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Terrestrial Vegetation Mapping

and

Wildlife Habitat Assessment

Park Bridge to Brake Check
Proposed Realignment of the Trans-Canada Highway
and Bridge Replacement

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FINAL REPORT

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1. Executive Summary

Terrestrial vegetation and wildlife habitat assessment of the Park Bridge to Brake Check Project area in the Kickinghorse Valley was conducted using primarily existing data and interpretation of high resolution digital photography. We documented environmental resource values that may be affected by the road improvements in the corridor 500 m on either side of the centreline of proposed road options. Emphasis was placed on identifying critical habitat features, high resource values and species at risk. The inventory of breeding birds was conducted by Robert Ferguson, MATRIX Resource Services. Wildlife movements and observation data were provided by Mike Demarchi and Gary Searing, LGL limited in their 1997 report.

The primary products of this work were a high resolution digital colour mosaic of the entire Kickinghorse corridor and a vegetation cover map overlain on the Park Bridge to Brake Check area. The vegetation cover types were cross referenced to inferred potential Biogeoclimatic (BEC) site-series and Biophysical Habitat Units as a starting point for potential consideration in Predictive Ecosystem Mapping or Terrestrial Ecosystem Mapping. The vegetation cover of the area was mapped through a stepwise process. Using 1:50,000 Biogeoclimatic maps, BEC subzones and variants were defined for the study area and using slope position, aspect and vegetation cover, the potential site series were assigned. Cover mapping is based on the predominant vegetation cover and field observations in previous reports and our limited aerial reconnaissance.

No species at risk were identified by the Conservation Data Centre within the Park Bridge to Brake Check corridor. There were reports of several red and blue listed plant species in the general vicinity of the Kickinghorse Valley that have potential to be present within the study area, including: *Carex crawei, Chenopodium atrovirens, Melica smithii, Solidago gigantean ssp., Lomatium triternatum ssp.* and *Platycarpum.* It is unlikely that the road realignment will significantly impact any of these plant species as they are not found in habitats affected by the road, or the road construction may enhance habitats in which some occur.

Sixteen cover types were mapped in corridor. The relative amount of each cover type potentially affected by the two road options was calculated. The open Douglas-fir – Aspen – Saskatoon – Wheatgrass (F2) cover type is the cover type most affected by both options, (23-30% of the corridor studied), followed by the Pine – Fir – Spruce with Aspen (PFA) cover class (8-13%). Both of these units have importance to ungulates primarily due to the presence of the clumps of trembling aspen and paper birch. Potential mitigation could include avoidance of the deciduous clumps by the road options or creation of additional habitat in nearby Douglas-fir - lodgepole pine cover types through the use of prescribed burning and logging. The southern aspects ungulate winter range is impacted by the majority of the footprint of both road options on the north side of the Kickinghorse River. It can be somewhat mitigated by selection of a route as close to the existing road corridor as possible and consideration of engineered

crossings for wildlife near creeks and natural draws. The habitat types associated with the vegetation cover types are not unique to the road corridor and similar habitat types are found throughout the MSdk, ICHmw and ICHmk subzones in BC, with higher quality ungulate habitat found in the nearby Columbia Valley.

All of the birds detected within the study area are widely distributed in suitable habitats throughout much of British Columbia, which is divided into 9 distinct ecoprovinces. Forty-three (90%) of the 48 species detected within the Kicking Horse River study area breed in 6 or more ecoprovinces in British Columbia. The remaining 5 species – Red-naped Sapsucker, Mountain Chickadee, Lazuli Bunting, Pine Grosbeak and Red Crossbill – breed in 4 or 5 ecoprovinces.

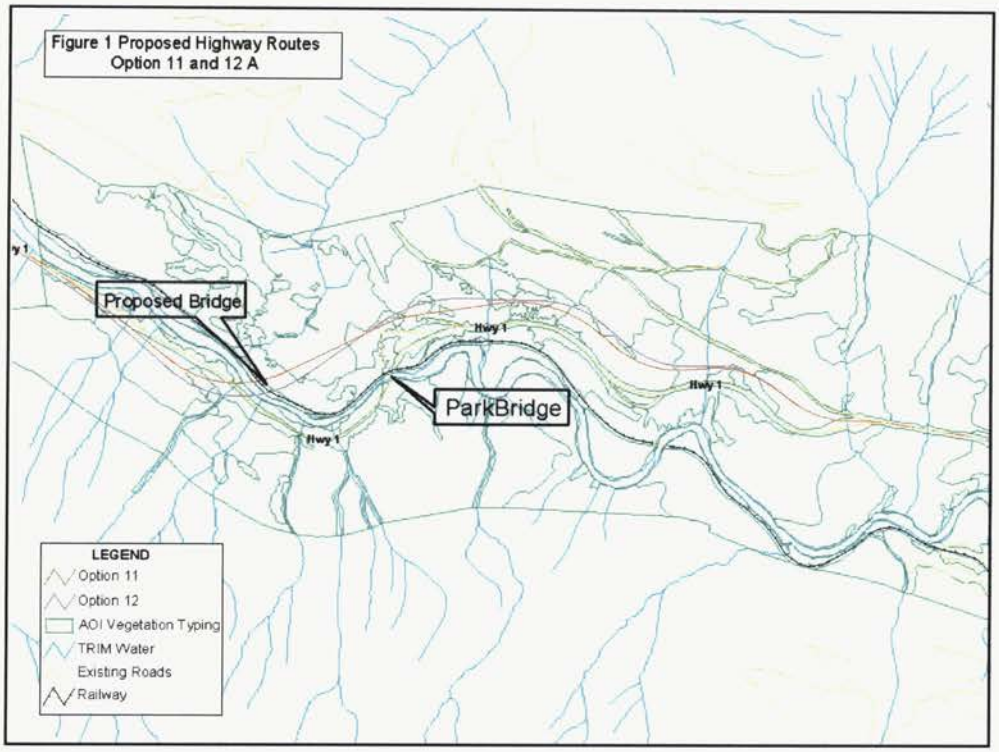
Wildlife tracking work between 1995 and 1997 was conducted by Searing and Demarchi (1997) to assess potential impacts of the Trans-Canada Highway on wildlife. Ungulate range and movements were well described and reinforced the relative importance of the southern aspects of the open Douglas-fir cover types associated with pockets of deciduous regeneration. No rare or endangered species were recorded for the area, although several blue-listed (vulnerable) species may frequent the Kickinghorse corridor, including grizzly bear (*Ursus horribilis*), wolverine (*Gulo luscus*) and mountain goat (*Oreamnus americanus*). Very limited sightings of wildlife and tracks occurred within the Park Bridge to Brake Check area. The only critical habitat feature identified in the area was a mineral lick located in the rocky bluffs above the talus on the south side of the valley approximately 200 metres east of Park Bridge. Based on the habitats available and species range maps, a list of potential wildlife species that might occur in the Park Bridge to Brake Check area was provided in this report.

The greatest hazard to wildlife in the area is likely collisions on the road and rail. Mortality rates may increase due to higher traffic volumes and speeds associated with the improved highway. Mitigation could include fencing areas with poor visibility, improving line-of-sight visibility for motorists, limiting speed in areas with frequent wildlife crossings and creating cross structures such as overpasses and underpasses. The incorporation of natural terrain features near draws and streams entering the Kickinghorse could be used to facilitate wildlife movement beneath them. Road option 11, including the tunnel, would have somewhat less impact on habitat and would be closer to the existing highway. In areas where the new route crosses ungulate winter range, we recommend that efforts be made to avoid removal of deciduous tree patches associated with the Douglas-fir and lodgepole pine forest cover on the south facing aspects and highway speeds be limited to 80 km/hr. Mitigation could also include creation of improved winter range in adjacent forest through prescribed burning and natural regeneration in logged areas. Neither road option appears to pose significant impacts to habitats or wildlife.

2. Introduction

The BC Ministry of Transportation retained Silvatech Consulting Ltd. to undertake the Terrestrial Vegetation and Wildlife Habitat Assessment of the Park Bridge to Brake Check Project area in the Kickinghorse Valley approximately 14km East of Golden. Using primarily existing data and interpretation of high resolution digital photography, we documented environmental resource values that may be affected by the road improvements in the corridor 500 m on either side of the centreline of proposed road options (figure 1). Emphasis was placed on identifying critical habitat features, high resource values and species at risk. The inventory of breeding birds was conducted by Robert Ferguson, MATRIX Resource Services. Wildlife movements and observation data were provided by Mike Demarchi and Gary Searing, LGL limited in their 1997 report.

The primary products of this work are a series of high resolution digital colour photographs covering the entire Kickinghorse corridor and a vegetation cover map overlain on the Park Bridge to Brake Check area. The vegetation cover types are cross referenced to inferred potential Biogeoclimatic (BEC) site-series and Biophysical Habitat Units. Due to the remote census basis of this assessment, final designation of BEC site series or specific habitat units as defined in the Resource Inventory Standards Committee (RISC) Standards would require comprehensive field work to define soil moisture, soil and topography and detailed vegetation plots. As this project is in close proximity to existing road and rail corridors, a general vegetation cover mapping rather than Terrestrial Ecosystem Mapping or Predictive Ecosystem Mapping is used to assess potential impacts.



3. Methods

Background data was gathered and reviewed, including: existing forest cover maps, TRIM coverage, geology maps, soil and terrain maps, 1:35,000 BW Aerial photographs, 1:15,000 Orthophotos, habitat suitability and capability maps for ungulates and grizzly bear, wildlife and fisheries studies for the Kicking Horse area and Yoho National Park. The Conservation Data Centre provided known records for rare and endangered species. Gaps in data were identified and courses of action proposed. These sources of data were examined and used to refine and direct interpretation of the vegetation cover and habitat values of polygons defined through interpretation of the Orthophoto and colour digital photography. A one hour helicopter reconnaissance (July 23) was used to assess preliminary cover typing and to obtain photo-documentation of the study area.

The vegetation cover of the area was defined through a stepwise process. Using 1:50,000 Biogeoclimatic maps, BEC subzones and variants were mapped for the study area and using slope position, aspect and vegetation cover, the potential site series were assigned. Mapping is based on the predominant vegetation cover and field observations in previous reports and our limited aerial reconnaissance. Biophysical broad ecosystem units for the Southern Interior Forest Ecosystem are cross linked to the likely BEC forest ecosystem site series vegetation associations.

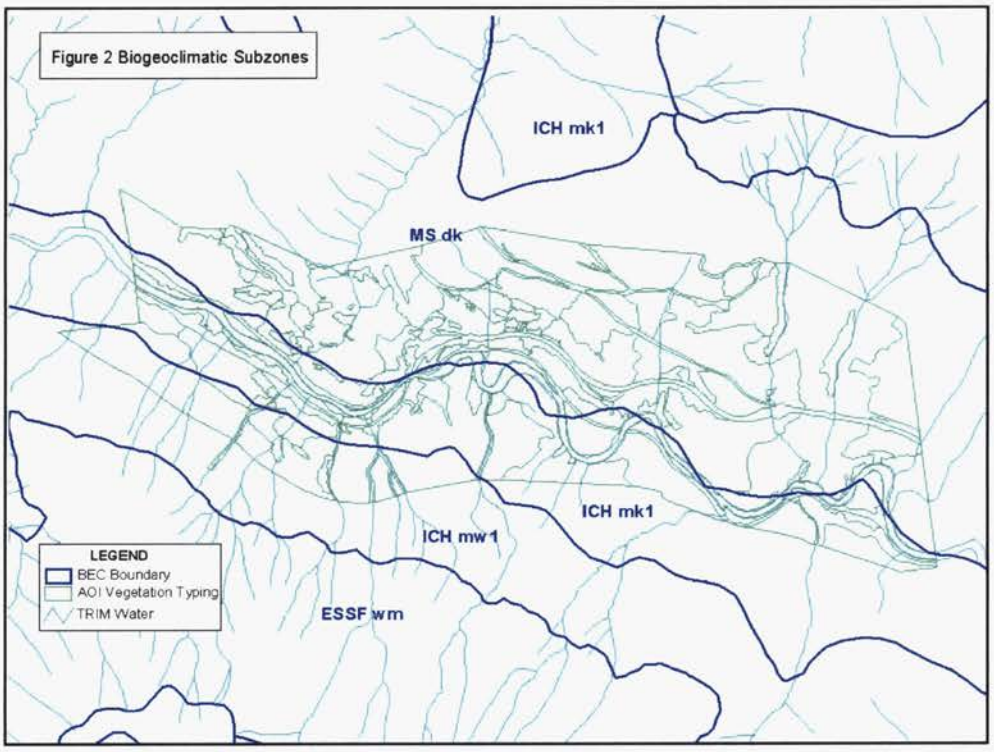
In reviewing past studies and available mapping, the major gaps in data relate to detailed site descriptions. The lack of site specific soil mapping and detailed vegetation plots limits the ability to develop a detailed vegetation community map based on aerial interpretation. To refine and develop a Terrestrial Ecosystem Map (TEM) or Predictive Ecosystem Map (PEM) is outside the scope of this project and would require extensive ground sampling to describe soils, soil moisture, landforms, and numerous detailed vegetation plots. However, there is sufficient information to describe general vegetation canopy cover and tentative vegetation site associations, and to assess relative risk of the proposed road realignment to vegetation and habitat. The BEC and BEU assignments are made solely for the purpose of pre-stratifying possible units for future field work for TEM or PEM.

