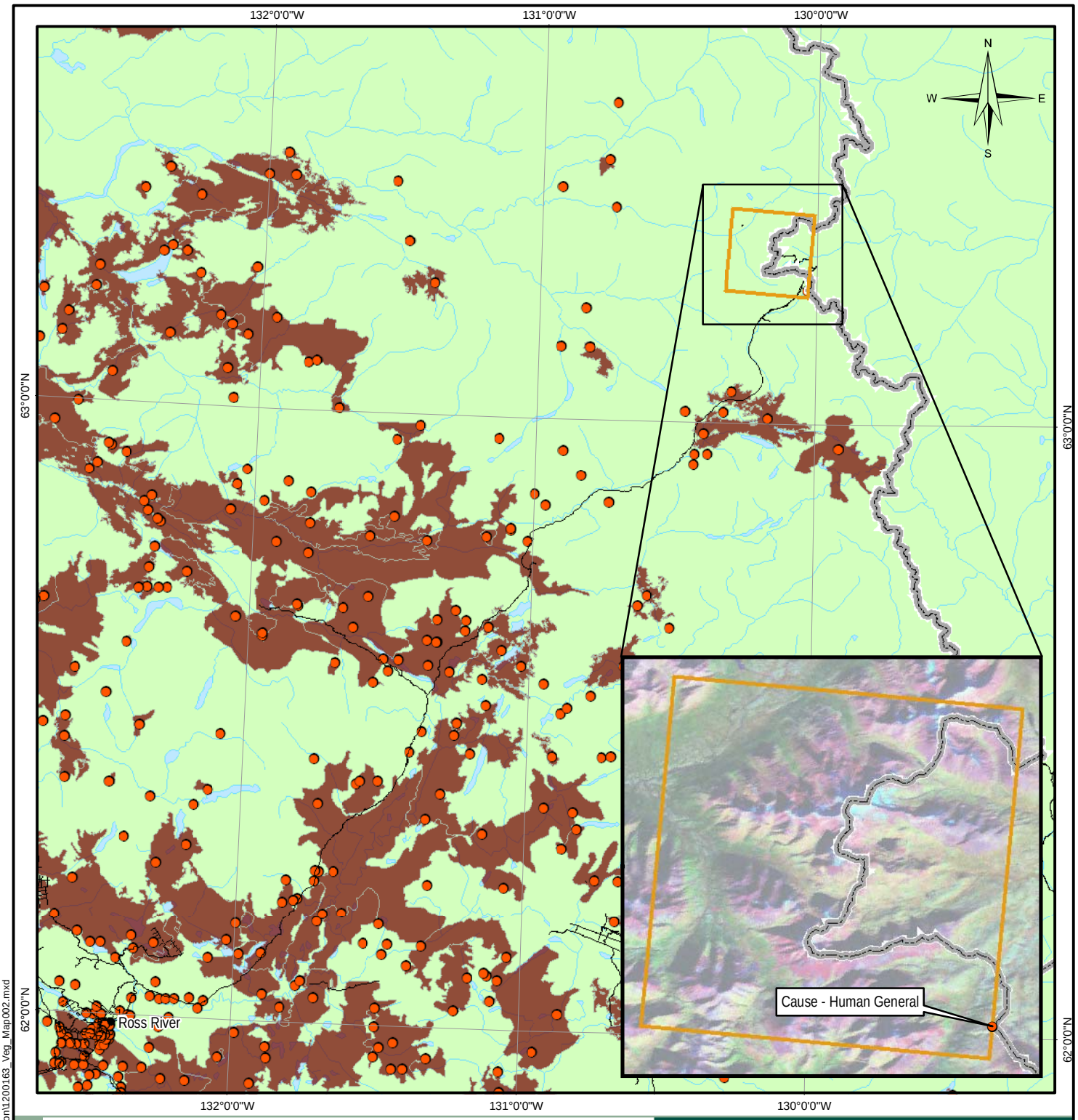


LEGEND

- Local Study Area
- NWT - Yukon Border
- Place Names
- Watercourse
- Waterbody
- Roads
- Fire Incident
- Fire Extent

NOTES

Base data source:
Yukon Government, NTS, Landsat

MACTUNG PROJECT
2006 Environmental Baseline Studies
Vegetation and Ecosystem Land Classification

# Regional Fire History

| PROJECTION | DATUM |
|---|---|
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| EBA-VANC | May 8, 2007 |

EBA Engineering Consultants Ltd.

Figure 2

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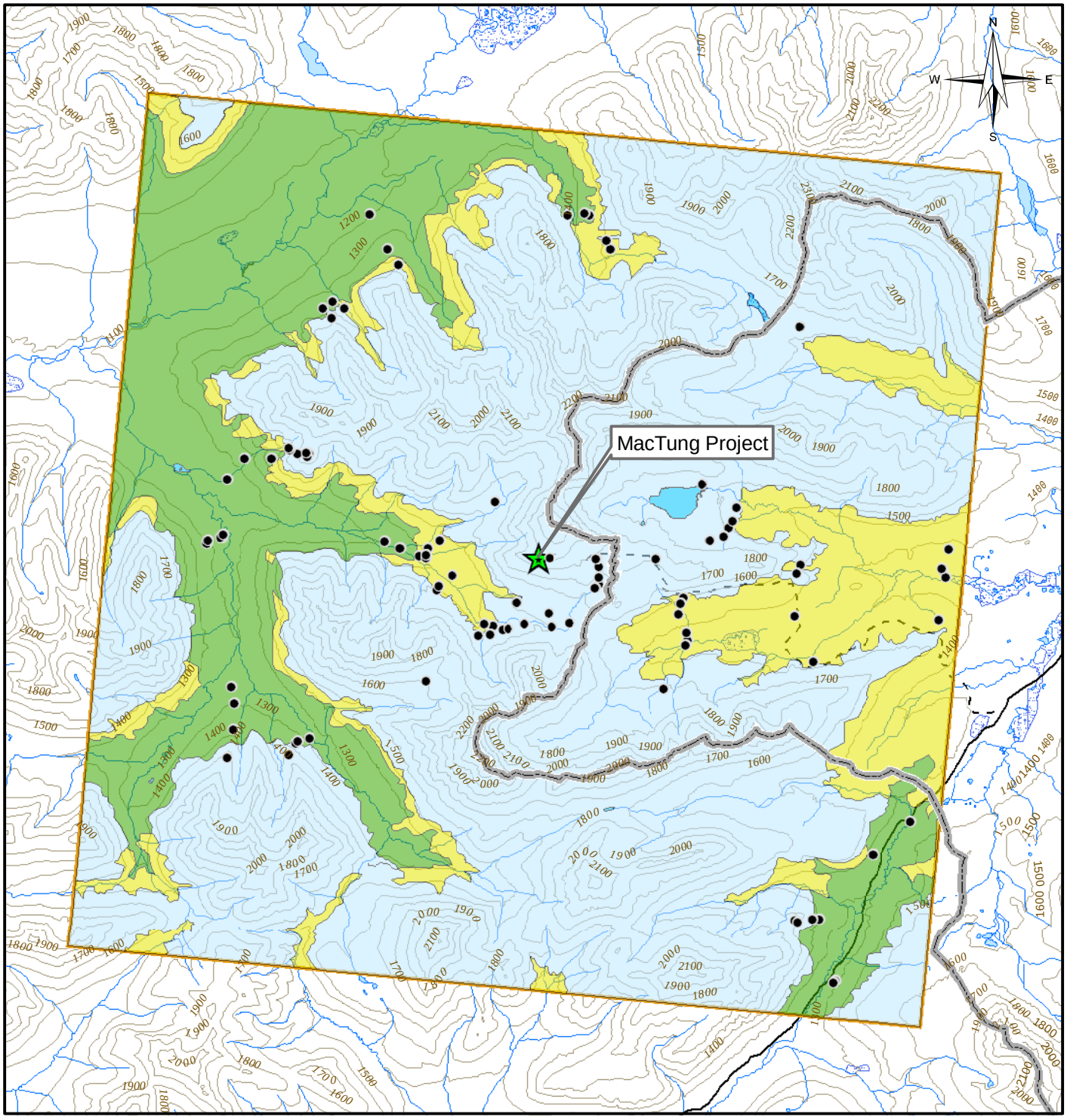


LEGEND

- MacTung Project
- Local Study Area
- NWT - Yukon Border
- North Canol Road
- Mine Road
- Vegetation Samples

Bioclimate Zones

- Alpine
- Shrub Taiga
- Wooded Taiga
- Water

NOTES

Base data source:
NTS 1:50,000

MACTUNG PROJECT
2006 Environmental Baseline Studies
Vegetation and Ecosystem Land Classification

# Bioclimate Zones

| PROJECTION | DATUM |
|---|---|
| UTM Zone 9 | NAD83 |

Scale: 1:100,000

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| EBA-VANC | April 27, 2007 |

EBA Engineering Consultants Ltd.

Figure 3

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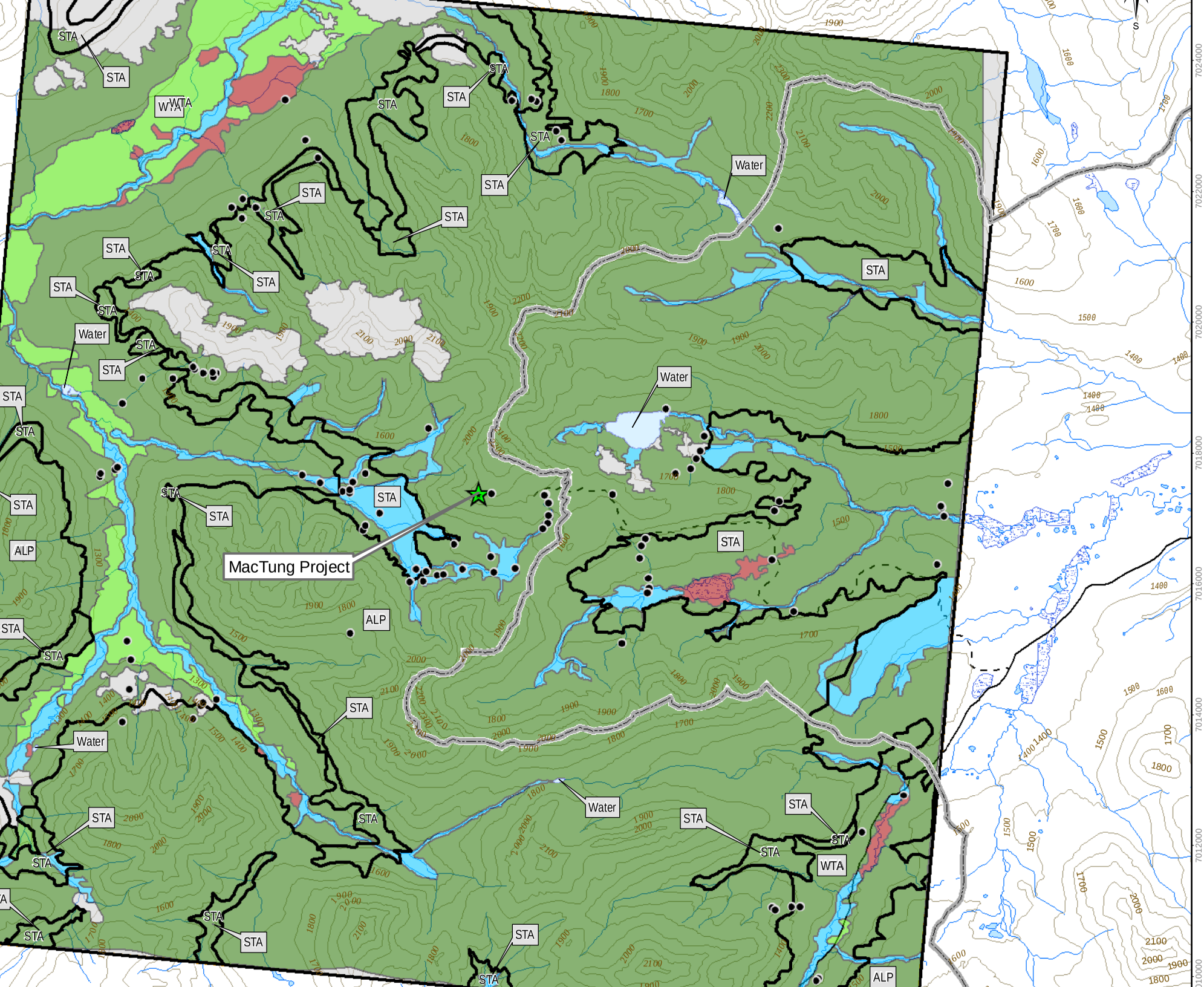
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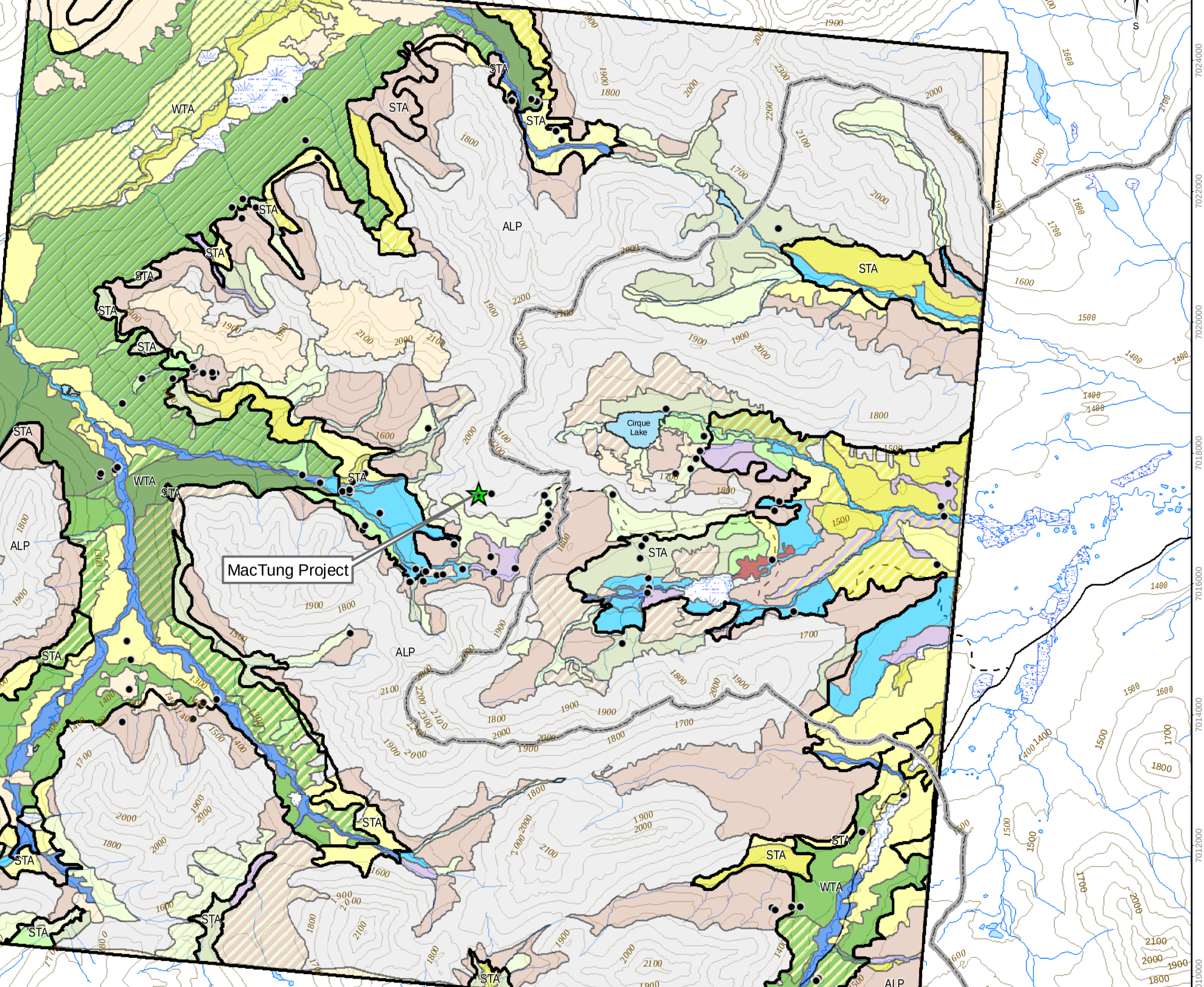
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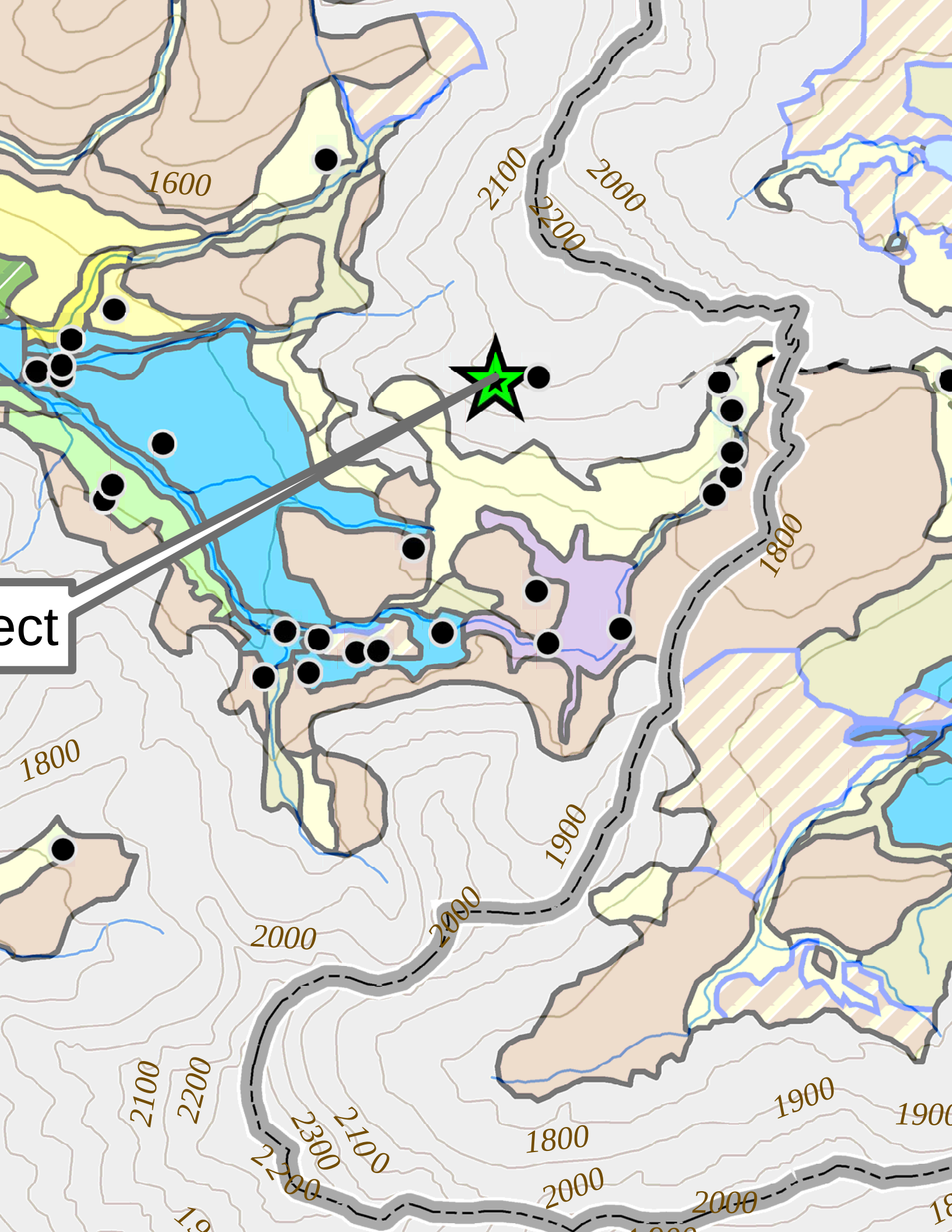
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# PHOTOGRAPHS

