



# Basic Impact Analysis (BIA)

## Illecillewaet Curve Safety Improvements

Glacier National Park, BC

March 2016



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Canada

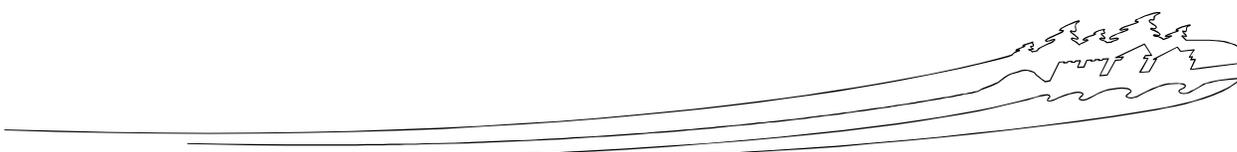
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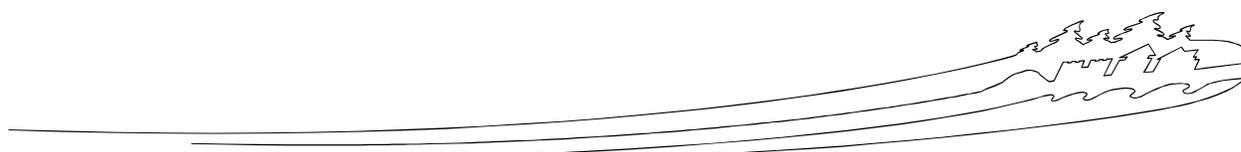
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- Appendix 1: Environmental Impact Analysis Tools: Effects Identification Matrix
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- Appendix 3: Design Drawings (January 15, 2016)
- Appendix 4: Vegetation Elements of Management Concern with Potential to Occur Near the Project
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## Parks Canada Basic Impact Analysis

### 1. PROJECT TITLE & LOCATION

Illecillewaet Curve Safety Improvements, in Glacier National Park, British Columbia. The Project is located along the TCH between KM 21.0 and KM 29.1.

### 2. PROPONENT INFORMATION

Parks Canada Agency: Ryan Syme, P.Eng., Engineer II – Highway Engineering Services

BIA Author: Tetra Tech EBA Inc.

### 3. PROPOSED PROJECT DATES

Planned commencement: 2016-03-01

Planned completion: 2017-10-30

### 4. INTERNAL PROJECT FILE #

### 5. PROJECT DESCRIPTION

#### Project Objective

The proposed project is located along the Trans-Canada Highway (TCH) from the west portal of Single Bench snowshed (TCH km 20.0<sup>1</sup>), through Rogers Pass, over the Illecillewaet River (referred to as Illecillewaet curve) and ending west of the Canadian Pacific Railway (CP) access road intersection (TCH km 29.1) (Figure 1). The entire project is within Glacier National Park (GNP). The project includes various components relating to highway widening and access improvements designed to improve network performance, road-user safety and visitor experience.

#### Project Rationale

This section of the TCH is a congested area with known major safety issues related to passing. In particular, the westbound/southbound traffic demonstrates high-risk passing behaviour at the Illecillewaet curve, which has resulted in multiple fatalities in recent years. The lane widening on the TCH westbound side on the approach and departure to the Illecillewaet curve will significantly improve passing opportunity throughout the entire area and therefore improve road user safety and network performance and visitor experience. It achieves this through the inclusion of passing opportunities in the westbound direction as traffic approach the Illecillewaet curve, thus extending the opportunity into areas with more favourable geometry.

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<sup>1</sup> Highway kilometre references start from 0 at the Glacier National Park east gate and increase westward.





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To further improve safety and network performance, a number of access amendments have been included. The median crossing access to Illecillewaet campground and Asulkan Trailhead parking lot will be closed thus requiring the addition of a turnaround facility at approximately TCH km 28.0, across from the CP access road, to allow westbound visitors to access both facilities safely. Additionally the Hermit Trailhead parking lot will be set back from the TCH providing the visitors a separation from high speed highway traffic.

During periods of TCH closures for avalanche control or other operational requirements, the existing vehicle ponding capacity will be increased through the inclusion of an additional storage area on the westbound side of the TCH at approximately km 23.40. This ponding area will extend into and connect with the existing parking facilities located in the vicinity of the Rogers Pass Discovery Centre. By extending the ponding capacity, the network performance and visitor safety will be improved through ease of access and reduced waiting times during times of closure.

### **Project Components**

The project will consist of several upgrades to the TCH in the vicinity of Rogers Pass and Illecillewaet curve (see the design drawings in Appendix 3).

#### Highway Widening (Shown on All Drawing Sheets)

The highway will be widened to accommodate an additional westbound lane through most of the project area. No work is proposed for the Illecillewaet curve itself, which is already two lanes in each direction. The widening will occur mainly on the westbound side but some widening will occur on the eastbound side to minimize cuts into the adjacent steep embankments. Where construction occurs all culverts will either be replaced or rehabilitated to address current TCH and culvert standards for aquatic connectivity and fish bearing streams. An 80 m long downslope retaining wall will be required on the north side of the TCH, beginning at km 27+120.

The additional westbound lane will allow faster-moving vehicles to safely pass slower-moving vehicles prior to approaching and after departing the Illecillewaet curve.

#### Access Consolidation for Hermit Trailhead and Explosives Magazine (Drawing Sheet 003)

The entrances to these two areas will be consolidated to one entrance and joined by a new frontage road. A new parking area will be developed for the trailhead and potentially allows for addition of new visitor amenities. The addition of the frontage road will require a new box or open arch culvert over a tributary to Connaught Creek (which crosses the TCH at km 21.06). The new consolidated entrance will allow for safer vehicle entry and exit for visitors to the trailhead.

#### Traffic Ponding Area (Drawing Sheet 005)

A new westbound traffic ponding area will be created north of the Rogers Pass Discover Centre. This area will be used to hold westbound traffic when the TCH is closed during avalanche control activities. The new traffic ponding area will allow for more efficient and safer traffic control in winter. The MRG FU will be consulted on the precise location and design of this ponding area.





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#### Consolidation and Formalization of Access at Discovery Centre Area (Drawing Sheets 005 and 006)

Access to the Discovery Centre will be consolidated at the central intersection across from the Parks compound. Westbound deceleration and acceleration lanes will be added. The current access to the summit area south of the former gas station will be gated to prevent vehicles from accessing the TCH at that location. These changes will improve traffic flow and improve road safety.

#### Formalization of Access at Monument Area (Drawing Sheet 008)

Westbound deceleration and acceleration lanes will be added to provide for safer entry and exit to the monument area. Across the TCH from the monument area, the Summit truck parking area and NRC Gulley Trailhead gravel pullout or layby will be improved with deceleration and acceleration lanes and a proper t-intersection to provide safer pullout of eastbound traffic visiting the monument area and for eastbound traffic from Illecillewaet Campground and Asulkan Trailhead to turn around and travel west.

#### Closure of Median Access to/from Illecillewaet Campground and Asulkan Trailhead (Drawing Sheet 012)

There are currently two gaps in the median on Illecillewaet curve that allow vehicles to cross oncoming traffic when entering Illecillewaet Campground and Asulkan Trailhead from the east and similarly when exiting these areas and travelling west. The median gaps will be closed to force exiting vehicles to turn right to more safely join eastbound traffic when exiting. Vehicles looking to exit to the west will be required to turn around at either the monument area or the Discovery Centre area. Westbound vehicles looking to enter the Illecillewaet Campground and Asulkan Trailhead will be required to continue further west to a new turnaround at the CP access road (described below).

#### West Turnaround (Drawing Sheet 014)

A new turnaround will be created at the CP access road. This will allow westbound vehicles to turn around to access the Illecillewaet Campground and Asulkan Trailhead.

### **Project Construction Phases and Activities**

The project will be conducted over two years, beginning in March 2016 and ending in October 2017. Civil construction work in the first year (2016) will be focused on the area south and west of the summit monument. Civil construction work in the second year (2017) will be focused on the area at and north and east of the summit monument. Clearing and grubbing for the 2017 work areas will be completed at the end of the 2016 construction season (end of August and later) in order to allow for further archaeological assessment in select areas prior to construction and to avoid clearing in the bird breeding season in spring/summer 2017.

The 2016 construction tender will be awarded by the end of May and the contractor may begin mobilization as early as June 1. Clearing and grubbing may begin soon after June 1 but only once permission has been given by the MRG FU Superintendent, archaeological work has been completed and pre-clearing nest surveys have been conducted. The 2016 construction will be completed by October 31.

Project work will include:

- Establishment of site office, staging and laydown areas,
- Asphalt removal,
- Vegetation clearing and grubbing (approximately 18 ha),
- Stripping and placement of topsoil,





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- Earthworks (road embankment/ditching),
- Rock blasting,
- Ditching,
- Culvert installation, extension and rehabilitation, including replacement of the existing culvert at Connaught Creek with an open-bottomed culvert,
- Construction of retaining wall,
- Relocation and re-configuration of avalanche control gun positions,
- Construction of base course and paving,
- Signage installation,
- Guardrail/barrier installation,
- Intersection treatments,
- Pavement marking,
- Utility relocation (electrical/ communications), and
- Re-seeding to restore vegetation in temporary disturbance areas.

Staging and laydown areas will be located at the Rogers Pass maintenance compound and on part of the gravel layby across from the monument.

