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## DESIGN ENVIRONMENTAL PROTECTION PLAN

# Yoho Trans-Canada Highway Twinning Km 82.5 to 88.3

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REPORT

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### 1.0 INTRODUCTION

Yoho National Park, established in 1886, protects 1,313 km<sup>2</sup> of the western slopes of the Main Ranges of the Rocky Mountains Natural Region. The park is bounded by Banff National Park to the east and Kootenay National Park to the south, and is an important component of the Canadian Rocky Mountain Parks World Heritage Site.

The Trans-Canada Highway (TCH) is a key transportation route that facilitates use by 5 million visitors to the Mountain Parks each year, with annual average daily traffic volumes near the Project area reaching 5,762 vehicles in 2014 (BC MOTI 2014). The reliability of movement through this corridor is a priority, which is achieved by facilitating safety and minimizing delays that can lengthen travel times (Government of British Columbia 2015). Parks Canada Agency (PCA) is planning to twin the TCH in Yoho National Park to fulfill the highway's role in the nation's transportation system while also maintaining and restoring ecological integrity in the park. Twinning of the TCH is needed to upgrade the capacity and safety of the roadway to accommodate increased traffic. The Yoho National Park's Management Plan (PCA 2010a) specifically refers to and makes allowances for upgrading the TCH.

In December 2004, PCA issued an Environmental Assessment Determination document for the TCH Phase IIIB twinning project, pursuant to the Canadian Environmental Assessment Act (CEAA), and concluded that after mitigation measures have been implemented, the Project was not likely to cause significant adverse environmental effects (Golder 2004; PCA 2004; PCA 2011). In 2011, an adjustment to the 2004 environmental screening report (Golder 2004) was prepared to extend the construction of the twinning right-of way length from the British Columbia (BC) border at Km 81.9 to slightly to the west of the Wapta Cut gravel pit, at approximately Km 88.3, and associated other project components within and adjacent to this area (PCA 2011). That adjustment was signed, giving environmental approval for that 6-km extension on the condition that commitments for certain actions or mitigations would be prescribed in what the adjustment document referred to as an environmental protection plan. Construction then proceeded to about km 82.5.

The purpose of this document is to describe mitigations for avoiding or reducing adverse environmental effects related to the design of twinning the TCH from km 82.5 to km 88.3 in Yoho National Park (the Project), and is therefore referred to as a Design Environmental Protection Plan (DEPP). This is distinct from a conventional construction Environmental Protection Plan (EPP) in that it does not refer specifically to mitigations related to construction activities, but rather focusses on the design stage of development of the Project. A construction EPP will be developed prior to the commencement of construction activities.

The TCH kilometre (km) markers in this document are based on a station system provided by McElhanney Consulting Services, which is measured in km along the TCH centerline and uses the east gate of Banff National Park as Station km 0.

### 2.0 MANAGEMENT OBJECTIVES AND DESIRED END RESULTS

A number of Management Objectives/Desired End Results (MO/DERs) have been identified by PCA to help guide the effective and appropriate management of the TCH. These MO/DERs are mostly related to the ecological integrity, commemorative integrity, and visitor experience of Banff and Yoho National Parks, although some are related to other mandated aspects of the management of these parks. These MO/DERs help to guide management decisions within Yoho National Park, including the development of mitigations related to the design of TCH improvement projects, such as the twinning of the TCH. Relevant MO/DERs for the design of the twinning of the TCH are summarized from PCA (2011) in Table 1.



### YOHO TRANS-CANADA HIGHWAY TWINNING KM 82.5 TO 88.3

Valued Components	Management Objectives and Desired End Results
Aquatia	<ul> <li>No release of sediments into watercourses at levels that are deleterious to fish or other aquatic life, or that would harmfully alter, disrupt, or destroy fish or aquatic habitat. Similarly there is to be no sediment release into areas of vegetation growth or sensitive areas of sediments in levels that would adversely alter growing or hydraulic conditions. The target is 0 mg/L of Total Suspended Solids (TSS) over background levels. The threshold (as established by CCME 2008) that shall not be exceeded is:</li> <li>During clear flow, maximum increase in TSS of 25 mg/L from background levels for any short-term exposure (e.g., 24 hour period). Maximum average increase in TSS of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 hour and 30 days); and</li> </ul>
Resources	<ul> <li>During high flows, maximum increase in TSS of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L. No increase in TSS more than 10% of background levels when background is greater than 250 mg/L.</li> </ul>
	<ul> <li>Natural form, pattern, frequency, productivity, and function of aquatic ecological integrity, with fish-bearing and non-fish-bearing watercourses given equal importance.</li> </ul>
	For wetlands, maintain natural levels and patterns of surface and subsurface hydrologic flow, with no unnatural impoundment of waters. Maintain natural composition, structure, quantity, and dynamics of wetland vegetation and growing conditions. No alteration or loss of wetland function for a period greater than 5 years.
	For the conservation of species at risk:
	<ul> <li>Patches and populations of rare or endangered species are conserved;</li> </ul>
	<ul> <li>Subsurface and surface water movement in wetland areas is sufficient to conserve habitats for populations of rare or endangered species; and</li> </ul>
	<ul> <li>Natural habitat conditions (including hydrological patterns and regimes) for rare or endangered plant species/communities are maintained or restored.</li> </ul>
	<ul> <li>For maintaining an ecologically appropriate community composition:</li> </ul>
Vegetation and Wetlands	<ul> <li>Native species of grasses, shrubs and forbs will be maintained or established that are adapted to the respective ecosystem but that have reduced attractiveness to grazing wildlife (e.g., ungulates, bears);</li> </ul>
	<ul> <li>Moderate and high priority (i.e., more invasive) non-native plant species are not established or spread and existing infestations are eradicated; and</li> </ul>
	<ul> <li>Low priority non-native plant species do not occupy more than 2% of ground cover on the right-of-way.</li> </ul>
	<ul> <li>Reclamation of disturbed areas, where appropriate, will involve the establishment of an early seral stage and successional trajectory.</li> </ul>

#### Table 1: Management Objectives and Desired End Results



### YOHO TRANS-CANADA HIGHWAY TWINNING KM 82.5 TO 88.3

Valued Components	Management Objectives and Desired End Results
	<ul> <li>For long-term species-specific meta-population viability component of ecological integrity, reduce incidents of highway related wildlife mortality.</li> </ul>
	<ul> <li>For the wildlife habitat component of ecological integrity, conserve wildlife habitat through maintenance or restoration to:</li> </ul>
	<ul> <li>Maintain habitat quantity and effectiveness;</li> </ul>
	<ul> <li>Minimize edge habitat;</li> </ul>
Wildlife	<ul> <li>Minimize sensory disturbance;</li> </ul>
	<ul> <li>Minimize air and water quality changes;</li> </ul>
	<ul> <li>Maintain mineral lick quality and availability; and</li> </ul>
	<ul> <li>Maintain hydrologic patterns to maintain wetland function.</li> </ul>
	<ul> <li>For the wildlife connectivity component of ecological integrity, habitat remains accessible and local and landscape connectivity is maintained to fulfill biological requirements and genetic connectivity.</li> </ul>
	<ul> <li>Site Contours: Post-construction contours of the right-of-way and temporary work areas match surrounding topography, and do not create conditions that would hinder establishment of native plant communities or alter natural drainage patterns.</li> </ul>
Soils and	<ul> <li>Rock outcrops and embankments: natural appearing or visually non-intrusive.</li> </ul>
Landform	<ul> <li>Soil Erosion: No acceleration of soil erosion rates beyond pre-disturbance levels.</li> </ul>
	<ul> <li>Natural-like growing conditions.</li> </ul>
	<ul> <li>No increase in rate or quantity of movement of contaminants from previously contaminated sites, if any are discovered during construction.</li> </ul>
0 * 1	The information that is potentially provided by in-situ paleontological resources is not lost. The interpretative value of these resources is not lost.
Cultural Resources	No loss of the information, knowledge and records that is provided by any in-situ cultural or archaeological resources that may be present, for the future understanding, appreciation and study for the benefit of present and future generations.
Visitor Experience	Connection to place among park visitors is deepened through expanded opportunities and increased visitation, while respecting protection goals and character of place.