**Photo 1**
Looking north from the local study area to Keele Peak with the Hess River in the foreground.

**Photo 2**
Area in unnamed Yukon Tributary with black spruce intermixed among alpine fir.

**Photo 3**
Looking south at Dale Valley with Epilithic Lichen vegetation unit in background.

**Photo 4**
The Fescue-Sedge vegetation unit.

**Photo 5**
The Fescue-Willow vegetation unit.

**Photo 6**
The Heath-Lichen vegetation unit.

**Photo 7**
The Sedge-Bluebell vegetation unit.

**Photo 8**
The Sedge-Cinquefoil vegetation unit.

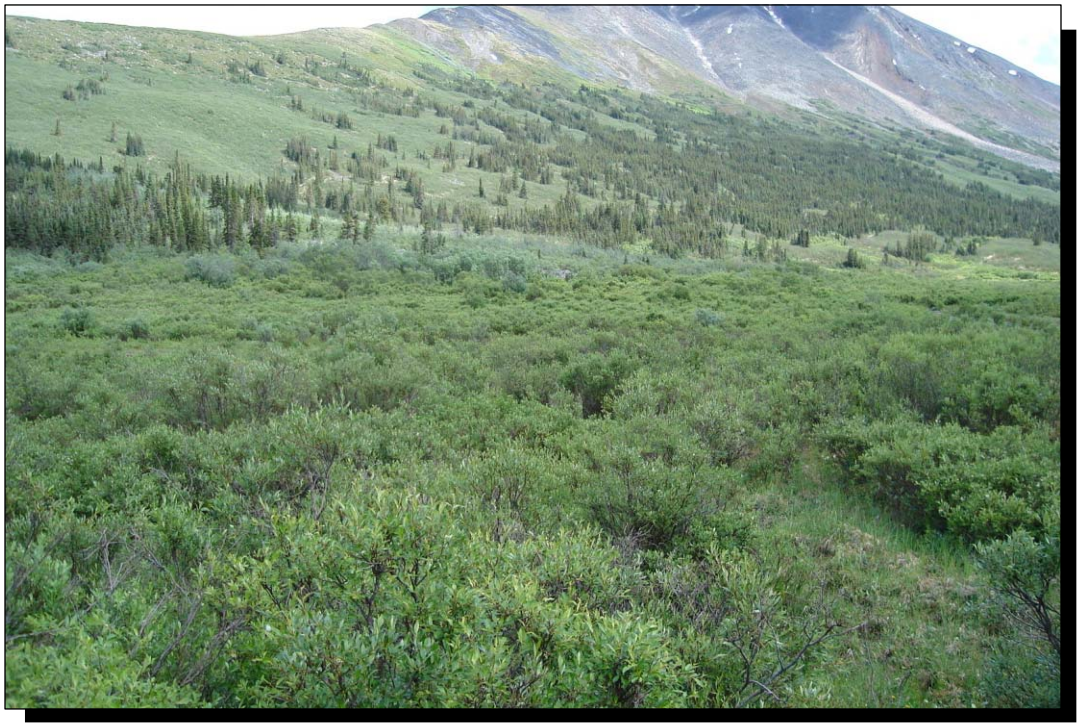

**Photo 9**
The Willow-Sedge vegetation unit.

**Photo 10**
Willow-Bluebell vegetation unit.

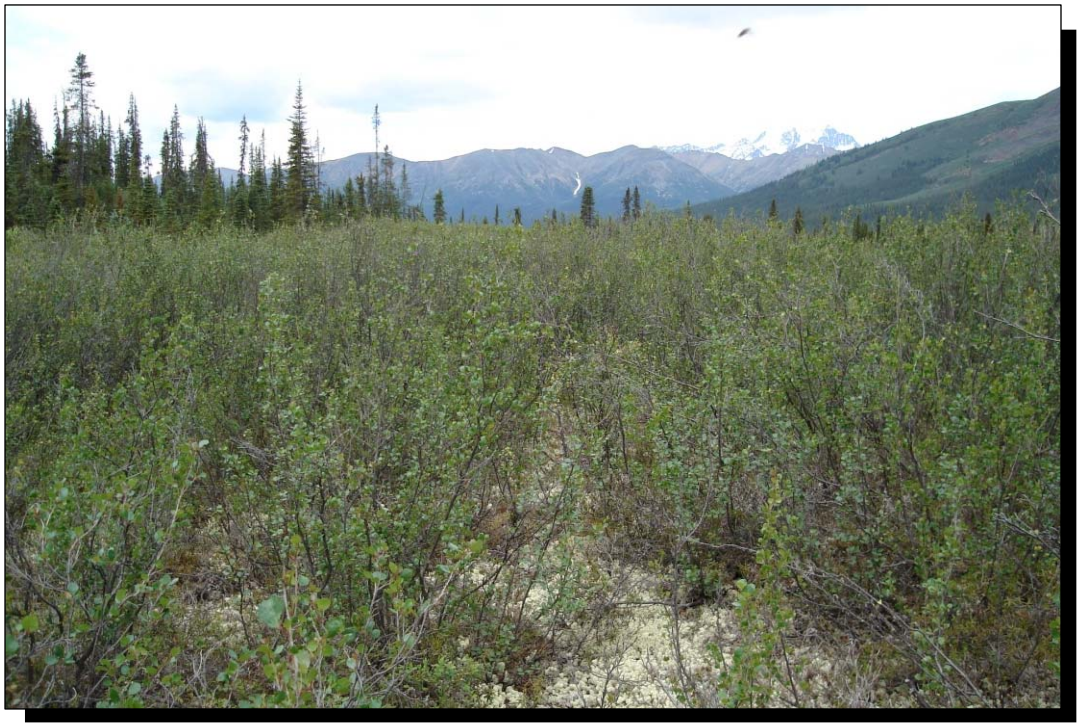

**Photo 11**
The Birch-Lichen vegetation unit..

**Photo 12**
The Birch-Moss vegetation unit.

**Photo 13**
The Fir-Lichen vegetation unit.

**Photo 14**
The Fir-Moss vegetation unit.

**Photo 15**
The Willow-Slope vegetation unit.

**Photo 16**
The Willow-Slope: avalanche chute vegetation unit.

**Photo 17**
The Wetland vegetation unit.

# APPENDIX

## APPENDIX A HISTORICAL LISTS OF PLANT SPECIES PRESENTED FOR THE AREA INCLUDING THE MACTUNG LOCAL STUDY AREA

Table 4.2: Common names of species with mean cover values of 1% or greater

Vascular Plants

*Abies lasiocarpa* - subalpine fir
*Alopecurus alpinus* - alpine foxtail
*Anemone parviflora* - northern anemone
*Arctostaphylos rubra* - red bearberry
*Artemisia arctica* - arctic wormwood
*Artemisia tilesii* - Tilesius wormwood
*Aster sibiricus* - Siberian aster
*Betula glandulosa* - shrub birch
*Calamagrostis canadensis* - bluejoint
*Calamagrostis inexpansa* - northern reed grass
*Calamagrostis neglecta* - narrow reed grass
*Carex aquatilis* - aquatic sedge
*Carex atrofusca* - sedge
*Carex microchaeta* - sedge
*Carex podocarpa* - short-stalked sedge
*Carex saxatilis* - russet sedge
*Carex scirpoidea* - scirpoid sedge
*Cassiope tetragona* - white arctic bell heather
*Chrysosplenium tetrandrum* - northern water carpet
*Deschampsia caespitosa* - tufter hair grass
*Dryas integrifolia* - arctic avens
*Dryas octopetala* - mountain avens
*Empetrum nigrum* - black crowberry
*Epilobium angustifolium* - common cottongrass
*Epilobium latifolium* - alpine fireweed
*Equisetum arvense* - common horsetail
*Equisetum pratense* - horsetail
*Equisetum sylvaticum* - wood horsetail
*Eriophorum angustifolium* - common cottongrass
*Festuca altaica* - rough fescue
*Hierochloe alpina* - alpine holy-grass
*Ledum decumbens* - northern Labrador tea
*Ledum groenlandicum* - common Labrador tea
*Linnaea borealis* - twin-flower
*Luzula confusa* - northern woodrush
*Lycopodium alpinum* - alpine club-moss
*Mertensia paniculata* - alpine bluebell
*Parnassia fimbriata* - fringed grass-of-parnassus
*Petasites frigidus* - arctic coltsfoot
*Picea glauca* - white spruce
*Picea mariana* - black spruce
*Poa arctica* - arctic bluegrass
*Poa lanata* - woolly bluegrass
*Polemonium acutifolium* - sharp leaf Jacob's ladder
*Potentilla fruticosa* - shrubby cinquefoil
*Potentilla palustris* - marsh cinquefoil
*Rhodiola integrifolia* - rose-root
*Rubus acaulis* - dwarf raspberry
*Rubus chamaemorus* - cloudberry
*Rumex arcticus* - arctic dock
*Salix alaxensis* - feltleaf willow
*Salix arctica* - arctic willow
*Salix barclayi* - Barclay willow
*Salix barrattiana* - Barratt willow
*Salix glauca* - grayleaf willow
*Salix lanata* - Richardson willow
*Salix padophylla* - park willow
*Salix planifolia* - diamond leaf willow
*Salix reticulata* - netleaf willow
*Senecio lugens* - black-tipped groundsel
*Senecio triangularis* - triangular groundsel
*Sibbaldia procumbens* - trailing sibbaldia
*Solidago multiradiata* - northern goldenrod
*Spiraea beauverdiana* - Alaska spiraea
*Trisetum spicatum* - spike trisetum
*Vaccinium uliginosum* - alpine blueberry
*Vaccinium vitis-idaea* - mountain cranberry
*Valeriana sitchensis* - valerian

Mosses

*Hylocomnium splendens* - feathermoss
*Polytrichum* sp. - haircap moss
*Sphagnum* sp. - sphagnum

Lichens

*Alectoria ochroleuca* - lichen
*Cetraria cucullata* - hooded lichen
*Cetraria islandica* - Iceland lichen
*Cetraria nivalis* - snow lichen
*Cetraria richardsonii* - Richardson lichen
*Cetraria tilesii* - lichen
*Cladonia mitis* - reindeer lichen
*Cladonia rangiferina* - reindeer lichen
*Nephroma arctica* - lichen
*Peltigera aphthosa* - lichen
*Peltigera canina* - dog lichen
*Umbilicaria* sp. - rock tripe

Appendix I Mean Cumulative Plant Cover By Species in Each Habitat Type in the MacTung Study Area

| Plant Species or Species Group | Plant Community Complexes: Tundra | | | | | | | | | | | Subarctic Forest | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 Epilithic Lichen | 2 Cushion Plant | 3 Alpine Meadow | 4 Alpine Lichen-Grass | 5 Lichen-Heath | 6 Birch-Lichen | 7 Birch-Moss | 8 Willow-Forb | 9 Riparian Willow | 10 Sedge Meadow | 11 Forb Meadow | 12 Lowland Lichen-Grass | 13 Krummholz | 14 Fir-Lichen | 15 Fir-Moss | 16 Lowland White Spruce | 17 Birch-Spruce |
| Vascular Plants | | | | | | | | | | | | | | | | | |
| BETULACEAE | | | | | | | | | | | | | | | | | |
| *Betula glandulosa* | | + | | | 5 | 66 | 160 | 4 | 6 | + | | + | 2 | + | 6 | | 78 |
| *B. pumila* var. *glandulifera* | | | | | | + | | | | | | | | | | | |
| BORAGINACEAE | | | | | | | | | | | | | | | | | |
| *Mertensia paniculata* | | | 1 | + | | | | 5 | 2 | | 5 | | + | | | 2 | |
| *Myosotis alpestris* | | | + | + | | | | + | | | + | | | | | | |
| CAMPANULACEAE | | | | | | | | | | | | | | | | | |
| *Campanula lasiocarpa* | | | + | | | | | + | + | | + | | | | | | |
| CAPRIFOLIACEAE | | | | | | | | | | | | | | | | | |
| *Linnaea borealis* | | | | | | | | + | | | | | + | | | 3 | |
| *Viburnum edule* | | | | | | | | | | | | | + | | | | |
| CARYOPHYLLACEAE | | | | | | | | | | | | | | | | | |
| *Cerastium beeringianum* | | | + | + | | | | | + | | + | | | | | | |
| *Melandrium apetalum* | | | + | | | | | | | | | | | | | | |
| *Minuartia biflora* | | | + | + | | | | | | | | | | | | | |
| *Minuartia* sp. | | | + | | | | | | | | | | | | | | |
| *Sagina linnaei* | | | + | | | | | | | | + | | | | | | |
| *Silene acaulis* | | + | + | + | | | | | | | | | | | | | |
| *Stellaria calycantha* | | | | | | | | | | + | + | | | | | | |
| *S. edwardsii* | | | | | | | | | | | | | | | | + | |
| *S. laeta* | | | | | | | + | + | | + | + | | | | | | |
| *S. longifolia* | | | | | | | | | | | + | | | | | | |
| *S. longipes* | | | | | | | | | | | + | | | | | | |
| *S. monantha* | | | | + | | | + | | | + | | | | | | | |
| *Stellaria* sp. | | | | + | | | + | + | + | | + | | | | | | |
| COMPOSITAE | | | | | | | | | | | | | | | | | |
| *Achillea millefolium* | | | | | | | | | + | | + | | | | | | |
| *Agoseris aurantiaca* | | | | | | | | + | | | | | | | | | |
| *Antennaria densifolia* | | | | | | | | | + | | | | | | | | |