Two avalanche control gun positions (GPs) will require relocation: Goddard GP at km 25+940 (Drawing Sheet 11) and CP GP at km 25+960 (Drawing Sheet 14). The new relocated GPs will be constructed and calibrated while the old ones are still operational. The process to relocate the GPs will be as follows:

- The military will take measurements for new GPs in winter 2016.
- The new GPs will be constructed in summer 2016 while leaving the old GPs in place.
- The military will configure targets from the new GPs in winter 2016-2017.
- The old GPs will be removed in summer 2017.

During construction, at least single-lane traffic will be maintained at all times. Access to all facilities will be maintained during construction.

### **Operations Phase**

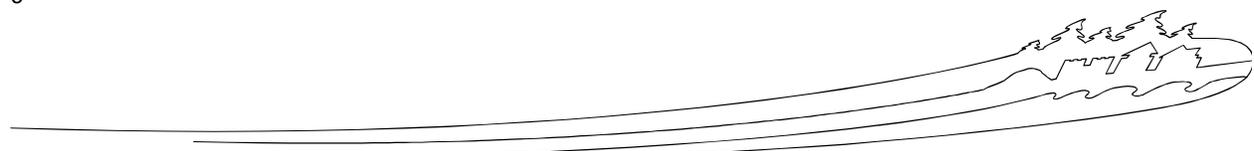
After all phases of construction are complete, the project area will continue to operate as a highway, consistent with the pre-project condition. Operations and maintenance activities will generally remain unchanged and include:

- Pavement surface management,
- Ditch, culvert and drainage management,
- Snow and ice control, and
- Roadside vegetation management.

## **6. VALUED COMPONENTS LIKELY TO BE AFFECTED**

This section includes the following information:

- Valued Components Selection Methods,





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- Existing Conditions, and
- Valued Components (VCs).

### Valued Components Selection Methods

The Canadian Environmental Assessment Agency defines Valued Ecosystem Components<sup>2</sup> as “the environmental element of an ecosystem that is identified as having scientific, social, cultural, economic, historical, archaeological or aesthetic importance”. The tool provided in Appendix 1 was used to identify the broad VC categories that are present in or near the project area and may potentially interact with the project. The VC categories include:

- Air and Noise,
- Soil & Landforms,
- Water (surface water, groundwater, fish [including species at risk] and fish habitat),
- Flora (including species at risk),
- Fauna (including species at risk),
- Cultural Resources, and
- Visitor Experience.

Specific VCs were selected using the following steps<sup>3</sup>:

Step 1: Identify Candidate Valued Components

Step 2: Evaluate Candidate Valued Components

Step 3: Select Appropriate Valued Components

Candidate VCs were identified based on discussion with the Mount Revelstoke and Glacier National Parks (MRG) Field Unit and supported by field reconnaissance and review of existing data and reports. The criteria used to evaluate candidate VCs included the following:

- Component is present in the vicinity of the project area and has potential to interact with the project; and
- Legally binding government requirement to protect the component (e.g., species listed under the *Species At Risk Act* [SARA]); or
- Component is of special management concern (e.g., provincial Red and Blue-listed species), or
- Component is particularly sensitive or vulnerable to disturbance; or
- Component is a particular concern to the public or government (e.g., iconic wildlife species like grizzly bear or recreation opportunities or viewscapes).

The final selection of VCs was refined from the candidate VCs by considering:

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<sup>2</sup> Though CEAA refers to VECs, in this document, the term Valued Components or VCs will be used.

<sup>3</sup> The VC selection process used in this assessment is adapted from the British Columbia Environmental Office VC selection framework, as describe in EAO (2013).





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- Can the potential effects of the project on the VC be measured and monitored? Is the candidate VC better represented by another VC?
- Can the potential effects on the candidate VC be effectively considered within the assessment of another VC?
- Is information about the candidate VC needed to support the assessment of potential effects on another VC? Specifically, this refers to an intermediate VC where the effects pathway leads to another VC that may be more relevant.

## **Existing Conditions**

### Air and Noise

Anthropogenic impacts to air quality in GNP are mainly a result of vehicle traffic along the TCH, including heavy-duty and light-duty diesel and gasoline vehicles; additional impacts may be incurred from the resulting road dust. Railway emissions also have an effect on air quality in GNP. Overall, the concentration of emissions is located along the highway corridor [Province of British Columbia 2015 - Air Emissions (1 km Grid)]. The landscape, climate, and abundance of vegetation likely help mitigate the effects of emissions on air quality in the vicinity. Existing noise is primarily related to vehicle traffic and routine maintenance of the roadway and park facilities.

Air Quality was identified as a candidate VC because dust and emissions may affect human health and visitor experience and deposition of dust may affect vegetation. Air Quality was considered to be an intermediate component and is assessed under the Vegetation, Visitor Experience and Human Health VCs. Noise was identified as a candidate VC because the project will generate noise which has the potential to affect wildlife and visitors. Noise was considered to be an intermediate component and is assessed under the Wildlife and Visitor Experience VCs.

### Soil and Landforms

The geologic bedrock in the project area consists of upper proterozoic coarse clastic sedimentary rocks (Province of British Columbia 2015). Well-drained Podzolics and well-developed Brunisolics are the most common soil parent materials in GNP due to the moist climate and coniferous forests; however, these are typically found at lower elevations (Alberta Institute of Pedology 1984).

There has been extensive site contamination around the works yard from historical operation, including coal slag in some areas (MRG 2012).

Soil Quality was identified as a candidate VC because of the risk of spills and existing contamination that may be disturbed by the project. It was carried forward as a VC in the effects assessment.

Soil Compaction was identified as a candidate VC as it may affect vegetation. It was considered to be an intermediate component and is assessed under the Vegetation VC.

Soil Erosion and Sedimentation was identified as a candidate VC but because it is primarily related to water, it was considered an intermediate component and is assessed under Fish and Fish Habitat.

Landforms was identified as a candidate VC as there will be rock blasting, but since it is primarily related to view and aesthetics, it is assessed under Visitor Experience.





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## Water

The project area is located across two drainages: the Illecillewaet River drainage south and west of the Rogers Pass summit monument and Connaught Creek, flowing to the Beaver River, north and east of the summit monument.

The Illecillewaet River is fed primarily by the Illecillewaet Glacier. The drainage basin is approximately 1,200 km<sup>2</sup> (Province of British Columbia 2000). Flowing southwest, it crosses the TCH within the project area at km 26+600 and then runs parallel to the TCH continuing westward. Base mapping indicates several tributaries draining to the Illecillewaet River with two crossing the TCH at km 24+600 and km 25+700.

Connaught Creek crosses the highway from west to east at about km 22+300 north of the Discovery Centre then continues north and eastward, eventually joining with the Beaver River. Base mapping indicates four tributaries draining to Connaught Creek with three crossing the TCH. Rogers Creek, one of the four tributaries, drains the area north of the summit monument on the east side of the TCH and passes behind the Parks compound. The channel is undefined in some areas. Two tributaries are near the Hermit Trailhead: one crosses at km 21+240 very close to the existing trailhead; the second at km 21+060.

Fish species documented in the Illecillewaet River and headwaters include Bull Trout (*Salvelinus confluentus*), Cutthroat Trout (*Oncorhynchus clarki*), Rainbow Trout (*Oncorhynchus mykiss*), Mountain Whitefish (*Prosopium williamsoni*) and Eastern Brook Trout (*Salvelinus fontinalis*); of these species, only Bull Trout has been identified as occurring near the project in the Illecillewaet drainage (Parks Canada internal document 2014).

The Westslope Cutthroat Trout (*Oncorhynchus clarki lewisi*) is regularly occurring in GNP according to the Parks Canada Biotics Web Explorer (Parks Canada 2013). The BC population of Westslope Cutthroat Trout is listed as 'Special Concern' under Schedule 1 of SARA (Government of Canada 2002). The only known population of this species within GNP resides in Schuss Lake and thus will not be encountered by the project (S. Boyle, pers. comm. 2015).

Fish species documented in the Beaver River include Bull Trout, Cutthroat Trout, Eastern Brook Trout, Mountain Whitefish, and Rainbow Trout (Parks Canada internal document 2014). Fish species documented in Connaught Creek include Bull Trout and Mountain Whitefish (Parks Canada internal document 2014). Bull Trout is known to occur in Rogers Creek adjacent to the Rogers Pass Maintenance Compound.

Many of the culverts along the highway are in poor conditions and are currently barriers to fish passage. Culvert replacement and rehabilitation will occur as part of this project and will improve fish passage in addition to improving aquatic connectivity.

The Illecillewaet and Beaver Rivers, as well as their tributaries, provide a source of water, food, and nutrients to fish and fish habitat, and therefore are subject to the Federal *Fisheries Act*. Given that the Project crosses fish-bearing watercourses, there is the potential for impacts to fish species and aquatic environments.

Benthic invertebrates are important indicators of freshwater ecosystem health. Baseline data for benthic invertebrate community assemblages is available for GNP through the Canadian Aquatic Biomonitoring Network (CABIN). The benthic macroinvertebrate community in Connaught Creek was sampled in 2013 and was determined to have high ecological integrity and thus may be used to compare the effects of future disturbances (Scrimgeour and Larson 2015).





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Fish was identified as a candidate VC and was carried forward as a VC in the effects assessment.

Fish Habitat was identified as a candidate VC and was carried forward as a VC in the effects assessment.

Benthic Invertebrates was identified as a candidate VC as they are important indicators of freshwater ecosystem health. Further evaluation of benthic invertebrates was not considered necessary in the context of the proposed project because measures to protect Water Quality, Fish and Fish Habitat would also protect Benthic Invertebrates. It was not carried forward as a VC in the effects assessment.