4. Results and Discussion

4.1 Study Area Description and wildlife values

Biogeoclimatic classification

The Park Bridge to Brake Check area of the Kickinghorse Valley highway corridor falls within 3 primary biogeoclimatic zones and subzones (Figure 2). On the north side of the river (south aspects), the area is classified as the dry cool Montane Spruce subzone (MSdk) dominated by Douglas-fir (*Pseudotsuga menziesii*) and lodgepole pine (*Pinus contorta*). Due to the fire history and logging, the vegetation of these southern aspects has a mix of early and transitional seral stages. The south slopes have the greatest potential for moderate to high value ungulate winter range, but are limited primarily by snow depth. On the south side of the river (north aspect) at the valley bottom, the area is classified as Kootenay Moist Cool Interior Cedar - Hemlock (ICHmk1) Variant. At middle elevations above the ICHmk1, the area is classified as the Golden Moist Warm Interior Cedar – Hemlock variant (ICHmw1). At the highest forested elevations of the north aspect of the Kickinghorse Valley (headwaters of the streams), the area is classified as the Warm Moist Engelmann Spruce – Subalpine Fir subzone (ESSFwm). The site series associated with these subzones and variants will be described in the vegetation results.



Dry Cool Montane Spruce Subzone (MSdk)

This subzone is located on mid slopes in the Rocky Mountain Trench and valley bottoms and lower slopes in the Rocky Mountains south of the Kickinghorse River. Located on south aspects between elevations of 1200-1650 m, the subzone is characterized by warm, dry summers and cold winters with shallow snowpack. Soils tend to be shallow or well drained and dry out for long periods during late summers. Lack of soil moisture and frost are the major growth limiting factors. Climax zonal sites have stands of Engelmann spruce (*Picea engelmannii)* and subalpine fir (*Abies lasiocarpa*), with minor amounts of Douglas-fir (*Pseudotsuga menziesii*). In the Kickinghorse Valley, the south aspects are dominated by seral stands of Douglas-fir (*Pseudotsuga menziesii*), lodgepole pine (*Pinus contorta*) and trembling aspen (*Populus tremuloides*) due to historic fire disturbance. False azalea (*Menziesia ferruginea*), Utah honeysuckle (*Lonicera utahensis*) and soopolallie (*Shepherdia canadensis*) are common shrubs, with grouseberry (*Vaccinium scoparium*), twinflower (*Linnaea borealis*), pinegrass (*Calamagrostis rubescens*) and heart-leaved arnica (*Arnica cordifolia*) as common herbs. The extensive stands dominated by fire origin early seral lodgepole pine (*Pinus contorta*) have been recently heavily attacked by mountain pine beetle throughout the Kickinghorse valley. The MSdk subzone is the most productive subzone of the dry climatic region and the predominance of early seral vegetation due to fire history has maintained a predominance of early seral wildlife species such as deer(*Odocoileus virginianus*) and (*Odocoileus hemionus)*, elk(*Cervus canadensis*), moose(*Alces alces*) and bighorn sheep

(*Ovis canadensis*). The subzone provides important late autumn and early winter range for these species. Due to some berry production in the understory of this unit and early spring green-up, this subzone is relatively important for black bears (Ursus americanus) and grizzly bears (Ursus horribilis). Pockets of old - growth forest are important for cavity nesting birds and for snow interception for ungulate late winter range. Mountain Goats (Oreanos americanus)may occasionally travel through the MSdk for summer forage, closer to the river.

Kootenay Moist Cool Interior Cedar – Hemlock Variant (ICHmk1)

Found on the valley bottom along the Kickinghorse River, this variant occurs on areas of moderate relief at elevations between 750 and 1500 metres on dolomitic soils and calcareous shales. Soils tend to dry out in late summer and have sufficient snowpack in the winter to prevent freezing to depth. Colluvial soils tend to form on lower portions of steep slopes and steep upper slopes may have thin soils with bedrock restricting rooting. Climax zonal sites have western redcedar (*Thuja plicata*), hybrid white spruce (*Picea glauca x engelmannii*), subalpine fir (*Abies lasiocarpa*), Douglas-fir (*Pseudotsuga menziesii*) and lodgepole pine (*Pinus contorta*). Seral stands in the Kickinghorse valley are common and are dominated by lodgepole pine (*Pinus contorta*), Douglas-fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis).* The understory is characterized by falsebox (*Paxistima myrsinites*), black huckleberry (*Vaccinium membranaceum*) and Utah honeysuckle (*Lonicera utahensis*) in the understory and twinflower (*Linnaea borealis*), bunchberry (*Cornus canadensis*), queen's cup (*Clintonia uniflora*), prince's pine (*Chimaphila umbellate*) and red-stemmed feathermoss (*Pleurozium schreberi*) in the herb and moss layers. The valley bottom ICHmk1 areas are frequently important to moose (*Alces alces*) in the summer and fall. As this variant is extensively affected by wildlfires and dominated by lodgepole pine (*Pinus contorta*) seral stands, it has extensive evidence of pine beetle infestation and is habitat for cavity nesting birds such as Williamson's sapsucker (*Sphyrapicus thyroideus*) and black-backed woodpecker (*Picoides arcticus*). Mineral licks associated with some sites within the ICHmk1 are important spring and early summer use sites for ungulates.

Golden Moist Warm Interior Cedar – Hemlock Variant (ICHmw1)

This variant is found at mid elevations on the south side of the Kickinghorse River, between 750 and 1500 m and on the eastern lower slopes of the Glenogle Creek. It is warmer and drier than the ESSFwm and typically associated with glaciofluvial or glaciolacustrine soils, but may be associated with colluvial soils on the steepest slopes. Climax zonal sites have stands of western hemlock and interior western cedar. Seral stands are more common in the Kickinghorse area, characterized by extensive stands dominated by even-aged lodgepole pine

(*Pinus contorta*) and Douglas-fir (*Pseudotsuga menziesii*), with Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) subcomponents. Common shrubs of this variant include falsebox (*Paxistima myrsinites*), false azalea (*Menziesia ferruginea*) and a sparse herb layer with queen's cup (*Clintonia uniflora*), bunchberry (*Cornus canadensis*), red-stemmed feathermoss (*Pleurozium schreberi*) and knight's plume moss (Ptilium crista-castrensis). In areas with mixed age structure, this variant can be important winter range for moose (*Alces alces*), Rocky mountain elk (*Cervus canadensis*) and Whitetail deer (*Odocoileus virginianus*) and Mule deer (*Odocoileus hemionus)*. Bluffs in the upper MSdk form important escape terrain and wintering habitat for mountain goats (*Oreamnos americanus*). Snags in older stands are important for a range of cavity nesting birds.

Wet Mild Engelmann Spruce – Subalpine Fir Subzone (ESSFwm)

This subzone in the Rocky Mountains is generally found between elevations of 1500 – 1900 metres on north aspects. It is wetter than the ESSFdk above it and colder and wetter than the ICHmw1. Colluvial soils and veneers are common on steep slopes and fluvial or morainal soils occur on lower slopes. Climax zonal sites have stands of subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*), with understories of false azalea (*Menziesia ferruginea*), black huckleberry (*Vaccinium membranaceum*), white-flowered rhododendron (Rhododendron albiflorum) and Utah honeysuckle (*Lonicera utahensis*). Oak fern (*Gymnocarpium dryopteris*), mountain arnica (*Arnica latifolia*), one-sided foamflower (*Tiarella trifoliate var. unifoliata*) and red-stemmed feathermoss (*Pleurozeum schreberi*) are common herbs. The transition to lower areas of ICHmw1 tends to be dominated by alder in the brush layer. As found in the MSdk, fire is the primary disturbance, occurring at a high frequency. In early seral stages, forests are dominated by a mix of lodgepole pine (Pinus contorta), Douglas-fir (*Pseudotsuga menziesii*) and subalpine fir (*Abies lasiocarpa*). Small patches and strings of trembling aspen (*Populus tremuloides*) are often associated with rocky ridges. The ESSFwm provides important summer range for Whitetail deer (*Odocoileus virginianus*) and Mule deer (*Odocoileus hemionus)*, Rocky mountain elk (*Cervus canadensis*), moose (*Alces alces*) and Rocky mountain bighorn sheep (*Ovis canadensis*).

Broad Ecosystem Units (BEU)

The Broad Ecosystem Units associated with the Kickinghorse valley are most useful for generalized interpretation of wildlife habitat and are based on the geographic location, climate, geomorphology and dominant vegetation cover. The primary BEU associated with the south aspects of the Kickinghorse valley are the Spruce – Douglas fir (SD), Interior Douglas Fir (DF), lodgepole pine (LP), Cliff (CL), Gravel Bar (GB), Rock (RO), Talus (TA) and Transportation Corridors (TC). On the northern aspects of the valley, the most common BEU classes are Spruce – Douglas Fir (SD), Engelmann Spruce – Subalpine Fir dry forest (EF), Interior Western Hemlock – Douglas Fir (IH), Interior Western Hemlock – White Spruce (IS), and Douglas-fir – Lodgepole Pine (DL). Some isolated patches of Engelmann Spruce Riparian (ER) may exist on small patches of stable floodplain or riparian areas.

Spruce – Douglas-fir (SD)

This is typically a dense coniferous forest, with a mixture of Douglas-fir (*Pseudotsuga menziesii*), lodgepole pine (*Pinus contorta*) and trembling aspen (*Populus tremuloides*) in early seral stands, progressing to western larch (*Larix occidentalis*), Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) at climax. The understory generally includes soopolallie (*Shepherdia canadensis*) and pinegrass (*Calamagrostis rubescens*), with willow species (*Salix spp.*) and alder (Alnus spp.) on wetter sites. Bunchberry (*Cornus canadensis*), grouseberry (*Vaccinium scoparium*), showy aster (*Aster conspicuous*) may also appear in the herb layer and abundant red-stemmed feathermoss (*Pleurozium schreberi*) and step moss (*Hylocomium splendens*).

Interior Douglas-fir (DF)

This are typically open stands dominated by Douglas-fir (*Pseudotsuga menziesii*) on shallow soils. They are found on steep southerly aspects with dry conditions and relatively low forage potential. Understory is usually limited to bunchberry (*Cornus canadensis*), pinegrass (*Calamagrostis rubescens*) and Idaho fescue (*Festuca idahoensis*), with sparse shrubs, such as soopolallie (*Shepherdia canadensis*).

Lodgepole Pine (LP)

This is typically an even-aged open lodgepole pine (*Pinus contorta*) forest with shrub, moss or lichen understory on moderate to low slopes with well drained, nutrient poor soils. In the Kickinghorse area, these units have minor amounts of Douglas-fir (*Pseudotsuga menziesii*), Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) at higher elevations and hybrid white spruce (*Picea glauca x engelmannii*) at lower elevations. The shrub layer is made up of

soopolallie (*Shepherdia canadensis*), common juniper (*Juniperus communis*), falsebox (*Paxistima myrsinites*), Utah honeysuckle (*Lonicera utahensis*) and birch-leaved spirea (*Spiraea betulifolia*). Grouseberry (*Vaccinium scoparium*), dwarf blueberry (Vaccinium caespitosum), pinegrass (Calamagrostis rubescens), kinnikinnick (*Arctostaphylos uva-ursi*) and twinflower (*Linnaea borealis*) form the herb layer. The moss and lichen layer is generally sparse with a variety of *Peltigera spp.* lichens and some red-stemmed feathermoss (*Pleurozium schreberi*) present.

Douglas-fir – Lodgepole Pine (DL)

This unit is also a dense coniferous forest with a mixture of lodgepole pine (*Pinus contorta*), trembling aspen (*Populus tremuloides*) and Douglas-fir (*Pseudotsuga menziesii*), progressing to a Douglas-fir (*Pseudotsuga menziesii*) climax stand. Common juniper (*Juniperus communis*), black huckleberry (*Vaccinium membranaceum*), birch–leaved spirea (*Spiraea betulifolia*) , Saskatoon (*Amelanchier alnifolia*) and prickly rose (*Rosa acicularis*) are the most common shrub species. The herb layer is characteristically composed of pinegrass (*Calamagrostis rubescens*), prince's pine (*Chimaphila umbellate*) and bluebunch wheatgrass (*Agropyron spicatum*). Drier sites include *Peltigera spp.* lichens and red-stemmed feathermoss (*Pleurozeum schreberi*). It occurs on a wide range of slope positions, being most common on colluvial or morainal sites and steep upper to crest slopes with south aspects.

Engelmann Spruce – Subalpine Fir dry forest (EF)

In the Kickinghorse, these forests are hybrid white spruce (*Picea glauca x engelmannii*) and subalpine fir (*Abies lasiocarpa*) dominated at climax. In early seral stages, these low elevation north aspect forests contain lodgepole pine (*Pinus contorta*) and some Douglas-fir (*Pseudotsuga menziesii*). The shrub layer tends to be dominated by false azalea (*Menziesia ferruginea*), white-flowered rhododendron (*Rhododendron albiflorum*) and heart-leaved arnica (*Arnica cordifolia*).

Interior Western Hemlock – White Spruce (IS)

This valley bottom and low elevation unit in the north aspects of the western portion of the study area is a dense coniferous forest with shrub and moss dominated understories, typified by long – lived seral stages of subalpine fir (*Abies lasiocarpa*), hybrid white spruce (*Picea glauca x engelmannii*) and lodgepole pine (*Pinus contorta*). At climax, western hemlock (*Tsuga heterophylla*) and western redcedar (*Thuja plicata*) are typical, along with hybrid white spruce (*Picea glauca x engelmannii*), subalpine fir (*Abies lasiocarpa*) and Douglas-fir (*Pseudotsuga menziesii*) at moist sites. Understory in moist locations can include devil's club (*Oplopanax horridus*), thimbleberry (*Rubus parviflorus*), red – osier dogwood (*Cornus stolonifera*), false azalea (*Menziesia ferruginea*) and black huckleberry (*Vaccinium membranaceum*). Drier sites have a mixture

of western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), hybrid white spruce (*Picea glauca x engelmannii*), subalpine fir (*Abies lasiocarpa*), Douglas-fir (*Pseudotsuga menziesii*) and lodgepole pine (*Pinus contorta*). Soopolallie (*Shepherdia canadensis*), falsebox (*Paxistima myrsinites*), Saskatoon (*Amelanchier alnifolia*), common juniper (*Juniperus communis*), and false azalea (*Menziesia ferruginea*) are typical shrub species on dry sites. Red-stemmed feathermoss (*Pleurozium schreberi*), step moss (*Hylocomium splendens*), twinflower (*Linnaea borealis*) and queen's cup (*Clintonia uniflora*) are also common on these sites.