#### Table 1: Management Objectives and Desired End Results



### 3.0 APPROACH

The identification of requirements and opportunities for mitigating predicted adverse effects of the Project involved a desktop review of existing data and documentation, combined with field surveys to fill in site-specific information gaps.

### 3.1.1 Background Information

Background information regarding sensitive environmental features in and around the Project footprint and predicted Project effects requiring mitigation were summarized from the following sources:

- Screening Report for the TCH Twinning Project Phase IIIB Banff National Park (Golder 2004).
- Adjustment to Environmental Screening Report: TCH Twinning Phase IIIB Adjustment Overview (PCA 2011).
- TCH Twinning Phase IIIB Project Amphibian Surveys 2010 (PCA 2010b).
- Basic Impact Analysis TCH Rock Slope Reprofiling 2015 Works (PCA 2015a).
- Basic Impact Analysis Vegetation Removal for 2015 TCH Rock Reprofiling (PCA 2015b).
- Basic Impact Analysis TCH Rock Slope Reprofiling- Yoho National Park -2016 Work (PCA 2016a).
- Basic Impact Analysis TCH Ottertail Rehabilitation, Paving, Guardrail and Culvert Repair (Golder 2016).
- BC Conservation Data Centre Species and Ecosystems Explorer (BC CDC 2016).
- PCA Biotics Web Explorer (PCA 2013).
- BC Ministry of Environment Habitat Wizard (BC MOE 2012).
- BC Ministry of the Environment Fisheries Information Summary System (FISS) database (BC MOE 2009).
- Government of Canada Species at Risk (SAR) Public Registry (Environment Canada 2016).
- The Lake Louise Yoho Kootenay (LLYK) Field Unit provided additional background data including:
  - observation data for wildlife and vegetation species; and
  - wildlife mortality data, specifying species and locations in proximity to the TCH.

### 3.2 2016 Field Surveys

### Aquatic Resources

To support the DEPP, field work was completed to identify fish and fish habitat within the Project area. Prior to the field program, a review of literature and previous surveys (e.g., Adjustment to Environmental Screening Report-TCH Twinning Phase IIIB [Parks Canada 2011], Screening Report for the TCH Twinning Project Phase IIIB Banff National Parks [Golder 2004]) was conducted to gather information regarding previously identified fish and fish habitat in and adjacent to the TCH from km 82.5 to km 88.3 in Yoho National Park.

Fish and fish habitat surveys focused on water features crossing or adjacent to the TCH between km 82.5 and km 88.3. These water features include a number of culvert crossings, tributaries of Wapta Lake, Wapta Lake and the Kicking Horse River. Visual surveys at the culvert locations were conducted to determine if a scoured channel and defined banks were present at each culvert. If no scoured channel and defined banks were identified, photographs were taken to document the conditions and no further assessment was completed. If a scoured channel and defined banks were identified, a detailed survey was conducted included surveying 100 m upstream and 100 m downstream of the TCH. Water features adjacent to the TCH were assessed throughout the length of the watercourse adjacent to the TCH. The detailed surveys included collecting fish habitat information at each water feature related to channel width and depth, water velocity, water quality parameters, substrate composition and fish habitat potential. Fish access and connectivity at culvert crossings to known fish habitat was determined for each crossing location. Visual surveys for fish were conducted at each watercourse. Photographs of all culvert crossings and water features were taken to document existing conditions.

### Vegetation and Wetlands

In support of the DEPP, additional field surveys were completed to identify rare plants and characterize the wetland near the Great Divide Lodge. Before the field program, a review of literature and available data (e.g., Adjustment to Environmental Screening Report-TCH Twinning Phase IIIB [PCA 2011], Screening Report for the TCH Twinning Project Phase IIIB Banff National Parks [Golder 2004], and British Columbia Conservation Data Centre [BC CDC] occurrence data) was conducted to identify areas with high rare plant potential, and to produce a list of rare plants with potential to occur based on known habitat associations.

Two federally listed species, Whitebark Pine (*Pinus albicaulis*) and Limber Pine (*Pinus flexilis*), are known to occur within YNP. However, a literature review and previous surveys of the area have determined that the proposed development sites have low potential for the Whitebark Pine (*Pinus albicaulis*) and Limber Pine (*Pinus flexilis*) (PCA 2015a, 2016; Golder 2016).

Rare plant surveys focused on high-potential areas identified by PCA, which may be affected by upgrades to the TCH within Yoho National Park. These included the wetland to the east of the Great Divide Lodge, and wetland areas east of Wapta Lake on the south side of the TCH along the length of the planned twinning alignment.

Rare plant surveys targeted species provincially red- or blue-listed by the BC CDC. Rare plant surveys were conducted according to the Alberta Native Plant Council (ANPC) Rare Plant Survey Guidelines (ANPC 2012) and Protocols for Rare Vascular Plant Surveys (Penny and Klinkenberg 2010). A systematic meander of varying lengths was undertaken at each sample site, exploring the various microhabitats present at each location. General site characters were recorded, including dominant plant species, soil moisture and nutrient regime, and vegetation community type. If encountered, additional data characterizing rare plants were collected, such as microhabitat characteristics, plant phenology, population size and distribution.

Rare plant surveys are typically conducted several times over the growing season during periods when potentially occurring rare species are most likely to be visible and with diagnostic features present. A single, early season survey was conducted before the finalization of this DEPP. A late season survey is planned and impacts to any rare plant occurrences will be mitigated during final design and construction, as appropriate.



Prior to conducting the field survey of the wetland near the Great Divide Lodge, a preliminary desktop assessment was completed to delineate the boundary of the wetland using recent aerial photographs. It is not feasible for the Project design to avoid this wetland completely, and therefore a portion of this wetland will be lost. Under the Federal Policy on Wetland Conservation, actions to enhance wetland function on federal lands and waters are encouraged, particularly in those areas of Canada where continuing loss or degradation of wetlands has reached critical levels (Environment Canada 1996). Land managers should endeavor to achieve no net loss of wetland function on federal areas secured for conservation purposes (Environment Canada 1996). As part of the desktop assessment, areas potentially suitable for wetland compensation (i.e., rehabilitation of reclamation) to contribute to a no net loss outcome were also identified.

In the field, the crew walked areas in and around the delineated wetland boundary to identify plant assemblages in the wetland and surrounding upland areas, and to determine landscape position of the wetland and surface water connections. The boundary of the wetland was identified using vegetation characteristics as the primary indicator, and focused on the presence of wetland and upland plant species, as well as the composition, density and height of the plant communities. Soils were considered as a secondary indicator; however, frozen soils prevented detailed characterization of upland-wetland transitional zones. Once the boundary of the wetland was identified, the crew walked the perimeter of the wetland and recorded the boundary as a GPS track file. In the office, boundaries were refined based on a review of imagery, field track files and GPS points, and field notes.