### Flora

British Columbia's Biogeoclimatic Ecosystem Classification (BEC) is a land classification system that groups similar ecosystems based on climate, geology/soils and vegetation. BEC Zones are the highest level of classification and represent areas of broad macroclimate. The Zones are generally named after the dominant tree species with a descriptor of the general climate (subzone).

The project area lies within the Engelmann Spruce – Subalpine Fir Very Wet Cold (ESSFvc) subzone. The vegetation within the ESSF Zone is typically dominated by Engelmann spruce (*Picea engelmannii*) in mature stands with subalpine fir (*Abies lasiocarpa*) in the understory. At higher elevations, subalpine fir sometimes dominates the stands. Whitebark pine (*Pinus albicaulis*), and alpine larch (*Larix lyallii*) occupy drier areas, usually at higher elevations, in the ESSF Zone. Characteristic shrubs include white-flowered rhododendron (*Rhododendron albiflorum*), black huckleberry (*Gaylussacia baccata*), grouseberry (*Vaccinium scoparium*), and false azalea (*Menziesia ferruginea*) (B.C. Ministry of Forests 1998a).

The vegetation adjacent to the TCH and the roadside clear zone is predominantly a mix of forest and shrubby avalanche paths. The forests are dominated by Engelmann spruce and subalpine fir. The avalanche paths are dominated by Scouler's willow (*Salix scouleriana*) and Sitka alder (*Alnus viridis* ssp. *sinuata*) and stunted spruce and fir. Areas directly adjacent to the road and shoulder are dominated by grasses, forbs and shrubs.

A list of vegetation elements of management concern (VEMC) that may occur in or near the project area was developed. VEMC was considered any plant that met one or more of the following criteria:

- Listed on the Red or Blue List (BC Ministry of Environment 2015),
- Assessed as Special Concern, Threatened, or Endangered by the Committee on the Status of Endangered Species in Canada (COSEWIC; Government of Canada 2015a), or
- Listed as Special Concern, Threatened, or Endangered in the SARA (Government of Canada 2002).

The list of VEMC was developed based on the following sources:

- The Parks Canada Biotics Web Explorer for SARA-listed species regularly occurring in GNP (Parks Canada 2013),
- BC Conservation Data Centre Internet Mapping tool for documented species within 5 km the Project (BC Conservation Data Centre 2015), and
- BC Species and Ecosystems Explorer for species occurring in both the ESSF BEC and Columbia-Shuswap Regional District (BC Conservation Data Centre 2015).

A total of 42 VEMC were identified as having potential to occur near the project area, of which 10 species have been documented as occurring within 5 km of the project (Figure 2; Appendix 4):

- Western St. John's wort (*Hypericum scouleri* ssp. *nortoniae*) – Blue List,





- Crested Wood Fern (*Dryopteris cristata*) – Blue List,
- Sutherland’s Larkspur (*Delphinium sutherlandii*) – Blue List,
- *Tayloria splachnoides* (no common name) – Red List,
- Elliptic Spike-rush (*Eleocharis elliptica*) – Blue List,
- Smooth Willowherb (*Epilobium glaberrimum* ssp. *fastigiatum*) - Blue List,
- Least Moonwort (*Botrychium simplex* var. *compositum*) – Blue List,
- Trelease’s Hybrid Willowherb (*Epilobium x treleasianum*) – Blue List,
- Slender Spike-rush (*Eleocharis nitida*) – Blue List, and
- Whitebark Pine – Blue List; Endangered under SARA and COSEWIC.

The closest record to the TCH is Western St. John’s wort near km 23.50 (Figure 2). Western St John’s wort is a vascular plant that occurs in alpine, tundra, grassland, shrub, rock and sparsely vegetated rock habitats. This species is designated as ‘sensitive’ in British Columbia and is on the Blue List (Appendix 4). The precise location of the occurrence is not known but the record description indicates it is in a wetland east of the TCH and suggests that it is not directly adjacent to the existing roadway.

One of the 42 VEMC is listed by either COSEWIC or SARA (Table 1).

**Table 1: Federally Plant Listed Species with Potential for Presence Near the Project**

English Name	Scientific Name	COSEWIC Status <sup>1</sup>	SARA Schedule <sup>2</sup>	Potential for Presence near Project
Whitebark Pine	<i>Pinus albicaulis</i>	Endangered	Endangered Schedule 1	Low - confirmed in vicinity of project but none appear in or adjacent to project footprint from site visits.

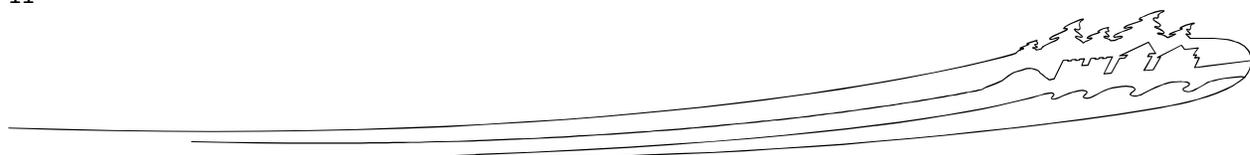
<sup>1</sup>COSEWIC – Committee on the Status of Endangered Wildlife in Canada (Government of Canada 2015a).

<sup>2</sup>SARA - *Species At Risk Act* (Government of Canada 2002). Schedule 1 is the official list of wildlife species at risk.

Whitebark Pine typically inhabits high mountain forests, occupying a narrow elevation zone from timberline, where it may occur as krummholz, to mixed, closed subalpine forest. It can be found at elevations from 1,950 - 2,250 m (COSEWIC 2010). Given the Project’s location and general ecology, the potential for Whitebark Pine to occur within the project footprint was considered low.

A site visit was conducted by a Tetra Tech EBA vegetation ecologist on June 15, 2015. Whitebark Pine was detected approximately 400 m from the TCH on higher elevation slopes but none within or adjacent to the project footprint.

A second site visit was conducted by Tetra Tech EBA on August 17, 2015 to identify potential to support VEMC. Overall the risk of encountering VEMC was considered low through most of the project area. A wet zone at the base of the avalanche chute east of the TCH between the summit monument area and the Parks compound (km 23.10 and 23.98) was considered moderate potential to support VEMC. A plant species inventory was conducted at one location within this area and no VEMC were identified.





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Vegetation was identified as a candidate VC as the project will result in loss of natural vegetation. It was carried forward as a candidate VC.

Listed Plant Species was identified as a candidate VC and was carried forward as a VC in the effects assessment.

### Fauna

The ESSF Zone offers a variety of habitats and supports a range of wildlife species, though the wildlife assemblage is strongly influenced by wet, cool summers and long, cold, snowy winters. Areas disturbed by avalanches and fires often have regenerating shrubby berry crops, and dense herbaceous vegetation, which tend to attract Grizzly Bears, Black Bears, and Moose during the spring and summer months. Other ungulates such as Caribou (*Rangifer tarandus caribou*), Mountain Goat (*Oreamnos americanus*), Elk (*Cervus elaphus*), and Mule Deer (*Odocoileus hemionus*) may be found in some areas; Caribou and Mountain Goat tend to overwinter in these areas as well. Other mammals including American Marten (*Martes americana*), Fisher (*Martes pennanti*), and Wolverine (*Gulo gulo*), as well as seed-eating birds such as Red Crossbill (*Loxia curvirostra*), White-winged Crossbill (*Loxia leucoptera*), Pine Siskin (*Carduelis pinus*), and Clark's Nutcracker (*Nucifraga columbiana*) can be found in coniferous forests within the ESSF Zone (B.C. Ministry of Forests 1998).

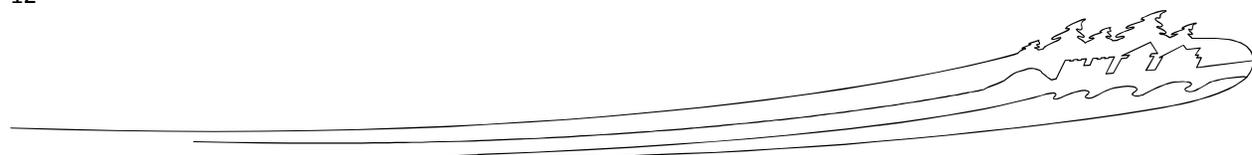
A list of wildlife species of management concern (SOMC) that may occur in or near the project area was developed. SOMC was considered any fauna that met one or more of the following criteria:

- Have federal restricted activity dates or setback distances (Environment Canada 2011),
- Assigned to Red or Blue lists by the BC Conservation Data Centre (2015), where Red lists include indigenous species or subspecies that are candidates for extirpated, endangered or threatened status and blue lists include indigenous species or subspecies considered to be of special concern,
- Assessed as Special Concern, Threatened, or Endangered by the Committee on the Status of Endangered Species in Canada (COSEWIC; Government of Canada 2015a), and
- Listed as Special Concern, Threatened, or Endangered, or under the SARA (Government of Canada 2002).

The list of SOMC was developed based on the following sources:

- The Parks Canada Biotics Web Explorer for species regularly occurring SARA-listed species in GNP (Parks Canada 2013),
- BC Conservation Data Centre Internet Mapping tool for documented species within 5 km the Project (BC Conservation Data Centre 2015),
- Known range maps for species of management concern (SOMC) that may occur within 1 km of the Project (Ridgely et al., 2007; International Union for Conservation of Nature, 2014), and
- Personal communication with PCA staff.

Results of the background search indicate that a total of 20 species of management concern have been found or can potentially be found near the Project Area, including 2 amphibians, 11 birds, and 9 mammals (Appendix 5). Of these species, 11 are listed under COSEWIC as Special Concern, Threatened, or Endangered; and 10 are listed under SARA as Special Concern, Threatened, or Endangered (Appendix 5). Woodland Caribou was identified as occurring within 5 km of the project to the northwest (Figure 2).