4.2 Terrestrial cover and Vegetation Mapping and habitat sensitivities

Vegetation cover polygons were delineated on 1:5000 BW Orthophotos and on 1:2000 colour digital aerial photographs. Photographs of terrestrial cover and vegetation were taken during the site reconnaissance and may be referred to in Appendix A. Vegetation class polygons are illustrated on the maps in Appendix B. Cover classes are related directly to BEU classes, or a combination of BEC site associations to allow for future work if required.

Rock (RO)

Rock outcrops and exposed cliffs are combined in this class. Vegetation cover is extremely sparse and limited to crustose lichens and stunted or isolated trembling aspen (*Populus tremuloides*), lodgepole pine (Pinus contorta) and Douglas-fir (*Pseudotsuga menziesii*). Some ledges are suitable for nesting raptors and ravens. This class has low risk of impact from highway development.

Talus (TA)

Talus slopes were closely related to rock outcrops and may include rock outcrops in some cases. These sites are very exposed unconsolidated eroded rock and till, steep and dry and have sparse vegetation cover. Small patches and isolated Douglas-fir (*Pseudotsuga menziesii*), lodgepole pine (Pinus contorta) and trembling aspen (*Populus tremuloides*) were most commonly associated with these sites. This class has low environmental risk due to the highway realignment. The talus slopes are frequently associated with the cut and fill required for the previous highway and railway construction, and would be increased by the new alignment.

Gravel Bar (GB)

These unvegetated, or partially vegetated sand and gravel bars are associated with the Kickinghorse River fall mainly within the ICHmk1 and some MSdk BEC subzones / variants. The Kickinghorse River is a turbulent, glacier fed river with

high bed load movement and steep canyon sides, limiting riparian habitat to a few island and gravel bars. Some colonial species such as fireweed (*Epilobium angustifolium*), pinegrass (*Calamagrostis rubescens*) and bluejoint (*Calamagrostis canadensis*) may be present, but the active channel and high bedload associated with flooding shifts the bars or strips them of later seral vegetation. Some sites with willow species (*Salix spp.*) or alders (Alnus spp.) may form important forage for moose. Hybrid spruce (*Picea glauca x engelmannii*) and paper birch (*Betula papyrifera*) are common along the river. These sites are not expected to be affected by construction except for limited areas affected by bridge footings.

Transportation Corridors (TC)

Although limited in area, there are numerous linear corridors in the Kickinghorse valley, associated with the highway, railroad and logging road. These areas contain early seral mixtures of pinegrass (*Calamagrostis rubescens*), forbs and shrubs. The potential impacts to sensitive species such as grizzly bears, is through displacement or barriers because of traffic, and collisions of vehicles or trains with wildlife. Linear corridors can have significant impacts on wildlife populations, if they separate them from important seasonal ranges or provide easy access for predators during winter seasons. Due to the pre-existing access on the north side of the Kickinghorse River, the proposed road realignment, bridge construction and tunnel would have negligible additional impact on large game species.

Cutblock / Burn (CB)

These are the largest anthropocentric impact on wildlife habitats in the Kickinghorse valley in terms of extent. Evidence of cutblocks, selective cutting, prescribed burns and wildlife fires have extensively altered the landscape. In many circumstances, the openings and early seral stages of vegetation are likely beneficial to wildlife, particularly if patches of old growth or escape terrain are nearby. Most of these sites are also classed by vegetation cover if replanted or regrown. Open lodgepole pine (*Pinus contorta*) and Douglas-fir (*Pseudotsuga menziesii*) classes are most common on these sites. In early seral sites, pinegrass (*Calamagrostis rubescens*) and shrub communities of common snowberry (*Symphoricarpos albus*), soopolallie (*Shepherdia canadensis*), saskatoon (*Amelanchier alnifolia*), rose (Rosa spp.), common juniper (*Juniperus communis*), Douglas maple (*Acer glabrum*), Tall Oregon grape (*Mahonia aquifolium*) and birch-leaved spirea (*Spiraea betulofolia)* dominate the areas. Proposed road realignment may pass through some areas of cutblocks or old burns.

Douglas-fir on morainal / colluvial slopes (F0)

This vegetation unit is primarily on the south aspects and characterized by relatively pure stands of dense Douglas-fir (*Pseudotsuga menziesii)* on colluvial slopes. Tentative BEC site associations of MSdk 02 (Pine / Douglas-fir – Saskatoon – Bluebunch wheatgrass) and MSdk 03 (Douglas Fir / Pine – Juniper – Pinegrass) are expected and BEU habitats class Interior Douglas Fir (DF) is common. These are relatively warm and dry sites (Site moisture regime of 0-3) with bluebunch wheatgrass (*Agropyron spicatum*), saskatoon (*Amelanchier alnifolia*), soopolallie (*Shepherdia canadensis*) and common juniper (*Juniperus communis*). Some lodgepole pine (Pinus contorta) is present, with kinnikinnick (*Arctostaphylos uva-ursi*) and fescue grasses (*Festuca spp.*) as ground cover. Importance as fall and early winter habitat for wildlife may be affected by construction, but due to abundance of this unit and similar MSdk habitats, impacts of the road realignment would be minimal.

Open Douglas-fir on Talus / steep slopes (F1)

These open canopy stands of Douglas-fir (*Pseudotsuga menziesii*) and occasional lodgepole pine (*Pinus contorta*) are assigned as BEU class Interior Douglas Fir (DF) and BEC site associations MSdk 02 (Douglas Fir – Saskatoon – Bluebunch Wheatgrass) on the southern aspects and ICHmk1 03 (Douglas-fir – Lodgepole Pine – Pinegrass – Twinflower) or ICHmk1 02 (Douglas-fir – Lodgepole Pine – Penstemon – Pinegrass) on the northern aspects. Due to the steep slopes and the potential association with cut and fill for roads, these habitats are not expected to be negatively affected by the realignment of the road.

Open Douglas-fir – Aspen – Saskatoon Wheatgrass (F2)

These stands are characterized by pure Douglas-fir (*Pseudotsuga menziesii*) canopies with small patches of trembling aspen (*Populus tremuloides*) and few pines. They are assigned BEC site association MSdk 02 (Pine / Douglas-fir – Saskatoon – Bluebunch wheatgrass) and MSdk 03 (Douglas Fir / Pine – Juniper – Pinegrass). BEU habitat classes Interior Douglas Fir (DF) and Douglas-fir – Lodgepole Pine (DL) are common. This cover class may be important to ungulates and bears because of the forage associated with the small patches of trembling aspen (*Populus tremuloides*) and paper birch (*Betula papyrifera*) interspersed within it. Impacts can be mitigated by avoiding trembling aspen (*Populus tremuloides)* patches, or creating new patches with prescribed burns. On portions of the east side of Glenogle Creek, there appear to be Lodgepole Pine – Juniper – Twinflower (ICHmw1 02) or Douglas-fir – Lodgepole Pine – Pinegrass – Twinflower (ICHmk1 03) and BEU habitat class Interior Western Hemlock – White Spruce (IS) (early seral stage).

Douglas-fir - Spruce – Pine – Aspen - juniper – pinegrass (F3)

This cover is very similar to F2, but includes a greater occurrence of lodgepole pine (*Pinus contorta*) within it. It is found primarily on south aspects and likely contains BEC site associations MSdk 01 (Hybrid Spruce – Douglas-fir – Soopolallie – Grouseberry), MSdk 03 (Douglas Fir / Pine – Juniper – Pinegrass) and MSdk 04 (Pine – Douglas Fir – Oregon Grape – Pinegrass). BEU habitat classes Spruce – Douglas-fir (SD) and Douglas-fir – Lodgepole Pine (DL). Similar to F2, the presence of open stands interspersed with trembling aspen (*Populus tremuloides*) and paper birch (*Betula papyrifera*) patches provides important ungulate forage and songbird habitat.

Douglas-fir – Spruce low elevation Colluvial / Glaciofluvial (F4)

These sites are dense conifer stands located on point bars near the Kickinghorse River. Patches of pine are evident in disturbed sites and understory in wetter sites appears to include red-osier dogwood (*Cornus stolonifera*) and common horsetail (*Equisetum arvense*). This transition site is tentatively assigned BEC site associations Hybrid Spruce – Douglas-fir – Gooseberry – Sarsaparilla (ICHmk1 05), Hybrid Spruce – Oak fern (ICHmk1 06) on the eastern part of the study area and Douglas-fir –Lodgepole Pine – Sitka alder – Pinegrass (ICHmk1 04) and Douglas-fir – Penstemon - Pinegrass (ICHmk1 02) in the western part of the F4. These stands are likely important winter range for ungulates and provide snow interception cover as well as forage. Due to the proximity to the river, some of these dense stands may serve to provide visual cover for bears and other animals moving along the river. Limited sections of the proposed road alignment affect this habitat.

Pine – Spruce – Douglas-fir – Soopolallie – Grouseberry (PS)

This cover type is very similar to F4, but located in the ICHmw1 variant and having a greater proportion of pine. It is assigned BEC site associations Lodgepole Pine – Juniper – Twinflower (ICHmw1 02), Hybrid Spruce – Douglas-fir – Gooseberry – Sarsaparilla (ICHmk1 05), and Hybrid Spruce – Oak fern (ICHmk1 06) and BEU habitat class Interior Western Hemlock – White Spruce (IS) (early seral stage).

Lodgepole Pine – Douglas-fir on talus / rock slopes (P1)

On the north aspect of the Kickinghorse Valley and the east side of Glenogle Creek, this area is assigned BEC site associations Lodgepole Pine – Juniper – Twinflower (ICHmw1 02) and Douglas-fir – Lodgepole Pine – Pinegrass –

Twinflower (ICHmk1 03) and BEU habitat class Lodgepole Pine (LP). On south aspects, there is likely a transition to BEC site association Lodgepole Pine – Oregon-Grape – Pinegrass (MSdk 04). This is mainly an early seral vegetation class associated with frequent fires. Pine beetle infestations and red attack are common throughout the Kickinghorse valley. No significant impacts from road realignment are expected in this habitat due to the relative abundance of this cover type.

Pine – Fir – Spruce (PF)

This class of vegetation is common on the steep north facing slopes of the valley and is characterized by a mix of lodgepole pine (*Pinus contorta*), hybrid white spruce (*Picea glauca x engelmannii*) growing on thin soils and moist, cool sites. In the lower elevations, I tentatively assign it to the BEC site variant Douglas-fir – Western Cedar – Soopolallie – Douglas Maple (ICHmw1 04) and Hybrid Spruce – Douglas-fir – Gooseberry – Sarsaparilla (ICHmk1 05) and the BEU habitat classes Engelmann Spruce – Subalpine Fir dry forest (EF), Spruce – Douglas Fir (SD) and Douglas Fir – Lodgepole Pine (DL). It is generally on the lower slopes of the north aspects and appears to have understory ranging from sites with azalea, white-flowered rhododendron (*Rhododendron albiflorum*) and heart-leaved arnica (*Arnica cordifolia*) to drier sites with red-stemmed feathermoss (*Pleurozeum schreberi*) and bluebunch wheatgrass (*Agropyron spicatum*). Due to the steep slopes and canopy closure, the habitat classes have limited large game use.

Pine – Fir – Spruce with trembling Aspen (PFA)

This is very similar to PF, but has obvious clumps of trembling aspen (*Populus tremuloides*) on disturbed areas and rocky ridge lines. Due to the incidence of trembling aspen (*Populus tremuloides*), I have assigned these sites as Western redcedar – Douglas-fir – Soopolallie – Douglas maple (ICHmw1 04). These deciduous areas may be important for a number of bird species and would provide potential winter forage for some ungulates in areas where slopes are not too steep.

Spruce – Subalpine Fir – Azalea – Queen's Cup (ES1)

This is the ICHmk1 conifer forest on moist north facing slopes, with few pines present. It is likely a combination of the BEC site associations Western redcedar – Hybrid Spruce – Falsebox (ICHmk1 01), Hybrid Spruce – Douglas-fir – Gooseberry – Sarsaparilla (ICHmk1 05) and Hybrid Spruce – Oak fern (ICHmk1 06) and BEU habitat class Engelmann Spruce – Subalpine Fir dry forest (EF). This forest would have lower habitat suitability for most large wildlife species, but old-growth patches with snags would be important for cavity nesting species and marten.

Spruce – Subalpine Fir – Devil's Club (ES2)

This class was assigned to the riparian zones on steep north aspect streams that had significant understory development and appeared to have devil's club (*Oplopanax horridus*) present. These areas were tentatively assigned BEC site associations Western Redcedar – Western Hemlock – Devil's Club – Lady Fern (ICHmw1 05) and Western Hemlock – Western Redcedar – Oval-leaved blueberry – Oak Fern (ICHmw1 06). These steep moist zones have alluvial and colluvial deposits thicker than the surrounding steep slopes. No significant impacts on these sites are likely from the road realignment.

4.3 Potential species at risk and projected impacts by the proposed road options

Vegetation / Habitat

No species at risk were identified by the Conservation Data Centre within the Park Bridge to Brake Check corridor. There were reports of several red and blue listed plant species in the general vicinity of the Kickinghorse Valley that have potential to be present within the study area, including:

Carex crawei (Crawe's sedge) – clay wetland. There is potential for finding this species in pocket wetlands near the river in the ICHmk1

Chenopodium atrovirens (dark lamb's quarters) – dry roadsides near Golden, British Columbia in ICHmk1 and MSdk and on scree slope, west of Field, British Columbia. There is potential for finding this species associated with the talus slopes associated with the roadcuts in ICHmw1 and MSdk. As the proposed road options would generally increase this habitat cover, risks of impact are probably low.

Melica smithii (Smith's Melic) – growing in lush herb meadows in Porcupine Creek. There is potential for finding in this species in isolated meadows in the ESSFwm, ICHmw1 and MSdk, but none of these habitats were observed near any of the road options.