Appendix 1 continued - 2

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Antennaria isolepis* | | | | | | | | + | + | | | | | | | | |
| *A. monocephala* | | | + | + | + | | | + | | | | + | + | | | | |
| *A. pedunculata* | | | | | | | | | + | | + | | | | | | |
| *Antennaria* sp. | | | | | | | | | + | | | | | | | | |
| *Arnica lessingii* | | | + | + | | | + | + | | | | | | | | | |
| *Artemisia arctica* | | + | 2 | 2 | 1 | + | 1 | 1 | + | + | 3 | 1 | 1 | | | | |
| *A. tilesii* | | | | | | | + | 2 | + | | + | | | | | | |
| *Aster sibiricus* | | | | | | | | | 3 | | | | | | | | |
| *Erigeron acris* | | | | | | + | | | | | | | | | | | |
| *Erigeron humilis* | | | + | | | + | | + | + | | | | | | | | |
| *Hieracium gracile* | | | | | + | | | | | | | | | | | | |
| *H. triste* | | | | + | | | + | | | | | | | | | | |
| *Petasites frigidus* | | | 3 | + | | + | 3 | 3 | + | 1 | 4 | | + | | | 5 | 2 |
| *Senecio lugens* | | | + | + | | | | + | + | 1 | + | | + | | | | |
| *S. triangularis* | | | 2 | + | | | + | 1 | | | 7 | | 2 | | | | |
| *S. yukonensis* | | + | | + | + | + | | | | | | + | | | | | |
| *Solidago multiradiata* | | | + | | | | + | 1 | + | | + | | + | | | + | |
| *Taraxacum* sp. | | | + | | | | | | | | | | | | | | |
| CORNACEAE | | | | | | | | | | | | | | | | | |
| *Cornus canadensis* | | | | | | + | | + | | | | | + | | | + | |
| CRASSULACEAE | | | | | | | | | | | | | | | | | |
| *Rhodiola integrifolia* | | | + | + | | | + | 1 | 1 | + | + | | + | | | | |
| CRUCIFERAE | | | | | | | | | | | | | | | | | |
| *Arabis lyrata* | | | + | | | | | + | + | | | | | | | | |
| *Braya humilis* | | | | + | | | | | | | | | | | | | |
| *Cardamine bellidifolia* | | + | | + | + | | | | | | | | | | | | |
| *C. pensylvanica* | | | | | | | | | | + | + | | | | | | |
| *C. pratensis* | | | | | | | | + | | + | + | | | | | | |
| *C. umbellata* | | | | | | | | | | | + | | | | | | |
| *Draba borealis* | | | | | | | | | | | + | | | | | | |
| *D. longipes* | | | | | | | | | | | + | | | | | | |
| *Parrya nudicaulis* | | | + | | | | | | | | | | | | | | |
| CYPERACEAE | | | | | | | | | | | | | | | | | |
| *Carex aenea* | | | | | | | | | | | + | | | | | | |
| *C. aquatilis* | | | | | | | + | 7 | + | 55 | 5 | | | | | | |
| *C. atrofusca* | | | | 2 | | + | | | | | | | | | | | |
| *C. atrosquama* | | | | | | | | | + | | | | | | | | |
| *C. brunnescens* | | | | | | | | | + | + | | + | | | | | |
| *C. capillaris* | | | | | | | | | | + | | | | | | | |
| *C. gynocrates* | | | | | + | | | | | | | | | | | | |
| *C. lachenallii* | | | | + | | | | | | | | + | | | | | |
| *C. macloviana* | | | | | | | | | + | | | + | | | | | |
| *C. media* | | | | | | | | | + | | | | | | | + | |
| *C. membranacea* | | | + | + | | | | + | + | + | | | | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Carex microchaeta* | | + | | + | + | | + | 1 | | | + | | | | | | |
| *C. microglochin* | | | | | | | | | | + | | | | | | | |
| *C. nardina* | | | | + | | | | | | | | | | | | | |
| *C. nigricans* | | | | | | | | | | + | | | | | | | |
| *C. petricosa* | | | + | | | | | | | | | | | | | | |
| *C. physocarpa* | | | | | | | | | | + | | | | | | | |
| *C. podocarpa* | | | 3 | + | + | | | + | + | | 2 | | + | | | | |
| *C. praticola* | | | | | | | | | | + | | | | | | | |
| *C. pyrenaica* | | | | | + | | | | | | | | | | | | |
| *C. rostrata* | | | | | | | | | | + | | | | | | | |
| *C. rupestris* | | + | | | | | | | | | | | | | | | |
| *C. saxatilis* | | | | | | | | + | | + | 1 | | | | | | |
| *C. scirpoidea* | | + | + | | | | | | | + | | | 2 | | | | |
| *C. vaginata* | | | | + | | | | | | | | | | | | | |
| *Carex* sp. | | + | | | + | | + | | | + | | | + | | | | |
| *Eriophorum angustifolium* | | | | + | | | | + | | + | 4 | | | | | | |
| EMPETRACEAE | | | | | | | | | | | | | | | | | |
| *Empetrum nigrum* | | + | | | 2 | + | + | + | + | | | | + | + | + | | 5 |
| EQUISETACEAE | | | | | | | | | | | | | | | | | |
| *Equisetum arvense* | | | + | + | | | | 18 | 1 | 1 | 25 | | | | | + | |
| *E. hyemale* | | | | | | | | | | | | | | | | | |
| *E. pratense* | | | | | | | | | + | | | | | | | 25 | |
| *E. scirpoides* | | | + | | | | + | + | + | + | + | | | | | + | |
| *E. sylvaticum* | | | | | | + | + | + | | + | | | | | | 7 | 5 |
| *E. variegatum* | | | | | | | | + | + | + | | | | | | | |
| ERICACEAE | | | | | | | | | | | | | | | | | |
| *Andromeda polifolia* | | | | | | | | | | | | | + | | | | |
| *Arctostaphylos alpina* | | | | | + | | | + | | | | | | | | | |
| *A. rubra* | | 2 | + | | | + | | + | | + | | | + | | | 1 | |
| *Cassiope tetragona* | | + | 1 | 1 | 18 | | | | | | | + | 3 | 5 | + | | |
| *Ledum decumbens* | | | | | | + | + | | | | | + | + | + | | | 2 |
| *L. groenlandicum* | | | | | + | 17 | + | + | | | | | 1 | + | + | + | 2 |
| *Oxycoccus microcarpus* | | | | | | | | + | | | | | | | | | + |
| *Phyllodoce empetriformis* | | | | | + | + | | | | | | | + | | | | |
| *Vaccinium uliginosum* | | 2 | | | 2 | 11 | + | + | 1 | | + | + | + | + | + | + | 2 |
| *V. vitis-idaea* | | 2 | | + | 1 | 3 | 1 | + | | | 2 | + | + | + | + | 2 | |
| GENTIANACEAE | | | | | | | | | | | | | | | | | |
| *Gentiana glauca* | | | + | + | + | + | | | + | | | + | + | | | + | |
| *G. propinqua* | | | | | | | | + | + | | | | | | | + | |
| GRAMINEAE | | | | | | | | | | | | | | | | | |
| *Agropyron violaceum* | | | | | | | | | + | + | + | | | | | | |
| *Agrostis gigantea* | | | | | | + | | | | | | | | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Agrostis scabra* | | | | | | | | | + | | | | | | | | |
| *Agrostis* sp. | | | | | | | | | | | + | | | | | | |
| *Alopecurus aequalis* | | | | | | | | | | + | | | | | | | |
| *A. alpinus* | | | | + | | | | 1 | | | + | | | | | | |
| *Arctagrostis arundinacea* | | | | + | + | | | + | + | | + | | | | | + | |
| *A. latifolia* | | | + | + | | | + | + | | | + | | | | | | |
| *Calamagrostis canadensis* | | | | 3 | 1 | + | | + | 2 | | 6 | | | | | | |
| *C. inexpansa* | | | | | | | 3 | | | | | | | | | | |
| *C. lapponica* | | + | | | | | | + | | + | | | | | | | |
| *C. neglecta* | | | | 2 | + | | | | | + | | + | | | | | |
| *Deschampsia caespitosa* | | | 3 | 2 | + | | | 1 | | | 23 | + | + | | | | |
| *Festuca altaica* | | | 7 | 11 | 1 | + | | 6 | 33 | | 15 | 7 | 6 | | | | |
| *F. saximontana* | | | | | | | | | + | | | | | | | | |
| *Hierochloe alpina* | | 2 | | 3 | 1 | | | | + | | | + | | | | | |
| *H. odorata* | | | | | | | | | + | | | | | | | | |
| *Phleum commutatum* | | | + | + | | | | + | | | + | + | | | | | |
| *Poa alpigena* | | | | | + | | | | + | | + | | | | | | |
| *P. alpina* | | | + | | | + | | + | + | | + | | | | | | |
| *P. arctica* | | | + | 5 | | + | + | + | 1 | | | | | | | | |
| *P. glauca* | | | + | | | | | | | | | | | | | | |
| *P. lanata* | | | + | | | | | + | + | | 4 | | | | | | |
| *P. paucispicula* | | | + | | | | | | | | | | | | | | |
| *Poa* sp. | | | | | | | 1 | | | | | | | | | | |
| *Trisetum spicatum* | | | 1 | + | | | | + | 4 | + | + | | + | 2 | | | |
| *Vahlodea atropurpurea* | | | | | | | | | | | | | + | | | | |
| HALORAGACEAE | | | | | | | | | | | | | | | | | |
| *Hippuris vulgaris* | | | | | | | | | | + | | | | | | | |
| JUNCACEAE | | | | | | | | | | | | | | | | | |
| *Juncus albescens* | | | | | | | | | | + | | | | | | | |
| *J. arcticus* | | | | | + | | | | | | | | | | | | |
| *J. balticus* | | | | | | | | + | | | | | | | | | |
| *J. biglumis* | | | | | | | | | + | | | | | | | | |
| *J. castaneus* | | | | | | | + | | + | | + | | | | | | |
| *Luzula arcuata* | | | + | + | + | | | | | | | | | | | | |
| *L. confusa* | | 4 | | 1 | 1 | | | | | | | | | | | | |
| *L. parviflora* | | | | | | | + | + | + | + | + | + | | | | | |
| *L. wahlenbergii* | | | | | + | | | | + | | | | | | | | |
| JUNCAGINACEAE | | | | | | | | | | | | | | | | | |
| *Triglochin palustre* | | | | | | | | | | + | | | | | | | |

Appendix I continued - 5.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LEGUMINOSAE | | | | | | | | | | | | | | | | | |
| *Astragalus umbellatus* | | | | | | | | | | + | + | | | | | | |
| *Astragalus* sp. | | | | | | | | + | | | | | | | | | |
| *Hedysarum alpinum* | | | | | | | | + | | | | | | | | | |
| *Lupinus arcticus* | | + | | | | + | | | | | + | | | | | | |
| LILIACEAE | | | | | | | | | | | | | | | | | |
| *Lloydia serotina* | | | | + | | | | + | | | | | | | | | |
| *Tofieldia pusilla* | | | | | | | | | | + | | | | | | | |
| *Veratrum eschscholtzii* | | | | | | | | | | | | | + | | | | |
| LYCOPODIACEAE | | | | | | | | | | | | | | | | | |
| *Lycopodium alpinum* | | | | | 1 | | | | | | | | + | + | | | |
| *L. annotinum* | | | | | | + | + | | | | | | + | + | | | |
| *L. complanatum* | | | | | | | | + | | | | | | | | | |
| *L. selago* | | + | + | + | + | + | | | | | | | | | | | |
| MONOTROPACEAE | | | | | | | | | | | | | | | | | |
| *Moneses uniflora* | | | | | | | | | | | | | | | | + | |
| ONAGRACEAE | | | | | | | | | | | | | | | | | |
| *Epilobium anagallidifolium* | | | + | + | | | | + | | + | + | | + | | | + | |
| *E. angustifolium* | | | | + | | | + | + | 1 | | + | | + | | | + | |
| *E. davuricum* | | | | | | | | | | + | | | + | | | | |
| *E. latifolium* | | | 3 | | | | | + | + | | + | | + | | | + | |
| *E. palustre* | | | | | | | | + | | | | | | | | | |
| *Epilobium* sp. | | | | | | | | | | | + | | | | | | |
| OPHIOGLOSSACEAE | | | | | | | | | | | | | | | | | |
| *Botrychium lunaria* | | | | | | | | | + | | | | | | | | |
| PINACEAE | | | | | | | | | | | | | | | | | |
| *Abies lasiocarpa* | | | | | | | | | | | | | 148 | 45 | 190 | | + |
| *Juniperis communis* | | | | | | | | | + | | | | | | | | |
| *Picea glauca* | | | | | | | | | | | | | | | | 43 | + |
| *P. mariana* | | | | | | | | | | | | | | | | | 8 |
| POLEMONIACEAE | | | | | | | | | | | | | | | | | |
| *Polemonium acutifolium* | | | + | + | | | 1 | 1 | 1 | + | 2 | | + | | | + | |
| POLYGONACEAE | | | | | | | | | | | | | | | | | |
| *Koenigia islandica* | | | | | | | | | + | | | | | | | | |
| *Oxyria digyna* | | | + | | | | | + | | | | | | | | | |
| *Polygonum viviparum* | | | + | + | | | | + | + | + | | | + | | | + | |
| *Rumex arcticus* | | | | | | | 1 | + | | 1 | 2 | | | | | + | + |
| PORTULACACEAE | | | | | | | | | | | | | | | | | |
| *Claytonia tuberosa* | | | | | | | | | | | + | | | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PYROLACEAE | | | | | | | | | | | | | | | | | |
| *Pyrola asarifolia* | | | | | | | + | + | + | | + | | + | | | + | |
| *P. minor* | | | | | | | | | | | + | | | | | | |
| *P. secunda* | | | | | | | | | | | | | + | | | | |
| *Pyrola* sp. | | | | | | | | | | | | | | | | + | |
| RANUNCULACEAE | | | | | | | | | | | | | | | | | |
| *Aconitum delphinifolium* | | | | + | | | | + | | | + | | + | | | + | |
| *Anemone narcissiflora* | | | | | + | + | | + | | | + | | + | | | | |
| *A. parviflora* | | | 1 | + | | + | | + | + | + | + | | + | | | 1 | |
| *A. richardsonii* | | | + | | | | | + | | | + | | | | | | |
| *Delphinium glaucum* | | | | | | | | + | + | | + | | | | | + | |
| *Ranunculus eschscholtzii* | | | + | | | + | | | | | | | | | | | |
| *R. flammula* | | | | | | | | | | + | | | | | | | |
| *R. gmelinii* | | + | + | | | | | | | + | | | | | | | |
| *R. lapponicus* | | | | | | | | | | | | | + | | | | |
| *R. nivalis* | | | + | | | | | | | | | | | | | | |
| *R. sulphureus* | | | | | | | | | | | + | | | | | | |
| *Ranunculus* sp. | | | + | | | | | | | | | | | | | | |
| ROSACEAE | | | | | | | | | | | | | | | | | |
| *Dryas integrifolia* | | 8 | | | | | | | | | | | | | | | |
| *D. octopetala* | | | 3 | 3 | | | | + | | | | | | | | | |
| *Geum macrophyllum* | | | | | | | | | | | + | | | | | | |
| *Geum rossii* | | | + | | | | | | | | | | | | | | |
| *Potentilla diversifolia* | | | | | | | + | | | | | | | | | | |
| *P. elegans* | | + | | + | | | | | | | | | | | | | |
| *P. fruticosa* | | | + | | | | + | 2 | + | | | | + | | | 8 | |
| *P. hyparctica* | | + | | | | | | | | | | | | | | | |
| *P. palustris* | | | | | | | | + | + | 3 | | | | | | | |
| *P. uniflora* | | + | | + | | | | | | | | | | | | | |
| *Rosa acicularis* | | | | | | | | | | | | | | | | + | |
| *Rubus acaulis* | | | | | | | + | + | 2 | + | 1 | + | + | | | + | |
| *R. chamaemorus* | | | | | | + | 1 | 1 | | | 1 | + | + | | + | | 5 |
| *Sibbaldia procumbens* | | | 1 | | + | + | + | | + | | + | + | + | | | | |
| *Spiraea beauverdiana* | | | | | 1 | | + | + | | + | + | + | + | | + | | |
| RUBIACEAE | | | | | | | | | | | | | | | | | |
| *Galium trifidum* | | | | | | | | + | | | | | | | | | |
| SALICACEAE | | | | | | | | | | | | | | | | | |
| *Populus balsamifera* | | | | | | | | | + | | | | | | | | |
| *Salix alaxensis* | | | | | | | | 1 | 52 | | | | | | | | |
| *S. arbusculoides* | | | | | | | | | | | | | | | + | | |
| *S. arctica* | | + | 10 | 8 | + | | | 2 | | | + | | + | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Salix barclayi* | | | | | | | | | | | | | | | | 10 | |
| *S. barrattiana* | | | 3 | + | | | | 3 | | | + | | 3 | | | | |
| *S. glauca* | | | | | | | + | + | | | | | | | | 10 | |
| *S. lanata* | | | | | | | + | 35 | 24 | + | 2 | 1 | 10 | | | | 5 |
| *S. myrtillifolia* | | | | | | | | | | | + | | | | | | |
| *S. padophylla* | | | | | | | | | | | | | | | | 2 | |
| *S. planifolia* | | | + | | + | + | 14 | 84 | 24 | + | 2 | 1 | 10 | | | | 5 |
| *S. reticulata* | | + | 15 | + | | | + | 15 | + | 10 | + | | 5 | | | + | |
| SAXIFRAGACEAE | | | | | | | | | | | | | | | | | |
| *Chrysosplenium tetrandrum* | | | + | | | + | | | | 1 | + | | | | | | |
| *Parnassia fimbriata* | | | | | | | | + | | | | | 1 | | | | |
| *P. kotzbuei* | | | + | | | | | + | + | | | | | | | | |
| *P. palustris* | | | | | | | | + | + | + | | | | | | | |
| *Ribes triste* | | | | | | | | | | | | | | | | + | |
| *Saxifraga cernua* | | | + | | | | | + | | | + | | | | | | |
| *S. hieracifolia* | | | + | + | | | | + | | | | | | | | | |
| *S. lyallii* | | | + | | | | | | | | | | | | | | |
| *S. oppositifolia* | | + | | | | | | | | | | | | | | | |
| *S. punctata* | | | + | | | | | | + | | + | | | | | | |
| *S. radiata* | | | + | | | | | | | | | | | | | | |
| *S. tricuspidata* | | + | | + | | | | | + | | | + | | | | | |
| *Saxifraga* sp. | | | + | | | | | + | | | + | | | | | | |
| SCROPHULARIACEAE | | | | | | | | | | | | | | | | | |
| *Pedicularis capitata* | | + | | | | | | + | | | | | | | | | |
| *P. labradorica* | | | | | | | + | + | | | | | | | | | + |
| *P. lanata* | | | + | + | | | | | | | | | | | | | |
| *P. sudetica* | | | + | + | | | + | + | + | + | + | | + | | | | |
| *Pedicularis* sp. | | | | | | | | | | | | | + | | | | |
| *Veronica wormskjoldii* | | | + | | | | + | + | + | | + | | + | | | | |
| SELAGINELLACEAE | | | | | | | | | | | | | | | | | |
| *Selaginella selaginoides* | | | | | | | | + | | | | | | | | | |
| SPARGANIACEAE | | | | | | | | | | | | | | | | | |
| *Sparganium minimum* | | | | | | | | | | + | | | | | | | |
| UMBELLIFERAE | | | | | | | | | | | | | | | | | |
| *Angelica lucida* | | | | | | | | + | | | | | + | | | | |
| *Heracleum lanatum* | | | | | | | | + | | | | | | | | | |
| VALERIANACEAE | | | | | | | | | | | | | | | | | |
| *Valeriana capitata* | | | | | | | | | | + | | | | | | | |
| *V. septentrionalis* | | | | | | | | + | | | | | | | | | |
| *V. sitchensis* | | | 4 | | | | | + | + | 1 | | | + | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VIOLACEAE | | | | | | | | | | | | | | | | | |
| *Viola adunca* | | | | | | | | + | + | | + | | | | | | |
| *V. epipsila* | | | | | | | | + | + | | | | | | | | |
| *Viola* sp. | | | | | | | | | | + | | | | | | | |
| Bryophytes | | | | | | | | | | | | | | | | | |
| Categories recognized during fieldwork | | | | | | | | | | | | | | | | | |
| *Hylocomnium splendens* | | | | | | | 17 | 15 | | | 15 | | 40 | 10 | 30 | 60 | 5 |
| Liverworts | | | | | | + | + | + | | | + | | | | | | |
| Misc. Mosses and Liverworts | 1 | + | 25 | 13 | 1 | 2 | 28 | 20 | 23 | 18 | 20 | + | 13 | 1 | 5 | + | 15 |
| *Polytrichum* sp. | | 3 | 1 | 11 | 5 | 2 | 8 | + | + | | + | 2 | + | 2 | 7 | | 5 |
| *Sphagnum* sp. | | | | | | + | + | 1 | | 40 | | | + | | 30 | | 20 |
| Moss Taxa | | | | | | | | | | | | | | | | | |
| AMBLYSTEGIACEAE | | | | | | | | | | | | | | | | | |
| *Amblystegium serpens* | | | | | | | | | | | | | | | | × | |
| *Calliergidium dendroides* | | | | | | | | | | | | | | | | | |
| *C. pseudostramineum* | | | | | | | | | × | | | | | | | | |
| *Calliegon cordifolium* | | | | | | | | | | | × | | | | | | |
| *C. giganteum* | | | | | | | | | | × | | | | | | | |
| *C. sarmentosum* | | | | | | | × | × | | | | | | | | | |
| *C. stramineum* | | | | | | | × | × | | × | | | | | | | |
| *Campylium stellatum* | | | × | | | | | × | | × | × | | × | | | | |
| *Drepanocladus aduncus* | | | × | | | × | × | | | × | × | | | | | | |
| *D. exannultus* | | | | | | | | | | × | | | | | | | |
| *D. fluitans* | | | | | | | | | | | | | | | | | |
| *D. revelvens* | | | | | | | × | × | | × | × | | | | | | |
| *D. tundrae* | | | | | | | | | | | | | | | | | |
| *D. uncinatus* | | | × | × | | × | × | × | × | × | × | | × | | × | | |
| *Scorpidium scorpidioides* | | | | | | | | | | × | | | | | | | |
| AULACOMNIACEAE | | | | | | | | | | | | | | | | | |
| *Aulacomnium palustre* | | | | | | | × | × | × | × | × | | × | | | | × |
| BARTRAMIACEAE | | | | | | | | | | | | | | | | | |
| *Bartramia ithyphylla* | | | | | | | | × | | | | | | | | | |
| BRACHYTHECIACEAE | | | | | | | | | | | | | | | | | |
| *Brachythecium* sp. | | | | | | | | | | × | | | | | | | |
| *B. erythrorrhizon* | | | | | | | | | × | | | | | | | | |
| *B. groenlandicum* | | | | | | | | | | | | | | | | | |
| *B. nelsonii* | | | | | | | | × | × | | × | | | | | | |
| *B. salebrosum* | | | × | | | | | × | | | × | | × | | | | |
| *Tomenthypnum nitens* | | | | | | | × | × | | × | × | | | × | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BRYACEAE | | | | | | | | | | | | | | | | | |
| *Bryum* sp. | | x | | | | | x | x | | | | | | | | x | |
| *B. caespiticium* | | | | | | | | x | | | | | | | | | |
| *B. pseudotriquetrum* | | | x | x | | | | x | x | x | x | | x | | | | x |
| *B. weigelii* | | | | | | | | x | | | | | | | | | |
| *Leptobryum pyriforme* | | | | | | | | x | x | | x | | | | | | |
| *Pohlia cruda* | | | | x | | | | x | | | x | | | | | x | |
| *P. nutans* | x | | | x | x | | x | x | | x | x | | x | x | x | | |
| *P. wahlenbergii* | | | | | | | | | | | | | | | | | |
| CATOSCOPIACEAE | | | | | | | | | | | | | | | | | |
| *Catoscopium nigritum* | | | | | | | | x | | x | | | | | | | |
| *Philonotis fontana* | | | x | | | | | x | | | x | | | | | | |
| CLIMACIACEAE | | | | | | | | | | | | | | | | | |
| *Climacium dendroides* | | | x | | | | | x | | x | x | | | | | | |
| DICRANACEAE | | | | | | | | | | | | | | | | | |
| *Cynodontium strumiferum* | | | x | | | | | | | | | | | | | | |
| *C. tenellum* | | | | | | | | | | | | | x | | | | |
| *Dicranella subulata* | | | | | | | | | | | | | | | | | |
| *Dicranum acutifolium* | | | | x | x | x | | x | | | | | x | | x | x | |
| *D. elongatum* | | x | | x | x | x | x | | | | x | | | | | | |
| *D. fuscescens* | | | | x | x | x | x | x | | | | | x | x | | x | |
| *D. groenlandicum* | | | | | | | x | | | | | | x | | | | |
| *D. muehlenbeckii* | | | | | | | | | | | | | | | | | |
| *D. scoparium* | | | | x | | | x | x | | | x | | | | | | |
| *D. spadiceum* | | | | | | | | | | | x | | | | | | |
| *D. undulatum* | | | | | | | x | | | | | | | | | | |
| *Dicranum* sp. | | | | | | | x | x | | | | | | | | | |
| *Kiaeria starkei* | | x | | | | | x | | | | | | | | | | |
| ENTODONTACEAE | | | | | | | | | | | | | | | | | |
| *Pleurozium schreberi* | | | x | | x | x | x | x | | x | x | x | x | x | x | | |
| GRIMMIACEAE | | | | | | | | | | | | | | | | | |
| *Grimmia affinis* | | x | | | | | | | | | | | | | | | |
| *G. apocarpa* | | x | | | | | | | | | | | | | | | |
| *Grimmia* sp. | | x | | | | | | | | | | | | | | | |
| *Rhacomitrium canescens* | | | x | x | | | | x | x | | x | | x | | | | |
| *R. fasciculare* | | | | | | | | | | x | | | | | | | |
| *R. heterostichum* | | | | | x | | | | x | | | | | | | | |
| *R. lanuginosum* | x | x | | x | x | | | | | | | | | | | | |
| HEDWIGIACEAE | | | | | | | | | | | | | | | | | |
| *Hedwigia ciliata* | | | x | | | | | | | | | | | | | | |