**Table 2: Federally Listed Wildlife Species with Potential for Presence Near the Project**

Common Name	Scientific Name	COSEWIC Status <sup>1</sup>	SARA Status <sup>2</sup>	Potential for Presence near Project
Coeur d'Alene Salamander	<i>Plethodon idahoensis</i>	Special Concern	Special Concern Schedule 1	Moderate – Suitable habitat, and regularly occurring in GNP
Western Toad	<i>Anaxyrus boreas</i>	Special Concern	Special Concern Schedule 1	High – Known to breed in Rogers Pass
Barn Swallow	<i>Hirundo rustica</i>	Threatened	-	High – Known to occur at Rogers Pass and on the underside of bridges in GNP
Olive-sided Flycatcher	<i>Contopus cooperi</i>	Threatened	Threatened Schedule 1	Moderate – Potentially suitable edge habitat and regularly occurring in GNP
Little Brown Myotis	<i>Myotis lucifugus</i>	Endangered	Endangered Schedule 1	Moderate – Potential foraging habitat and regularly occurring in GNP
Northern Long-eared Myotis	<i>Myotis septentrionalis</i>	Endangered	Endangered Schedule 1	Moderate – Potential for maternal colonies in large diameter trees and regularly occurring in GNP
Woodland Caribou - Southern Mountain population	<i>Rangifer tarandus pop. 1</i>	Endangered	Threatened Schedule 1	Moderate – Mapped critical habitat and known occurrences several kilometers from Project
Wolverine	<i>Gulo</i>	Special Concern	-	Moderate – Large home ranges and documented presence in vicinity
Grizzly Bear	<i>Ursus arctos</i>	Special Concern	-	High – Known to occur
Mountain Goat	<i>Oreamnos americanus</i>	-	-	Moderate – Regularly occurring in GNP and potential to be encountered crossing highway.
Seed-eating Birds	-	-	-	High – Known to occur along TCH.

<sup>1</sup>COSEWIC – Committee on the Status of Endangered Wildlife in Canada (Government of Canada 2015a).

<sup>2</sup>SARA - *Species At Risk Act* (Government of Canada 2002). Schedule 1 is the official list of wildlife species at risk.





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### Coeur d'Alene Salamander

Coeur d'Alene Salamanders require moist, shady habitat which could include rockwalls with flowing seepages or streams, waterfall splash zones, caves, streams with exposed bedrock, avalanche paths and moist talus. They also require wet, rocky crevices to avoid freezing (Government of Canada 2015c). This species is most likely to be found below 1,365 m in elevation which is within the range of the project. Suitable seepages or streams may be present. This species is regularly occurring in GNP and thus there is a moderate risk of encountering the species. There is a rock cut that may provide suitable habitat for Coeur d'Alene Salamander, located between km 24+000 and km 24+200, just north of the Illecillewaet curve.

This species was carried forward as a VC in the effects assessment.

### Western Toad

Western Toads are known to occur at all elevations within GNP (PCA 2012). This species spends a majority of their time in terrestrial habitats including forested areas, moist shrub-lands, meadows and avalanche slopes (Government of Canada 2015d). They use a wide variety of aquatic habitats for breeding, including wetlands and temporary pools. The species has been documented as breeding in Rogers Pass (MacHutchon 2007).

Wetland surveys in GNP<sup>4</sup> have found Western Toad in two locations near the project area:

- Rogers Pass Sewage Lagoon: In the riparian area adjacent to the lagoon, 175 m from the TCH, and
- Vent Shaft Wetland: Wetland Located approximately 850m south of the actual vent shaft and 110 m east of the TCH.

This species was carried forward as a VC in the effects assessment.

### Barn Swallow

Barn Swallows historically nested mostly in caves, holes, crevices and ledges in cliff faces, though since European settlement, they have shifted largely to nesting in and on artificial structures, including barns and other outbuildings, garages, houses, bridges, and road culverts (COSEWIC 2011). Barn Swallows prefer various types of open habitats for foraging, including grassy fields, pastures, agricultural crops, lake and river shorelines, cleared rights-of-way, and wetlands. Barn Swallow colonies are present at the Rogers Pass maintenance compound and under some bridges in GNP. Barn Swallows may be found foraging adjacent to the highway.

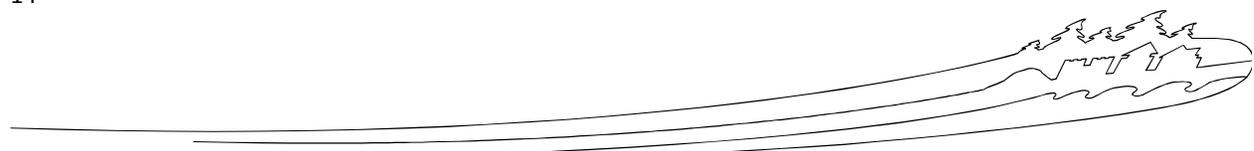
This species was carried forward as a VC in the effects assessment.

### Olive-sided Flycatcher

Olive-sided Flycatcher inhabit forests with open areas containing or surrounded by tall trees, often in association with water. Open areas may include human-made openings and thus edges beside the existing highway right-of-way may offer suitable habitat for the Olive-sided Flycatcher. This species is regularly occurring in GNP and reported in annual songbird monitoring in Mount Revelstoke and Glacier National

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<sup>4</sup> Data provided by MRG Field Unit December 17, 2015.





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Parks (Gillies 2013). There is a federally recommended setback of up to 300 m for active nests (Gregoire 2013). This species was carried forward as a VC in the effects assessment.

### Bats

Little Brown Myotis and Northern Long-eared Myotis) are present in GNP but detailed data on their distributions are not available. A bat survey at Nakimu Caves, a cave system approximately 4 km east of the project at its closest location, confirmed presence of Little Brown Myotis and likely presence of Northern Long-eared Myotis (Kingbird Biological Consultants Ltd. 2014). It is unknown if suitable hibernation locations exist in the vicinity of the project, but forest edge areas surrounding the project may provide suitable foraging and breeding habitat. Both species are regularly occurring in GNP and thus the risk of encountering is moderate. GNP is home to several other species of bats and these will be carried forward as one VC: bats.

### Woodland Caribou

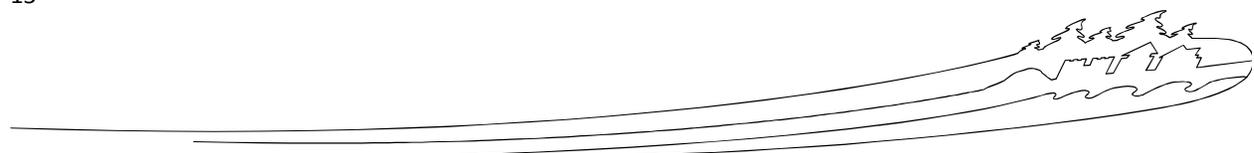
Woodland Caribou that are found within GNP are of the Southern Mountain Population. This population tends to migrate vertically but not over large distances. The Caribou are adapted to living with deep snow, using packed snow to reach tree lichens – one of their primary winter food sources. There are two herds of the Southern Mountain Population known to occur within GNP – the Columbia South herd and the Duncan herd;

Mountain caribou is a SARA species listed as threatened, that is sensitive to long term disturbance. Caribou are considered part of the climax biota because of their dependence on late successional forests and associated lichen forage. Caribou use old-growth and mature coniferous stands across their range. Caribou in the Columbia Mountains primarily inhabit Engelmann spruce-subalpine fir and western red cedar-western hemlock forests >4,000 feet (1,200 m) in elevation with mixed stands of old growth Engelmann spruce-subalpine fir (*Picea engelmannii-Abies lasiocarpa*) preferred in late winter.

The Columbia South caribou herd utilizes Glacier National Park as part of their home range, and as of the last census in 2013 is at 6 animals, numbering at 105 in 1994 (Furk *et al.* 2011 and Legebokow and Serrouya 2013). Approximately 30% of this herd's home range is in Mount Revelstoke and Glacier National Parks (MRG) the remaining 70% on provincial lands. In national parks and provincial lands there is ski touring, and on provincial lands heli-skiing occurs in addition to forestry operations.

The Duncan Valley herd, a part of the Central Selkirks caribou population and uses the Southern portion of the Glacier National Park (the upper Beaver Valley). As of the last census in 2015 the Duncan Valley herd is at 1 animal, compared to 2 in 2012, and 7 in 2010. A small portion of this herd's home range is in Glacier National Park, but historically the Beaver Valley acted as a dispersal corridor between the Columbia South and Duncan Valley herds, with records of 100s of caribou recorded in the 20 mile and 30 miles areas in the 1920s.

The project is not within mapped critical habitat for Southern Mountain Caribou though critical habitat is present within about 4 kilometers of the project (Her Majesty the Queen in Right of Canada 2010). There is one record of a caribou occurrence within about one kilometer of the project (Figure 2). During the construction period, it is possible that a caribou may encounter highway construction activities, but the probability is likely to be low. No caribou-vehicle collisions have been reported near Rogers Pass (Clevenger *et al.* 2014). Given their listing as Endangered by COSEWIC (Table 2), this species was carried forward as a VC in the effects assessment.