*Solidago gigantean ssp. Serotina (*giant goldenrod) – Golden. This species has potential to occur in disturbed sites along the road right-of-ways and in the MSdk and ICHmw1 in open stands.

Lomatium triternatum ssp. Platycarpum – steep Douglas-fir (Pseudotsuga menziesii) south aspect along ridge and *Astragalus bourgovii* – near Mount Hunter, along ridge in Yoho National Park. These species have potential to occur along rock outcrops and ridges of the MSdk, on the south aspects of the Kickinghorse valley. The proposed road options are not expected to affect these habitats.

It is unlikely that the road realignment will impact any of these plant species as they are not found in habitats affected by the road, or the road construction may enhance habitats that they occur in (e.g.Talus and roadside species such as *Chenopodium atrovirens* (dark lamb's quarters) or *Solidago gigantean ssp. Serotina (*giant goldenrod)). Site specific assessment of vegetation on the footprint of the road corridor could be conducted to ensure that no rare or endangered species would be directly affected.

The amount of each vegetation cover class potentially affected by the two road options is illustrated in Table 1. With respect to potential habitat effects, the open Douglas-fir – Aspen – Saskatoon – Wheatgrass (F2) cover type is the unit most affected by both options followed by the Pine – Fir – Spruce with Aspen (PFA). Both of these units have importance to ungulates primarily due to the presence of the clumps of trembling aspen and paper birch. Potential mitigation could include avoidance of the deciduous clumps by the road option, or creation of additional habitat in nearby Douglas-fir - lodgepole pine cover types through the use of prescribed burning and logging. The southern aspects ungulate winter range is impacted by the majority of the footprint of both road options on the north side of the Kickinghorse River. It can be somewhat mitigated by selection of a route as close to the existing road corridor as possible. Similar habitat types are found throughout the MSdk, ICHmw and ICHmk subzones in BC, with higher quality ungulate habitat found in the nearby Columbia Valley.

Cover Type	Area of Interest Total (m2)	Option 11 area (m2)	Percent of area affected	Option 12 area (m2)	Percent of area affected
			Option 11		Option 12
CB	274296.22	21998.39	8.0%	24236.43	8.8%
CB/F2	174593.13	3483.08	2.0%	12270.92	7.0%
CB/F3	494218.65		0.0%		0.0%
ES1	401779.32		0.0%		0.0%
ES2	57214.97		0.0%	81.88	0.1%
F0	677012.32	25303.08	3.7%	23398.36	3.5%
F1	544678.98	23691.36	4.3%	24868.38	4.6%
F2	357688.51	106319.37	29.7%	80808.54	22.6%
F3	1578162.71	29527.99	1.9%	31688.19	2.0%
F4	129140.66		0.0%		0.0%
GB	338338.08	1143.12	0.3%	1025.17	0.3%
P1	724550.48	3419.67	0.5%	23488.65	3.2%
PF	933095.06	24196.16	2.6%	27302.91	2.9%
PFA	346228.41	26338.24	7.6%	45465.05	13.1%
PS	42068.12		0.0%		0.0%
RO	30911.90		0.0%		0.0%
Ta	396756.58	33379.61	8.4%	22993.23	5.8%
TC	478578.07	57963.68	12.1%	52898.22	11.1%
Total	**7979312.18**	**356763.76**		**370525.92**	

Table 1. Amount of each vegetation class affected by the two road options.

Birds

All of the birds detected within the study area are widely distributed in suitable habitats throughout much of British Columbia, which is divided into 9 distinct

ecoprovinces (Demarchi 1988). Forty-three (90%) of the 48 species detected within the Kicking Horse River study area breed in 6 or more ecoprovinces in British Columbia (Campbell et al. 2001). The remaining 5 species – Red-naped Sapsucker, Mountain Chickadee, Lazuli Bunting, Pine Grosbeak and Red Crossbill – breed in 4 or 5 ecoprovinces (Ferguson 2004). The detailed report on bird species and relative abundance is found in Appendix C. No Red- or Blue-listed bird species, as designated by the BC Conservation Data Centre (2004), were detected within the study area during June-July 2004.

Other Wildlife

Wildlife tracking work between 1995 and 1997 was conducted by Searing and Demarchi (1997) to assess potential impacts of the Trans-Canada Highway on wildlife. Ungulate range and movements were well described and reinforced the relative importance of the southern aspects of the open Douglas-fir cover types associated with pockets of deciduous regeneration. No rare or endangered species were recorded for the area, although several blue-listed (vulnerable) species may frequent the Kickinghorse corridor, including grizzly bear (*Ursus horribilis*), wolverine (*Gulo luscus*) and mountain goat (*Oreamnus americanus*). Very limited sightings of wildlife and tracks occurred within the Park Bridge to Brake Check area. The only critical habitat feature identified in the area is a mineral lick located in the rocky bluffs above the talus on the south side of the valley approximately 200 metres east of Park Bridge (UTM E 514500, N 5680500). Based on the habitats available and previous literature, a list of potential wildlife species that might occur in the Park Bridge to Brake Check area is listed in Appendix E.

The greatest hazard to wildlife in the area is likely collisions on the road and rail. Searing and Demarchi (1997) have discussed the background and historical data in depth. The greatest concern is that mortality may increase due to higher traffic volumes and speeds associated with the improved highway. Mitigation can include fencing areas with poor visibility, improving line-of-sight visibility for motorists, limiting speed in areas with frequent wildlife crossings and creating cross structures such as overpasses and underpasses. The incorporation of natural terrain features near draws and streams entering the Kickinghorse could be used to facilitate wildlife movement beneath them.

Road Option Recommendations

Road option 11, including the tunnel, would have somewhat less impact on habitat footprint and would have the added benefit of having a route somewhat lower on the slope and closer to the existing highway through most of the route. Other mitigation measures include the creation of wildlife crossings at draws and creeks whenever possible and limiting highway speeds to 80 km/hour. In areas where the new route crosses ungulate winter range, I recommend that efforts be made to avoid removal of deciduous tree patches associated with the Douglas-fir and lodgepole pine forest cover on the south facing aspects. Mitigation could

also include creation of improved winter range in adjacent forest through prescribed burning and natural regeneration in logged areas. Neither road option appears to pose significant impacts to habitats or wildlife.

4.4 Colour digital photography Kickinghorse Corridor

As a separate component of the contract to Silvatech Consulting Ltd., high resolution digital imagery of the entire Project Area is provided. The digital orthophoto imagery was captured by Terrasaurus on July 17, 2004. This imagery was captured using a 22 mega pixel digital aerial camera and has a 25cm pixel size. The digital imagery is in UTM zone 11, Nad83 projection. It was orthorectified by Terrasaurus using a DEM built by Silvatech. Digital files are provided for future use in engineering or baseline environmental work.

5. Summary and conclusions

Although the vegetation classification is an interpretation of high resolution aerial photography, it is sufficient to determine relative risk to vegetation and habitat by the Park Bridge to Brake Check Project. A number of key factors contribute to this assessment, including the pre-existence of long time transportation corridors in close proximity to the proposed re-alignment and the relatively low wildlife value of habitats directly affected by the proposed route. There are a number of general concerns for wildlife and habitat related to this project. The valley bottom and south aspect slopes are relatively important wildlife habitat and seasonal movements of animals might necessitate crossing the highway. The re-aligned highway may facilitate greater highway speeds and traffic volumes which in turn could contribute to an increase in animal-vehicle collisions and possible displacement or behavioural avoidance by species like grizzly bears. If possible, engineering design should consider natural underpasses or overpasses and fencing in areas with a history of animal collisions. The straighter road alignment may have the positive effect of providing greater visibility and allow motorists time to slow down and avoid wildlife that does enter the highway corridor.

Overall, the proposed road alignment does not appear to have any significant impact on rare or key wildlife habitats or resource values. No species at risk are known to occupy the proposed route.

6. References

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Appendix A

Vegetation and terrain photographs of Park Bridge to Brake Check corridor; key map and photographs
See digital pdf attachments (final report)

Appendix A
Vegetation and Terrain Photographs

photo01

photo02

Appendix A
Vegetation and Terrain Photographs

photo03

photo04

Appendix A
Vegetation and Terrain Photographs

photo05

photo06

Appendix A
Vegetation and Terrain Photographs

photo07

photo08

Appendix A
Vegetation and Terrain Photographs

photo09

photo10

Appendix A
Vegetation and Terrain Photographs

photo11

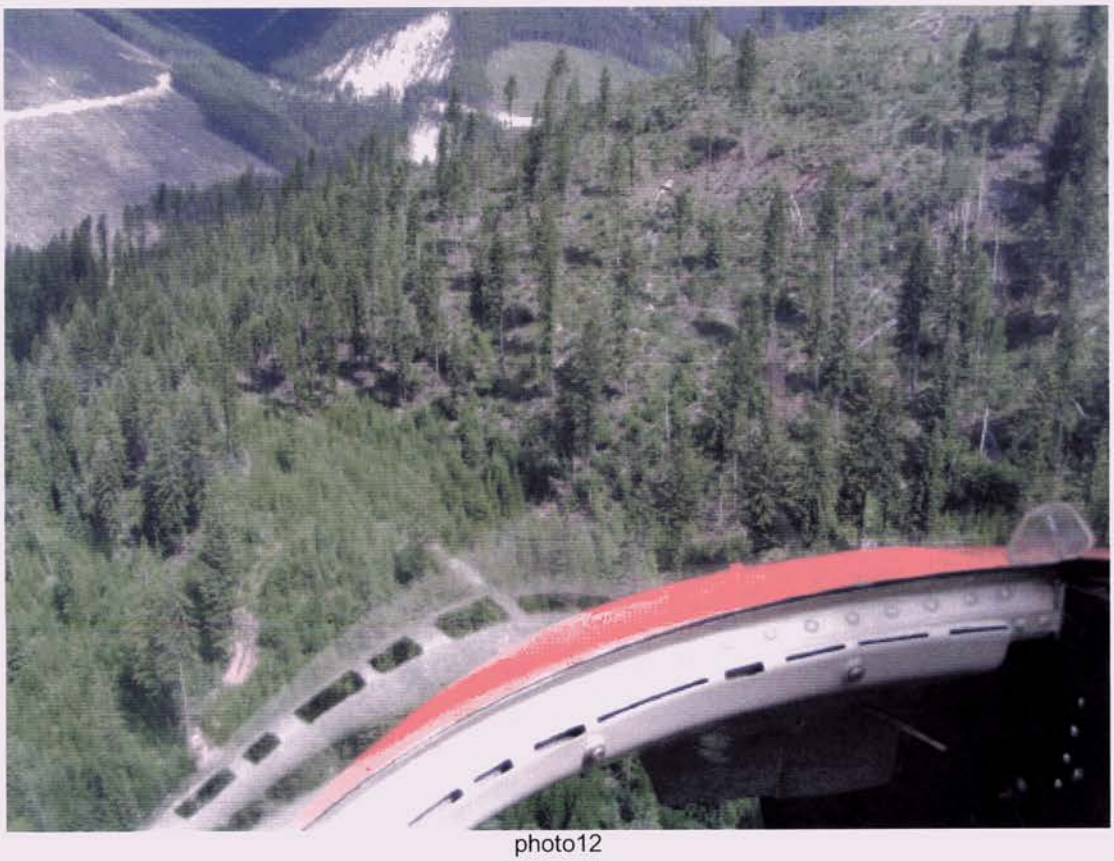
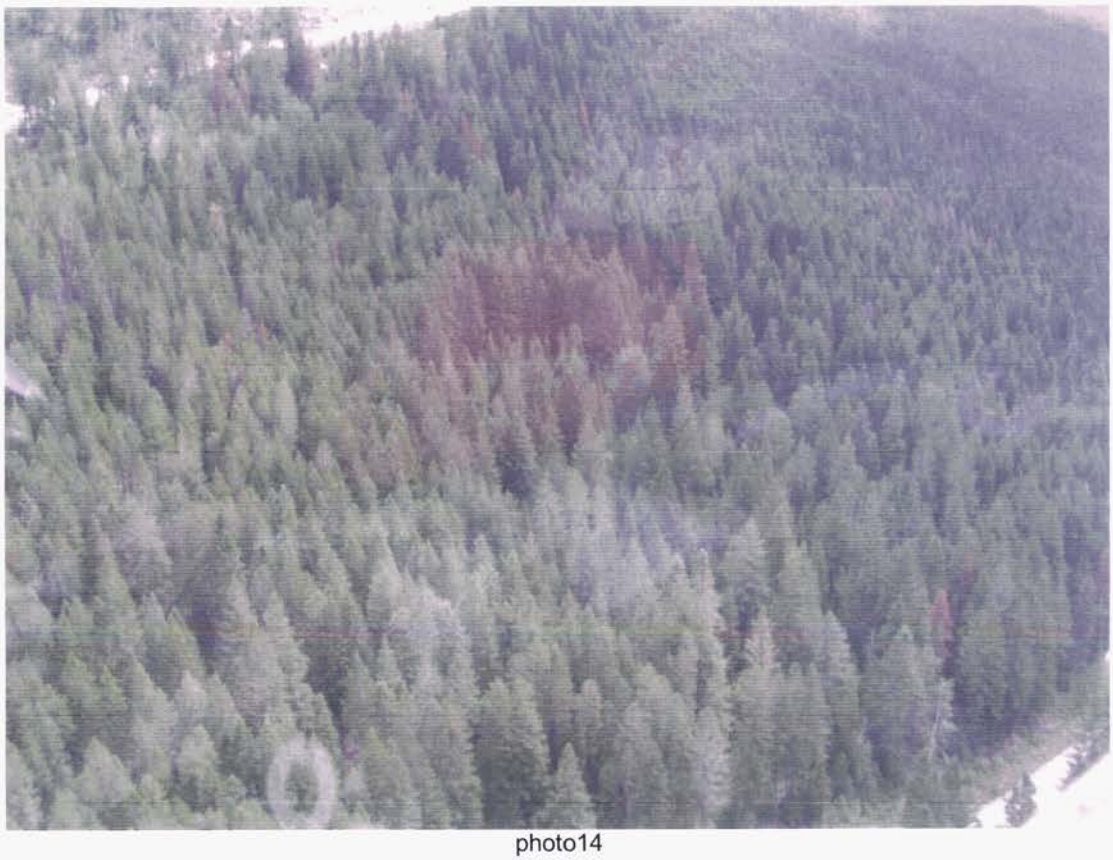