Appendix I continued - 10

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HYLOCOMNIACEAE | | | | | | | | | | | | | | | | | |
| *Hylocomnium pyreniacum* | | | | | | | | x | | | | | | | | | |
| *H. splendens* | | | x | x | x | | x | x | | | x | | x | x | x | x | x |
| HYPNACEAE | | | | | | | | | | | | | | | | | |
| *Hypnum pratense* | | | | | | | | x | | x | x | | | | | | |
| *H. revolutum* | | x | | | | | | | | | | | | | | | |
| *H. vaucheri* | | x | | | | | | | | | | | | | | | |
| *Pylaisiella polyantha* | | | | | | | | x | | | | | | | | | |
| LESKEACEAE | | | | | | | | | | | | | | | | | |
| *Leskeela nervosa* | | | | | | | | x | | | | | | | | | |
| MEESEACEAE | | | | | | | | | | | | | | | | | |
| *Meesia triquetra* | | | | | | | | x | | | | | | | | | |
| *M. uliginosa* | | | | | | | x | x | | x | | | | | | | |
| *Paludella squarrosa* | | | | | | | x | x | | x | | | | | | | |
| MNIACEAE | | | | | | | | | | | | | | | | | |
| *Mnium* sp. | | | | | | | | | | x | | | | | | | |
| *Plagiomnium ellipticum* | | | | x | | | | | | x | x | | | | | | |
| *Rhizomnium gracile* | | | | | | | x | x | | | x | | | | | | |
| *R. pseudopunctatum* | | | | | | | x | x | | | | | x | | | | |
| POLYTRICHACEAE | | | | | | | | | | | | | | | | | |
| *Pogonatum alpinum* | x | x | x | | | | | | | | x | | | | | | |
| *P. contortum* | | | x | | | | | | | | | | | | | | |
| *Polytrichum commune* | | | x | | x | x | x | x | | x | | x | x | x | x | | x |
| *P. juniperinum* | | | | x | | x | x | x | x | | x | x | | | | | |
| *P. piliferum* | x | x | x | | | | | | x | | | x | | | | | |
| *P. sexangulare* | | | | | | | | | | x | | | | | | | |
| *P. strictum* | | | | x | x | x | x | x | | x | x | x | x | x | x | | x |
| POTTIACEAE | | | | | | | | | | | | | | | | | |
| *Tortula norvegica* | | | | | | | | | | | | | | | | | |
| *T. ruralis* | | | | | | | | x | | | | | | | | | |
| SPHAGNACEAE | | | | | | | | | | | | | | | | | |
| *Sphagnum* sp. | | | | | | x | x | x | | x | | | x | | x | | x |
| *S. angustifolium* | | | | | | | | | | | | | | | | | x |
| *S. fimbriatum* | | | | | | | | | | x | | | | | x | | x |
| *S. fuscum* | | | | | | x | x | | | | | | | | | | x |
| *S. lindbergii* | | | | | | | | | | x | | | | | | | |
| *S. magellanicum* | | | | | | | | | | x | | | | | | | |
| *S. nemoreum* | | | | | | | x | | | | | | x | | | | |
| *S. obtusum* | | | | | | x | | | | | | | | | | | |
| *S. riparium* | | | | | | | | | | x | | | | | | | |
| *S. rubellum* | | | | | | | | x | | | | | | | | | |
| *S. warnstorfii* | | | | | | | x | x | | x | | | | | x | x | x |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SPLACHNACEAE | | | | | | | | | | | | | | | | | |
| *Splachnum* sp. | | | | | | | | | | | | | | | x | x | |
| **Liverwort Taxa** | | | | | | | | | | | | | | | | | |
| CEPHALOZIACEAE | | | | | | | | | | | | | | | | | |
| *Cephalozia lunifolia* | | | | | | | | | | | | | | | | | |
| JUGERMANIACEAE | | | | | | | | | | | | | | | | | |
| *Anastrophyllum* sp. | | | | x | x | | | | | x | | | | | | | |
| *A. minutum* | | | | | x | | x | x | | x | | | x | x | | | |
| *Barbilophozia hatcheri* | | | | | | | | x | | | | x | | | | | |
| *B. lycopodioides* | | | x | x | | | | x | x | | x | | x | x | x | | |
| *B. trichophyllum* | | | | | | | | | | | | | | | | x | |
| *Lophozia* sp. | | x | | x | x | | x | x | | | x | x | x | x | x | x | |
| *L. kunzeaea* | | | | | | | | | | x | | | | | | | |
| *Tritomaria* sp. | | | | | | | | x | | | | | | | | | |
| *T. exsecta* | | | | | | x | | | | | | | | | | | |
| MARCHANTIACEAE | | | | | | | | | | | | | | | | | |
| *Marchantia polymorpha* | | | | | | | | x | | | x | | | | | | |
| MARSUPELLACEAE | | | | | | | | | | | | | | | | | |
| *Marsupella* sp. | | | | | | x | | | | x | | | | | | | |
| PLAGIOCHILACEAE | | | | | | | | | | | | | | | | | |
| *Mylia anomala* | | | | | | x | | | | | | | | x | | | |
| PTILIDIACEAE | | | | | | | | | | | | | | | | | |
| *Blepharaostoma trichophyllum* | | | | | | | | x | | | | | | | | | |
| *Ptilidium ciliare* | | | | x | | | | | | | | x | | | | | |
| *P. pulcherrimum* | | | | | | | | | | | | | | | | x | |
| SCAPANIACEAE | | | | | | | | | | | | | | | | | |
| *Scapania irrigua* | | | | | | | x | | | | | | | | | | |
| *Scapania* sp. | | | | | | | x | x | | x | | | | | | | |
| **Lichens** | | | | | | | | | | | | | | | | | |
| Categories recognized during fieldwork | | | | | | | | | | | | | | | | | |
| *Alectoria ochroleuca* | + | 2 | | + | 6 | 4 | | | | | | 6 | | | + | | |
| *Cetraria cucullata* | | 3 | | 3 | 2 | 2 | + | + | | | | 1 | | | | | |
| *C. islandica* | + | + | + | 1 | + | + | + | + | | | + | + | + | + | | | |
| *C. nivalis* | + | 2 | + | 3 | 17 | 6 | | + | | | | 10 | + | 2 | | | |
| *C. richardsonii* | | + | + | + | 1 | + | | | | | | + | | | | | |
| *C. tilesii* | | 1 | + | | | | | | | | | | | | | | |
| *Cetraria* sp. | | + | | | + | | | | | | | | | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Cladonia mitis* | | | | 4 | 23 | 37 | 1 | + | | | + | 65 | 1 | 70 | | + | 5 |
| *Cladonia rangiferina* | | | + | | + | 5 | 3 | + | | | + | + | + | 1 | + | + | 3 |
| Misc. *Cladonia* sp. | | + | + | 1 | + | 2 | + | + | + | | + | | 2 | 3 | + | + | 2 |
| Crustose Lichens | 15 | 9 | | + | 1 | + | + | | | | | + | | | | | |
| *Dactylina arctica* | | + | + | + | + | + | | + | | | | + | + | + | + | | |
| *Dactylina* sp. | | + | | | + | + | | | | | | | + | | | | |
| Epiphytic Lichens | | | | | | | + | + | + | | 30 | | 23 | 50 | 50 | 30 | |
| *Nephroma arcticum* | | | + | + | + | + | 3 | + | 2 | + | | | + | + | 20 | + | 1 |
| *Nephroma* sp. | | | | + | + | | | | | | | | | | | | |
| *Peltigera aphthosa* | | | + | + | | + | + | + | 1 | | + | | + | | + | + | 1 |
| *P. canina* | | | + | | | | 1 | 1 | 1 | + | | | + | + | + | + | |
| *Peltigera* sp. | | | 1 | + | + | | + | + | | | | | | | | | |
| *Rhizocarpon* sp. | | | | | + | | | | | | | | | | | | |
| Saxicolous Lichens | 6 | 3 | + | + | 1 | | | | | | | | | | | | |
| *Solarina crocea* | + | | + | + | + | | | + | | | | | + | | | | |
| Solicolous Lichens | | | 3 | 2 | 1 | | | + | | | | | 1 | | | | |
| *Stereocaulon* sp. | + | | 5 | 7 | 2 | 10 | + | 1 | 10 | | + | 7 | 1 | | + | | |
| *Thamnolia subuliformis* | + | + | | + | + | | | | | | | | | | | | |
| *Umbilicaria* sp. | 30 | 7 | | 1 | + | | | | | | | + | | | | | |

Lichen Taxa

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BAEOMYCETACEAE | | | | | | | | | | | | | | | | | |
| *Baeomyces rufus* | | | | | x | | | | | | | | | | | | |
| BUELLIACEAE | | | | | | | | | | | | | | | | | |
| *Buellia papillata* | | | | x | | | | | | | | | | | | | |
| *Rinodina turfacea* | | | | x | | | | | | | | | | | | | |
| CALICIACEAE | | | | | | | | | | | | | | | | | |
| *Calicium viride* | | | | | | | | | | | x | | | | | | |
| CLADONIACEAE | | | | | | | | | | | | | | | | | |
| *Cladonia amaurocraea* | | x | | | | x | x | | | | | x | | | | | |
| *C. arbuscula* | | | x | | x | | x | x | | | | x | | | | x | |
| *C. bacillaris* | | | | | | | | | | | | | | | | x | |
| *C. bellidiflora* | | | | | | | x | | | | | | x | | | | |
| *C. carneola* | | | | x | | x | | | | | | | | | | | |
| *C. cenotea* | | | | | | | | | | | | | | | | x | |
| *C. chlorophaea* | | | | | x | | | x | x | | | | x | | | | |
| *C. coccifera* | | x | x | x | x | x | x | x | | | x | x | | x | | | |
| *C. cornuta* | | | | | | x | x | x | | | | | x | x | | | x |
| *C. crispata* | | | | x | | x | | | | | | | x | x | x | | x |
| *C. deformis* | | | x | | | x | x | | | | | | x | x | | | |
| *C. ecmocyna* | | | x | | | x | x | | | | | x | x | | | | |
| *C. fimbriata* | | | | | | | | x | x | | | | | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Cladonia gonecha* | | | | | | x | x | | | | | | | | | | |
| *C. gracilis* | | | | x | x | x | x | x | x | | | x | x | x | x | x | x |
| *C. macrophylla* | | | | x | | x | | | | | | | x | | | | |
| *C. mitis* | | | | x | x | x | x | x | | | | x | x | x | | x | x |
| *C. phyllophora* | | | | | | x | | | | | | x | | | | | |
| *C. pleurota* | | | | | | x | | | | | | x | x | | | | |
| *C. pocillum* | | | | x | | | | | | | | | | | | | |
| *C. pseudostellatum* | | | | | | | | | | | | | | | | | x |
| *C. pyxidata* | | | x | | | x | | x | | | | x | | | | | |
| *C. rangiferina* | | | x | | x | x | x | x | | | x | x | x | x | x | x | x |
| *C. stellaris* | | | x | x | x | x | x | | | | | x | | | | | |
| *C. subfurcata* | | x | | | x | x | | | | | | | | | | | |
| *C. subulata* | | | | | | | | x | | | | | | | | x | |
| *C. sulphurina* | | | x | x | x | x | x | x | | | | x | x | | x | | x |
| *C. uncialis* | | x | | x | | x | x | | | | | x | x | | | | |
| *C. verticillata* | | | | x | | x | | | | | | | | | x | | |
| *Cladonia* sp. | | x | x | x | x | x | x | x | x | | x | | x | x | x | x | x |
| LECANORACEAE | | | | | | | | | | | | | | | | | |
| *Icmadophila ericetorum* | | | | | x | x | | | | | | | x | | x | | |
| *Lecanora epibyron* | | x | | | | | | | | | | | | | | | |
| *L. polytropa* | | | | | | x | | | | | | | | | | | |
| *L. supertegens* | x | | | | | | | | | | | | | | | | |
| *Ochrolechia androgyna* | | | | x | | | | | | | | | | | | | |
| *O. arborea* | | | | | | | | | | | | | x | | | | |
| *O. frigida* | | x | | | | | | | | | | | | | | | |
| *Ochrolechia* sp. | | | | x | | | | | | | | | | | | | |
| LECIDEACEAE | | | | | | | | | | | | | | | | | |
| *Bacidia alpina* | | | x | | | | | | | | | | | | | | |
| *B. obscurata* | | | x | | | | | | | | | | | | | | |
| *Lecidea atrata* | | x | | | | | | | | | | | | | | | |
| *L. flavocaerulescens* | | | | | | | | | | | | | | | | | |
| *L. granulosa* | | | | | | | | | | | | | x | | | | |
| *L. jurana* | | | | | x | | | | | | | | | | | | |
| *Lecidea* sp. | | | | | x | | | | | | | | | | | | |
| *Lecidella stigmatea* | | x | | | x | | | | | | | | | | | | |
| *Rhizocarpon chioneum* | | x | | | | | | | | | | | | | | | |
| *R. eupetraeoides* | x | x | | | x | | | | | | | | | | | | |
| *R. geographicum* | x | x | x | | x | x | | | | | | | | | | | |
| *R. inarense* | x | | | | | | | | | | | | | | | | |
| *R. intermediellum* | x | | | | | | | | | | | | | | | | |
| *R. riparium* | x | | | | | | | | | | | | | | | | |
| *R. superficiale* | | x | | | | | | | | | | | | | | | |