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### Wolverine

Wolverine can be found within a wide range of habitats within GNP. Data from the MRG Field Unit indicate several observations of wolverines along the TCH at Rogers Pass and slightly north of Rogers Pass. Wolverines typically utilize a wide variety of forested and alpine habitats and exist in low population densities with accompanying large home ranges. Preliminary results of non-invasive genetic sampling suggest a combined population of 25 individuals in GNP and Mount Revelstoke NP (Pilgrim and Schwartz 2015). Although no wolverine-vehicle collisions have been reported near Rogers Pass (Clevenger et al. 2014), a recent observation was made of a wolverine crossing the TCH at the top of the Illecillewaet curve in January 2016. A wolverine was struck and killed in summer 2015 at the provincial snowsheds, west of Rogers Pass. This species was not carried forward as a VEC as the effects and mitigations are consistent with other large ranging wildlife species.

### Grizzly Bear

Grizzly bears can be found within a wide range of habitats within GNP. Data from the MRG Field Unit indicate a high concentration of incidental observations along GNP roadways and hiking trails (e.g., Balu Pass, Asulkan Valley). Grizzly bears are known to regularly use alder habitats along the TCH. Grizzly bear sightings in GNP are most common at lower elevations (914-1218 m) in spring and at higher elevations (1219-1523 m) in summer (Van Tighem & Gyug 1984). This species was carried forward as a VC in the effects assessment.

### Mountain Goat

Mountain Goats are most closely associated with steep slopes and rocky cliffs but can be found moving through a variety of habitats. They often descend to lower elevations to access and consume mineral soils or deposits (salt licks), either natural or artificial. This species is regularly occurring in GNP and in the Rogers Pass area. Numerous goat-vehicle collisions have occurred along the TCH in the vicinity of the east snowsheds and one collision near the Rogers Pass summit monument (Clevenger et al. 2014). Collisions have been found to be more frequent in June and July. Mountain goats may cross TCH while moving between areas of suitable habitat, and may also be attracted to the road due to road salt. This species was carried forward as a VC in the effects assessment.

### Seed-Eating Birds

Seed-eating birds including White-winged Crossbill, Red Crossbill (*Loxia curvirostra*), Pine Grosbeak (*Pinicola enucleator*), Pine Siskin and Evening Grosbeak (*Coccothraustes vespertinus*) are commonly found along the TCH in winter eating grit from the salt and sand mix applied to the road. Many of these seed-eating birds become casualties from vehicular collisions, sometimes in large numbers. The sand and salt mix applied to the roads includes magnesium chloride (used when very cold) which may have a neurological effects on these birds and reduce their reaction times, compounding the problem (A. Taylor, pers. comm. 2015).

This species guild was carried forward as a VC in the effects assessment.

### Other Species

The Short-eared Owl (*Asio flammeus*), and Spotted Bat (*Euderma maculatum*) are both unlikely to occur in the Project area due to lack of suitable habitat but appeared on database searches (Appendix 5). These species were not carried forward as VCs in the effects assessment.





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### Wildlife Movements and Vehicle Collisions

Clevenger et al. (2015) conducted a study of wildlife-vehicle collisions in Mount Revelstoke and Glacier National Parks. Large mammal collisions in the Rogers Pass area include Black Bear, deer species, Grizzly Bear and Mountain Goat. Further analysis of animal location data and connectivity modelling identified a high priority wildlife-vehicle collision mitigation site at Rogers Pass and recommend a wildlife overpass structure, at approximately km 24+300, which would target mountain goat, grizzly bear and wolverine. The conceptual design of this wildlife overpass is being completed as part of this project, however, the construction of the wildlife overpass is being pursued as a separate project. The effect of the project on wildlife-vehicle collisions is considered under other wildlife VCs.

### Cultural Resources

The project falls within the Rogers Pass National Historic Site. Rogers Pass National Historic Site was declared in 1971 as the area was significant during the completion of the CPR across Canada (PCA 2015b). The Discovery Centre provides the public with the history and culture of the construction of the CPR during the late 1800's.

Additionally, in 2015, a recent review of this national historic site by the HSMBC has expanded its historical significance to include the construction and operation of the TCH through this transportation corridor. As a result, archeological and cultural resources related to the TCH will be evaluated to determine their national significance.

### Archaeological Resources

It is known that at least four aboriginal groups used the region in some capacity; however, no occupation sites have been discovered. First Nations' use within GNP is not well understood (PCA 2015b). The use of the area by the CPR is well understood and resources related to its construction and operation are present in and near the project area. Historic viewsapes associated with the railway and road have been identified. Resources related to road construction and operation have not been identified and may be present.

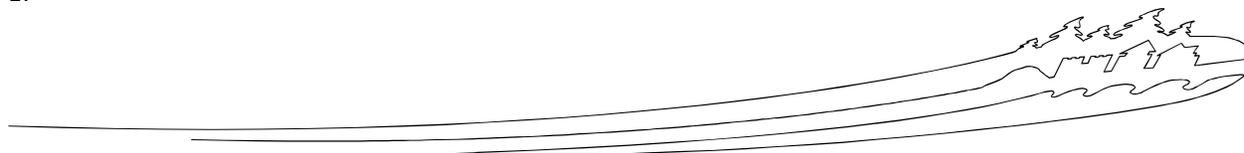
The Heritage Conservation and Commemoration Directorate (HCCD) of PCA completed an Archaeological Overview Assessment (AOA) of the project area. The AOA is included in Appendix 6. The locations of known archaeological sites are shown on the design drawings in Appendix 3.

During the preliminary project design phase, one of the design principles was to avoid known archaeological sites. However some archaeological sites are unavoidable and lie within the project footprint. Furthermore, while some areas of Rogers Pass have been extensively surveyed, others have not. Construction areas within known archaeological sites and others that have high archaeological potential will require Archaeological Impact Assessments (AIAs) prior to clearing and grubbing. The AOA provides a list of areas of archaeological concern (see Appendix 6).

Archaeological Sites was carried forward as a VC in the effects assessment.

### Historic Viewsapes

Historic viewsapes are part of the character-defining elements (CDEs) that embodied the historic, cultural, spiritual and aesthetic values associated with Roger Pass cultural landscape. These historic viewsapes are linked to the commemorative intent. HCCD provided a preliminary list of historic viewsapes at Rogers Pass that may be affected by the project:





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- West Bound from the Discovery Centre to Rogers Pass National Historic Site Boundary (descending):
  - Views of slide paths along Mount Cheops, above to the right.
  - Views of Avalanche Ridge and Mt. McDonald behind, above to the left.
  - Views of Illecillewaet and Asulkan Glaciers to the left on the curve, near Glacier Station.
  - View of Bonny Glacier, above to the left after the curve.
  - Sense of the valley opening up, widening out as one descends; the route ahead is clear.
- East Bound from Rogers Pass National Historic Site Boundary to the Discovery Centre (ascending):
  - View of Bonny Glacier, above to the right before the curve.
  - Views entering the curve of Mt. McDonald and Mt. Sir Donald, straight ahead, above.
  - Views of Illecillewaet Glacier and Asulkan Glaciers to the right on the curve, near Glacier Station.
  - View of Avalanche Ridge and Mt. McDonald on the right, leaving the curve.
  - View of avalanche paths to the left on Mt. Cheops and others.
  - View ahead to wall of mountains: Tupper, Sifton, Hermit with TCH arch in foreground, ascending from the curve.
  - Sense of the valley narrowing, vanishing as one approaches the pass; the way through is not visible at various vantage points.

Historic Viewscapes was carried forward as a VC in the effects assessment.

#### Visitor Experience

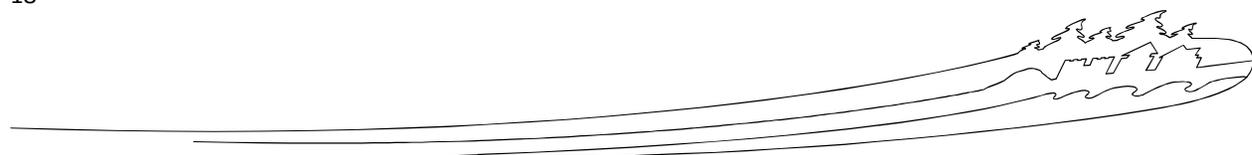
The Rogers Pass area is used by visitors in all seasons and provides a range of visitor opportunities:

- Scenic driving,
- Camping,
- Hiking and mountaineering,
- Ski touring,
- Wildlife viewing, and
- History appreciation.

Visitor facilities that are within or adjacent to the project area include:

- Hermit Trail trailhead,
- Rogers Pass Discovery Centre,
- Balu Pass Trail trailhead
- Abandoned Rails Trail
- Illecillewaet Campground and Picnic Area, and
- Asulkan Valley Trail/1885 Trail trailhead.

Viewscapes and soundscapes above and away from the highway corridor are scenic and natural with little anthropogenic disturbance.





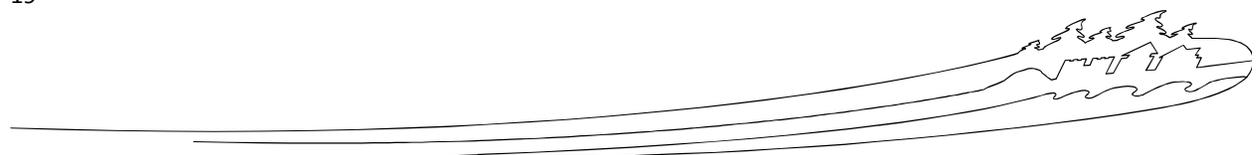
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Visitors to Rogers Pass arrive and depart via the TCH. This section of the TCH is a congested area with known major safety issues related to vehicle speeds and lack of passing opportunities. In particular, the westbound/southbound traffic demonstrates high speed and high-risk passing behaviour at the Illecillewaet curve, which has resulted in multiple fatalities in recent years.