photo12

Appendix A
Vegetation and Terrain Photographs

photo13



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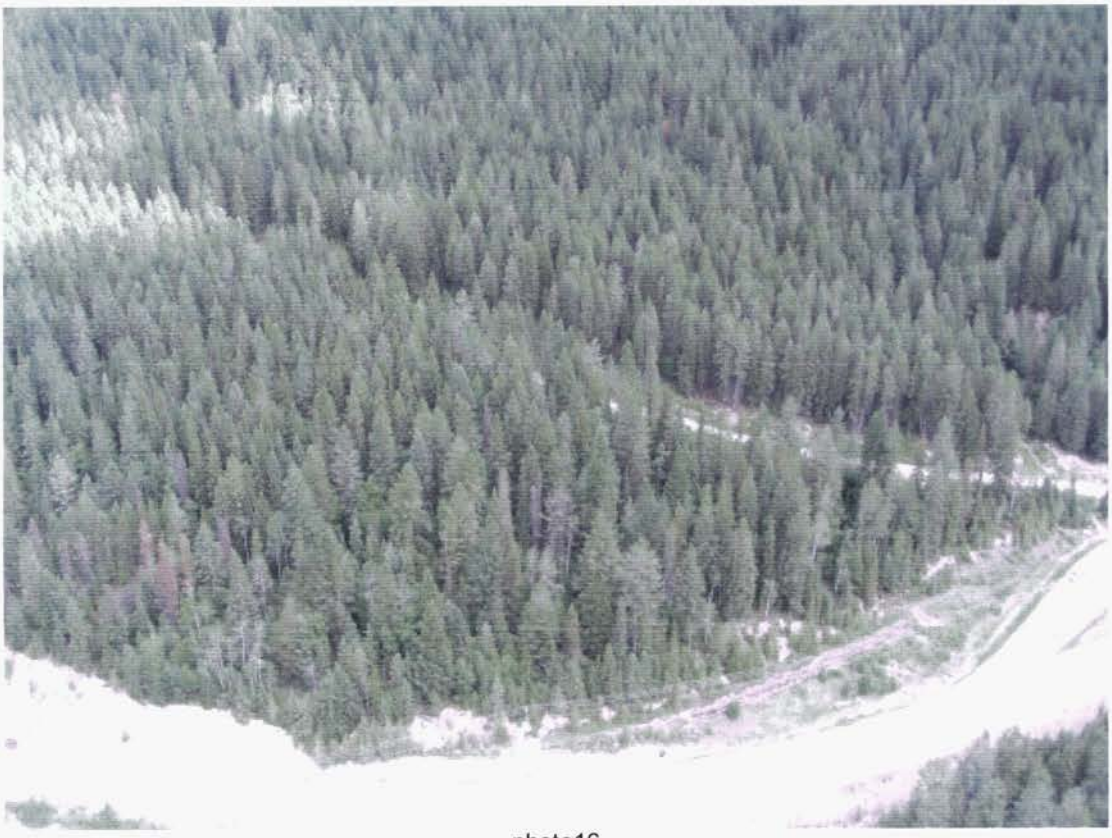
Appendix A
Vegetation and Terrain Photographs

photo15



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Appendix A
Vegetation and Terrain Photographs

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Appendix A
Vegetation and Terrain Photographs

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Appendix A
Vegetation and Terrain Photographs

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Vegetation and Terrain Photographs

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Vegetation and Terrain Photographs

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Vegetation and Terrain Photographs

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Vegetation and Terrain Photographs

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Vegetation and Terrain Photographs

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Vegetation and Terrain Photographs

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Vegetation and Terrain Photographs

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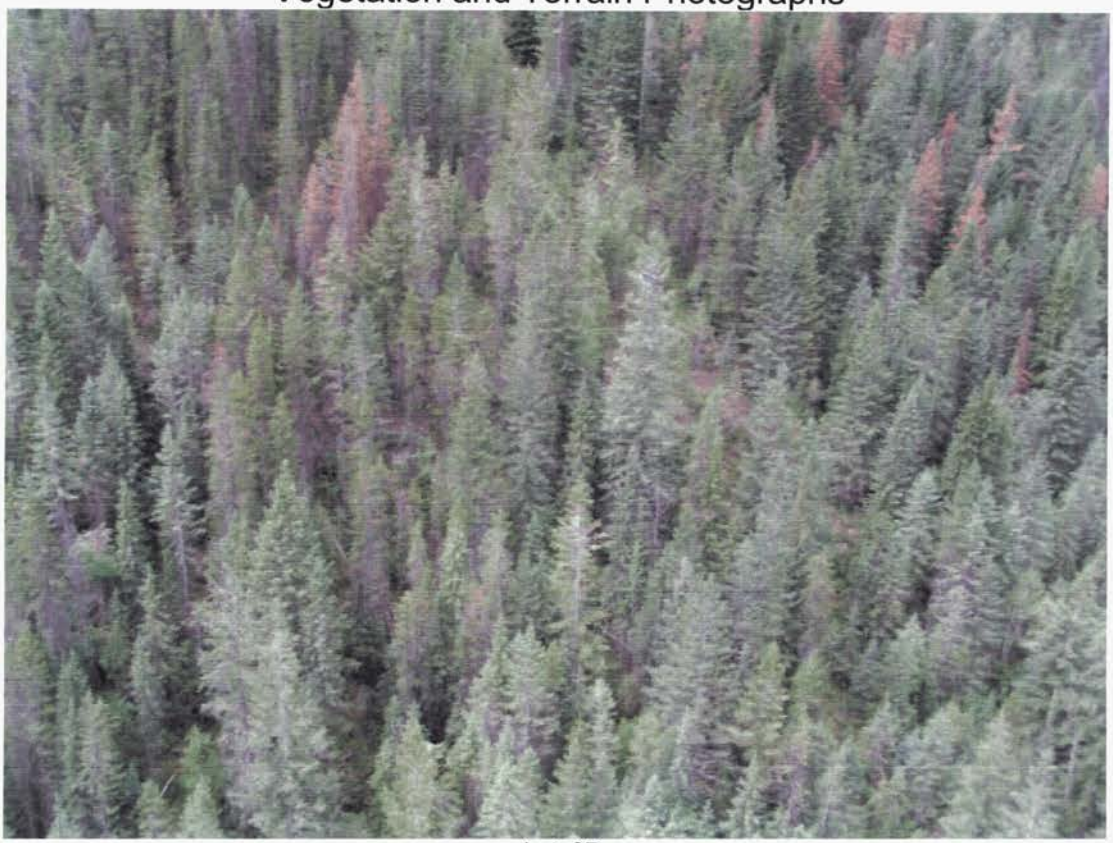
Appendix A
Vegetation and Terrain Photographs



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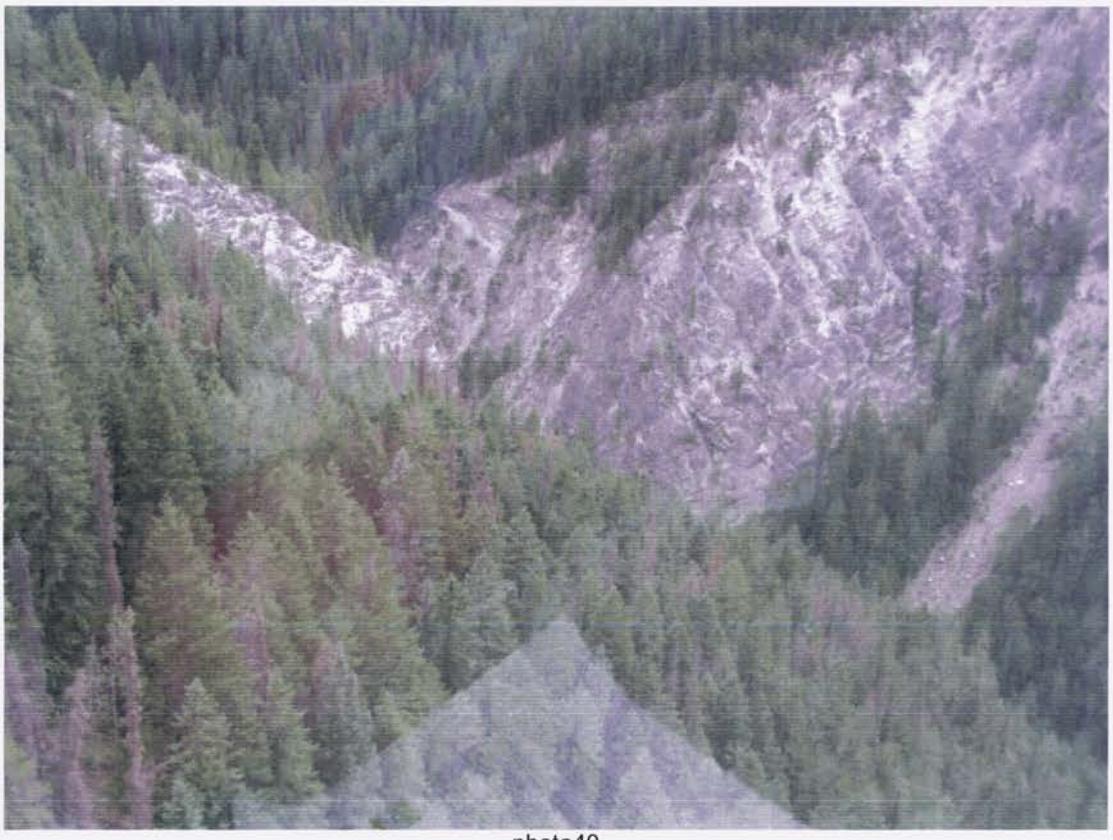
Appendix A
Vegetation and Terrain Photographs

photo39



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Appendix A
Vegetation and Terrain Photographs

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Appendix A
Vegetation and Terrain Photographs

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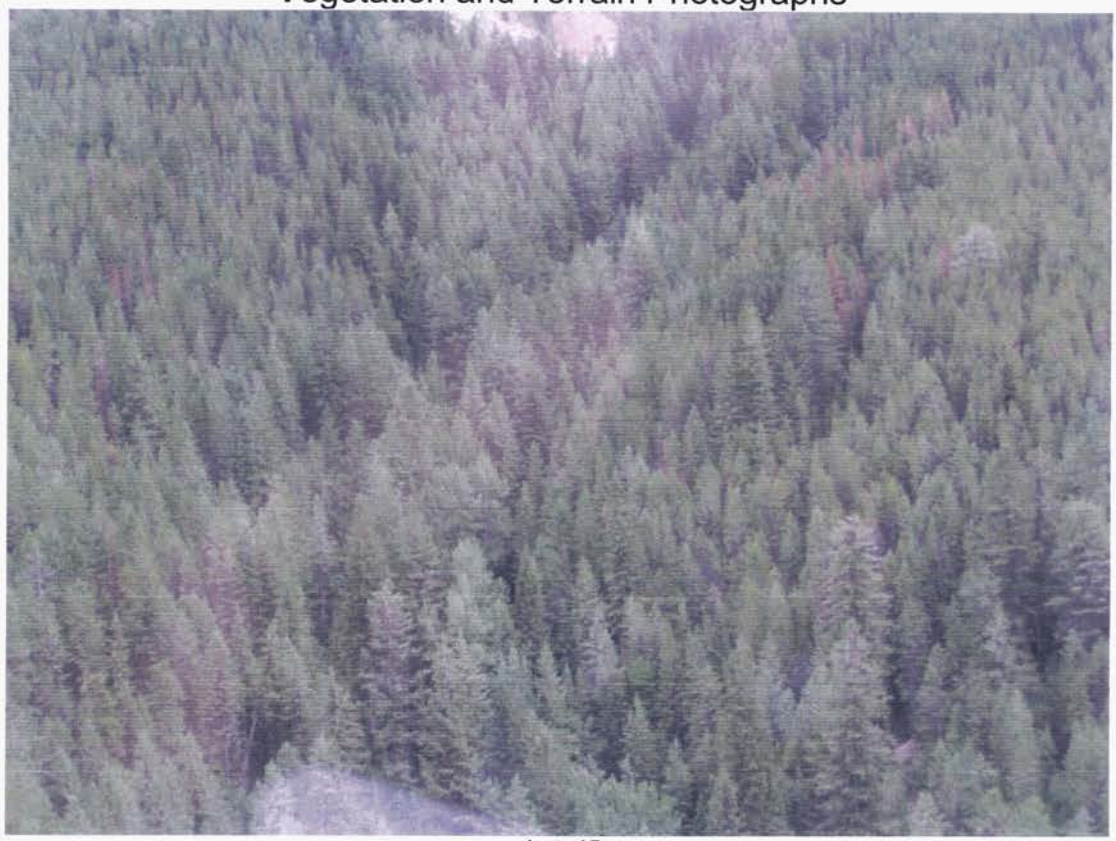
Appendix A
Vegetation and Terrain Photographs



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Appendix A
Vegetation and Terrain Photographs