Appendix I continued - 14

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Rhizocarpon umbilicatum* | | x | | | | | | | | | | | | | | | |
| *Rhizocarpon* sp. | | | | | x | | | | | | | | | | | | |
| LICHENES IMPERFECTI | | | | | | | | | | | | | | | | | |
| *Lepraria neglecta* | | | | | | | | | | | | x | | | | | |
| *Lepraria* sp. | | | | | | x | | | | | | | | | | | |
| PANNARIACEAE | | | | | | | | | | | | | | | | | |
| *Pannaria pezizoides* | | | x | | | | | x | x | | | | x | | | | |
| *Psoroma hypnorum* | | | | | | | | x | | | | | | | | | |
| PARMELIACEAE | | | | | | | | | | | | | | | | | |
| *Cetraria commixta* | x | | x | | x | | | | | | | | | | | | |
| *C. cucullata* | | x | | x | x | x | x | x | | | | x | | | | | |
| *C. delisei* | | | x | x | | | | | | | | | | | | | |
| *C. ericetorum* | x | | x | | x | | | | | | | | | | | | |
| *C. hepatizon* | x | | | | x | | | | | | | | | | | | |
| *C. islandica* | x | x | x | x | x | x | x | x | | | x | x | x | x | | | |
| *C. nigricans* | x | x | x | | x | | | | | | | x | | | | | |
| *C. nivalis* | x | x | x | x | x | x | | x | | | | x | x | x | | | |
| *C. pinastri* | | | | | | x | x | x | | | | | | | | | |
| *C. richardsonii* | | x | x | x | x | x | | | | | | x | | | | | |
| *C. tilesii* | | x | x | | | | | | | | | | | | | | |
| *Cetraria* sp. | x | | | | | | | | | | | | | | | | |
| *Dactylina arctica* | | x | x | x | x | x | | x | | | | x | x | x | x | | |
| *D. ramulosa* | | | | x | x | | | x | | | | x | | | | | |
| *Dactylina* sp. | | x | | | x | | x | | | | | | x | | | | |
| *Hypogymnia austerodes* | | | | | | | | | | | | | x | x | x | x | |
| *H. bitteri* | | | | | | | | | | | | | | x | x | x | |
| *H. oroarctica* | | | | | x | | | | | | | | | | | | |
| *H. physodes* | | | | | | | | | | | | | | | x | | |
| *H. vittata* | | | | | | | | | | | | | x | | | | |
| *Parmelia centrifuga* | | | | | | | | | | | | | | | | | |
| *P. separata* | | | x | | x | | | | | | | | | | | | |
| *P. sulcata* | | | | | | | | | | | | | x | | | x | |
| *Parmeliopsis aleurites* | | | | | | | | | | | | | | | x | | |
| *P. ambigua* | | | | | | x | | | | | | | x | x | | | |
| *P. hyperota* | | | | | | x | x | | | | | | | x | | x | |
| PELTIGERACEAE | | | | | | | | | | | | | | | | | |
| *Nephroma arcticum* | | | | x | x | x | x | x | x | x | | | x | x | x | x | x |
| *N. expallidum* | | | x | x | | | x | x | x | | | | | | | x | |
| *N. parile* | | | | | | | | | x | | | | | | | | |
| *N. resupinatum* | | | | | | | | | x | | | | | | | | |
| *Nephroma* sp. | | | | x | x | | | | | | | | | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Peltigera aphthosa* | | | x | x | | x | x | x | x | | x | | x | | x | x | x |
| *P. canina* | | | x | | | | x | x | x | x | | | x | x | x | x | |
| *P. collina* | | | | | | | x | | | | | | | | | | |
| *P. malacea* | | | x | | | | | x | | | | | | | x | x | x |
| *P. polydactyla* | | | | | | | x | x | | | | | x | | | | |
| *P. pulverulenta* | | | | | | | x | | | | | | | | | | |
| *P. rufescens* | | | | | | | | x | x | | | x | | | | | |
| *Peltigera* sp. | | | x | x | x | | x | x | | x | | | | | | | |
| *Solarina crocea* | x | | x | x | x | | | x | | | | | x | | | | |
| *S. saccata* | | | x | | | | | | | | | | | | | | |
| *S. spongiosa* | | | | | | | | x | | | | | | | | | |
| PERTUSARIACEAE | | | | | | | | | | | | | | | | | |
| *Pertusaria dactylina* | | | | | x | | | | | | | | | | | | |
| STEREOCAULACEAE | | | | | | | | | | | | | | | | | |
| *Stereocaulon alpinum* | | | x | x | | | x | x | x | | x | x | | | x | | |
| *S. paschale* | | | x | | x | x | x | | x | | | x | x | | | | x |
| *S. rivulorum* | x | | x | | | | | | | | x | | | | | | |
| *S. saxatile* | x | | | | | | | | | | | | | | | | |
| *S. tomentosum* | | | | | | | | | | x | | x | | | | | |
| *Stereocaulon* sp. | x | | x | x | x | x | x | x | x | | x | | | | x | | |
| STICTACEAE | | | | | | | | | | | | | | | | | |
| *Lobaria linita* | | | | | | | | x | | | x | | | | | | |
| UMBILICARIACEAE | | | | | | | | | | | | | | | | | |
| *Agyrophora lyngei* | x | x | | | x | | | | | | | | | | | | |
| *A. rigida* | x | x | | | x | | | | | | | | | | | | |
| *Agyrophora* sp. | | | | | | | | | | | | | | | | | |
| *Lasallia pustulata* | | | | | | x | | | | | | x | | | | | |
| *Omphalodiscus virginis* | x | | | | | | | | | | | | | | | | |
| *Umbilicaria cylindrica* | x | x | | | | | | | | | | | | | | | |
| *U. deusta* | | | | | | | | | | | | x | | | | | |
| *U. hyperborea* | x | | | x | x | | | | | | | x | | | | | |
| *U. krascheninnikovii* | | | | | | x | | | | | | | | | | | |
| *U. proboscidea* | | x | x | | x | | | | | | | x | | | | | |
| *Umbilicaria* sp. | x | x | | x | x | | | | | | | x | | | | | |
| USNEACEAE | | | | | | | | | | | | | | | | | |
| *Alectoria nigricans* | | x | | x | | | | | | | | | | | | | |
| *A. ochroleuca* | x | x | | x | x | x | | | | | | x | | | x | | |
| *A. sarmentosa* | | | | | | | | | | | | | x | | | | |
| *Bryoria fuscescens* | | | | | | | | | | | | | x | | | x | |
| *B. lanestris* | | | | | | | | | | | | | | | x | x | |
| *B. pseudofuscescens* | | | | | | | | | | | | | | | | x | |
| *B. simplicior* | | | | | | | | | | | | | | x | x | | |

Appendix I continued - 16

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Cornicularia divergens* | x | | x | | | | | | | | | | | | | | |
| *Pseudophebe pubescens* | x | x | | | | | | | | | | | | | | | |
| *Thamnolia subuliformis* | x | x | | x | x | | | | | | | x | | | | | |
| *Usnea sorediifera* | | | | | | | | | | | | | | | | x | |

'+' cover value of less than 1%

'x' collected during the course of the 1981-1982 survey or reported from previous studies.

# APPENDIX

## APPENDIX B HIERARCHICAL CLASSIFICATION OF VEGETATION UNITS FOR ALL SAMPLE PLOTS RECORDED WITHIN THE MACTUNG LOCAL STUDY AREA- 2006

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| -56 | NT | STA | Lr | SC | SC Salix-Carex | SC3aBgi | 1487 | c |
| -50 | NT | STA | Lr | WS | SP Salix-Poa | SP3aBcw | 1502 | c |
| -66 | NT | STA | Lt | BM | BM Betula-Moss | BM3aBgw | 1384 | w |
| -65 | NT | STA | Lt | CM | CS Carex-Salix | CS2bgi | 1372 | w |
| -55 | NT | STA | Lt | FC | FC Festuca-Carex | FC2bgw | 1491 | w |
| -01 | NT | STA | Lt | SC | SC Salix-Carex | SC3aBci | 1480 | c |
| -60 | NT | STA | Lt | SC | SC Salix-Carex | SC3aBgi | 1454 | c |
| -47 | NT | STA | Lt | WS | SL Salix-Cladina | SL3aBgw | 1575 | na |
| -53 | NT | STA | Uu | CM | CV Carex-Veratum | CV3aBcw | 1577 | c |
| -52 | NT | STA | Uu | WS | SF Salix-Festuca | SF3aBcw | 1616 | w |
| -36 | YN | ALP | Ld | CM | CM Carex-Mertensia | CM2bgw | 1621 | w |
| -37 | YN | ALP | Ld | CM | CS Carex-Salix | CS2bgi | 1589 | w |
| -34 | YN | ALP | Lr | FS | SP Salix-Moss | SP2dBww | 1782 | w |
| 76 | YN | ALP | Uu | FC | FC Festuca-Carex | FC2bww | 1675 | |
| -14 | YN | ALP | Uu | CC | CC Cassiope-Cladina | CC2dBww | 1761 | w |
| -32 | YN | ALP | Uu | CC | CC Cassiope-Cladina | CC2dgr | 1648 | c |
| -42 | YN | ALP | Uu | CC | CC Cassiope-Cladina | CC2dB | 1634 | |
| -03 | YN | ALP | Uu | CC | CC-Cassiope-Cladina | CC2dgw | 1620 | w |
| -61 | YN | ALP | Uu | CC | CC Cassiope-Cladina | CC2dBcv | 1545 | c |
| -22 | YN | ALP | Uu | CC | CC Cassiope-Cladina | CC2dcr | 1540 | c |
| -68 | YN | ALP | Uu | CC | CC Cassiope-Cladina | CC2dBcr | 1470 | c |
| -25 | YN | ALP | Uu | CC | CC Cassiope-Cladina | CC2dcx | 1459 | c |
| -31 | YN | ALP | Uu | CC | CC Cassiope-Cladina | CC2dgr | 1405 | c |
| -62 | YN | ALP | Uu | CC | CF Cassiope-Festuca | CF2dBwr | 1524 | w |
| -38 | YN | ALP | Uu | FC | FC Festuca-Carex | FC2bcw | 1585 | w |
| -40 | YN | ALP | Uu | FC | FC Festuca-Carex | FC2bgw | 1529 | c |
| -41 | YN | ALP | Uu | FC | FC Festuca-Carex | FC2bBgm | 1515 | |
| -43 | YN | ALP | Uu | FC | FL Festuca-Lichen | FL2d | 1870 | c |
| -13 | YN | ALP | Uu | FC | FL Festuca-Lichen | FL2bHww | 1763 | w |
| -35 | YN | ALP | Uu | FL:CC | 5FL:5CC | FL:CC | 1772 | c |
| -12 | YN | ALP | Uu | FS | FS Festuca-Salix | FS2dgw | 1770 | w |
| -15 | YN | ALP | Uu | FS | FS Festuca-Salix | FS2dwr | 1590 | w |
| -07 | YN | STA | Lr | CM | CM Carex-Mertensia | CM2bgm | 1406 | |
| -39 | YN | STA | Lr | SM | SM Salix-Mertensia | SM3aB | 1523 | |
| -28 | YN | STA | Lr | SM | SM Salix-Mertensia | SM3aBgi | 1518 | |
| -10 | YN | STA | Lr | SM | SM Salix-Mertensia | SM3aBgp | 1509 | |
| -11 | YN | STA | Lr | SM | SM Salix-Mertensia | SM3aBgp | 1455 | w |
| -60 | YN | STA | Lr | BC:BM | BC:BM | 5BC:5BM | 1352 | |
| -29 | YN | STA | Uu | BC | BC-Betula-Cladina | BC3aBgx | 1528 | w |
| -08 | YN | STA | Uu | BC | BC Betula-Cladina | BC3aBgw | 1467 | w |
| 72 | YN | STA | Uu | BC | BC Betula-Cladina | BC3aBcr | 1465 | |
| -04 | YN | STA | Uu | BC | BC-Betula-Cladina | BC3aBgw | 1420 | w |
| -06 | YN | STA | Uu | BM | BM Betula-Moss | BM3aBgm | 1418 | |
| -09 | YN | STA | Uu | WS | SS Salix-Salix | SP3aBcw | 1500 | c |
| -71 | YN | WTA | Lr | SC | SC Salix-Carex | SC3bBgi | 1283 | na |
| -21 | YN | WTA | Lr | SC | SP Salix-Moss | SP3bBgi | 1170 | na |
| -05 | YN | WTA | Lr | SM | SM Salix-Mertensia | SM3aBgp | 1400 | w |
| -24 | YN | WTA | Lt | BC | BC Betula-Cladina | BC3aBgw | 1301 | |
| -17 | YN | WTA | Lt | WS | SM Salix-Mertensia | SM:Ta-3agw | 1260 | w |
| -18 | YN | WTA | Ut | AM | AM Abies-Moss | AM5iCcm | 1199 | c |
| -20 | YN | WTA | Ut | BC | BC Betula-Cladina | BC3aBgw | 1175 | na |
| -28 | YN | WTA | Ut | FS | FP Festuca-Mertensia | FP2bgw | 1363 | c |
| -19 | YN | WTA | Ut | WS | SM Salix-Mertensia | SM:Ta-3acm | 1202 | c |
| -74 | YN | WTA | Uu | AC | AC Abies-Cladina | AC5iCcr | 1418 | c |
| -69 | YN | WTA | Uu | AC | AC Abies-Cladina | AC5iCcr | 1362 | c |
| -33 | YN | WTA | Uu | AC | AC Abies-Cladina | AC5iCgw | 1444 | c |
| -26 | YN | WTA | Uu | AC | AC Abies-Cladina | AC5iCcw | 1373 | c |
| -23 | YN | WTA | Uu | AC | AC Abies-Cladina | AC5iCcx | 1370 | c |
| -16 | YN | WTA | Uu | AM | AM Abies-Moss | AM4tCwi | 1450 | 280 |
| -30 | YN | WTA | Uu | AM | AM Abies-Moss | AM5iCgw | 1439 | w |
| -64 | YN | WTA | Uu | AM | AM Abies-Moss | AM5iCcw | 1389 | c |
| -70 | YN | WTA | Uu | AM | AM Abies-Moss | AM5iCcw | 1338 | |
| -27 | YN | WTA | Uu | AM | AM Abies-Moss | AM5iCcw | 1336 | c |
| -57 | YN | WTA | Uu | AM | AM Abies-Moss | AM5iCcr | 1282 | c |
| -59 | YN | WTA | Uu | BC | BC Betula-Cladina | BC3aBcw | 1378 | c |

# APPENDIX

## APPENDIX C VEGETATION PLOT DATA MACTUNG LSA 2006

Appendix C. Vegetation Plot Data MacTung LSA 2006

| PlotNumber | Species | Lifeform | LatinName | CommonName | AvgOfCover |
|---|---|---|---|---|---|
| VG-01 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 3 |
| VG-01 | EQUIPRA | 5 | Equisetum pratense | meadow horsetail | 15 |
| VG-01 | MERTPAN | 7 | Mertensia paniculata | tall bluebells | 3 |
| VG-01 | PARNFIM | 7 | Parnassia fimbriata | fringed grass-of-Parnassus | 1 |
| VG-01 | PETAFRI | 7 | Petasites frigidus | sweet coltsfoot | 2 |
| VG-01 | POLEACU | 7 | Polemonium acutiflorum | tall Jacob's-ladder | 2 |
| VG-01 | POLYVIV | 7 | Polygonum viviparum | alpine bistort | 1 |
| VG-01 | PYROLA | 7 | Pyrola sp. | wintergreen | 1 |
| VG-01 | RANUNCU | 7 | Ranunculus sp. | buttercup | 2 |
| VG-01 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 2 |
| VG-01 | RUMEX | 7 | Rumex sp. | | 1 |
| VG-01 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 35 |
| VG-01 | SAXINEL | 7 | Saxifraga nelsoniana | dotted saxifrage | 1 |
| VG-01 | SENETRI | 7 | Senecio triangularis | arrow-leaved groundsel | 40 |
| VG-01 | VAHLATR | 6 | Vahlodea atropurpurea | mountain hairgrass | 5 |
| VG-02 | ANEMNAR | 7 | Anemone narcissiflora | narcissus anemone | 2 |
| VG-02 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 10 |
| VG-02 | CLADMIT | 11 | Cladina mitis | lesser green reindeer | 10 |
| VG-02 | DANTSPI | 6 | Danthonia spicata | poverty oatgrass | 1 |
| VG-02 | FESTALT | 6 | Festuca altaica | Altai fescue | 20 |
| VG-02 | PEDILAB | 7 | Pedicularis labradorica | Labrador lousewort | 1 |
| VG-02 | POA | 6 | Poa sp. | bluegrass | 2 |
| VG-02 | POLYSPH | 9 | Polytrichum sphaerothecium | | 50 |
| VG-02 | RANUESC | 7 | Ranunculus eschscholtzii | subalpine buttercup | 2 |
| VG-02 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 2 |
| VG-02 | SALIRET | 12 | Salix reticulata | net-veined willow | 5 |
| VG-02 | SENETRI | 7 | Senecio triangularis | arrow-leaved groundsel | 1 |
| VG-02 | VACCVIT | 12 | Vaccinium vitis-idaea | | 5 |
| VG-02 | VAHLATR | 6 | Vahlodea atropurpurea | mountain hairgrass | 12 |
| VG-03 | ARCTALP | 12 | Arctostaphylos alpina | alpine bearberry | 5 |
| VG-03 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 2 |
| VG-03 | CASSTET | 12 | Cassiope tetragona | four-angled mountain-heather | 40 |
| VG-03 | CETRARI | 11 | Cetraria sp. | icelandmoss lichens | 10 |
| VG-03 | CLADMIT | 11 | Cladina mitis | lesser green reindeer | 35 |
| VG-03 | CLADSTE | 11 | Cladina stellaris | star-tipped reindeer | 2 |
| VG-03 | POLYTRI | 9 | Polytrichum sp. | haircap moss | 2 |
| VG-03 | RHIZATR | 11 | Rhizocarpon atroflavescens | | 1 |
| VG-03 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 2 |
| VG-03 | SALIARC | 12 | Salix arctica | arctic willow | 5 |
| VG-03 | SALIX | 0 | Salix sp. | willow | 1 |
| VG-03 | VACCVIT | 12 | Vaccinium vitis-idaea | | 2 |
| VG-03 | VAHLATR | 6 | Vahlodea atropurpurea | mountain hairgrass | 5 |
| VG-04 | CALACAN | 6 | Calamagrostis canadensis | bluejoint reedgrass | 2 |
| VG-04 | CETRARI | 11 | Cetraria sp. | icelandmoss lichens | 10 |
| VG-04 | CLADMIT | 11 | Cladina mitis | lesser green reindeer | 50 |
| VG-04 | CLADSTE | 11 | Cladina stellaris | star-tipped reindeer | 5 |
| VG-04 | DESCCES | 6 | Deschampsia cespitosa | tufted hairgrass | 15 |
| VG-04 | FESTALT | 6 | Festuca altaica | Altai fescue | 10 |
| VG-04 | POLYTRI | 9 | Polytrichum sp. | haircap moss | 10 |
| VG-04 | RUBUCHA | 12 | Rubus chamaemorus | cloudberry | 1 |
| VG-04 | VACCVIT | 12 | Vaccinium vitis-idaea | | 3 |
| VG-05 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 2 |
| VG-05 | DESCCES | 6 | Deschampsia cespitosa | tufted hairgrass | 10 |
| VG-05 | EPILANG | 7 | Epilobium angustifolium | fireweed | 2 |