Areas that were identified during the desktop assessment as potentially suitable for wetland compensation were also visited in the field. Any potentially suitable areas that were determined in the field to lack effective hydrologic connectivity were considered to be unsuitable as a wetland compensation site. Potentially suitable areas that did appear to have effective hydrologic connectivity were identified as suitable sites for compensatory wetland development through restoration or reclamation.

Invasive plant (i.e., weeds) survey protocols were similar to those outlined for listed plants, but focused on disturbed areas, where weeds were most likely to occur. For the purposes of these surveys, the definition of an invasive plant is limited to those plants listed as noxious weed species under the *BC Weed Control Act* (Government of British Columbia 2016), and priority invasive plant species identified by PCA.

### Wildlife

General wildlife and amphibian surveys were conducted from June 2 through 6 between km 82.5 and 88.3 on the TCH in Yoho National Park. General wildlife surveys were conducted by traveling by foot and vehicle along the length of the planned twinning alignment.

All observations of wildlife and their sign were recorded within 50 m of the planned Project footprint, as well as any observations of potentially important wildlife habitat features, such as nests, dens, burrows (e.g., ground squirrel burrows), mineral licks, nests, and standing dead trees (i.e., snags) with evidence of potential wildlife value (e.g., cavities as potential nests and dens, loose bark as potential bat roosts). When Columbian Ground Squirrel (*Urocitellus columbianus*) burrow entrances were encountered, biologists attempted to determine the status (i.e., active or abandoned) and extent of the burrows. Using binoculars, raptor stick nests were searched for about 100 m from the Project footprint.



Visual surveys for amphibians were conducted in wetlands within 50 m of the Project footprint. Survey methods were based on the Resource Inventory Methods Committee (RISC) standards for amphibian non-acoustic surveys (RIC 1998). Visual searches for amphibian presence and evidence of breeding activity were conducted by a two-person crew around the perimeter of wetlands. Crews recorded species encountered, life phase (i.e., egg masses, larvae and adults), number of individuals, date, waypoint of individuals located, observer names, temperature of natal ponds, and weather. Habitat characteristics in natal ponds were also recorded and photographed. Surveys for adult amphibians were conducted in suitable habitat adjacent to natal ponds where breeding was recorded during the previous survey.

### 4.0 SENSITIVE ENVIRONMENTAL FEATURES AND CONDITIONS

Sensitive environmental features and conditions that require consideration and TCH twinning design mitigation were identified through a background information review and supplemental field surveys (see Section 3.0 for data collection methods).

### 4.1.1 Aquatic Resources

The field program and literature review determined that aquatic resources within the Project area were consistent with those presented in the Screening Report for the Trans-Canada Highway Twinning Project Phase IIIB Banff National Park (Golder 2004) and the Adjustment to Environmental Screening Report: TCH Twinning Phase IIIB Adjustment Overview (PCA 2011).

The field program and the existing information review indicated fish and fish habitat is present in Wapta Lake, Blue Creek, an unnamed tributary of Wapta Lake entering the north edge of the lake, and the Kicking Horse River. Brook Trout (*Salvelinus fontinalus*) and Lake Trout (*Salvelinus namaycush*) are present in these waterbodies. Both species were introduced and these waterbodies historically had no fish present. Wapta Lake currently contains a self-sustaining fish population that supports a recreational fishery. Brook Trout have been sampled upstream of the culvert within the unnamed watercourse of Wapta Lake (TCHYOHO\_39.8) that crosses the TCH at km 86.5 (PCA 2010a). Upstream of the culvert there is a braided channel and wetland that provides fish habitat adjacent to the Great Divide Lodge.

All other identified culvert crossings within the Project area were determined to not be fish habitat because they lacked a scoured channel with defined banks. The culverts primarily transport water collected by seepage from ditches along the TCH.

Wapta Lake is directly adjacent to the TCH between km 86.3 to km 87.2 (Figure 2). The headwaters of the Kicking Horse River originates at Wapta Lake and Brook Trout and Lake Trout are able to access the habitats upstream and downstream of Wapta Lake. The Kicking Horse River parallels the TCH from Wapta Lake at km 87.2 to the end of the Project area at km 88.3 (Figure 2). There is potential fish access throughout the reach paralleling the TCH.

Neither of the above species is provincially or federally listed under SARA (Environment Canada 2016) or COSEWIC, and both species are introduced. Based on the species identified, BC MOE identifies the period of least risk for instream works by fish species as July 15 to August 15 (BC MOE 2009).





### 4.1.2 Vegetation and Wetlands

During the literature review and field surveys, it was determined that vegetation resources within the Project area were consistent with those described in the Screening Report for the TCH Twinning Project Phase IIIB Banff National Park (Golder 2004) and the Adjustment to Environmental Screening Report: TCH Twinning Phase IIIB Adjustment Overview (PCA 2011). A number of vegetation resources may be affected by the Project, and to which Management Objectives/ Desired End Results (MO/DERs) will be directed.

### **Listed Plant Species**

Rare plants (including Whitebark Pine and Limber Pine) were not observed during the June, 2016 field survey, which was intended to identify the presence of early blooming plant species. A late season field survey will be conducted in August 2016 and any findings will be considered in final design and mitigations. Two species, Tall White Bog Orchid (*Platanthera dilatata*) and Small Northern Grass-of-parnassus (*Parnassia parviflora*) were identified as rare species of management concern in the 2011 Adjustment. These two species were present and abundant within the wetland near the Great Divide Lodge during the June 2016 survey; however, they are no longer considered rare in BC (BC CDC 2016). Although Tall White Bog Orchid and Northern Grass-of-parnassus are no longer considered rare, these species and the vegetation community composition within this wetland are relatively uncommon along the Project alignment. Mitigations will address the conservation of these plants within their community and their habitat.

### Plant and Wetland Communities

The Bow Valley 2 (BV2) ecosite type is uncommon within YNP (PCA 2011), but is more common to the east in Banff National Park (Golder 2004). The BV2 ecosite type is adjacent to the Project footprint near the BC/ Alberta border (km 82.0) and near Wapta Cut (km 87.0) at the western boundary of the Project area (Figure 2). Mitigations will focus on avoiding or minimizing disturbance of intact areas of this ecosite type, to the extent practicable. The locations of BC2 ecosite type is illustrated in Figures 1 and 2.

The wetland by the Great Divide Lodge was determined during the field survey to be at least partially on a historically disturbed area, which has subsequently revegetated. This wetland was crossed by several permanent and ephemeral channels with flowing water and was dominated by willow (*Salix* sp.) and sedge (*Carex* sp.) species. Forb species abundant across the wetland included Tall White Bog Orchid, Small Northern Grass-of-parnassus and *Pinguicula vulgaris* (Common Butterwort). Using GIS to integrate field data with available imagery, the area of the wetland was determined to be 0.46 ha, of which 0.14 ha has the potential of being lost because of overlap with the Project footprint. The wetland is illustrated in Figure 2.

Proposed compensation areas were evaluated in the field for the potential of creating high-quality wetland habitat with structure, quantity, function and dynamics that are similar to the wetland by the Great Divide Lodge. Potential compensation areas without existing hydrologic connectivity were determined to be unsuitable for rehabilitation or reclamation. Disturbed areas associated with historic TCH alignment around this wetland were determined to have the highest potential for successful reclamation, which could be achieved through the removal of fill and recontouring. Several creeks and drainages run through disturbed areas around the existing wetland, which could be used to maintain hydrologic patterns through the compensation wetland. Additionally, proximity of this site to an existing wetland will facilitate plant species recruitment and maximize the likelihood of the successful establishment of wetland species. Using GIS to integrate field data with available imagery, the proposed compensation area was determined to be 0.40 ha. The proposed compensation area is illustrated in Figure 2.