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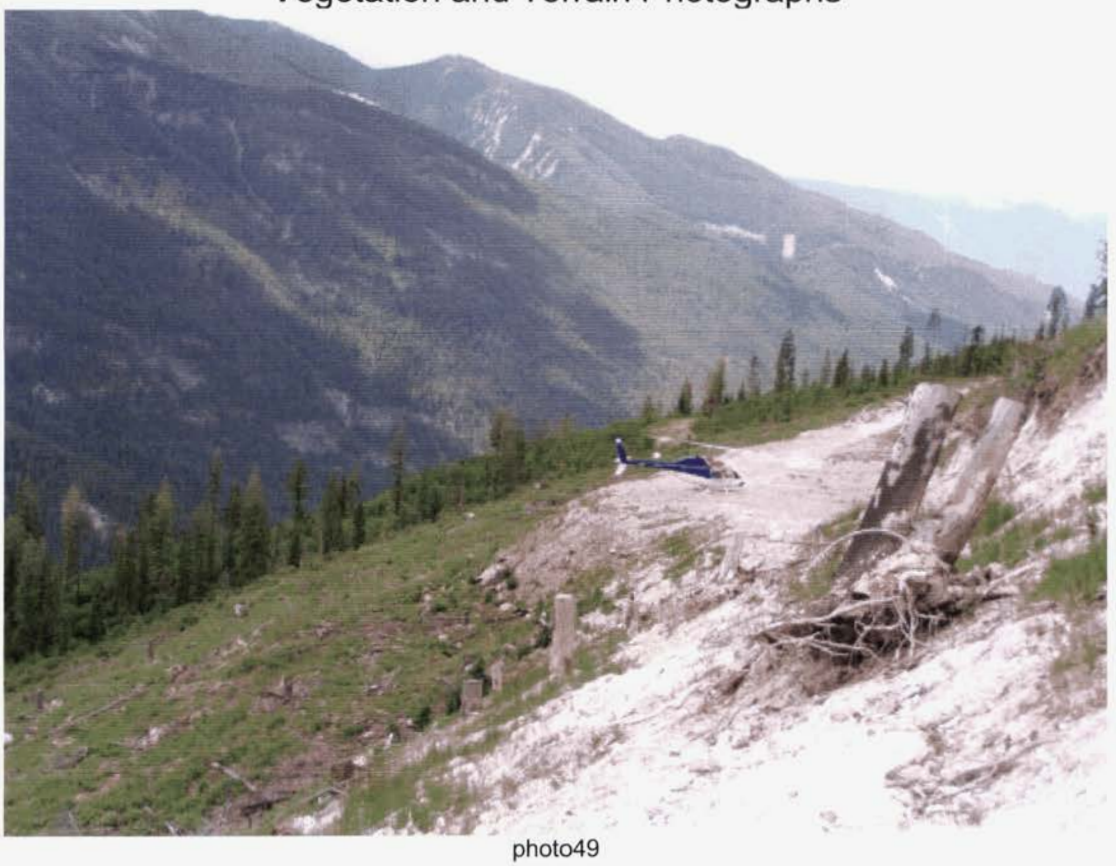
Appendix A
Vegetation and Terrain Photographs



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Appendix A
Vegetation and Terrain Photographs

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Vegetation and Terrain Photographs

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Vegetation and Terrain Photographs

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Vegetation and Terrain Photographs

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Vegetation and Terrain Photographs

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Appendix A
Vegetation and Terrain Photographs

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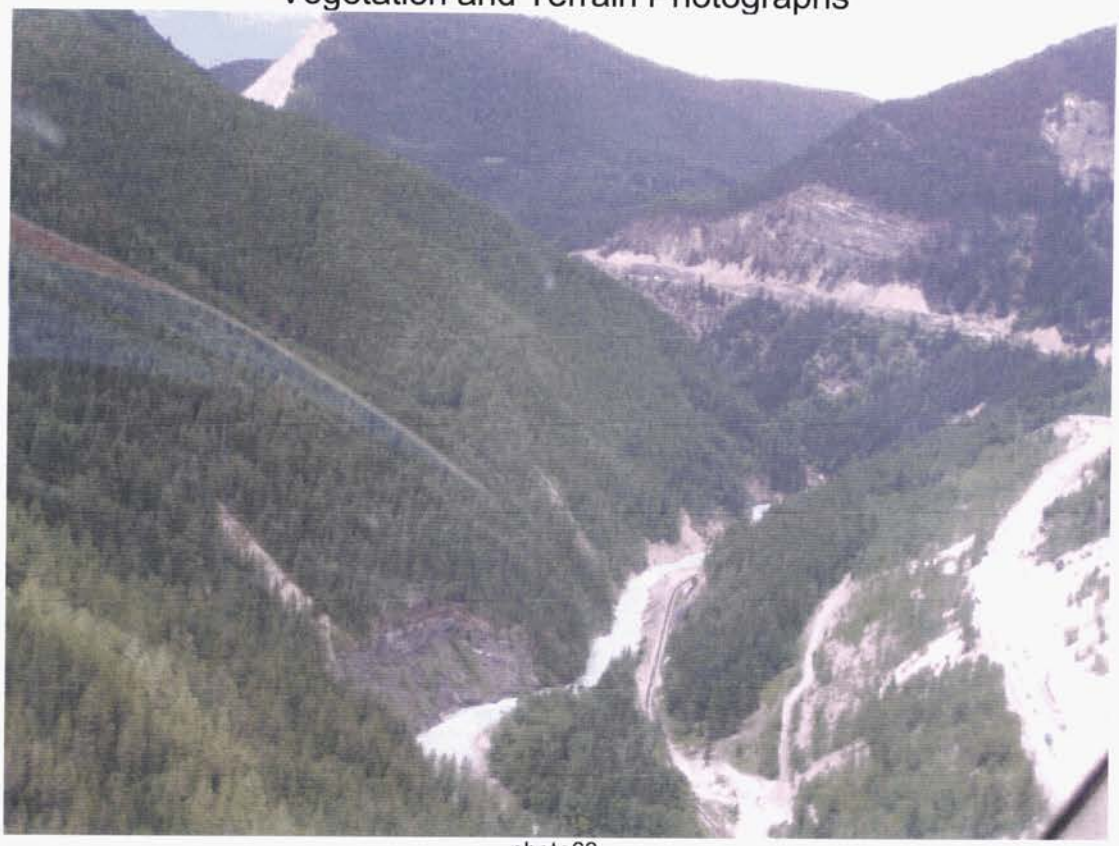
Appendix A
Vegetation and Terrain Photographs



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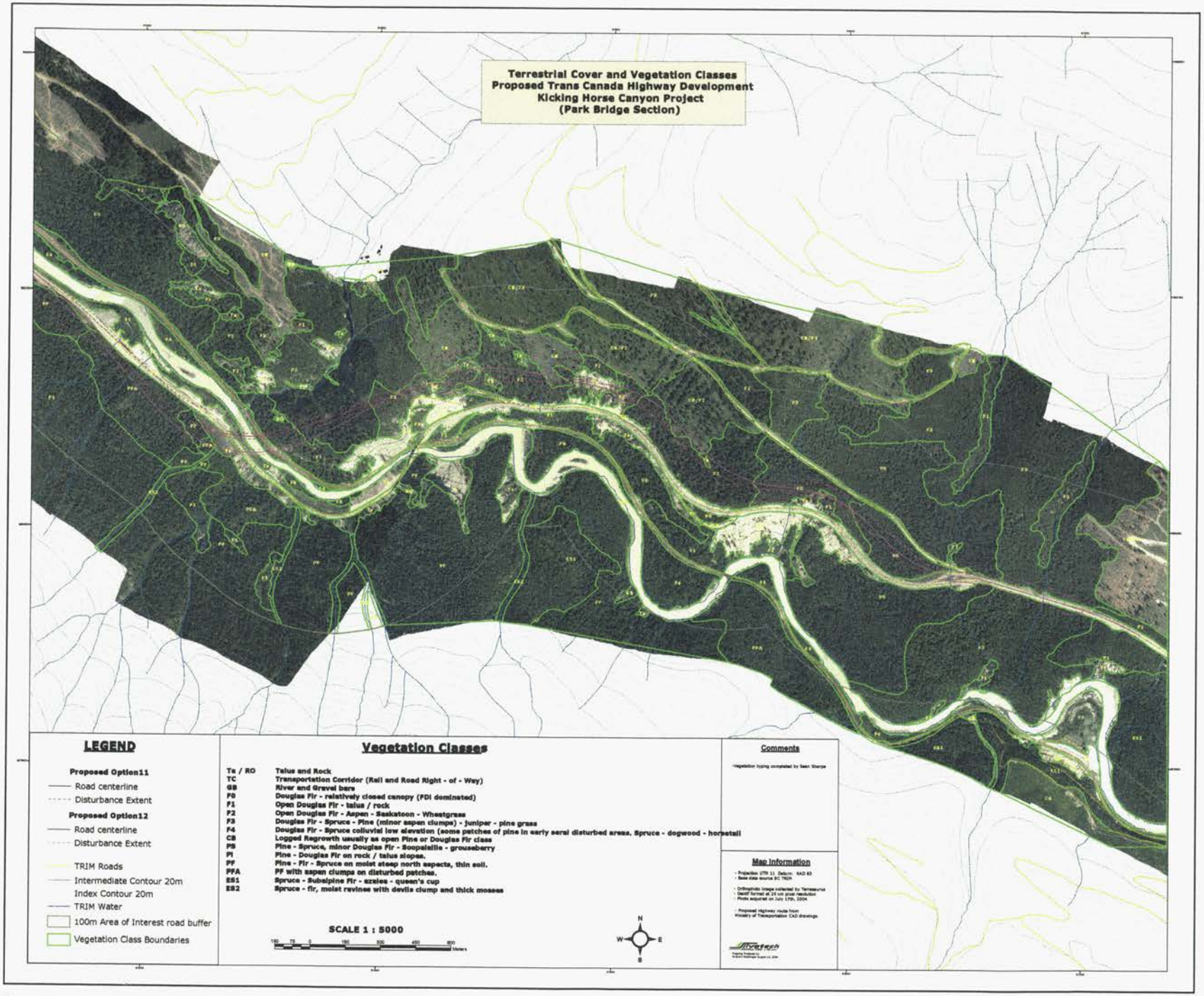
Appendix B

Terrestrial cover and vegetation cover map for Park Bridge to Brake Check
See folded maps attached to back cover (final report).


Terrestrial Cover and Vegetation Classes
Proposed Trans Canada Highway Development
Kicking Horse Canyon Project
(Park Bridge Section)
LEGEND
Proposed Option11
Road centerline
Disturbance Extent
Proposed Option12
Road centerline
Disturbance Extent
TRIM Roads
Intermediate Contour 20m
Index Contour 20m
TRIM Water
100m Area of Interest road buffer
Vegetation Class Boundaries
Vegetation Classes
Ta / RO Talus and Rock
TC Transportation Corridor (Rail and Road Right - of - Way)
GB River and Gravel bars
F0 Douglas Fir - relatively closed canopy (FDi dominated)
F1 Open Douglas Fir - talus / rock
F2 Open Douglas Fir - Aspen - Saskatoon - Wheatgrass
F3 Douglas Fir - Spruce - Pine (minor aspen clumps) - juniper - pine grass
F4 Douglas Fir - Spruce colluvial low elevation (some patches of pine in early seral disturbed areas. Spruce - dogwood - horsetail
CB Logged Regrowth usually as open Pine or Douglas Fir class
PS Pine - Spruce, minor Douglas Fir - Soopalallie - grouseberry
PI Pine - Douglas Fir on rock / talus slopes.
PF Pine - Fir - Spruce on moist steep north aspects, thin soil.
PFA PF with aspen clumps on disturbed patches.
ES1 Spruce - Subalpine Fir - azalea - queen's cup
ES2 Spruce - fir, moist ravines with devils club and thick mosses
SCALE 1 : 5000
Comments
Map Information
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Appendix C

Inventory of Breeding Birds along proposed Realignment of the Trans Canada Highway at the Park Bridge, Kickinghorse Canyon, British Columbia

Inventory of Breeding Birds along the Proposed Realignment of the Trans-Canada Highway at the Park Bridge, Kicking Horse Canyon, British Columbia

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AUGUST 2004

Introduction

Within the next few years, the British Columbia Ministry of Transportation is proposing to replace the Park Bridge along the Trans-Canada Highway in the Kicking Horse Canyon, British Columbia. The bridge replacement project includes realignment of a 4-km stretch of the Trans-Canada Highway – from the existing brake-check stop at the junction of the Glenogle Forest Service Road and the Trans-Canada Highway, west to near the confluence of the Kicking Horse River and Glenogle Creek. The proposed locations of the new bridge and highway realignment are detailed on preliminary alignment drawings prepared by the Ministry of Transportation in November 2002 (Drawing No.'s R2-213-102 to R2-213-107).

As part of its environmental impact assessment, the Ministry of Transportation retained the services of MATRIX Resource Services for the purpose of collecting baseline information on breeding bird populations along the route of the 4-km realignment, including the proposed site of the new bridge crossing the Kicking Horse River. These baseline data will be used by the Ministry of Transportation to assess the potential impacts of the bridge-replacement and highway-realignment construction project on wildlife and wildlife habitats in the Kicking Horse Canyon.

The objectives of the project undertaken by MATRIX Resource Services in 2004 were:

- to determine the species of birds present at the project location during the 2004 breeding season;
- to document the breeding status and habitat associations of bird species encountered during the inventory;
- to document the presence of any red-listed or blue-listed species, or other species-at-risk at the project location; and
- to document the locations of any critical habitat features (such as raptor nest sites or the nests of other high-profile species) that may warrant special management consideration.

The following report documents the results of the breeding bird inventory carried out by MATRIX Resource Services during the 2004 breeding season.

Study Area

The Park Bridge (known locally as the Ten-Mile Bridge) crosses the Kicking Horse River 12 km east of Golden, British Columbia, and 11 km west of the boundary of Yoho National Park. The study area for the breeding bird inventory extends upslope from the existing Trans-Canada Highway, from near the mouth of Glenogle Creek (0.8 km northwest of the Park Bridge), east to the Highway's junction with the Glenogle Forest Service Road. The upper limit of the study area approximates the 1,250-m contour on the north side of the Kicking Horse River, which is about 800 m (horizontal distance) or 930 m (slope distance) above the existing Trans-Canada Highway.