| | | | | | |
|---|---|---|---|---|---|
| VG-05 | EQUIPRA | 5 | Equisetum pratense | meadow horsetail | 2 |
| VG-05 | HYLOSPL | 9 | Hylocomium splendens | step moss | 40 |
| VG-05 | MERTPAN | 7 | Mertensia paniculata | tall bluebells | 5 |
| VG-05 | PARNFIM | 7 | Parnassia fimbriata | fringed grass-of-Parnassus | 1 |
| VG-05 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 2 |
| VG-05 | RUBUARC | 7 | Rubus arcticus | nagoonberry | 1 |
| VG-05 | SALIALA | 4 | Salix alaxensis | Alaska willow | 25 |
| VG-05 | SALIGLA | 4 | Salix glauca | grey-leaved willow | 20 |
| VG-05 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 25 |
| VG-05 | SAXILYA | 7 | Saxifraga lyallii | red-stemmed saxifrage | 2 |
| VG-05 | SELAGIN | 5 | Selaginella sp. | | 2 |
| VG-05 | SENETRI | 7 | Senecio triangularis | arrow-leaved groundsel | 2 |
| VG-05 | SPIRBET | 4 | Spiraea betulifolia | birch-leaved spirea | 2 |
| VG-09 | ANEMNAR | 7 | Anemone narcissiflora | narcissus anemone | 5 |
| VG-09 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 2 |
| VG-09 | CASSTET | 12 | Cassiope tetragona | four-angled mountain-heather | 10 |
| VG-09 | EPILLAT | 7 | Epilobium latifolium | broad-leaved willowherb | 2 |
| VG-09 | OXYRDIG | 7 | Oxyria digyna | mountain sorrel | 2 |
| VG-09 | PARNFIM | 7 | Parnassia fimbriata | fringed grass-of-Parnassus | 1 |
| VG-09 | POA | 6 | Poa sp. | bluegrass | 2 |
| VG-09 | POLYTRI | 9 | Polytrichum sp. | haircap moss | 40 |
| VG-09 | RANUESC | 7 | Ranunculus eschscholtzii | subalpine buttercup | 2 |
| VG-09 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 35 |
| VG-09 | SALIRET | 12 | Salix reticulata | net-veined willow | 60 |
| VG-11 | ACONDEL | 7 | Aconitum delphiniifolium | mountain monkshood | 1 |
| VG-11 | AGOSAUR | 7 | Agoseris aurantiaca | orange agoseris | 1 |
| VG-11 | ANEMNAR | 7 | Anemone narcissiflora | narcissus anemone | 1 |
| VG-11 | ASTRAGA | 7 | Astragalus sp. | | 2 |
| VG-11 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 10 |
| VG-11 | DESCCES | 6 | Deschampsia cespitosa | tufted hairgrass | 10 |
| VG-11 | EQUIPRA | 5 | Equisetum pratense | meadow horsetail | 3 |
| VG-11 | HYLOSPL | 9 | Hylocomium splendens | step moss | 35 |
| VG-11 | MERTPAN | 7 | Mertensia paniculata | tall bluebells | 5 |
| VG-11 | ORYZOPS | 6 | Oryzopsis sp. | | 2 |
| VG-11 | OXYRDIG | 7 | Oxyria digyna | mountain sorrel | 5 |
| VG-11 | PEDIBRA | 7 | Pedicularis bracteosa | bracted lousewort | 1 |
| VG-11 | PETAFRI | 7 | Petasites frigidus | sweet coltsfoot | 1 |
| VG-11 | RANUESC | 7 | Ranunculus eschscholtzii | subalpine buttercup | 2 |
| VG-11 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 2 |
| VG-11 | RUBUARC | 7 | Rubus arcticus | nagoonberry | 2 |
| VG-11 | SALIGLA | 4 | Salix glauca | grey-leaved willow | 25 |
| VG-11 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 50 |
| VG-11 | SENETRI | 7 | Senecio triangularis | arrow-leaved groundsel | 3 |
| VG-11 | VALESIT | 7 | Valeriana sitchensis | Sitka valerian | 1 |
| VG-12 | ARTENOR | 7 | Artemisia norvegica | mountain sagewort | 5 |
| VG-12 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 3 |
| VG-12 | CASSTET | 12 | Cassiope tetragona | four-angled mountain-heather | 2 |
| VG-12 | CETRARI | 11 | Cetraria sp. | icelandmoss lichens | 4 |
| VG-12 | CLADONI | 11 | Cladonia sp. | clad lichens | 1 |
| VG-12 | DACTYLN | 11 | Dactylina sp. | finger lichens | 1 |
| VG-12 | DRYAINT | 12 | Dryas integrifolia | entire-leaved mountain-avens | 1 |
| VG-12 | FESTALT | 6 | Festuca altaica | Altai fescue | 20 |
| VG-12 | GENTGLA | 7 | Gentiana glauca | glaucous gentian | 1 |
| VG-12 | ORYZOPS | 6 | Oryzopsis sp. | | 5 |
| VG-12 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 2 |

| | | | | | |
|---|---|---|---|---|---|
| VG-12 | POLYTRI | 9 | Polytrichum sp. | haircap moss | 10 |
| VG-12 | RHIZATR | 11 | Rhizocarpon atroflavescens | | 1 |
| VG-12 | SALIARC | 12 | Salix arctica | arctic willow | 20 |
| VG-12 | STERCON | 11 | Stereocaulon condensatum | granular soil-foam | 1 |
| VG-15 | ARTENOR | 7 | Artemisia norvegica | mountain sagewort | 1 |
| VG-15 | CASSTET | 12 | Cassiope tetragona | four-angled mountain-heather | 10 |
| VG-15 | CETRARE | 11 | Cetrariella sp. | | 5 |
| VG-15 | DRYAOCT | 12 | Dryas octopetala | white mountain-avens | 3 |
| VG-15 | EMPENIG | 12 | Empetrum nigrum | crowberry | 5 |
| VG-15 | EPILLAT | 7 | Epilobium latifolium | broad-leaved willowherb | 1 |
| VG-15 | FESTALT | 6 | Festuca altaica | Altai fescue | 15 |
| VG-15 | HYLOSPL | 9 | Hylocomium splendens | step moss | 20 |
| VG-15 | JUNICOM | 3 | Juniperus communis | common juniper | 2 |
| VG-15 | MERTPAN | 7 | Mertensia paniculata | tall bluebells | 1 |
| VG-15 | SALIGLA | 4 | Salix glauca | grey-leaved willow | 10 |
| VG-15 | SALIRET | 12 | Salix reticulata | net-veined willow | 5 |
| VG-15 | SOLIDAG | 7 | Solidago sp. | | 1 |
| VG-15 | STELLOG | 7 | Stellaria longipes | long-stalked starwort | 1 |
| VG-15 | STERCON | 11 | Stereocaulon condensatum | granular soil-foam | 15 |
| VG-15 | VACCULI | 4 | Vaccinium uliginosum | bog blueberry | 10 |
| VG-15 | VACCVIT | 12 | Vaccinium vitis-idaea | | 10 |
| VG-16 | ABIELAS | 1 | Abies lasiocarpa | subalpine fir | 50 |
| VG-16 | ANEMNAR | 7 | Anemone narcissiflora | narcissus anemone | 1 |
| VG-16 | CASSTET | 12 | Cassiope tetragona | four-angled mountain-heather | 2 |
| VG-16 | CLADONI | 11 | Cladonia sp. | clad lichens | 8 |
| VG-16 | LYCOPOI | 5 | Lycopodium sp. | clubmoss | 1 |
| VG-16 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 15 |
| VG-16 | PHYLEMP | 12 | Phyllodoce empetriformis | pink mountain-heather | 2 |
| VG-16 | PLEUSCH | 9 | Pleurozium schreberi | red-stemmed feathermoss | 50 |
| VG-16 | POLYTRI | 9 | Polytrichum sp. | haircap moss | 15 |
| VG-16 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 2 |
| VG-16 | SPIRBET | 4 | Spiraea betulifolia | birch-leaved spirea | 1 |
| VG-17 | ABIELAS | 1 | Abies lasiocarpa | subalpine fir | 1 |
| VG-17 | ARTENOR | 7 | Artemisia norvegica | mountain sagewort | 2 |
| VG-17 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 5 |
| VG-17 | CORNCAN | 7 | Cornus canadensis | bunchberry | 2 |
| VG-17 | DELPGLA | 7 | Delphinium glaucum | tall larkspur | 1 |
| VG-17 | EPILANG | 7 | Epilobium angustifolium | fireweed | 2 |
| VG-17 | EQUIARV | 5 | Equisetum arvense | common horsetail | 20 |
| VG-17 | HEDYALP | 7 | Hedysarum alpinum | alpine hedysarum | 2 |
| VG-17 | LINNBOR | 12 | Linnaea borealis | twinflower | 5 |
| VG-17 | MERTPAN | 7 | Mertensia paniculata | tall bluebells | 2 |
| VG-17 | PHYLEMP | 12 | Phyllodoce empetriformis | pink mountain-heather | 3 |
| VG-17 | POLEACU | 7 | Polemonium acutiflorum | tall Jacob's-ladder | 1 |
| VG-17 | ROSAACI | 4 | Rosa acicularis | prickly rose | 2 |
| VG-17 | SALIBAA | 4 | Salix barrattiana | Barratt's willow | 30 |
| VG-17 | SALIGLA | 4 | Salix glauca | grey-leaved willow | 30 |
| VG-17 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 15 |
| VG-17 | SHEPCAN | 4 | Shepherdia canadensis | soopolallie | 2 |
| VG-20 | CLADSTE | 11 | Cladina stellaris | star-tipped reindeer | 60 |
| VG-20 | EMPENIG | 12 | Empetrum nigrum | crowberry | 2 |
| VG-20 | FESTALT | 6 | Festuca altaica | Altai fescue | 5 |
| VG-20 | PLEUSCH | 9 | Pleurozium schreberi | red-stemmed feathermoss | 10 |
| VG-20 | POLYTRI | 9 | Polytrichum sp. | haircap moss | 20 |
| VG-20 | VACCULI | 4 | Vaccinium uliginosum | bog blueberry | 5 |

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|---|---|---|---|---|---|
| VG-20 | VACCVIT | 12 | Vaccinium vitis-idaea | | 3 |
| VG-21 | AGOSERI | 7 | Agoseris sp. | | 1 |
| VG-21 | CORNCAN | 7 | Cornus canadensis | bunchberry | 2 |
| VG-21 | EPILANG | 7 | Epilobium angustifolium | fireweed | 1 |
| VG-21 | EQUIARV | 5 | Equisetum arvense | common horsetail | 5 |
| VG-21 | HYLOSPL | 9 | Hylocomium splendens | step moss | 30 |
| VG-21 | MERTPAN | 7 | Mertensia paniculata | tall bluebells | 1 |
| VG-21 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 2 |
| VG-21 | RIBES | 4 | Ribes sp. | currant or gooseberry | 1 |
| VG-21 | RUBUARC | 7 | Rubus arcticus | nagoonberry | 2 |
| VG-21 | RUBUCHA | 12 | Rubus chamaemorus | cloudberry | 1 |
| VG-21 | SALIALA | 4 | Salix alaxensis | Alaska willow | 10 |
| VG-21 | SALIGLA | 4 | Salix glauca | grey-leaved willow | 45 |
| VG-21 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 30 |
| VG-21 | SONCHUS | 7 | Sonchus sp. | | 0.1 |
| VG-21 | STELLON | 7 | Stellaria longifolia | long-leaved starwort | 1 |
| VG-21 | VIOLA | 7 | Viola sp. | violet | 2 |
| VG-22 | ANEMNAR | 7 | Anemone narcissiflora | narcissus anemone | 1 |
| VG-22 | CAREALB | 6 | Carex albonigra | two-toned sedge | 2 |
| VG-22 | CASSTET | 12 | Cassiope tetragona | four-angled mountain-heather | 15 |
| VG-22 | CLADMIT | 11 | Cladina mitis | lesser green reindeer | 25 |
| VG-22 | CLADSTE | 11 | Cladina stellaris | star-tipped reindeer | 35 |
| VG-22 | FESTALT | 6 | Festuca altaica | Altai fescue | 5 |
| VG-22 | GENTGLA | 7 | Gentiana glauca | glaucous gentian | 1 |
| VG-22 | HYLOSPL | 9 | Hylocomium splendens | step moss | 10 |
| VG-22 | LYCOPOI | 5 | Lycopodium sp. | clubmoss | 1 |
| VG-22 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 2 |
| VG-22 | RHIZOBS | 11 | Rhizocarpon obscuratum | | 1 |
| VG-22 | SALIARC | 12 | Salix arctica | arctic willow | 10 |
| VG-22 | SALIGLA | 4 | Salix glauca | grey-leaved willow | 1 |
| VG-22 | SOLIDAG | 7 | Solidago sp. | | 1 |
| VG-22 | SPIRBET | 4 | Spiraea betulifolia | birch-leaved spirea | 1 |
| VG-23 | ABIELAS | 1 | Abies lasiocarpa | subalpine fir | 16.667 |
| VG-23 | CASSTET | 12 | Cassiope tetragona | four-angled mountain-heather | 10 |
| VG-23 | CLADBEL | 11 | Cladonia bellidiflora | toy soldiers | 1 |
| VG-23 | CLADMIT | 11 | Cladina mitis | lesser green reindeer | 5 |
| VG-23 | CLADSTE | 11 | Cladina stellaris | star-tipped reindeer | 50 |
| VG-23 | HYLOSPL | 9 | Hylocomium splendens | step moss | 25 |
| VG-23 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 5 |
| VG-23 | SPIRBET | 4 | Spiraea betulifolia | birch-leaved spirea | 2 |
| VG-23 | STERDEP | 11 | Stereocaulon depressum | creeping foam | 5 |
| VG-23 | VACCVIT | 12 | Vaccinium vitis-idaea | | 2 |
| VG-25 | CASSTET | 12 | Cassiope tetragona | four-angled mountain-heather | 5 |
| VG-25 | CLADMIT | 11 | Cladina mitis | lesser green reindeer | 50 |
| VG-25 | EMPENIG | 12 | Empetrum nigrum | crowberry | 3 |
| VG-25 | FESTALT | 6 | Festuca altaica | Altai fescue | 2 |
| VG-25 | HIERALP | 6 | Hierochloë alpina | alpine sweetgrass | 5 |
| VG-25 | HYLOSPL | 9 | Hylocomium splendens | step moss | 7 |
| VG-25 | LYCOPOI | 5 | Lycopodium sp. | clubmoss | 1 |
| VG-25 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 2 |
| VG-25 | RHIZOCA | 11 | Rhizocarpon sp. | | 2 |
| VG-25 | SALIRET | 12 | Salix reticulata | net-veined willow | 7 |
| VG-25 | SPIRBET | 4 | Spiraea betulifolia | birch-leaved spirea | 1 |
| VG-25 | STERDEP | 11 | Stereocaulon depressum | creeping foam | 15 |
| VG-25 | VACCULI | 4 | Vaccinium uliginosum | bog blueberry | 2 |