### **Invasive Plant Species**

Parks Canada documented three occurrences of invasive plant species within the Project Area in 2014. These include two occurrences of Common Tansy (*Tanacetum vulgare*) observed at km 84.2 and km 84.4 and one of hound's tongue (*Cynoglossum officinale*) at km 84.7 (Figure 1). During the field survey, Tall Buttercup (*Ranunculus acris*) was abundant between km 85.9 and 86.2 on the south side of the TCH near Wapta Lake (Figure 2). A single patch of ten bull thistle was observed at km 86.2 to the east of the brake check along with a few occurrences of Tall Buttercup. Common Tansy, Hound's Tongue and Tall Buttercup (Figure 2) are all identified as invasive species that are a priority for active management within Yoho National Park (McLellan 2016, pers. comm.). Dandelions (*Taraxicum officinale*) were abundant in all roadside ditches observed during the surveys.

### 4.1.3 Wildlife

A variety of wildlife occupy and move through the area that will be affected by the Project, such as ungulates, medium to large-sized carnivores, smaller mammals, waterfowl, resident and migratory species of songbirds and raptors, and amphibians. Several wildlife species that occur in the area are classified as being at risk by the federal or provincial government, such as the Mountain Goat (*Oreamnos americanus*), Wolverine (*Gulo gulo*), and Grizzy Bear (*Ursus arctos*) (Golder 2004).

### **General Wildlife Movement and Mortality Sensitivities**

The TCH both attracts and deters wildlife. It is likely that some ungulates are attracted to the TCH due to the availability of forage and salt. Prior to twinning, about half of all ungulate mortality along the TCH Phase IIIB was due to collisions with vehicles (Golder 2004). Wolverine are wary of crossing the TCH, and although a rare occurrence, Wolverine road mortality has been documented (Golder 2004). Road and rail collisions are considered to be major sources of mortality for Wolves (*Canis lupus*), occur occasionally for Grizzly Bears, and occur relatively often for Black Bears (*Ursus americanus*) (Golder 2004).

### **Species-Specific Sensitivities**

In addition to the general sensitivities of wildlife to mortality and barriers to movement due to the TCH, the following species-specific sensitivities have been identified:

- Mountain Goats are drawn close the TCH due in part to a primary mineral lick at km 85.4 and a secondary mineral lick at km 85.3 on Mount Bosworth (Figure 1), as well as road salt (PCA 2011). Mineral lick activity by Mountain Goats in the Project footprint primarily occurs from May to mid-August, with a second wave of lower activity occurring in October and November (PCA 2015f). Road mortalities have been concentrated at kms 85.1 to 85.2 (Figure 1).
- Potential Western Toad breeding habitat exists in the Wapta Lake area and an adult toad was observed in the area in 2010 (PCA 2010b) (Figure 2). No amphibian breeding evidence was observed during surveys conducted in and around the Project footprint, including during 2016 surveys.
- Ground squirrel colonies were identified at kms 83.7 to 84.3 and 86.2 to 87.5 in 2016 (Figures 1 and 2).
- Migratory songbirds, including federal and provincial species at risk, may nest in and around the Project footprint. The general nesting period for wetland and upland migratory birds in the Project footprint is April 14 to August 19 (ECCC 2016).



- Bats, including federal and provincial species at risk, may roost in cavities or behind the loose bark of mature and old trees in and around the Project footprint in the spring and summer.
- No critical habitat for federally listed species has been designated in the area that will be directly or indirectly affected by the Project footprint.

### 4.1.4 Terrain and Soils

There are no sensitive soils identified or expected in the Project area. There are areas that may be subject to slope instability along the Project area that will require terrain stability assessment and geotechnical design mitigations to limit the terrain hazard of the area. Based on an overview examination of the available aerial imagery, such locations are apparent at kms 83.4, 83.6 to 83.8, 84.2 to 84.4, 87.9 to 88.0, and 88.2 to 88.5.

### 4.1.5 Cultural Resources

The Project area is within the Kicking Horse Pass National Historic Site (NHS), which follows the railway corridor from Field, BC to Lake Louise, AB. This NHS "retains a strong sense of place, inspiring views and intact cultural resources that connect people to the history and cultural landscape of the historic railway corridor" (PCA 2007). The Environmental Screening Report- TCH Twinning Phase IIIB (PCA 2011) did not mention project mitigations in the Kicking Horse Pass National Historic Site that runs along the CPR from Lake Louise to Field.

Parks Canada has completed an extensive inventory of cultural resources, including archeological remains within Yoho National Park (PCA 2007). A cultural resources assessment of the TCH Phase IIIB twinning project was conducted by Gwyn Langemann from km 76 to 82 in Banff National Park in 2004, and to km 88.3 in 2011. The 2011 cultural resources assessment was conducted mainly by oral communication, and there is no formal standalone document describing the archaeological impacts of TCH twinning from km 82.5 to km 88.3. No formal recommendations regarding sensitive cultural resources of concern due to TCH twinning activities were conveyed for the landscape and its features. The commemorative integrity statement (CIS) stated that "Level I resources related to the construction phase of 1881 to 1909 period are abundant, and taken as whole, they constitute a significantly engineered cultural landscape" (PCA 2006). Therefore, it is important to minimize impacts on key landscapes features (e.g., remnants of the surviving roadbed, rail grade, embankments, rock cuts, siding and the associated wyes and yards, structural remains of bridges, culverts, a stone bake oven, snowsheds and the two tunnels; PCA 2006) due to construction and operations of TCH twinning.

The Project is not anticipated to affect existing viewscapes or otherwise affect the quality of the Kicking Horse Pass National Historic Site. The Project has been designed to avoid all known historic sites and is not anticipated to have an effect on cultural resources. An Archeological Overview Assessment (AOA) will be completed by the Archaeology and History Branch of PCA for this Project, which may identify additional cultural resource sites that have the potential of being affected by Project activities.

### 4.1.6 Visitor Experience/ Public Safety

High quality visitor experience has been identified as a priority for Yoho National Park (PCA 2008). Visitor experiences vary widely, and include those who seek solitude and adventure in back-country experiences, to those who seek good opportunities for driving and sightseeing at popular front-country attractions (PCA 2008) and can be affected by traffic pattern changes, site access and quality of infrastructure.



It is a priority of PCA to provide for reliable movement along the TCH in Yoho National Park by maximizing highway safety and minimizing delays that can lengthen travel times (Government of British Columbia 2015). The reliability of transportation along the TCH during winter is affected by avalanche risk at Mount Bosworth and avalanche control activities. Mount Bosworth has historically required avalanche control work by helicopter to maintain an acceptable level of risk for the public use of the TCH (McElhanney 2013).

There are several locations near Wapta Lake used by visitors to Yoho National Park. For example, Wapta Lake is used by anglers and is generally accessed from two east-bound parking spots: at the outlet of Wapta Lake at km 87.2 on the shoulder of the TCH, and at the current chain-off location at km 86.1. Access to Wapta Lake will be altered by the Project through changes to parking availability through the TCH widening and the installation of wildlife fencing. These changes may affect visitor experience and will therefore require design mitigation to maintain visitor access to Wapta Lake.