Recreational Opportunities, Viewscales & Soundscapes and Visitor Safety and Health were considered candidate VCs and all three were carried forward as a VC in the effects assessment.

### **Valued Components**

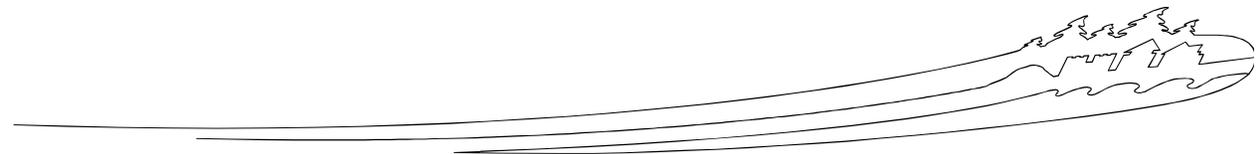
Table 3 provides a summary of the selection of VCs for the Illecillewaet curve assessment, including the candidate VCs, the rationale for selection and inclusion as a final VC that was carried forward to the effects assessment.





**Table 3: Candidate and Final Valued Components Considered for the Illecillewaet Curve Safety Improvements Project**

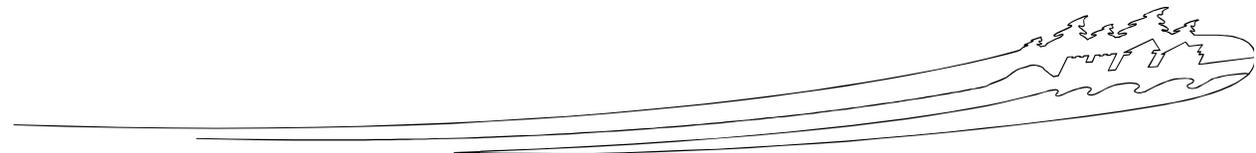
<b>Component Category</b>	<b>Candidate Valued Component</b>	<b>Rationale for Inclusion</b>	<b>Included as Stand-alone VC in Effects Assessment</b>
<b>Air and Noise</b>	Air Quality	Dust and emissions may affect human health and visitor experience. Deposition of dust may affect vegetation. This is an intermediate component and is assessed under Vegetation, Visitor Experience and Human Health.	No
	Noise	Potential to affect Visitor Experience and Wildlife (avoidance). This is an intermediate component and assessed under Wildlife and Visitor Experience.	No
<b>Soil &amp; Landforms</b>	Soil Quality	Spills in work areas may affect soil quality and future use. Risk of spreading existing contaminated soils. Risk to workers from contact with contaminated soils or vapors	Yes
	Soil Compaction	Compacted soils may affect vegetation. An intermediate component that is assessed under Vegetation.	No
	Soil Erosion and Sedimentation	May affect water quality and fish habitat. An intermediate component that is assessed under Fish and Fish Habitat.	No
	Landforms	Rock blasting will modify landforms and landscapes and may affect salamanders and Mountain Goats. An intermediate component that is assessed under Wildlife and Viewscapes.	No





**Table 3: Candidate and Final Valued Components Considered for the Illecillewaet Curve Safety Improvements Project**

<b>Component Category</b>	<b>Candidate Valued Component</b>	<b>Rationale for Inclusion</b>	<b>Included as Stand-alone VC in Effects Assessment</b>
<b>Water</b>	Surface Water Quality	An intermediate component leading to primarily aquatic health (fish and benthic invertebrates) though has other possible effects pathways and is therefore included in the effects assessment.	Yes
	Groundwater Quality	Project interactions with groundwater are not anticipated.	No
	Fish	Watercourses are fish bearing (Bull Trout and Mountain Whitefish). This category represents all fish species potentially present.	Yes
<b>Water</b>	Fish Habitat	Potential for loss of riparian habitat, which is essential for aquatic health. Potential for loss of instream habitat through sedimentation.	Yes
	Benthic Invertebrates	Benthic invertebrates are important indicators of freshwater ecosystem health. Baseline data exists for Connaught Creek. Further evaluation of benthic invertebrates was not considered necessary in the context of the proposed project because measures to protect Water Quality, Fish and Fish Habitat would protect Benthic Invertebrates as well.	No
<b>Flora</b>	Listed Plant Species	Potential for the SARA-listed Whitebark Pine. Known and potential presence of other provincially listed species.	Yes
	Vegetation	Project will result in loss of natural vegetation. Vegetation health and vigour may be affected by soil compaction, trampling and dust deposition.	Yes





**Table 3: Candidate and Final Valued Components Considered for the Illecillewaet Curve Safety Improvements Project**

Component Category	Candidate Valued Component	Rationale for Inclusion	Included as Stand-alone VC in Effects Assessment
<b>Fauna</b>	Coeur d’Alene Salamander	Listed species. Suitable habitat and regularly occurring in GNP.	Yes
	Western Toad	Listed species. Breeds near Rogers Pass.	Yes
	Barn Swallow	Listed species. Present at Rogers Pass.	Yes
<b>Fauna</b>	Olive-sided Flycatcher	Listed species. Potentially suitable edge habitat and regularly occurring in GNP	Yes
	Little Brown Myotis	Listed species. Project area has potential foraging habitat and regularly occurring in GNP.	Yes Under combined Bats VC
	Northern Long-eared Myotis	Listed species. Project area has potential foraging habitat and regularly occurring in GNP.	Yes Under combined Bats VC
	Woodland Caribou - Southern Mountain population	Listed species (Threatened under SARA, Endangered under COSEWIC). Project is not within mapped Critical Habitat though known occurrences near project.	Yes
	Wolverine	Listed species. Documented presence in Rogers Pass.	No

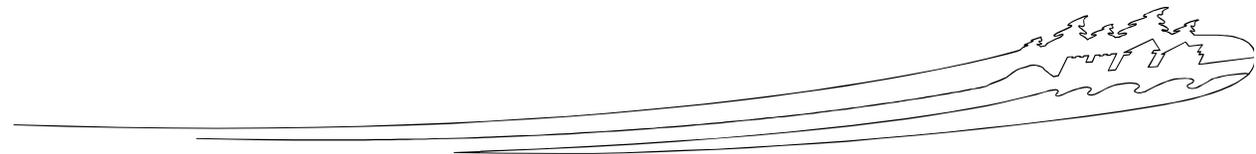




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**Table 3: Candidate and Final Valued Components Considered for the Illecillewaet Curve Safety Improvements Project**

<b>Component Category</b>	<b>Candidate Valued Component</b>	<b>Rationale for Inclusion</b>	<b>Included as Stand-alone VC in Effects Assessment</b>
	Grizzly Bear	Iconic park species that is known to occur in project area, including being encountered crossing the highway.	Yes
	Mountain Goat	Iconic park species, regularly occurring in GNP with potential to be encountered crossing highway.	Yes
	Seed-eating Birds	Includes a number of seed-eating species. Concerns about mortality resulting from bird-vehicle collisions.	Yes
<b>Cultural Resources</b>	Archaeological Sites	Many known archaeological resources in project area.	Yes
<b>Cultural Resources</b>	Historic Viewpoints	Historic viewpoints have been identified and have the potential to interact with the project.	Yes
<b>Visitor Experience</b>	Recreational Opportunities	Potential for effects on visitor access and traffic delays.	Yes
	Viewscapes and Soundscapes	Potential for increased noise and negative visual aesthetics.	Yes
	Visitor Safety and Health	This section of the TCH is a congested area with known major safety issues related to vehicle speeds and passing behaviour.	Yes





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## 7. EFFECTS ANALYSIS

This section provides an analysis of potential effects of construction and operation of the project on the Valued Components identified and described in the preceding section. Effects during the operation phase were considered in terms of additional or incremental impacts beyond the baseline or pre-project condition.

The potential effects described below do not include application of mitigation measures (which are discussed in Section 8) but assume application of routine or standard environmental best management practices.

### Soil and Landforms

#### Soil Quality

##### Construction

- Accidental spills or leaks during construction may adversely affect soils and soil biota, and
- There is known soil contamination in the area of the Parks compound. If contaminated soils are disturbed, they may be spread further if not properly managed. They also pose a health risk if workers come into contact with contaminated soil or vapor.

##### Operation

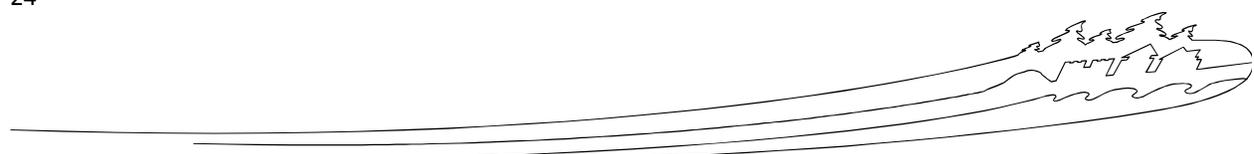
- Accidental spills or leaks from vehicles during operation or during maintenance activities may adversely affect soils. Run-off containing road salt may negatively affect soil chemistry and biota in the immediate vicinity of the roadway. With increased pavement area and consequently increased road run-off, there may be a small, incremental increase in potential impacts to soil quality.

### Water

#### Surface Water Quality

##### Construction

- Construction will require work over and adjacent to watercourses,
- Accidental spills or leaks during construction may enter the Illecillewaet River or Connaught Creek and their tributaries, and
- Stripping, handling, or storing of soils, or drilling into rock has the potential to create sedimentation, which can be released into watercourses downstream, potentially creating harm for fish and fish habitat.