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|---|---|---|---|---|---|
| VG-25 | VACCVIT | 12 | Vaccinium vitis-idaea | | 7 |
| VG-26 | ABIELAS | 1 | Abies lasiocarpa | subalpine fir | 60 |
| VG-26 | CASSTET | 12 | Cassiope tetragona | four-angled mountain-heather | 2 |
| VG-26 | CLADMIT | 11 | Cladina mitis | lesser green reindeer | 10 |
| VG-26 | CLADSTE | 11 | Cladina stellaris | star-tipped reindeer | 30 |
| VG-26 | EMPENIG | 12 | Empetrum nigrum | crowberry | 3 |
| VG-26 | HYLOSPL | 9 | Hylocomium splendens | step moss | 35 |
| VG-26 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 5 |
| VG-26 | PHYLEMP | 12 | Phyllodoce empetriformis | pink mountain-heather | 3 |
| VG-26 | POLYTRI | 9 | Polytrichum sp. | haircap moss | 15 |
| VG-26 | SPIRBET | 4 | Spiraea betulifolia | birch-leaved spirea | 3 |
| VG-26 | VACCULI | 4 | Vaccinium uliginosum | bog blueberry | 3 |
| VG-26 | VACCVIT | 12 | Vaccinium vitis-idaea | | 1 |
| VG-27 | ABIELAS | 1 | Abies lasiocarpa | subalpine fir | 20 |
| VG-27 | ARTENOR | 7 | Artemisia norvegica | mountain sagewort | 1 |
| VG-27 | DELPGLA | 7 | Delphinium glaucum | tall larkspur | 1 |
| VG-27 | EPILANG | 7 | Epilobium angustifolium | fireweed | 1 |
| VG-27 | HYLOSPL | 9 | Hylocomium splendens | step moss | 70 |
| VG-27 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 3 |
| VG-27 | PETAFRI | 7 | Petasites frigidus | sweet coltsfoot | 1 |
| VG-27 | PHYLEMP | 12 | Phyllodoce empetriformis | pink mountain-heather | 2 |
| VG-27 | POLEACU | 7 | Polemonium acutiflorum | tall Jacob's-ladder | 0.1 |
| VG-27 | POLYTRI | 9 | Polytrichum sp. | haircap moss | 10 |
| VG-27 | PYROMIN | 7 | Pyrola minor | lesser wintergreen | 1 |
| VG-27 | RIBES | 4 | Ribes sp. | currant or gooseberry | 0.1 |
| VG-27 | RUBUARC | 7 | Rubus arcticus | nagoonberry | 0.1 |
| VG-27 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 7 |
| VG-27 | SAXIFRA | 7 | Saxifraga sp. | saxifrage | 0.1 |
| VG-27 | SENETRI | 7 | Senecio triangularis | arrow-leaved groundsel | 2 |
| VG-27 | SPIRBET | 4 | Spiraea betulifolia | birch-leaved spirea | 2 |
| VG-27 | VACCULI | 4 | Vaccinium uliginosum | bog blueberry | 2 |
| VG-28 | ACONDEL | 7 | Aconitum delphiniifolium | mountain monkshood | 1 |
| VG-28 | ANEMCYL | 7 | Anemone cylindrica | long-headed anemone | 1 |
| VG-28 | EPILANG | 7 | Epilobium angustifolium | fireweed | 2 |
| VG-28 | FESTALT | 6 | Festuca altaica | Altai fescue | 50 |
| VG-28 | LUPIARC | 7 | Lupinus arcticus | arctic lupine | 1 |
| VG-28 | MERTPAN | 7 | Mertensia paniculata | tall bluebells | 3 |
| VG-28 | POA | 6 | Poa sp. | bluegrass | 25 |
| VG-28 | POLEACU | 7 | Polemonium acutiflorum | tall Jacob's-ladder | 0.1 |
| VG-28 | SENETRI | 7 | Senecio triangularis | arrow-leaved groundsel | 1 |
| VG-29 | ABIELAS | 1 | Abies lasiocarpa | subalpine fir | 1 |
| VG-29 | CASSTET | 12 | Cassiope tetragona | four-angled mountain-heather | 1 |
| VG-29 | CLADMIT | 11 | Cladina mitis | lesser green reindeer | 10 |
| VG-29 | EMPENIG | 12 | Empetrum nigrum | crowberry | 2 |
| VG-29 | FESTALT | 6 | Festuca altaica | Altai fescue | 7 |
| VG-29 | HYLOSPL | 9 | Hylocomium splendens | step moss | 5 |
| VG-29 | PEDILAB | 7 | Pedicularis labradorica | Labrador lousewort | 1 |
| VG-29 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 1 |
| VG-29 | SPIRBET | 4 | Spiraea betulifolia | birch-leaved spirea | 2 |
| VG-29 | STERDEP | 11 | Stereocaulon depressum | creeping foam | 10 |
| VG-29 | VACCULI | 4 | Vaccinium uliginosum | bog blueberry | 7 |
| VG-29 | VACCVIT | 12 | Vaccinium vitis-idaea | | 5 |
| VG-30 | ABIELAS | 1 | Abies lasiocarpa | subalpine fir | 67.5 |
| VG-30 | ANEMNAR | 7 | Anemone narcissiflora | narcissus anemone | 1 |
| VG-30 | CORNCAN | 7 | Cornus canadensis | bunchberry | 3 |

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|---|---|---|---|---|---|
| VG-30 | EPILANG | 7 | Epilobium angustifolium | fireweed | 1 |
| VG-30 | FESTALT | 6 | Festuca altaica | Altai fescue | 2 |
| VG-30 | HYLOSPL | 9 | Hylocomium splendens | step moss | 75 |
| VG-30 | LINNBOR | 12 | Linnaea borealis | twinflower | 3 |
| VG-30 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 2 |
| VG-30 | PETAFRI | 7 | Petasites frigidus | sweet coltsfoot | 0.1 |
| VG-30 | POLYTRI | 9 | Polytrichum sp. | haircap moss | 5 |
| VG-30 | RUBUARC | 7 | Rubus arcticus | nagoonberry | 1 |
| VG-30 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 2 |
| VG-30 | VACCVIT | 12 | Vaccinium vitis-idaea | | 3 |
| VG-31 | CASSTET | 12 | Cassiope tetragona | four-angled mountain-heather | 1 |
| VG-31 | CLADMIT | 11 | Cladina mitis | lesser green reindeer | 50 |
| VG-31 | EMPENIG | 12 | Empetrum nigrum | crowberry | 5 |
| VG-31 | FESTALT | 6 | Festuca altaica | Altai fescue | 3 |
| VG-31 | SALIRET | 12 | Salix reticulata | net-veined willow | 10 |
| VG-31 | STERDEP | 11 | Stereocaulon depressum | creeping foam | 5 |
| VG-31 | VACCULI | 4 | Vaccinium uliginosum | bog blueberry | 2 |
| VG-31 | VACCVIT | 12 | Vaccinium vitis-idaea | | 7 |
| VG-32 | ANEMNAR | 7 | Anemone narcissiflora | narcissus anemone | 2 |
| VG-32 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 2 |
| VG-32 | CASSTET | 12 | Cassiope tetragona | four-angled mountain-heather | 5 |
| VG-32 | CLADMIT | 11 | Cladina mitis | lesser green reindeer | 40 |
| VG-32 | DRYAOCT | 12 | Dryas octopetala | white mountain-avens | 1 |
| VG-32 | FESTALT | 6 | Festuca altaica | Altai fescue | 10 |
| VG-32 | LUPIARC | 7 | Lupinus arcticus | arctic lupine | 0.1 |
| VG-32 | SALIARC | 12 | Salix arctica | arctic willow | 7 |
| VG-32 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 1 |
| VG-32 | SALIRET | 12 | Salix reticulata | net-veined willow | 3 |
| VG-32 | STERDEP | 11 | Stereocaulon depressum | creeping foam | 10 |
| VG-32 | VACCULI | 4 | Vaccinium uliginosum | bog blueberry | 0.1 |
| VG-32 | VACCVIT | 12 | Vaccinium vitis-idaea | | 3 |
| VG-33 | ABIELAS | 1 | Abies lasiocarpa | subalpine fir | 37.5 |
| VG-33 | ANEMNAR | 7 | Anemone narcissiflora | narcissus anemone | 2 |
| VG-33 | CASSTET | 12 | Cassiope tetragona | four-angled mountain-heather | 5 |
| VG-33 | CLADMIT | 11 | Cladina mitis | lesser green reindeer | 20 |
| VG-33 | CLADSTE | 11 | Cladina stellaris | star-tipped reindeer | 30 |
| VG-33 | CORNCAN | 7 | Cornus canadensis | bunchberry | 1 |
| VG-33 | HYLOSPL | 9 | Hylocomium splendens | step moss | 15 |
| VG-33 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 2 |
| VG-33 | POLEACU | 7 | Polemonium acutiflorum | tall Jacob's-ladder | 7 |
| VG-33 | VACCULI | 4 | Vaccinium uliginosum | bog blueberry | 1 |
| VG-33 | VACCVIT | 12 | Vaccinium vitis-idaea | | 3 |
| VG-34 | ANEMPAR | 7 | Anemone parviflora | northern anemone | 2 |
| VG-34 | ARTENOR | 7 | Artemisia norvegica | mountain sagewort | 2 |
| VG-34 | CLADINA | 11 | Cladina sp. | reindeer lichens | 1 |
| VG-34 | DRYAOCT | 12 | Dryas octopetala | white mountain-avens | 2 |
| VG-34 | LYCOPOI | 5 | Lycopodium sp. | clubmoss | 5 |
| VG-34 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 3 |
| VG-34 | POLYTRI | 9 | Polytrichum sp. | haircap moss | 50 |
| VG-34 | POTEANS | 7 | Potentilla anserina | common silverweed | 5 |
| VG-34 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 3 |
| VG-34 | SALIARC | 12 | Salix arctica | arctic willow | 30 |
| VG-34 | SENETRI | 7 | Senecio triangularis | arrow-leaved groundsel | 1 |
| VG-34 | STERDEP | 11 | Stereocaulon depressum | creeping foam | 2 |
| VG-36 | ANEMNAR | 7 | Anemone narcissiflora | narcissus anemone | 5 |

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| VG-36 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 50 |
| VG-36 | EQUIARV | 5 | Equisetum arvense | common horsetail | 2 |
| VG-36 | FESTALT | 6 | Festuca altaica | Altai fescue | 5 |
| VG-36 | MERTPAN | 7 | Mertensia paniculata | tall bluebells | 3 |
| VG-36 | OXYRDIG | 7 | Oxyria digyna | mountain sorrel | 2 |
| VG-36 | POLYTRI | 9 | Polytrichum sp. | haircap moss | 7 |
| VG-36 | POTEANS | 7 | Potentilla anserina | common silverweed | 3 |
| VG-36 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 3 |
| VG-36 | RUBUCHA | 12 | Rubus chamaemorus | cloudberry | 3 |
| VG-36 | SAXILYA | 7 | Saxifraga lyallii | red-stemmed saxifrage | 1 |
| VG-36 | SENETRI | 7 | Senecio triangularis | arrow-leaved groundsel | 7 |
| VG-36 | SENEVUL | 7 | Senecio vulgaris | common groundsel | 1 |
| VG-37 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 20 |
| VG-37 | CAREX | 6 | Carex sp. | sedge | 17 |
| VG-37 | DRYAINT | 12 | Dryas integrifolia | entire-leaved mountain-avens | 1 |
| VG-37 | EQUIARV | 5 | Equisetum arvense | common horsetail | 10 |
| VG-37 | MERTPAN | 7 | Mertensia paniculata | tall bluebells | 2 |
| VG-37 | PETAFRI | 7 | Petasites frigidus | sweet coltsfoot | 5 |
| VG-37 | POLEACU | 7 | Polemonium acutiflorum | tall Jacob's-ladder | 0.1 |
| VG-37 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 1 |
| VG-37 | RUBUARC | 7 | Rubus arcticus | nagoonberry | 1 |
| VG-37 | SALIALA | 4 | Salix alaxensis | Alaska willow | 3 |
| VG-37 | SALIARC | 12 | Salix arctica | arctic willow | 10 |
| VG-37 | SALIRET | 12 | Salix reticulata | net-veined willow | 2 |
| VG-37 | SAXILYA | 7 | Saxifraga lyallii | red-stemmed saxifrage | 1 |
| VG-37 | SENETRI | 7 | Senecio triangularis | arrow-leaved groundsel | 0.1 |
| VG-37 | SPHAGNU | 9 | Sphagnum sp. | peat-moss | 75 |
| VG-38 | ARTENOR | 7 | Artemisia norvegica | mountain sagewort | 3 |
| VG-38 | CAMPROT | 7 | Campanula rotundifolia | common harebell | 1 |
| VG-38 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 20 |
| VG-38 | CLADMIT | 11 | Cladina mitis | lesser green reindeer | 10 |
| VG-38 | DACTYLN | 11 | Dactylina sp. | finger lichens | 3 |
| VG-38 | DRYAINT | 12 | Dryas integrifolia | entire-leaved mountain-avens | 1 |
| VG-38 | FESTALT | 6 | Festuca altaica | Altai fescue | 30 |
| VG-38 | HYLOSPL | 9 | Hylocomium splendens | step moss | 60 |
| VG-38 | PEDILAB | 7 | Pedicularis labradorica | Labrador lousewort | 1 |
| VG-38 | POLEACU | 7 | Polemonium acutiflorum | tall Jacob's-ladder | 1 |
| VG-38 | POLYTRI | 9 | Polytrichum sp. | haircap moss | 10 |
| VG-38 | SALIARC | 12 | Salix arctica | arctic willow | 10 |
| VG-38 | SAXILYA | 7 | Saxifraga lyallii | red-stemmed saxifrage | 2 |
| VG-38 | STERDEP | 11 | Stereocaulon depressum | creeping foam | 2 |
| VG-40 | ANEMNAR | 7 | Anemone narcissiflora | narcissus anemone | 1 |
| VG-40 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 7 |
| VG-40 | CLADMIT | 11 | Cladina mitis | lesser green reindeer | 3 |
| VG-40 | CLADONI | 11 | Cladonia sp. | clad lichens | 1 |
| VG-40 | DRYAOCT | 12 | Dryas octopetala | white mountain-avens | 1 |
| VG-40 | EPILLAT | 7 | Epilobium latifolium | broad-leaved willowherb | 0.1 |
| VG-40 | EQUIARV | 5 | Equisetum arvense | common horsetail | 2 |
| VG-40 | FESTALT | 6 | Festuca altaica | Altai fescue | 30 |
| VG-40 | LYCOPOA | 5 | Lycopodiaceae | | 0.1 |
| VG-40 | MERTPAN | 7 | Mertensia paniculata | tall bluebells | 5 |
| VG-40 | PEDICUL | 7 | Pedicularis sp. | lousewort | 1 |
| VG-40 | PLEUROI | 9 | Pleurozium sp. | feathermoss | 5 |
| VG-40 | POA | 6 | Poa sp. | bluegrass | 3 |
| VG-40 | POTENTI | 0 | Potentilla sp. | | 1 |

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| VG-40 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 2 |
| VG-40 | SALIARC | 12 | Salix arctica | arctic willow | 7 |
| VG-40 | SALIRET | 12 | Salix reticulata | net-veined willow | 3 |
| VG-40 | SENETRI | 7 | Senecio triangularis | arrow-leaved groundsel | 1 |
| VG-45 | ANEMPAR | 7 | Anemone parviflora | northern anemone | 1 |
| VG-45 | EQUIARV | 5 | Equisetum arvense | common horsetail | 7 |
| VG-45 | FESTALT | 6 | Festuca altaica | Altai fescue | 10 |
| VG-45 | HYLOCOM | 9 | Hylocomium sp. | wood-moss | 80 |
| VG-45 | MERTPAN | 7 | Mertensia paniculata | tall bluebells | 2 |
| VG-45 | MYOSASI | 7 | Myosotis asiatica | mountain forget-me-not | 1 |
| VG-45 | PETAFRI | 7 | Petasites frigidus | sweet coltsfoot | 1 |
| VG-45 | POA | 6 | Poa sp. | bluegrass | 35 |
| VG-45 | POLEACU | 7 | Polemonium acutiflorum | tall Jacob's-ladder | 1 |
| VG-45 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 2 |
| VG-45 | SALIARC | 12 | Salix arctica | arctic willow | 15 |
| VG-45 | SALIRET | 12 | Salix reticulata | net-veined willow | 20 |
| VG-45 | THALOCC | 7 | Thalictrum occidentale | western meadowrue | 1 |
| VG-46 | AULAACU | 9 | Aulacomnium acuminatum | | 20 |
| VG-46 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 20 |
| VG-46 | EQUIARV | 5 | Equisetum arvense | common horsetail | 20 |
| VG-46 | MERTPAN | 7 | Mertensia paniculata | tall bluebells | 17 |
| VG-46 | POLEACU | 7 | Polemonium acutiflorum | tall Jacob's-ladder | 3 |
| VG-46 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 1 |
| VG-46 | RUBUCHA | 12 | Rubus chamaemorus | cloudberry | 0.1 |
| VG-46 | SENETRI | 7 | Senecio triangularis | arrow-leaved groundsel | 20 |
| VG-48 | ANEMPAR | 7 | Anemone parviflora | northern anemone | 1 |
| VG-48 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 5 |
| VG-48 | DRYAINT | 12 | Dryas integrifolia | entire-leaved mountain-avens | 1 |
| VG-48 | FESTALT | 6 | Festuca altaica | Altai fescue | 10 |
| VG-48 | HYLOCOM | 9 | Hylocomium sp. | wood-moss | 75 |
| VG-48 | MERTPAN | 7 | Mertensia paniculata | tall bluebells | 2 |
| VG-48 | MYOSOTI | 7 | Myosotis sp. | | 0.1 |
| VG-48 | PEDICUL | 7 | Pedicularis sp. | lousewort | 1 |
| VG-48 | PETAFRI | 7 | Petasites frigidus | sweet coltsfoot | 1 |
| VG-48 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 1 |
| VG-48 | SALIARC | 12 | Salix arctica | arctic willow | 5 |
| VG-48 | SALIRET | 12 | Salix reticulata | net-veined willow | 40 |
| VG-48 | VIOLA | 7 | Viola sp. | violet | 5 |
| VG-49 | AULACOM | 9 | Aulacomnium sp. | groove-moss | 30 |
| VG-49 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 80 |
| VG-50 | ACONDEL | 7 | Aconitum delphiniifolium | mountain monkshood | 0.1 |
| VG-50 | CAREAQU | 6 | Carex aquatilis | water sedge | 3 |
| VG-50 | EPILANG | 7 | Epilobium angustifolium | fireweed | 10 |
| VG-50 | EPILLAT | 7 | Epilobium latifolium | broad-leaved willowherb | 2 |
| VG-50 | FESTALT | 6 | Festuca altaica | Altai fescue | 15 |
| VG-50 | GEUMMAC | 7 | Geum macrophyllum | large-leaved avens | 1 |
| VG-50 | HYLOSPL | 9 | Hylocomium splendens | step moss | 30 |
| VG-50 | MERTPAN | 7 | Mertensia paniculata | tall bluebells | 7 |
| VG-50 | MYOSOTI | 7 | Myosotis sp. | | 1 |
| VG-50 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 2 |
| VG-50 | POA | 6 | Poa sp. | bluegrass | 30 |
| VG-50 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 1 |
| VG-50 | RUBUARC | 7 | Rubus arcticus | nagoonberry | 1 |
| VG-50 | SALIALA | 4 | Salix alaxensis | Alaska willow | 10 |
| VG-50 | SALIARC | 12 | Salix arctica | arctic willow | 2 |