### 5.0 MITIGATION MEASURES

Mitigations measures related to Project design are intended to avoid or reduce the adverse effects of the Project on sensitive environmental features and conditions through careful planning during the design phase of the Project. Design mitigation measures that are likely to be effective may be general in nature and broadly applicable, or location and resource-specific. Mitigations to avoid or reduce adverse effects of the Project during the construction phase are not described in detail here, but will be described in a separate construction EPP that will be developed prior to the commencement of construction activities.

### 5.1 General Mitigation Measures

General mitigation measures are applicable to more than one resource in and around the Project footprint. General mitigation measures to avoid or reduce adverse effects are described in the Screening Report for the TCH Twinning Project Phase IIIB Banff National Park (Golder 2004). The primary general mitigation measure refers to keeping construction activity within transportation rights-of-way (Zones IV). The surrounding wilderness areas are classified as Zone II to protect ecological integrity (PCA 2007). The project will be designed to follow the existing TCH alignment and will not encroach into the designated wilderness zone (i.e., Zone II, which occurs greater than 125 m from either side of the TCH centreline; PCA 2008; PCA 2011).

### 5.2 Resource-Specific Mitigations

Resource-specific mitigations are applicable to specific resources, and may be also focussed on specific locations, or throughout the Project footprint.

### 5.2.1 Aquatic Resources

Design mitigations for fish and fish habitat are required to avoid or reduce adverse effects of the Project on fish and fish habitat.

Culverts extension and replacements will be designed and constructed (i.e., with proper size and gradient) such that flows and flow paths maintain or improve connectivity. A Fisheries and Oceans Canada (DFO) Request for Review will be required for the replacement and extension of culvert TCHYOHO\_39.8 that crosses the TCH at km 86.5 and is a tributary of Wapta Lake. The design of this culvert will be a net-improvement for aquatic habitat including enhancement of fish passage.



- Culvert TCHYOHO\_39.8 replacement and extension should be conducted outside of the Restricted Activity Period (RAP) of August 16 to July 14 for the watercourse. Additional mitigation measures will be required if works are completed within the RAP. A fish salvage will be included as a mitigation measure for the crossing.
- Mitigation measures for the design of the Project will be in accordance with DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2015).
- The project footprint will not encroach on Wapta Lake or the Kicking Horse River. However, due to the close proximity of the TCH to Wapta Lake and the Kicking Horse River, no current mitigation option is available or practical to reduce inputs of debris (i.e. gravel and salt) caused by snow plowing of the TCH during winter.
- The chain off area across from Wapta Cut will be designed to divert drainage away from Kicking Horse River.

### 5.2.2 Vegetation and Wetlands

Existing approaches to mitigation measures for vegetation and wetlands will apply and have been determined to be appropriate for the Project. Design mitigations for vegetation were developed to avoid or minimize adverse effects of the Project on listed plant species, vegetation communities, vegetation community composition, and successional trajectory.

### Rare Plant Species

A late season rare plant survey will be conducted in August, 2016; if any rare plants are found during that survey, occurrences will be flagged and will be prioritized for transplant.

### **BV2 Ecosite**

 Project design will be laterally constricted to minimize impacts on the BV2 ecosite type near the Welcome Station and Wapta Cut, to the extent practicable (Figure 2).

### Wetlands

- The Project will be designed to achieve no net loss of wetland function (Government of Canada 1991). Wetlands will be avoided to the extent practicable during Project design.
- The Project design is anticipated to result in some losses of wetland area. These losses will be compensated to a target ratio of approximately 3:1; however, although a compensation ratio of 3:1 is the target, compensation wetland area should not come at the expense of intact natural areas. The disturbed areas surrounding the wetland near the Great Divide Lodge have been identified as the preferred location for the creation of wetlands; however, if more detailed planning indicates that reclamation of this site is not feasible within the Project timeline, wetland compensation will be deferred or will be achieved elsewhere in YNP.
- Wetland habitat outside the Project footprint will be preserved. This will be achieved through actively avoiding, protecting and monitoring wetland habitat during and after construction. For example, the construction footprint at the south entrance of the wildlife underpass at km 85.9 will be limited to avoid impacts on the adjacent wetland east of Wapta Lake.
- Vegetation clearing within the wetland near the Great Divide Lodge will be limited to that required to maintain line-of-sight along the TCH, to the extent practicable.



### **Reclamation and Community Composition**

- A qualified Environmental Professional will develop a detailed revegetation plan on finalization of the Project design. This may include bioengineering measures, such as willow staking, joint planting, and/ or live pole drains to help increase bank stability, maintain water runoff patterns, restore integrity and quality of wetland and riparian habitat, and improve overall ecological value of all reclaimed habitat. The post construction landscape will be designed considering natural-like growing conditions, where practicable.
- Revegetation will include use of LLYK Field Unit approved seed mixtures and plant species, where appropriate. This may include seed collection, nursery propagation and native plant salvage and transplant within the right-of-way.
- Plant species selected should be adapted to the vegetation community, and must have reduced attractiveness to grazing wildlife (e.g., ungulates, bears).
- During the creation of compensation wetlands, mitigation measures directed at reducing impacts to species composition will involve the salvage of vegetation mats from areas within the wetland that will be directly impacted by the Project footprint.
- Reclamation techniques such as those specified in PCA (2015b), TeraWestland (2007) and ANPC (2009) will be applied to maximize the likelihood of successful transplantation and to maintain species diversity:
  - salvage will occur during the dormant season (i.e., mid-September to bud break), when practicable;
  - where the use of salvage vegetation mats is appropriate, they will include as much plant material as possible (i.e., an excavator or similar equipment should be used to remove plant material);
  - salvage vegetation mats will be relocated to sites with similar environmental conditions (e.g., moisture, aspect, soil);
  - salvage vegetation mats will be replaced on the same day as they were removed, if possible, or as soon as the reclamation site can be prepared following disturbance;
  - reclamation sites that contain transplanted rare plants should be protected from future development; and
  - salvage activities and follow-up monitoring will be conducted by Environmental Professionals.
- A follow-up wetland monitoring program will be developed and implemented to evaluate the success of mitigations applied to preserve and create wetland habitat. This monitoring program may include:
  - determining performance criteria to evaluate plant species establishment and successional trajectory;
  - verifying surface and subsurface water movement;
  - documenting vegetation community composition;
  - documenting use as habitat by wildlife species; and
  - using monitoring data within the framework of an adaptive management program to maximize the effectiveness of wetland reclamation efforts, as appropriate.



### Invasive Plant Species

- During construction, PCA's Best Management Practices will be implemented to prevent introduction and spread of invasive plant species (PCA 2015e). This will include spraying, controlling soil movement and cleaning equipment.
- Imported topsoil for reclamation will be certified free of weeds and non-native seeds.
- Where appropriate, the revegetation plan will include direction for revegetation of exposed soil and stockpiles using LLYK Field Unit approved seed mixtures to reduce erosion and the introduction of invasive species.
- Post-construction monitoring will be implemented to assess the establishment and presence of invasive plant species. If invasive plant species are discovered, control measures will be implemented, when practicable.

### 5.2.3 Wildlife

Design mitigations for wildlife were developed to avoid or reduce adverse effects of the Project on a wide diversity of wildlife, and also with species- and species group-specific considerations, where appropriate.

### General Wildlife Movement and Mortality Mitigations

### **Crossing Structures**

A variety of wildlife passage structures combined with the use of wildlife exclusion fencing will be used to facilitate movement for a diversity of wildlife species across the TCH and maintain ecological connectivity, while minimizing road mortality. Parks Canada (2011) previously identified the potential for the following:

- a 10 to 20 m wide wildlife underpass near Sink Lake;
- several large-diameter culverts east of the Lake O'Hara junction to accommodate both drainage and wildlife; and
- an approximately 50 to 60 m wide structure west of the Lake O'Hara junction.