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## Operation

- Surface water may be negatively affected during operation of the road and/or maintenance activities through accidental spills, dust, debris, salt, sand and road run-off. With increased pavement area and consequently increased road run-off, there may be a small, incremental increase in potential impacts to water quality.

## Fish

### Construction

- Fish could be directly harmed during culvert rehabilitation or installation through direct impact or stranding during dewatering, and
- Stripping, handling, or storing of soils, or drilling into rock has the potential to create sedimentation, which can be released into fish-bearing watercourses and directly affect fish.

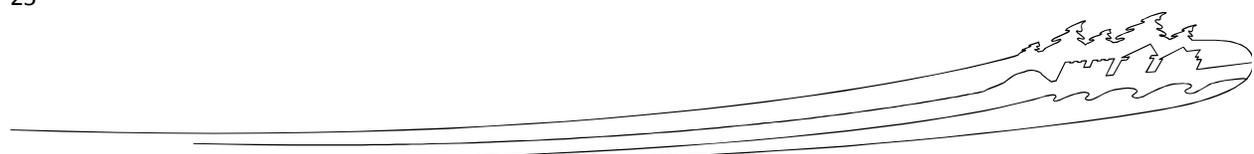
### Operation

- Fish may be negatively affected during operation and/or maintenance through accidental spills, dust, debris, salt, sand and road run-off and during ditch, culvert and drainage management. With increased pavement area and consequently increased road run-off, there may be a small, incremental increase in impacts to fish.

## Fish Habitat

### Construction

- Because the roadway will be wider and culverts longer, there will be a small, incremental loss of fish habitat,
- Removal, rehabilitation and installation of culverts may degrade instream fish habitat,
- Extended culverts and improperly placed culverts (e.g., perched culverts) may create barriers to fish movement,
- Many of the existing culverts are in poor condition and are impeding fish passage. These culverts will be rehabilitated or replaced to improve fish passage. In addition, a new bottomless culvert will be installed over Connaught Creek (at km 22+300), improving fish habitat and passage at this location,
- Clearing and grubbing within 30 m of watercourses may degrade fish habitat through loss of riparian vegetation, and
- An 80 m long downslope retaining wall will be required on the north side of the TCH, beginning at km 27+120. Depending on final design, the retaining wall and associated work area may be within 30 m of the Illecillewaet River.





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## Operation

- Fish habitat may be negatively affected during operation and/or maintenance through accidental spills, dust, debris, salt, sand and road run-off and during vegetation, ditch, culvert and drainage management. With increased pavement area and consequently increased road run-off, there may be a small, incremental increase in impacts to fish habitat.

## Flora

### Vegetation

#### Construction

- The proposed disturbance footprint between the existing edge of pavement and new daylighting will be approximately 18 ha. Much of this area will require new vegetation clearing; however, because the existing gravel shoulder is mostly unvegetated, the amount of new clearing will be less than the total footprint. An MRG Field Unit approved native seed mix will be used to reseed temporary work areas. Some woody vegetation will become established over time but routine vegetation clearing will prevent this in most roadside areas.
- Vegetation in the immediate vicinity of the project may be affected by dust and debris resulting from clearing activities.
- Soils that become compacted by vehicle and equipment use may impact vegetation growth and restoration through decrease in soil permeability, restriction of root growth and reduced availability of nutrients.
- Adjacent vegetation could be affected by an accidental spill of a harmful substance.
- There is potential for the introduction of weeds and/or invasive species from machinery and after vegetation clearing.

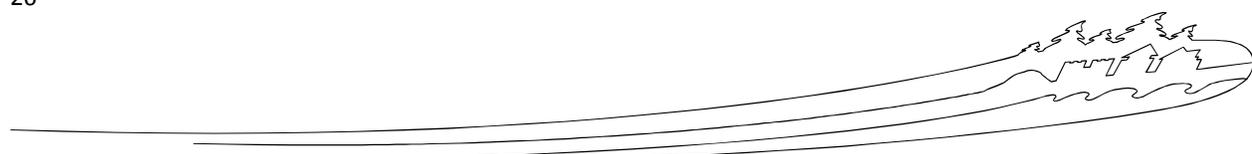
#### Operations

- Native vegetation may be negatively affected by the normal operation of the road and/or maintenance activities via vehicular emissions, accidental spills, dust, debris, salt, sand, run-off, snow clearing and vegetation management. These effects are not expected to increase as a result of the project.

### Listed Plant Species

#### Construction

- The potential for VEMC within the project footprint was considered low.
- No Whitebark Pine was found near the Project footprint and none are expected.
- The Blue-listed (sensitive) Western St. John's Wort is the only record of a listed plant in or near the project footprint. The record description indicates that it is in a wetland at the base on an avalanche chute. If present within the footprint, the individual plants will be destroyed and suitable habitat will be lost due to the new road embankment.





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## Operations

- Listed plant species, if present, may be negatively affected by the normal operation of the road and/or maintenance activities via vehicular emissions, accidental spills, dust, debris, salt, sand, run-off, snow clearing and vegetation management. These effects are not expected to increase as a result of the project.

## Wildlife

### Coeur d'Alene Salamander

#### Construction

- There is a rock road cut that may provide suitable habitat for Coeur d'Alene Salamander, located between km 24+000 to km 24+200, just north of Illecillewaet curve. The highway will not be widened in this area and the habitat will not be altered.
- Based on a site reconnaissance, there does not appear to be other suitable rock habitat within the project area. It is possible they are present in non-rock riparian areas.

#### Operation

- During operations and maintenance, salamanders could be impacted by ditch cleaning, culvert repair and cleaning, water diversion and salt. These effects are not expected to increase as a result of the project.

### Western Toad

#### Construction

- Construction activities can harm Western Toad eggs or tadpoles if they occur in wet areas within the project area.
- Inadequate drainage or irregular surfaces left behind post construction could result in temporary puddles that attract toads to lay eggs but which later dry out resulting in the death of eggs or tadpoles.

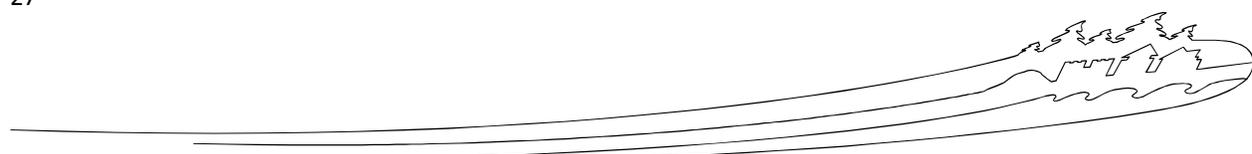
#### Operation

- During operations and maintenance, Western Toad could be impacted by ditch cleaning, culvert repair and cleaning, and any activity that results in water ponding during the breeding season (spring and summer). These effects are not expected to increase as a result of the project.

### Barn Swallow

#### Construction

- Barn Swallows typically nest on artificial structures such as road culverts and bridges; as such, constructed aspects of the project and work areas may provide suitable nesting habitat, although swallows are unlikely to initiate nesting when work is underway.





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- Barn Swallows that are present in or adjacent to work areas when clearing or construction activities commence may be displaced, potentially affecting breeding and/or foraging.

#### Operation

- During operations and maintenance, Barn Swallows could be impacted if they have initiated nesting on built structures. If maintenance activities are appropriately scheduled (i.e., when nest are not active), these effects are not expected to increase as a result of the project.

#### Olive-sided Flycatcher

##### Construction

- Suitable habitat for Olive-sided Flycatcher may be within project work areas and nests may be destroyed if clearing occurs in the bird breeding season (approximately April 1 to August 31).
- Birds that are present in or adjacent to work areas when clearing or construction activities commence may be displaced, potentially affecting breeding and/or foraging.

##### Operation

- During operations and maintenance, Olive-sided Flycatcher nest could be impacted by vegetation management. These effects are not expected to increase as a result of the project.

#### Bats

##### Construction

- Although there is some evidence in BC that bats potentially use tree roots and large tree as hibernacula, existence of hibernacula within the project area is unknown and considered low.
- Tree clearing in the spring and summer (April 1 to August 31) may impact roosting bats or maternal colonies.
- Bats that are foraging adjacent to work areas when construction activities commence may be displaced.

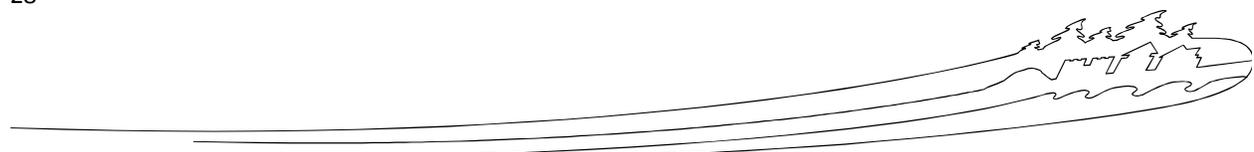
##### Operation

- Bats are not likely to be impacted during operations and maintenance activities.

#### Woodland Caribou

##### Construction

- The project area provides potentially suitable caribou habitat though proximity to the roadway limits its use. The project area is not within mapped critical habitat.
- The potential for caribou to encounter highway construction activities is very low. In the event that caribou are present in the Rogers Pass area during construction, they may be displaced as a result of increased noise and human presence, resulting in temporary disruption or impediment of wildlife movement or use near the work areas.