Elevations in the study area range from 920 m at the Kicking Horse River to 1,250 m on the south-facing slope above the Trans-Canada Highway. This study area encompasses the full range in elevation of the proposed highway realignment, as determined from the preliminary drawings (R2-213-102 to R2-213-107) prepared by the British Columbia Ministry of Transportation in November 2002. The 1,250-m contour approximates the elevation of the point of commencement of the 1.6 Km Branch Road, where it joins the Glenogle Forest Service Road.

The study area lies within the Southern Rocky Mountains Ecoregion of the Southern Interior Mountains Ecoprovince (Demarchi 1988). Forest cover and other vegetation in the study area generally are characteristic of relatively dry, south-facing slopes in the Montane Spruce biogeoclimatic zone (Braumandl and Curran 1992). Cool aspects on the east side of Glenogle Creek exhibit some vegetation characteristics of the Interior Cedar-Hemlock biogeoclimatic zone.

In recent years, pine-dominated stands on lower slopes in the Kicking Horse Canyon and in tributary drainages (e.g. Glenogle Creek) have experienced widespread infestations by the mountain pine beetle. As a result, over half of the remaining lodgepole pine trees within the study area are either dead (i.e., standing snags) or dying. On accessible sites in the upper part of the study area, many pine-dominated stands have been recently logged.

Cover Types in the Study Area

I identified 7 broad cover types within the study area – they are described as follows:

Mature Douglas-Fir Forest The eastern third of the study area is dominated by mature stands of Douglas-fir, with a minor component of lodgepole pine, spruce, western red-cedar (on localized seepage sites), trembling aspen and white birch (Figure 1). This cover type occurs between the Trans-Canada Highway and the Glenogle Forest Service Road, from the brake-check stop at the top of the hill to the recently logged cut blocks, about 1.2 km west of the brake-check stop. The south-facing slopes generally range from 20 to 60%, with localized steeper slopes and scattered depressional areas and narrow, relatively level benches. Understory shrubs include Douglas maple, soopolallie, saskatoon,

common juniper, rose, snowberry, Oregon grape and high-bush cranberry (restricted to wet sites).

Mature Lodgepole Pine – Douglas-Fir Forest This cover type dominates the summit and the northern and western aspects of the rock bluff adjacent to the west-bound lane on the existing Park Bridge (Figure 2), and the western aspects on the east side of Glenogle Creek. Forest cover is a mixture of lodgepole pine (50-60% as dead standing snags) and Douglas-fir, with scattered spruce, trembling aspen and white birch. This cover type also occurs on the south-facing, middle slopes above the Park Bridge Slide and above the runaway lane. Slopes are predominantly steep (50-80%).

On warm, south-facing slopes understory shrubs include Douglas maple, saskatoon, soopolallie, common juniper, kinnikinnick, rose, Oregon grape and birch-leaved spirea. The vegetation on cool aspects and depressional areas includes more white birch and spruce, scattered western hemlock, western red-cedar and subalpine fir (Abies lasiocarpa) in the understory, as well as red-osier dogwood, high-bush cranberry, oval-leaved blueberry, willow, false azalea, and white-flowered rhododendron.

Early Seral (Post-Logging) Grass – Shrub Recently logged areas are dominated by early seral, grass-shrub communities with variable retention of mature Douglas-fir, trembling aspen and white birch trees (Figure 3). This cover type occurs west of the Mature Douglas-Fir Forest cover type, between the Trans-Canada Highway and the Glenogle Forest Service Road, and on upper slopes above the runaway lane and above the "Park Bridge Slide" (Figure 4). Slopes are generally south-facing, they vary from 10 to 50%, and they are characterized by open shrub – grass communities. Major shrubs include snowberry, soopolallie, saskatoon, rose, common juniper, Douglas maple, Oregon grape and birch-leaved spirea.

Cliff-Face – Canyon Wall (Consolidated Bedrock) The east- and south-facing slopes of the canyon wall adjacent to the west-bound lane of the Park Bridge comprise near-vertical cliffs of consolidated bedrock (Figures 5 and 6). Most of the canyon wall is devoid of trees and other vascular plants. Lichens comprise the dominant ground cover.

Actively Eroding Sites (Unconsolidated Bedrock) Lower slopes immediately adjacent to the north side of the Trans-Canada Highway are characterized by non-vegetated, actively-eroding substrates and unconsolidated bedrock. The largest of these areas is referred to as the "Park Bridge Slide" (Drawing No. R2-213-104), which occurs between the Park Bridge and the runaway lane (Figure 7). Smaller areas of this cover type occur between the runaway lane and the brake-check stop, many of which were created by the road-cuts for the Trans-Canada Highway right-of-way. Patches of consolidated bedrock also occur along the road-cuts.

Kicking Horse River and Associated Shorelines The Kicking Horse River is a cold, turbulent, glacier-fed river with turbid, fast-flowing water and frequent white-water sections during the summer months. Slopes on both sides of the river rise abruptly from the shorelines, limiting the development of riparian vegetation and extent of riparian habitats (Figure 8). The close proximity of the main Canadian Pacific Railway line and the Trans-Canada Highway to the river channel (Figure 8) has also likely resulted in near-permanent changes to shoreline and lower-slope vegetation communities. White birch and spruce are the main tree species growing on sites influenced by the Kicking Horse River.

Roadsides and Other Disturbed Areas These are predominantly a mixture of non-vegetated areas and grass/forb/shrub communities associated with places of frequent human-caused disturbance, including highway and railway right-of-ways, highway pull-offs, forestry roads, skid trails, landings, and the runaway lane and brake-check rest stop.

Methods

The study area presents a number of logistical challenges regarding breeding bird inventory work. Most significantly, the high traffic volumes on the Trans-Canada Highway, and the close proximity of the main Canadian Pacific Railway line and Kicking Horse River, all contribute to high, background noise levels, which interfere with auditory detections of songbirds. In forested habitats, up to 95% of songbird detections during breeding bird surveys are made by auditory detections (Petit et al. 1995), underscoring the need for low levels of background noise for sampling effectiveness.

Secondly, ground access to parts of the study area is very difficult due to the steepness of slopes and the presence of near-vertical cliffs and canyon walls. Given these logistical constraints, a variety of sampling methods designed to minimize interference from background noise and to overcome access problems, was used to inventory bird populations within the study area:

1. A linear transect approximately 1,500 m in length was established along the Glenogle Forest Service Road to quantify relative abundance of birds within the Mature Douglas-Fir Forest east of the brake-check stop. This transect also sampled small forest openings where recent logging has removed beetle-infested lodgepole pine trees. About 15% of the area sampled from this transect comprised small logged openings.

   The point of commencement of the transect was at the junction of the Glenogle Forest Service Road Field and the 1.6 Km Branch Road. The transect terminated at the brake-check stop. Along the transect, all birds detected within an estimated 200 m of the road (on both sides) were counted.

This transect was far enough away from the highway, railway and river that background noise from these sources did not interfere with auditory detections along most of the transect. Highway noise and truck use of the brake-check stop sometimes caused temporary interference with auditory detections at the eastern end of the transect.

2. A second linear transect about 1,000 m in length was established along the 1.6 Km Branch Road to quantify relative abundance of birds within the Early Seral (Post-Logging) Grass – Shrub cover type. The transect was walked in an east-to-west direction, with the point of commencement at the junction of the Glenogle Forest Service Road Field and the 1.6 Km Branch Road.

   This transect also sampled second-growth forest (6-8 m tall lodgepole pine with scattered mature Douglas-fir) on the north side of the Branch Road. About 50% of the area sampled from this transect comprised second-growth forest. Along the transect, all birds detected within an estimated 200 m of the road (on both sides) were counted.

   Traffic and river noise did not interfere with auditory detections along this transect.

3. Sampling of birds along the linear transects was augmented by reconnaissance-level walkthroughs of areas with relatively good ground access. The warm aspects of the Lodgepole Pine – Douglas Fir Forest above the Park Bridge Slide were accessed by walking up the runaway lane. The cool aspects of this cover type (on the east side of Glenogle Creek) were accessed by walking down slope through the large cut-block at the end of the 1.6 Km Branch Road. All species detected during the reconnaissance-level surveys were noted according to relative abundance and cover type, but quantitative assessments of bird numbers were not recorded.

4. Areas having limited or no ground access, such as the **Cliff-Face – Canyon Wall (Consolidated Bedrock)** cover type, were surveyed from remote vantage points that provided unrestricted visibility. Binoculars and a high-powered scope were used to scan these areas to document the species of birds that used these cover types. The best vantage point for the eastern face of the canyon wall was on the wide shoulder of the east-bound lane of the Trans-Canada Highway, about 250 m east of the Park Bridge. The best vantage point for the southern face of the canyon wall was on the wide pull-off along the west-bound lane of the Trans-Canada Highway, about 200 m west of the Park Bridge.

   Background noise levels were generally high when sampling this cover type, as well as the **Kicking Horse River and Associated Shorelines** cover type, due to their close proximity to the highway, railway and river. However, as these cover types are more open compared to forested cover types, they are more easily surveyed using visual detection methods.

Results and Discussion

Eleven days were spent within the study area during the 2004 breeding season, 8 days in June and 3 days in July (Table 1). All surveys were carried out by the author between 0600 and 1300 hours, Mountain Daylight Time. Bird species were identified both visually (with the aid of 8x40 binoculars and a 15-45x spotting scope) and by voice (e.g., territorial songs of singing males).

Forty-eight species of birds were detected within the study area between 2 June and 22 July 2004 (Appendix 1). This sample is considered to be a close approximation of the total number of species present within the project area, as only 3 new species were added during the final three visits (Table 1).

Table 1. Number of new species detected with each successive visit to the study area.

Survey Date	June								July		
	2	3	8	9	14	20	23	28	5	13	22
Number of New Species	29	9	1	2	1	0	1	2	1	2	0

There are two areas within the project area that were particularly difficult to sample because of difficult access and/or the high levels of background noise associated with the river, highway and railway. The shorelines along the Kicking Horse River were difficult to survey due to background noise. The west- and southwest-facing aspects near the mouth of Glenogle Creek posed sampling problems because of lack of ground access, as well as high background noise levels. Thus, some species in these 2 areas may have been undetected.

Measures of Relative Abundance

Indices of the relative abundance of 41 species (based on the total number of detections during all visits) along the two linear transects are provided in Appendices 2 and 3. Eighty-five percent of all the species detected within the study area were encountered along these two transects.

A second measure of species "abundance" is provided in Appendix 1, which depicts how frequently each species was detected over the sampling period (expressed as a proportion of the total number (n=11) of field visits). Ten species were detected on all 11 visits to the study area; 20 species were detected on >70% of the visits to the study area (Appendix 1).

Red Crossbill was detected on only 55% of the visits to the study area, yet it was the most abundantly detected species along the Glenogle Forest Service Road transect, and the fourth most-abundant species detected along the 1.6 Km Branch Road transect. Four of the five detections of Red Crossbill along the linear transects comprised feeding flocks of 6-22 individuals, which accounts for the high relative abundance of this species. Red Crossbills did not appear to be breeding within the study area, as the flocks remained only briefly while feeding in the tops of mature Douglas-fir trees.

Evidence of Breeding

Direct evidence of breeding was obtained for 13 species of birds (Appendix 1). I located active nests of 3 species – Common Raven, Red-tailed Hawk and Red-naped Sapsucker.

Common Raven An active nest containing three nearly full-grown young was discovered on 2 June near the top of the southern face of the canyon wall beside the Park Bridge (Figure 9). The stick nest was located on a rock ledge within 10 m of the top of the canyon wall. The young ravens fledged between 9 and 14 June.

Red-tailed Hawk A pair of Red-tailed Hawks nested on top of a bulky *Chrysomyxa* broom in a large spruce tree near the eastern face of the canyon wall beside the Park Bridge (Figure 10). One or both adults were observed on every visit to the study area. The nest was discovered on 9 June. It contained one young, which left the nest between 28 June and 5 July. On 5 July, the young was observed perched on a limb of the nest tree, about 3-4 m below the nest platform. On 22 July, a young Red-tailed Hawk (presumably from this nest) was detected approximately 300 m north of the nest site.

The Red-tailed Hawk nest located in June 2001 on the Park Bluffs on the south side of the Kicking Horse River (Ferguson 2001) was not active in 2004. That site is <500 m from the 2004 nest site. It is likely that the sites represent alternate nesting locations of a single pair of Red-tailed Hawks, as many birds of prey have alternate nest sites within a breeding territory.

Red-naped Sapsucker A pair nested in a cavity in a dead trembling aspen beside the 1.6 Km Branch Road. The nest was discovered on 3 June, and young were heard calling from the nest cavity on 23 and 28 June.

Seven species were observed feeding newly-fledged young – Dark-eyed Junco (on 8 June and 13 July), Yellow-rumped Warbler (on 28 June, 5 and 13 July), Golden-crowned Kinglet (on 13 July), Western Tanager (on 13 July), MacGillivray's Warbler (on 22 July), Dusky Flycatcher (on 22 July) and Chipping Sparrow (on 22 July).

A fledgling Hairy Woodpecker (with patches of downy feathers) was observed on 22 July.

Both Violet-green and Northern Rough-winged swallows were observed carrying nesting materials into crevices and small cavities in the canyon wall and cliff-face during the first 10 days of June.

I suspect that another 20 species also nested within or near the study area, as most of these birds were detected in relative abundance on >50% of the visits to the area (Appendix 1). Most of these species were detected on the basis of frequently repeated songs of territorial males. These species are also known to breed in suitable habitats throughout much of the upper Columbia River valley (Ferguson and Halverson 1997), which is just west of the study area.

A few other species may also have nested within the study area, either in very low numbers or in localized areas. For example, both Varied Thrush and Winter Wren were detected only in forests on the cool north-facing aspects above Glenogle Creek, which comprised a very small proportion of the entire study area.

The primary cover-type associations of the species detected within the study area are provided in Appendix 4.