There is no suitable site for a large highway crossing structure west of the Lake O'Hara junction to Wapta Lake (km 84.8 to 86.3) because of the proximity of the CPR tracks, high water table, rock bluffs and the presence of mineral licks at km 85.3 and 85.4. In addition, a crossing structure is not feasible from km 86.3 to km 88.0 because the highway in that area is immediately adjacent to either Wapta Lake or the Wapta Cut and the Kicking Horse River. Following careful consideration, the following crossing sites and structures have been selected by PCA for km 82.5 to 88.3:

- A 7 x 4 m elliptical multi-plate steel culvert at km 82.3, which was installed in 2013.
- A 20 m open-span wildlife underpass at km 83.1, east of Sink Lake.
- An overpass with a target width of about 60 m at km 84.5, just east of the Lake O'Hara junction. This site takes advantage of high ground on both sides of the highway, a greater distance between the TCH and the CPR compared to locations farther west, a good view of oncoming train traffic from near the south entrance, and separation from the junction. The distance to the nearest goat lick is about 800 m, which will put the crossing structure in sight of goats at the lick while not funneling carnivores directly towards it.



- A 7 x 4 m elliptical pipe immediately east of the Lake O'Hara junction at km 85.0. This will provide additional crossing opportunities at what is considered to be an important landscape linkage point for Mountain Goats, Grizzly Bears and other species.
- An 4.75 x 3.2 m elliptical pipe underpass at km 86.0 and the wetlands east of Wapta Lake. The structure's height will be limited by the shallow water table, and its width will depend on the availability of appropriate products. This represents the most westerly location between kms 82.5 to 88.3 that is suitable for installation of a wildlife underpass crossing opportunity. This location takes advantage of tree cover on both sides of the highway, is at a point where the CPR and TCH are diverging, and is immediately adjacent to a wetland.
- Although a transition from 4 lanes to 3 lanes will be constructed between km 88.0 and km 88.3, this does not preclude future decision to put a wildlife crossing structure within that 300-m area under potential future twinning projects.
- To facilitate highway crossing opportunities for small animals with small home ranges (e.g., hares, squirrels, martens, voles), small to large crossing structures that are at least seasonally dry will be installed at frequent intervals. This will include the planned overpass and underpasses and any small drainage culverts or bridges already built or planned. If the planned crossing structures discussed above result in an average of fewer than two crossing structures per kilometre of highway within the Project right-of-way, additional small culverts (e.g., 60 cm diameter) will be installed.
- The ends of crossing structures will be landscaped to provide a gradual transition from natural conditions to the crossing structure and to facilitate wildlife access and use to the extent that is practicable.
- The use of crossing structures will be monitored using remote cameras to determine the species using the structures, as well as the timing and frequency of crossing events.

### Wildlife Fencing

Wildlife fencing will be installed along the boundaries of the TCH right-of-way along the Project alignment, where practicable, to minimize wildlife access to the TCH and funnel wildlife movement towards crossing structures. Fencing will be built to wildlife fencing standards recently employed elsewhere in the LLYK Field Unit, as follows:

- Fencing will be constructed of mesh that is 2.4 m high, with variable opening sizes (smaller near the bottom), a buried chain-link apron and a tensioned top cable.
- Posts will generally be preserved wood of a type compliant with the current draft PCA guidelines (PCA 2015c; PCA 2015d) for the use of treated wood. Wherever possible, the alignment will avoid wet soils and seasonally flooded ground but if there are no feasible options to do so, alternative construction materials or methods will be employed to limit the risk of leachate from posts entering the water. Where necessary to install posts in bedrock, holes will be drilled and posts will be set in concrete within those holes.

Additional design considerations specific to the Project are as follows:

- Where side roads intersect the highway at km 84.8 (O'Hara Lake Road) and km 86.7 (The Great Divide Lodge), the openings created in the fence will be protected with cattle guards (Texas gates). At the time of writing, limitations regarding the power requirements for, and reliability of, permanent electric mats capable of melting snow and ice are sufficient that they are not considered fully reliable to use in place of cattle guards.
- Due to the anticipated reliability of proposed remote avalanche control systems planned for the Mount Bosworth avalanche paths, the fence will extend across the base of those paths.



- Single-swing gates will be constructed on each of the four quadrants adjacent to the animal overpass and each of the underpasses, i.e., immediately east and immediately west of each crossing structure, on both the eastbound and westbound sides of the highway. Additional single- or double-swing gates or self-closing pedestrian gates will be constructed if necessary to provide access for management purposes or for park visitors. Up to 10 animal jump-outs will be constructed if desired by the LLYK Field Unit and if appropriate terrain is available.
- The default alignment for the fence is about 2 m toward the highway from the edge of tree clearing. However, given the complex terrain and the presence of other infrastructure, the fence will be field-fitted and the alignment will be variable. It will be at, below, or above the highway grade depending on location.
- At animal crossing structures or other bridges or large culverts, the fence will be aligned more closely to the road to attach to abutments or go over top of underpasses or culverts. The ends of smaller culverts will generally be on the highway side of the fence.
- Detailed decisions about fence design at the Bosworth Mountain Goat lick (i.e., km 85.3 and km 85.4) will be made after earthworks have been completed there, and will be approved by the LLYK Field Unit prior to construction.
- Subject to confirmation with the LLYK Field Unit, it is anticipated that there will be no fence on the south side of the highway adjacent to Wapta Lake because the risk of animal intrusions via the lake is low, the guardrail provides a partial barrier, and motorists' views are downward over the lake and would be impeded by a fence.
- The fence will at no point enter the Wilderness Zone (i.e., Zone II).

### Species-Specific Mitigations

### **Migratory Birds**

- Avoid vegetation clearing and other activities that may disrupt nesting during the general migratory bird nesting season. The Project Area is located in migratory bird nesting zone A3, in which the general nesting period for wetland and upland birds is April 14 to August 19 (ECCC 2016).
- Where vegetation disturbance cannot be avoided within the general migratory bird nesting season, pre-clearance nesting surveys will be conducted by Qualified Environmental Professionals with an appropriate level of experience identifying birds and conducting nest sweeps. Should active nests be detected during surveys, consultation will occur with LLYK Field Unit staff to determine the appropriate course of action. Most migratory birds, their nests and eggs are protected under the Migratory Birds Convention Act, 1994 (MBCA) (Government of Canada 1994).

### Bats

Bat roosting in cavities or behind the loose bark of mature and old trees may also occur during the migratory bird nesting season. Where vegetation disturbance cannot be avoided within the general migratory bird nesting season, a pre-disturbance bat assessment will be conducted by a Qualified Environmental Professional. The assessment will involve first determining whether there are trees that would function as high-potential roosting habitat within the Project area. If high-potential habitat is identified, then a follow-up survey will be completed to determine whether bats are present. Should active bat roosts be detected during surveys, consultation will occur with LLYK Field Unit staff to determine the appropriate course of action.