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|---|---|---|---|---|---|
| VG-50 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 50 |
| VG-50 | SALIRET | 12 | Salix reticulata | net-veined willow | 2 |
| VG-50 | SENETRI | 7 | Senecio triangularis | arrow-leaved groundsel | 1 |
| VG-50 | VALESIT | 7 | Valeriana sitchensis | Sitka valerian | 1 |
| VG-50 | ZIGAELE | 7 | Zigadenus elegans | mountain death-camas | 0.1 |
| VG-52 | CLADONI | 11 | Cladonia sp. | clad lichens | 5 |
| VG-52 | EPILANG | 7 | Epilobium angustifolium | fireweed | 3 |
| VG-52 | EPILLAT | 7 | Epilobium latifolium | broad-leaved willowherb | 0.1 |
| VG-52 | FESTALT | 6 | Festuca altaica | Altai fescue | 15 |
| VG-52 | HYLOCOM | 9 | Hylocomium sp. | wood-moss | 7 |
| VG-52 | MERTPAN | 7 | Mertensia paniculata | tall bluebells | 1 |
| VG-52 | MYOSOTI | 7 | Myosotis sp. | | 0.1 |
| VG-52 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 0.1 |
| VG-52 | RUBUARC | 7 | Rubus arcticus | nagoonberry | 1 |
| VG-52 | SALIALA | 4 | Salix alaxensis | Alaska willow | 50 |
| VG-52 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 10 |
| VG-52 | SALIRET | 12 | Salix reticulata | net-veined willow | 5 |
| VG-52 | SENELUG | 7 | Senecio lugens | black-tipped groundsel | 0.1 |
| VG-52 | SENETRI | 7 | Senecio triangularis | arrow-leaved groundsel | 1 |
| VG-52 | ZIGAELE | 7 | Zigadenus elegans | mountain death-camas | 1 |
| VG-54 | CASSTET | 12 | Cassiope tetragona | four-angled mountain-heather | 10 |
| VG-54 | CLADMIT | 11 | Cladina mitis | lesser green reindeer | 30 |
| VG-54 | EMPENIG | 12 | Empetrum nigrum | crowberry | 10 |
| VG-54 | FESTALT | 6 | Festuca altaica | Altai fescue | 5 |
| VG-54 | GENTGLA | 7 | Gentiana glauca | glaucous gentian | 1 |
| VG-54 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 1 |
| VG-54 | PLEUROA | 10 | Pleurozia sp. | | 3 |
| VG-54 | POLYTRI | 9 | Polytrichum sp. | haircap moss | 15 |
| VG-54 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 0.1 |
| VG-54 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 5 |
| VG-54 | SALIRET | 12 | Salix reticulata | net-veined willow | 10 |
| VG-54 | STERDEP | 11 | Stereocaulon depressum | creeping foam | 3 |
| VG-55 | ALOPALP | 6 | Alopecurus alpinus | alpine meadow-foxtail | 5 |
| VG-55 | ANEMNAR | 7 | Anemone narcissiflora | narcissus anemone | 3 |
| VG-55 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 15 |
| VG-55 | EPILLAT | 7 | Epilobium latifolium | broad-leaved willowherb | 2 |
| VG-55 | FESTALT | 6 | Festuca altaica | Altai fescue | 30 |
| VG-55 | MYOSOTI | 7 | Myosotis sp. | | 2 |
| VG-55 | POLEACU | 7 | Polemonium acutiflorum | tall Jacob's-ladder | 2 |
| VG-55 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 1 |
| VG-55 | RUBUCHA | 12 | Rubus chamaemorus | cloudberry | 1 |
| VG-55 | SALIRET | 12 | Salix reticulata | net-veined willow | 3 |
| VG-55 | SENETRI | 7 | Senecio triangularis | arrow-leaved groundsel | 5 |
| VG-57 | ABIELAS | 1 | Abies lasiocarpa | subalpine fir | 20.5 |
| VG-57 | BETUNAN | 4 | Betula nana | scrub birch | 4 |
| VG-57 | CASSTET | 12 | Cassiope tetragona | four-angled mountain-heather | 3 |
| VG-57 | CLADINA | 11 | Cladina sp. | reindeer lichens | 2 |
| VG-57 | CORNCAN | 7 | Cornus canadensis | bunchberry | 1 |
| VG-57 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 3 |
| VG-57 | PHYLEMP | 12 | Phyllodoce empetriformis | pink mountain-heather | 5 |
| VG-57 | PLEUROI | 9 | Pleurozium sp. | feathermoss | 60 |
| VG-57 | POLYTRI | 9 | Polytrichum sp. | haircap moss | 20 |
| VG-57 | RUBUARC | 7 | Rubus arcticus | nagoonberry | 0.1 |
| VG-57 | RUBUCHA | 12 | Rubus chamaemorus | cloudberry | 2 |
| VG-57 | SPIRAEA | 4 | Spiraea sp. | | 2 |

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|---|---|---|---|---|---|
| VG-57 | VACCULI | 4 | Vaccinium uliginosum | bog blueberry | 3 |
| VG-57 | VACCVIT | 12 | Vaccinium vitis-idaea | | 1 |
| VG-59 | BETUNAN | 4 | Betula nana | scrub birch | 70 |
| VG-59 | CLADINA | 11 | Cladina sp. | reindeer lichens | 70 |
| VG-59 | CLADONI | 11 | Cladonia sp. | clad lichens | 10 |
| VG-59 | EMPENIG | 12 | Empetrum nigrum | crowberry | 10 |
| VG-59 | HYLOCOM | 9 | Hylocomium sp. | wood-moss | 5 |
| VG-60 | AGOSERI | 7 | Agoseris sp. | | 1 |
| VG-60 | CAREAQU | 6 | Carex aquatilis | water sedge | 30 |
| VG-60 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 2 |
| VG-60 | FESTALT | 6 | Festuca altaica | Altai fescue | 5 |
| VG-60 | PEDICUL | 7 | Pedicularis sp. | lousewort | 0.1 |
| VG-60 | PETAFRI | 7 | Petasites frigidus | sweet coltsfoot | 2 |
| VG-60 | PLEUROI | 9 | Pleurozium sp. | feathermoss | 85 |
| VG-60 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 1 |
| VG-60 | SALIALA | 4 | Salix alaxensis | Alaska willow | 15 |
| VG-60 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 30 |
| VG-60 | SALIRET | 12 | Salix reticulata | net-veined willow | 15 |
| VG-60 | SENETRI | 7 | Senecio triangularis | arrow-leaved groundsel | 1 |
| VG-60 | THALOCC | 7 | Thalictrum occidentale | western meadowrue | 1 |
| VG-60 | ZIGAELE | 7 | Zigadenus elegans | mountain death-camas | 1 |
| VG-61 | ANEMNAR | 7 | Anemone narcissiflora | narcissus anemone | 1 |
| VG-61 | BETUNAN | 4 | Betula nana | scrub birch | 3 |
| VG-61 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 3 |
| VG-61 | CASSMER | 12 | Cassiope mertensiana | white mountain-heather | 15 |
| VG-61 | CLADINA | 11 | Cladina sp. | reindeer lichens | 78 |
| VG-61 | CLADONI | 11 | Cladonia sp. | clad lichens | 2 |
| VG-61 | DRYAOCT | 12 | Dryas octopetala | white mountain-avens | 3 |
| VG-61 | FESTALT | 6 | Festuca altaica | Altai fescue | 2 |
| VG-61 | HYLOCOM | 9 | Hylocomium sp. | wood-moss | 5 |
| VG-61 | LYCOPOA | 5 | Lycopodiaceae | | 2 |
| VG-61 | PEDILAB | 7 | Pedicularis labradorica | Labrador lousewort | 0.1 |
| VG-61 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 0.1 |
| VG-61 | SALIARC | 12 | Salix arctica | arctic willow | 7 |
| VG-61 | SALIRET | 12 | Salix reticulata | net-veined willow | 2 |
| VG-61 | SILEACA | 7 | Silene acaulis | moss campion | 1 |
| VG-61 | VACCULI | 4 | Vaccinium uliginosum | bog blueberry | 7 |
| VG-61 | VACCVIT | 12 | Vaccinium vitis-idaea | | 2 |
| VG-62 | ANEMNAR | 7 | Anemone narcissiflora | narcissus anemone | 1 |
| VG-62 | CASSMER | 12 | Cassiope mertensiana | white mountain-heather | 1 |
| VG-62 | CASSTET | 12 | Cassiope tetragona | four-angled mountain-heather | 20 |
| VG-62 | CLADINA | 11 | Cladina sp. | reindeer lichens | 5 |
| VG-62 | EMPENIG | 12 | Empetrum nigrum | crowberry | 2 |
| VG-62 | FESTALT | 6 | Festuca altaica | Altai fescue | 10 |
| VG-62 | HYLOCOM | 9 | Hylocomium sp. | wood-moss | 20 |
| VG-62 | LYCOPOA | 5 | Lycopodiaceae | | 0.1 |
| VG-62 | MERTPAN | 7 | Mertensia paniculata | tall bluebells | 1 |
| VG-62 | RANUNCU | 7 | Ranunculus sp. | buttercup | 2 |
| VG-62 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 0.1 |
| VG-62 | SALIALA | 4 | Salix alaxensis | Alaska willow | 5 |
| VG-62 | SALIRET | 12 | Salix reticulata | net-veined willow | 3 |
| VG-62 | SILEACA | 7 | Silene acaulis | moss campion | 1 |
| VG-62 | SOLIDAG | 7 | Solidago sp. | | 0.1 |
| VG-62 | VACCULI | 4 | Vaccinium uliginosum | bog blueberry | 1 |
| VG-62 | VALESIT | 7 | Valeriana sitchensis | Sitka valerian | 1 |

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|---|---|---|---|---|---|
| VG-62 | VERAVIR | 7 | Veratrum viride | Indian hellebore | 1 |
| VG-62 | VIOLA | 7 | Viola sp. | violet | 3 |
| VG-62 | ZIGAELE | 7 | Zigadenus elegans | mountain death-camas | 0.1 |
| VG-64 | ABIELAS | 1 | Abies lasiocarpa | subalpine fir | 33.75 |
| VG-64 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 13 |
| VG-64 | PHYLEMP | 12 | Phyllodoce empetriformis | pink mountain-heather | 5 |
| VG-64 | PLEUROI | 9 | Pleurozium sp. | feathermoss | 80 |
| VG-64 | POLYTRI | 9 | Polytrichum sp. | haircap moss | 5 |
| VG-64 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 3 |
| VG-65 | AGOSERI | 7 | Agoseris sp. | | 3 |
| VG-65 | CAREPOD | 6 | Carex podocarpa | graceful mountain sedge | 30 |
| VG-65 | CERASTI | 7 | Cerastium sp. | | 1 |
| VG-65 | DESCCES | 6 | Deschampsia cespitosa | tufted hairgrass | 7 |
| VG-65 | EQUIARV | 5 | Equisetum arvense | common horsetail | 1 |
| VG-65 | FESTALT | 6 | Festuca altaica | Altai fescue | 1 |
| VG-65 | OXYRDIG | 7 | Oxyria digyna | mountain sorrel | 2 |
| VG-65 | PLEUROI | 9 | Pleurozium sp. | feathermoss | 75 |
| VG-65 | POLEACU | 7 | Polemonium acutiflorum | tall Jacob's-ladder | 3 |
| VG-65 | RUBUCHA | 12 | Rubus chamaemorus | cloudberry | 2 |
| VG-65 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 5 |
| VG-65 | SALIRET | 12 | Salix reticulata | net-veined willow | 15 |
| VG-66 | BETUNAN | 4 | Betula nana | scrub birch | 75 |
| VG-66 | CLADINA | 11 | Cladina sp. | reindeer lichens | 8 |
| VG-66 | FESTALT | 6 | Festuca altaica | Altai fescue | 3 |
| VG-66 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 1 |
| VG-66 | PLEUROI | 9 | Pleurozium sp. | feathermoss | 20 |
| VG-66 | POLYTRI | 9 | Polytrichum sp. | haircap moss | 60 |
| VG-66 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 2 |
| VG-67 | ANEMNAR | 7 | Anemone narcissiflora | narcissus anemone | 5 |
| VG-67 | CAREX | 6 | Carex sp. | sedge | 1 |
| VG-67 | CLADINA | 11 | Cladina sp. | reindeer lichens | 30 |
| VG-67 | FESTALT | 6 | Festuca altaica | Altai fescue | 35 |
| VG-67 | HYLOCOM | 9 | Hylocomium sp. | wood-moss | 15 |
| VG-67 | LYCOPOA | 5 | Lycopodiaceae | | 3 |
| VG-67 | MYOSOTI | 7 | Myosotis sp. | | 0.1 |
| VG-67 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 1 |
| VG-67 | POLEACU | 7 | Polemonium acutiflorum | tall Jacob's-ladder | 3 |
| VG-67 | POLYTRI | 9 | Polytrichum sp. | haircap moss | 5 |
| VG-67 | RANUNCU | 7 | Ranunculus sp. | buttercup | 5 |
| VG-67 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 1 |
| VG-67 | SALIARC | 12 | Salix arctica | arctic willow | 15 |
| VG-67 | STEREOC | 11 | Stereocaulon sp. | foam lichens | 10 |
| VG-69 | ABIELAS | 1 | Abies lasiocarpa | subalpine fir | 16.25 |
| VG-69 | CASSMER | 12 | Cassiope mertensiana | white mountain-heather | 2 |
| VG-69 | CASSTET | 12 | Cassiope tetragona | four-angled mountain-heather | 5 |
| VG-69 | CLADINA | 11 | Cladina sp. | reindeer lichens | 55 |
| VG-69 | CLADONI | 11 | Cladonia sp. | clad lichens | 3 |
| VG-69 | HYLOCOM | 9 | Hylocomium sp. | wood-moss | 10 |
| VG-69 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 7 |
| VG-69 | PHYLEMP | 12 | Phyllodoce empetriformis | pink mountain-heather | 5 |
| VG-69 | PLEUROA | 10 | Pleurozia sp. | | 25 |
| VG-69 | VACCULI | 4 | Vaccinium uliginosum | bog blueberry | 3 |
| VG-71 | BETUNAN | 4 | Betula nana | scrub birch | 5 |
| VG-71 | CAREAQU | 6 | Carex aquatilis | water sedge | 30 |
| VG-71 | EPILANG | 7 | Epilobium angustifolium | fireweed | 2 |

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| VG-71 | EQUIARV | 5 | Equisetum arvense | common horsetail | 15 |
| VG-71 | HYLOCOM | 9 | Hylocomium sp. | wood-moss | 60 |
| VG-71 | MERTPAN | 7 | Mertensia paniculata | tall bluebells | 1 |
| VG-71 | PEDICUL | 7 | Pedicularis sp. | lousewort | 1 |
| VG-71 | PETAFRI | 7 | Petasites frigidus | sweet coltsfoot | 2 |
| VG-71 | POLEACU | 7 | Polemonium acutiflorum | tall Jacob's-ladder | 2 |
| VG-71 | RANUNCU | 7 | Ranunculus sp. | buttercup | 3 |
| VG-71 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 2 |
| VG-71 | SALIALA | 4 | Salix alaxensis | Alaska willow | 15 |
| VG-71 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 60 |
| VG-71 | SALIRET | 12 | Salix reticulata | net-veined willow | 2 |
| VG-71 | SENETRI | 7 | Senecio triangularis | arrow-leaved groundsel | 1 |
| VG-71 | VIOLA | 7 | Viola sp. | violet | 2 |
| VG-74 | ABIELAS | 1 | Abies lasiocarpa | subalpine fir | 13.333 |
| VG-74 | BETUNAN | 4 | Betula nana | scrub birch | 5 |
| VG-74 | CLADINA | 11 | Cladina sp. | reindeer lichens | 55 |
| VG-74 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 3 |
| VG-74 | PHYLEMP | 12 | Phyllodoce empetriformis | pink mountain-heather | 5 |
| VG-74 | PLEUROI | 9 | Pleurozium sp. | feathermoss | 40 |
| VG-74 | RUBUCHA | 12 | Rubus chamaemorus | cloudberry | 3 |
| VG-74 | VACCULI | 4 | Vaccinium uliginosum | bog blueberry | 5 |
| VG-75 | ABIELAS | 1 | Abies lasiocarpa | subalpine fir | 15 |
| VG-75 | BETUNAN | 4 | Betula nana | scrub birch | 75 |
| VG-75 | CLADINA | 11 | Cladina sp. | reindeer lichens | 70 |
| VG-75 | CLADONI | 11 | Cladonia sp. | clad lichens | 1 |
| VG-75 | PELTIGE | 11 | Peltigera sp. | pelt lichens | 4 |
| VG-75 | PLEUROI | 9 | Pleurozium sp. | feathermoss | 15 |
| VG-75 | SALIPLA | 4 | Salix planifolia | plane-leaved willow | 15 |
| VG-77 | ANEMNAR | 7 | Anemone narcissiflora | narcissus anemone | 2 |
| VG-77 | CAREALB | 6 | Carex albonigra | two-toned sedge | 15 |
| VG-77 | CLADONI | 11 | Cladonia sp. | clad lichens | 3 |
| VG-77 | DESCCES | 6 | Deschampsia cespitosa | tufted hairgrass | 3 |
| VG-77 | DRYAINT | 12 | Dryas integrifolia | entire-leaved mountain-avens | 3 |
| VG-77 | HYLOCOM | 9 | Hylocomium sp. | wood-moss | 75 |
| VG-77 | PEDICUL | 7 | Pedicularis sp. | lousewort | 0.1 |
| VG-77 | PETAFRI | 7 | Petasites frigidus | sweet coltsfoot | 1 |
| VG-77 | POA | 6 | Poa sp. | bluegrass | 15 |
| VG-77 | POLEACU | 7 | Polemonium acutiflorum | tall Jacob's-ladder | 1 |
| VG-77 | RANUNCU | 7 | Ranunculus sp. | buttercup | 1 |
| VG-77 | RHODROS | 9 | Rhodobryum roseum | rose-moss | 1 |
| VG-77 | SALIARC | 12 | Salix arctica | arctic willow | 20 |