All of the birds detected within the study area are widely distributed in suitable habitats throughout much of British Columbia, which is divided into 9 distinct ecoprovinces (Demarchi 1988). Forty-three (90%) of the 48 species detected within the Kicking Horse River study area breed in 6 or more ecoprovinces in British Columbia (Campbell et al. 2001). The remaining 5 species – Red-naped Sapsucker, Mountain Chickadee, Lazuli Bunting, Pine Grosbeak and Red Crossbill – breed in 4 or 5 ecoprovinces.

Species at Risk/Rare Species

No Red- or Blue-listed species, as designated by the BC Conservation Data Centre (2004), were detected within the study area during June-July 2004.

Critical Habitat Features and Recommendations

One raptor (Red-tailed Hawk) nest was discovered on a *Chrysomyxa* broom in a spruce tree west of the "Park Bridge Slide" (Figure 10). Red-tailed Hawks in south-eastern British Columbia are migratory and generally return to the upper Columbia Valley during mid-March. Fledging of young from the two known nest sites near the Park Bridge occurred between 5 July (2004 nesting season) and 14-17 July (2001 nesting season, Ferguson 2001).

Based on an incubation period of 34 days and a fledging period of 45 days, the approximate dates of egg-laying in these two nests would have been between 15 and 25 April. Thus, in most years, Red-tailed Hawk nesting sites in this area are likely occupied from about the middle of April to the middle of July.

A pair of Common Ravens nested in a stick nest on a ledge near the top of the vertical cliff-face, about 120 m above the Kicking Horse River (Figure 9). Common Ravens are year-round residents in the upper Columbia Valley. Young fledged from this site between 9 and 14 June 2004; egg-laying would have occurred during the second week of April (based on estimated incubation and fledging periods of 20 and 40 days, respectively).

In future years when bridge/highway construction activities are undertaken, known nesting sites in the area of the proposed highway and bridge realignment corridor should be monitored during late April/early May to determine site occupancy, so that appropriate measures may to taken to avoid disturbance to active nests.

On account of its inaccessibility near the top of a 120-m cliff-face, the Common Raven nest site seems secure from most human land-use activities, barring physical alteration of the cliff-face. Inaccessible rock ledges with protective overhanging rock provide ideal nesting sites for raptors, and efforts should be made to ensure that such features are protected, wherever possible.

Other Wildlife Observations

Red Squirrels (5-10 per day) were observed on every visit to the study area. Black Bears (3 sightings of lone individuals) were observed on 20 and 23 June, and on 13 July. Mule Deer (1-3 per day) were observed on 2, 3 and 20 June. One Rocky Mountain Elk was observed on 14 June. Chipmunks (species unconfirmed) were observed in small numbers (1-2 per day) on 3, 14 and 23 June, and on 22 July.

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Appendix D.

Vegetation Species common to the Kickinghorse Study area by BEC subzone and variant

MSdk

Trees	*Pseudotsuga menziesii*	Douglas-fir
	Pinus contorta	lodgepole pine
	Larix occidentalis	western larch
	Picea glauca x engelmannii	hybrid white spruce
	Abies lasiocarpa	subalpine fir
	Populus tremuloides	trembling aspen
	Betula papyrifera	paper birch
Shrubs	*Amelanchier alnifolia*	saskatoon
	Acer glabrum	Douglas maple
	Juniperus scopulorum	Rocky mountain juniper
	Juniperus communis	common juniper
	Mahonia aquifolium	tall Oregon grape
	Symphoricarpos albus	common snowberry
	Sheperdia canadensis	soopolallie
	Lonicera utahensis	Utah honeysuckle
	Cornus stolonifera	red-osier dogwood
	Betula glandulosa	scrub birch
	Ledum groenlandicum	Labrador tea
Forbs	*Agropyron spicatum*	bluebunch wheatgrass
	Huechera cylindrical	round-leaved alumroot
	Arctostaphylos uva-ursi	kinnikinnick
	Linnaea borealis	twinflower
	Calamagrostis rubescens	pinegrass
	Aster conspicuous	showy aster
	Arnica cordifolia	heart-leaved arnica
	Vaccinium scoparium	grouseberry
	Cornus canadensis	bunchberry
	Thalictrum occidentale	western meadowrue
	Equisetum arvense	common horsetail
Mosses	*Polytrichum juniperinum*	juniper haircup moss
Lichens	*Pleurozium schreberi*	red-stemmed feathermoss
	Hylocomium splendens	step moss
	Aulacomnium pallustre	glow moss
	Sphagnum capillaceum	common red sphagnum

ICHmw1

Trees	*Pseudotsuga menziesii*	Douglas-fir
	Pinus contorta	lodgepole pine
	Pinus albicaulis	whitebark pine
	Picea glauca x engelmannii	hybrid white spruce
	Abies lasiocarpa	subalpine fir
	Populus tremuloides	trembling aspen
	Betula papyrifera	paper birch
	Thuja plicata	western redcedar
	Tsuga heterphylla	western hemlock
Shrubs	*Amelanchier alnifolia*	saskatoon
	Acer glabrum	Douglas maple
	Shepherdia canadensis	Soopolallie
	Juniperus communis	common juniper
	Paxistima myrsinites	falsebox
	Oplopanax horridus	devil's club
	Menziesia ferruginea	false azalea
	Cornus stolonifera	red-osier dogwood
Forbs	*Arctostaphylos uva-ursi*	kinnikinnick
	Linnaea borealis	twinflower
	Calamagrostis rubescens	pinegrass
	Aralia nudicaulis	wild sarsaparilla
	Vaccinium scoparium	grouseberry
	Clintonia uniflora	queen's cup
	Cornus canadensis	bunchberry
	Gymnocarpium dryopteris	oak fern
	Equisetum arvense	common horsetail
Mosses	*Cladonia spp.*	Cladonias
Lichens	*Pleurozium schreberi*	red-stemmed feathermoss
	Ptilium crista-castrensis	knight's plume
	Hylocomium splendens	step moss
	Rhytidiopsis robusta	pipecleaner moss

ICHmk1

Trees	*Pseudotsuga menziesii*	Douglas-fir
	Pinus contorta	lodgepole pine
	Picea glauca x engelmannii	hybrid white spruce
	Abies lasiocarpa	subalpine fir
	Populus tremuloides	trembling aspen
	Betula papyrifera	paper birch
	Thuja plicata	western redcedar
	Larix occidentalis	western larch
Shrubs	*Penstemon fruticosus*	shrubby penstemon
	Amelanchier alnifolia	saskatoon
	Acer glabrum	Douglas maple
	Juniperus communis	common juniper
	Spiraea betulifolia	birch-leaved spirea
	Paxistima myrsinites	falsebox
	Vaccinium membranaceum	black huckleberry
	Lonicera utahensis	Utah honeysuckle
	Oplopanax horridus	devil's club
	Menziesia ferruginea	false azalea
	Cornus stolonifera	red-osier dogwood
	Rubus parviflorus	thimbleberry
	Shepherdia canadensis	Soopolallie
Forbs	*Arctostaphylos uva-ursi*	kinnikinnick
	Linnaea borealis	twinflower
	Calamagrostis rubescens	pinegrass
	Aralia nudicaulis	wild sarsaparilla
	Clintonia uniflora	queen's cup
	Cornus canadensis	bunchberry
	Gymnocarpium dryopteris	oak fern
	Equisetum arvense	common horsetail
Mosses		
Lichens	*Pleurozium schreberi*	red-stemmed feathermoss
	Mnium spp.	leafy mosses
	Peltigera spp.	Peltigeras

ESSFwm and lower ESSFdk

Trees	*Pseudotsuga menziesii*	Douglas-fir
	Pinus monticola	western white pine
	Pinus contorta	lodgepole pine
	Larix occidentalis	western larch
	Abies lasiocarpa	subalpine fir
	Picea engelmannii	Engelmann spruce
Shrubs	*Alnus crispa ssp. sinuata*	Sitka alder
	Acer glabrum	Douglas maple
	Amelanchier alnifolia	saskatoon
	Juniperus communis	common juniper
	Sheperdia canadensis	soopolallie
	Salix spp.	willow species
	Rhododendron albiflorum	white-flowered Rhododendron
	Vaccinium membranaceum	black huckleberry
	Lonicera utahensis	Utah honeysuckle
	Menziesia ferruginea	false azalea
	Paxistima myrsinites	falsebox
	Ribes lacustre	black gooseberry
	Vaccinium ovalifolium	oval-leaved blueberry
	Rubus parviflorus	thimbleberry
	Oplopanax horridus	devil's club
Forbs	*Linnaea borealis*	twinflower
	Arnica latifolia	mountain arnica
	Vaccinium scoparium	grouseberry
	Thalictrum occidentale	western meadowrue
	Equisetum arvense	common horsetail
	Orthilia secunda	one-sided wintergreen
	Goodyera oblongifolia	rattlesnake-plantain
	Tiarella trifoliate var. unifoliata	one-sided foamflower
	Clintonia uniflora	queen's cup
	Gymnocarpium dryopteris	oak fern
	Rubus pedatus	five-leaved bramble
	Lycopodium annotinum	stiff club moss
	Mitella breweri	Brewer's miterwort
	Athyrium filix-femina	lady fern

Mosses	*Peltigera spp.*	peltigera
Lichens	*Pleurozium schreberi*	red-stemmed feathermoss
	Rhytidiopsis spp.	pipecleaner moss
	Mnium spp.	leafy moss
	Sphagnum capillaceum	common red sphagnum
	Ptilium crista-castrensis	knight's plume

Appendix E.

Potential Mammal Species in the Kickinghorse valley.

White-tailed deer	*Odocoileus virginianus*
Mule deer	*Odocoileus hemionus*
Mountain goat	*Oreamnus americanus*
Rocky mountain bighorn sheep	*Ovis canadensis*
Rocky mountain elk	*Cervus canadensis*
Moose	*Alces alces*
Coyotes	*Canis latrans*
Black bear	Ursus americanus
Grizzly bear	Ursus horribilis
Wolverine	*Gulo luscus*
Mountain Caribou	*Rangifer caribou*
Gray wolf	*Canis lupus*
Fox	*Vulpes fulva*
Ermine	*Mustela erminea*
Yellow pine chipmunk	*Eutamias amoenus*
Porcupine	*Erethizon dorsatum*
Hoary marmot	*Marmota caligata*
Red squirrel	*Tamiasciurus hudsonicus*
Northern flying squirrel	*Glaucomys sabrinus*
Golden-mantled squirrel	*Citellus lateralis*
Thirteen-lined ground squirrel	*Citellus tridecemlineatus*
Marten	*Martes americana*
Fisher	*Martes pennanti*
Long-tailed weasel	*Mustela frenata*
Least weasel	*Mustela rixosa*
Cougar	*Felis concolor*
bobcat	*Lynx rufus*
Canada lynx	*Lynx canadensis*
deermice	*Peromyscus maniculatus*
bushytail woodrat	*Neotoma cinerea*
Muskrat	*Ondatra zibethica*
Pika	*Ochotona princeps*
Western jumping mouse	*Zapus princeps*
Redback vole	*Chlethrionomys gapperi*
Heather vole	*Phenacomys intermedius*
Longtail vole	*Microtus longicaudus*
Meadow vole	*Microtus pennsylvanicus*
Richardson's vole	*Microtus richardsoni*
Mountain vole	*Microtus montanus*
Northern water shrew	*Sorex palustris*
Dusky shrew	*Sorex obscurus*
Masked shrew	*Sorex cinereus*
varying hare	*Lepus americanus*
Hoary bat	*Lasiurus cinereus*
Little brown myotis	*Myotis lucifugus*
Big brown bat	*Eptesicus fuscus*

Appendix F.

Terrestrial Cover and Vegetation Classes, Proposed Trans Canada Highway Development, Kicking Horse Canyon Project (Park Bridge Section)

Scale 1:5000 (2 Pages)

Terrestrial Cover and Vegetation Classes
Proposed Trans Canada Highway Development
Kicking Horse Canyon Project
(Park Bridge Section)

513000 514000 515000 516000 517000

5682500 5681500 5680500 5679500

LEGEND

Proposed Option11
- Road centerline
- Disturbance Extent

Proposed Option12
- Road centerline
- Disturbance Extent

- TRIM Roads
- Intermediate Contour 20m
- Index Contour 20m
- TRIM Water
- 100m Area of Interest road buffer
- Vegetation Class Boundaries
- 15 Photo Number Locations

Vegetation Classes

Ta / RO	Talus and Rock
TC	Transportation Corridor (Rail and Road Right - of - Way)
GB	River and Gravel bars
F0	Douglas Fir - relatively closed canopy (FDi dominated)
F1	Open Douglas Fir - talus / rock
F2	Open Douglas Fir - Aspen - Saskatoon - Wheatgrass
F3	Douglas Fir - Spruce - Pine (minor aspen clumps) - juniper - pine grass
F4	Douglas Fir - Spruce colluvial low elevation (some patches of pine in early seral disturbed areas. Spruce - dogwood - horsetail
CB	Logged Regrowth usually as open Pine or Douglas Fir class
PS	Pine - Spruce, minor Douglas Fir - Soopalallie - grouseberry
Pl	Pine - Douglas Fir on rock / talus slopes.
PF	Pine - Fir - Spruce on moist steep north aspects, thin soil.
PFA	PF with aspen clumps on disturbed patches.
ES1	Spruce - Subalpine Fir - azalea - queen's cup
ES2	Spruce - fir, moist ravines with devils clump and thick mosses

SCALE 1 : 5000

150 75 0 150 300 450 600 Meters

N W E S

Comments

-Vegetation typing completed by Sean Sharpe

Map Information

- Projection UTM 11 Datum: NAD 83
- Base data source BC TRIM

- Orthophoto image collected by Terrasaurus
- Geotif format at 25 cm pixel resolution
- Photo acquired on July 17th, 2004

- Proposed Highway route from Ministry of Transportation CAD drawings.

Silvatech Consulting Ltd.

Mapping Produced by: Graham MacGregor August 13, 2004