#### **Mountain Goats**

- Avoid impacts to documented mineral licks used by Mountain Goats at km 85.4 (primary) and km 85.3 (secondary) (Figure 1). During construction, there will be a Mountain Goats management zone that will extend from the vicinity of (but not including) the wildlife underpass construction site at about km 85.0 and up to km 85.7. Within the management zone, earthworks on the north side of the highway are permitted during daylight hours but not at night.
- Culling trees in the vicinity of the mineral licks has previously been suggested as a potential mitigation to reduce predator visual cover, which may have developed due to fire suppression activities (PCA 2011). In addition to roadside clearing, additional areas above the goat licks will be cleared to improve sight lines for goats if direction to do so is provided by the LLYK Field Unit prior to completion of roadside clearing
- Follow-up monitoring (i.e., remote camera survey) of Mountain Goat use of the mineral lick at km 85.4 to evaluate the effectiveness of the retaining wall as mitigation for preserving the accessibility and attractiveness of the lick for goats.

### **Columbian Ground Squirrels**

Columbian Ground Squirrels will be trapped and relocated to the extent that is practicable. Trapping efforts will focus on burrow locations that were confirmed to be active during field surveys. However, to be precautionary, trapping will also occur at burrows where activity was not confirmed to verify field survey observations.

#### Amphibians

Avoid potential amphibian habitat at the wetland near the Great Divide Lodge and to the south of the TCH between km 85.75 to 86.5.

### 5.2.4 Terrain and Soils

- Known or potential contaminated sites will be avoided during construction, and identified as per Phase I and Phase II Environmental Site Assessments as applicable.
- Post-construction contours of the right-of-way and temporary work areas (including the roach and slump) will be designed to match surrounding topography, and will not create conditions that would hinder establishment of native plant communities or alter natural drainage patterns.
- Rock outcrops and embankments will be designed to be natural appearing or visually non-intrusive.
- Acceleration of soil erosion rates will be limited to pre-disturbance levels or lower within the adjusted Project area and on specific soil conditions (the latter category includes sites with little or no topsoil, steep slopes, poor moisture availability, or exposure to high winds).
- The post construction landscape will be designed considering natural-like growing conditions, including consideration of soil salvage and storage locations, as applicable.
- Construction activities and stormwater drainage will be designed such that there is no increase in rate or quantity of movement of contaminants from previously contaminated sites, if any are discovered or identified prior to or during construction. The septic field for the Great Divide Lodge will be avoided.

Existing (see Appendix VII of the 2004 Environmental Assessment Document) and equivalent typical approaches to mitigation will apply and are still considered feasible and sufficient. During the detailed construction planning stage the Environmental Protection Plan developed by the contractor will address how construction will ensure the conservation and protection of soil resources on and off-site during construction and reclamation.

### 5.2.5 Cultural Resources

- The Project will be designed to avoid all known cultural resource sites; therefore, the Project is not anticipated to have an effect on cultural resources.
- There may be cultural resources present within the Project area that have not been documented. If staff observe any significant cultural resources while they are working, they should stop work in the immediate area, and contact the project manager, or a PCA archaeologist or cultural resource advisor (contacts listed below), to discuss any protective actions that might be needed. Isolated historic items are quite likely to be found, such as bottles or cans, but these are not reason to stop work.
  - Significant resources in this context could include abandoned railway grades, railway-related water diversion log cribbing or earthworks, historic cabin foundations or dumps, large concentrations of turn of the century bottles or cans, structural features, or pre-contact resources such as concentrations of butchered animal bone, hearths, stone features, or artefacts.

### 5.2.6 Visitor Experience/ Public Safety

- The installation of remote avalanche control systems is planned at Mount Bosworth to reduce road closures during avalanche control cycles and improve winter road safety, while also reducing dependence on avalanche control by helicopter. A separate BIA is produced to assess the effects of the construction and operation of remote avalanche control systems at Mount Bosworth, and to identify appropriate associated mitigations.
- The Project will be designed to maximize motorist safety along the TCH, including through safe transitions to/from four lanes and safe navigation of steep areas.
- The Sherbrooke Lake Paget lookout trailhead near Wapta Lake is accessed both from the Great Divide Lodge parking lot and from a frontage road to the picnic shelter/ trailhead. For safety and to avoid conflicts with acceleration and deceleration lanes along the TCH, access to the Trailhead will be limited to a single entrance and trail head facility at Great Divide Lodge, if practicable.
- No dedicated pullouts will be constructed specifically for the purpose of providing access for anglers at the east and west ends of Wapta Lake. However, the new chain off area at km 87.46 and a remaining wide shoulder at the site of the existing chain off at km 86.1 will continue to provide informal access.
- Pedestrian gates in the wildlife fence will be included in the final design to allow access to highly used areas, such as Wapta Lake.



### 6.0 **REFERENCES CITED**

- ANPC (Alberta Native Plant Council). 2009. Guidelines on Plant Rescues. 3 pp. Available at: <u>http://anpc.ab.ca/wp-content/uploads/2015/01/2009\_plant\_rescue.pdf</u>
- ANPC. 2012. Guidelines for Rare Vascular Plant Surveys in Alberta 2012 Update. Alberta Native Plant Council. Edmonton, AB. 22 pp.
- BC CDC (British Columbia Conservation Data Centre). 2016. BC Species and Ecosystems Explorer. BC Ministry of Environment, Victoria BC. Available at: <u>http://a100.gov.bc.ca/pub/eswp/</u>. Accessed: June 2016
- BC MOE (British Columbia Ministry of the Environment). 2009. Kootenay Region (Region 4) Periods of Least Risk for Instream Works by Fish Species. Available at: http://www2.gov.bc.ca/assets/gov/environment/air-landwater/working-around-water/work\_window\_kootenays.pdf. Accessed June, 2016.
- BC MOE. 2010. Management Plan for the Mountain Goat (*Oreamnos americanus*) in British Columbia. Prepared by the Mountain Goat Management Team. Available at: http://www.env.gov.bc.ca/wld/documents/recovery/ management\_plans/MtGoat\_MP\_Final\_28May2010.pdf. Accessed June 2016.
- BC MOE. 2012. Habitat Wizard. Available at: <u>http://maps.gov.bc.ca/ess/sv/habwiz/.</u> Accessed December 23, 2015.
- BC MOTI (British Columbia Ministry of Transportation and Infrastructure). 2014. Annual day of week summary for 2014. Site name: Kicking Horse - P-37-5EW, T Location: Route 1, 15.0 km east of Route 95 (at the east end of Park Bridge), Golden - Report generated online from: http://www.th.gov.bc.ca/trafficData/index.html. Accessed February 2016.
- CCME (Canadian Council of Ministers of the Environment). 2008. Canadian water quality guidelines for the protection of aquatic life. Canadian Council of Ministers of the Environment, Winnipeg. Available at: http://www.ccme.ca/files/Resources/supporting\_scientific\_documents/cwqg\_pn\_1040.pdf. Accessed January 15, 2016.
- DFO (Fisheries and Oceans Canada). 2015. Measures to avoid causing harm to fish and fish habitat. Available at: http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/measures-mesures-eng.html. Accessed June 10, 2016.
- Environment Canada. 1996. The Federal Policy of Wetland Conservation Implementation Guide for Federal Land Managers. Wildlife Conservation Branch, Canadian Wildlife Service. Ottawa, ON. 33 pp.
- Environment Canada. 2016. Species at Risk Public Registry. http://sararegistry.gc.ca/search/ SpeciesSearch\_e.cfm\_[updated January 19, 2016]. Accessed June 10, 2016.
- ECCC (Environment and Climate Change Canada). 2016. General nesting period of migratory birds in Canada. Available at: http://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=4F39A78F-1. Accessed June 2016.
- Fisheries and Oceans Canada (DFO). 2015. Measures to avoid causing harm to fish and fish habitat. Available at: http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/measures-mesures-eng.html. Accessed June 10, 2016.





- Golder (Golder Associates Ltd.). 2004. Screening Report for the TCH Twinning Project Phase IIIB Banff National Park.
- Golder. 2016. Basic Impact Analysis TCH Ottertail Rehabilitation, Paving, Guardrail and Culvert Repair. 120 pp.
- Government of British Columbia. 2015. B.C. on the Move: A 10-Year Transportation Plan. Available at: gov.bc.ca/transportationplan. Accessed November 25, 2015.
- Government of British Columbia. 2016. BC Weed Control Act. [RSBC 1996] CHAPTER 487. Available at: http://www.bclaws.ca/Recon/document/ID/freeside/00\_96487\_01. Updated June 8, 2016.
- Government of Canada. 1991. The Federal Policy on Wetland Conservation. Canadian Wildlife Service, Environment Canada. Ottawa.
- Government of Canada. 1994. Migratory Birds Convention Act, 1994. S.C. 1994, c. 22. Available at: <u>http://laws-lois.justice.gc.ca/eng/acts/M-7.01/</u>. Current to May 24, 2016. Last amended on December 10, 2010.
- McElhanney (McElhanney Consulting Services Ltd.). 2013. TCH Avalanche Risk Management Mount Bosworth Remote Avalanche Control System Study. pp. 25.
- McLellan, Charlie. 2016. Resource Management Officer II Fire and Vegetation. PCA. Email with Trevor Kinley (PCA) on June 13, 2016.
- PCA (Parks Canada Agency). 2004. Trans-Canada Highway Phase IIIB Environmental Assessment Determination.
- PCA. 2006. Kicking Horse Pass National Historic Site of Canada Commemorative Integrity Statement. Banff National Park of Canada and Yoho National Park of Canada. July 2006. 33 pp.
- PCA. 2007. Mountain Parks: National Historic Sites of Canada Management Plans. Available at: http://www.pc.gc.ca/pn-np/inc/PM-MP/plan/pd-mp\_e.pdf
- PCA. 2008. Yoho National Park, State of the Park Report. 56 pp. Available at: <u>http://www.pc.gc.ca/eng/pn-np/bc/yoho/plan/gestion-management/plandirecteur-mgmtplan.aspx</u>
- PCA. 2010a. Yoho National Park of Canada Management Plan. Available at: <u>http://www.pc.gc.ca/docs/v-g/yoho/plan1/index.aspx</u>
- PCA. 2010b. TCH Twinning Phase IIIB Project Amphibian Surveys 2010. Prepared by Brendan Brown.
- PCA. 2011. Adjustment to Environmental Screening Report: TCH Twinning Phase IIIB Adjustment Overview.
- PCA. 2013. PCA Biotics Web Explorer. Available at: http://www.pc.gc.ca/apps/bos/bosfieldselection\_e.asp? oqqc=aqs. Accessed June, 2016.
- PCA. 2015a. Basic Impact Analysis (BIA): TCH Rock Slope Reprofiling 2015 Works. TCH: Sherbrooke Creek, Lower Sherbrooke Creek, Little Topple and Phyllite Rock Slopes, Yoho National Park, BC. May 2015.
- PCA. 2015b. BIA. Vegetation Removal for 2015 TCH Rock Reprofiling- Yoho National Park. April 16, 2015. pp 27.
- PCA. 2015c. Parks Canada Treated Wood Management Standard. December 2015.





- PCA. 2015d. Parks Canada Treated Wood Management Guide. December 2015.
- PCA. 2015e. PCA National Best Management Practices. Roadway, Highway, Parkway and Related Infrastructure BMP. May 2015.
- PCA. 2015c. Seasonal and Diurnal use of Mineral Licks by Mountain Goats on Mt. Bosworth in Yoho National Park and Mt. Wardle in Kootenay National Park. Prepared by Hannah Flagg.
- PCA. 2016a. BIA: TCH Rock Slope Reprofiling Yoho National Park -2016 Work.
- Penny, J. and R. Klinkenberg. 2010. Protocols for Rare Vascular Plant Surveys. In: Klinkenberg, Brian. (Editor) 2010. E-Flora BC: Electronic Atlas of the Plants of British Columbia [eflora.bc.ca]. Lab for Advanced Spatial Analysis, Department of Geography, University of British Columbia, Vancouver.
- RIC (Resources Inventory Committee). 1998. Inventory Methods for Pond-breeding Amphibians and Painted Turtle. Standards for Components of British Columbia's Biodiversity No. 37. Ministry of Environment, Lands and Parks Resources Inventory Branch, Government of BC.

TeraWestland. 2007. Restoration Plan for the TMX-Anchor Loop Project.





## **Report Signature Page**

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YOHO TRANS-CANADA HIGHWAY TWINNING KM 82.5 TO 88.3

# APPENDIX A Figures



			N N	/oho National Park Trans-Canada Highway Twinning KM 82	2 to 88		
		ТСН ҮОНО 41.2, ТСН ҮОНО 41.4,	TCH YOHO 41.9,	TCH YOHO 42.4,	TCH YOHO 42.9,	ТСН ҮОНО 43.6, ТСН ҮОНО 43.8,	
	AQUATICS	No Culvert Identified No Channel or Fish Habitat	Dry Ditch and No Fish Habitat	No Channel or Fish Habitat	No Channel مِر Fish Habitat	No Culvert Identified No Channel or Fish Habitat	
	WEILANDS						
	LISTED PLANTS						
	WEEDS	Hounds Tong	e Common Tansy Common Tan	sy			
UNICE - Second From From Volume Second From From Volume From Volume	SENSITIVE ECOSITE					BV2 (BV2/5C) (Bow Valley 2)	
		Mountain Goat Management Zone / High Historical Wildlife Mortalit High Historical Wildlife Mortality	1	High Historical Wildlife Mortality			
	WILDLIFE AREAS	Bosworth Lick East	Ground Squ	uirrel Colonies Ground Squirrel Colony	Migratory Bird Zone A3		
	SOILS AND TERRAIN						
	HISTORIC RESOURCES						
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NE Note 3     See Note 3     See Note 7       Stand TERRAIN CRITERIA		Mountain Goat Management Zone - May 15 to Oct 15		Zone A3 - Migratory Bird Nesting Period	April 17 to August 19		
STORIC RESOURCES Project has been designed to avoid impact on recorded archeaological sites.		See Note 3	See	Note 7 See Note 3 See Note 7			
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101117100	Kicking Horse River         Wanta Lake         TCH YOHO 39.5,         TCH YOHO 39.6,         TCH YOHO 40.0.         TCH YOHO 40.5.         TCH YOHO 40.7.         TCH YOHO 41.0.
	No Channel or Fish Habitat Tributary of Wapta Lake No Channel or Fish Habitat Dry Ditch and No Fish Habitat
WETLANDS	
LISTED PLANTS	Moderate Listed Plant Potential
WEEDS	Tall Buttercup     Tall Buttercup. Bull Thistle     Tall Buttercup
	BV2 (BV2/3C) (Bow Valley 2)
	Mountain Goat Mountain Goat Management Zone /
	Migratory Bird Zone A3       Ground Squirrel Colonies       Potential Amphibian Breeding Site
WILDLIFE AREAS	Bosworth Lick West
SOILS AND TERRAIN	Known Contaminated Site
HISTORIC RESOURCES	Maste Later Obsthere for Later Teril Master Later
VISITOR EXPERIENCE	Wapta Lake Shebbooke Lake man Wapta Lake
LOMETRE POSTS (KP)	88 87 86
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As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

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