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## Operation

The primary potential impact to caribou during highway operation is the potential for wildlife-vehicle collisions. When crossing the highway, caribou will be required to traverse a wider distance which may possibly affect their crossing behaviour (i.e., decision to cross) or place them at increased risk of collision. The potential magnitude of this could be low to moderate.

## Grizzly Bear

### Construction

- Grizzly bears are known to occur in the Rogers Pass area and along the TCH. Clearing of natural vegetation will result in a loss of Grizzly Bear food habitat, though it is very small relative to availability in the area.
- If bears are present during construction, they may be displaced as a result of increased noise and human presence, resulting in temporary disruption or impediment of movement or use near the work areas.

### Operation

- The primary potential impact to bears during highway operation is the potential for wildlife-vehicle collisions. When crossing the highway, bears will be required to traverse a wider distance which may possibly affect their crossing behaviour (decision to cross) or place them at increased risk of collision. In addition, the closure of the median access at the campground road and Asulkan Trailhead may decrease the permeability of the highway to bear movement at those specific locations. The potential magnitude of this effect could be moderate given the regular crossing rate and slow reproductive rates of the species.
- Other wildlife mitigations may need to be considered as wildlife movements and crossing change due to new TCH barriers or other obstructions.

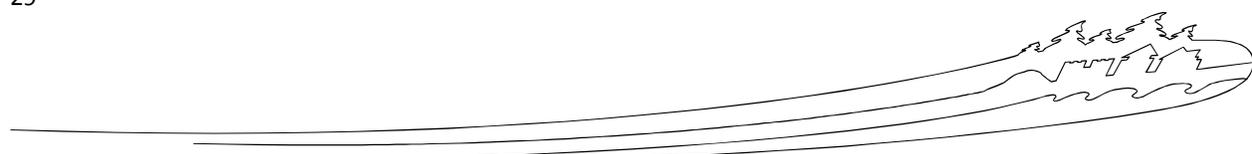
## Mountain Goat

### Construction

- Mountain Goat may occur near work areas and may be displaced as a result of increased noise and human presence, resulting in temporary disruption or impediment of movement or use near the work areas.

### Operation

- The primary potential impact to goats during highway operation is the potential for wildlife-vehicle collisions. When crossing the highway, goats will be required to traverse a wider distance which may possibly affect their crossing behaviour (decision to cross) or place them at increased risk of collision. The potential magnitude of this effect could be low to moderate given the cumulative impact of an increasing trend in Mountain Goat strikes on the TCH within Glacier and Mount Revelstoke National Parks.





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### Seed-eating Birds

#### Construction

- The primary concern with seed-eating birds is vehicle-collisions in winter when they are ingesting grit along the roadway. Because construction will be outside the winter season and further will not involve fast-moving vehicles, construction effects on seed-eating birds is not anticipated.

#### Operation

- The project is designed to enhance traffic flow through the Rogers Pass area. This will allow traffic to more consistently maintain highway speed to the posted limit. This may result in an incremental increase of higher speed vehicles and could result in an increase in mortality of seed-eating birds. In addition, a wider highway may mean increased escape distance for birds feeding on the highway resulting in increased strike susceptibility.

### **Cultural Resources**

#### Archaeological Resources

##### Construction

- Known archaeological resources are present within portions of the footprint and have the potential to be negatively impacted (e.g., destroyed, misplaced, removed) during construction.
- Potential impacts to and recommendations for archaeology have been provide by the HCCD in the AOA:
  - Archaeologists know the railway corridor very well, but not the valley slopes beyond.
  - There are nationally significant archaeological sites here.
  - The cumulative impact to these sites has already been high.
  - Because they cannot be avoided, an Archaeological Impact Assessment is needed for the most vulnerable sites, and monitoring is needed in many other areas.
  - AIA work must be done while the ground is not frozen.

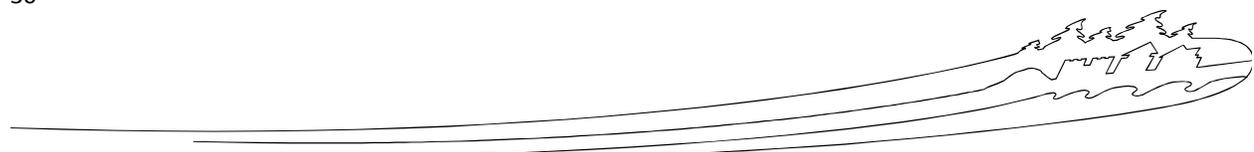
##### Operation

- During operations, archaeological resources can be affected by any activity involving ground disturbance and existing restrictions and accidental finds protocols must be followed. Once the project is complete, further impacts to cultural resources as a result of the project are not anticipated.

#### Historic Viewscapes

##### Construction

- During construction, the form and character of the TCH will be temporarily altered and historic viewscapes may be obscured through presence of construction equipment and temporary facilities.





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## Operation

- Although the highway alignment is not changing, the form and character of the TCH will change with the addition of a new travelling lane.
- The historic viewsapes identified in Section 6 will not be changed by the project.

## Visitor Experience

### Recreational Opportunities

#### Construction

- Access to all facilities will be maintained throughout project construction.
- Construction activities will cause traffic delays and may result in a negative experience for Park visitors.

#### Operation

- Park recreational facilities will generally remain unchanged, but there will be impacts of varying significance (below).
- Hermit Trailhead will be enhanced through provision of additional parking and the opportunity for additional day use amenities.
- Access to the Rogers Pass Discovery Centre will be affected by changes to the frontage road, highway access and nearby parking opportunities.
- The visitor experience at the Summit of Rogers Pass Day-Use Area and the Abandoned Rails Trail will be affected by any loss of green space and forest coverage.
- There will be a small increase in travel times and navigational complexity for those accessing or departing Asulkan trailhead or Illecillewaet campground when entering from the east and departing to the west which may lead to opportunity costs and potential for lost revenue.

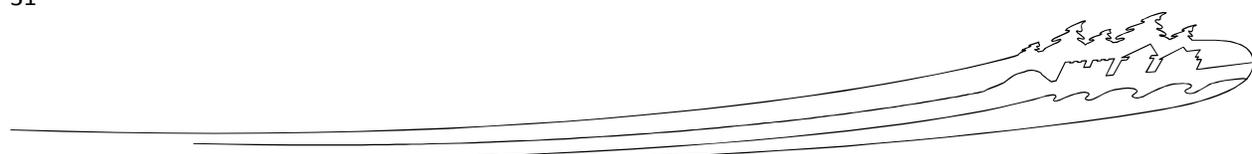
### Viewsapes and Soundscapes

#### Construction

- Temporary noise from construction activities may result in a negative experience for visitors.
- Construction activities will have negative aesthetics and may result in negative experience for GNP visitors.

#### Operation

- After construction is complete, the project area viewsapes and soundscapes will be similar to the pre-construction condition. The exception will be the Abandoned Rails Trail, where loss of the forest buffer will expose visitors to more pronounced traffic noise.





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## Visitor Safety and Health

### Construction

- The use of machinery, and the transport of materials and equipment will increase vehicular traffic to the project site and thus increase emissions and dust mobilization into the air, thus temporarily affecting human health.
- Depending on wind direction, changes in air quality during construction (e.g., dust, fumes) may negatively affect nearby wildlife and park visitors using recreational trails in the vicinity.

### Operation

- The purpose of the project is to increase vehicular safety, and will therefore result in a positive effect on visitor safety by reducing incidences of injury or mortality.

## **8. MITIGATION MEASURES**

This section describes the environmental management practices and specific Valued Component mitigation measures that will be applied.

### **Guidance and Specifications**

The project will be conducted according to and in compliance with all PCA guidance and specifications:

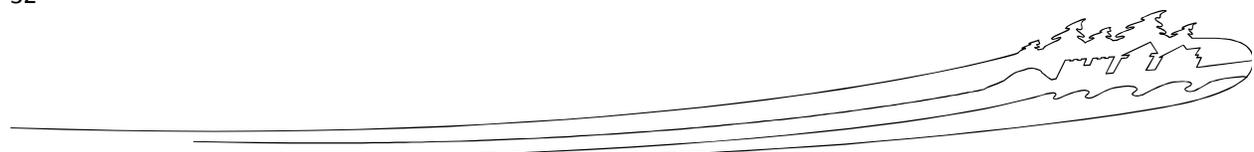
- Parks Canada National Best Management Practices for Roadway, Highway, Parkway and Related Infrastructure (PCA 2015d);
- Concrete Waste Management (PCA 2010);
- Nesting Bird Windows Mt Revelstoke & Glacier National Parks (MRG 2012a);
- Best Management Practice 01.00 – Vegetation Removal (MRG 2015);
- Contaminated Soils Guide June 2012 (MRG 2012b);
- Best Management Practices – Asphalt applications – Mt Revelstoke & Glacier National Parks (MRG 2011); and
- General Guidelines for Work within 50 m of Salamander Sites (Ohanjanian. 2003).

It will be expected that project staff and contractors will understand and comply with all National Park regulations within the Park. Pre-work briefings/meetings, including an Environmental Briefing, are required to address environmental sensitivities within the project site, such as potential to harm vegetation, wildlife interactions, equipment spills or leaks. This briefing will be scheduled two weeks prior to contractors arriving on site.

### **Environmental Protection Plan**

An Environmental Protection Plan (EPP) will be prepared and provided to MRG for comment and review two weeks prior to work commencement. The EPP will:

- Be available to all staff during project activities;





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- Include an access plan including access routes, traffic safety, type of equipment used for various construction phases, and lay down areas in order to prevent/minimize disturbance to vegetation and soils. Lay down areas will occur on paved and/or hardened surfaces, where possible. Any new laydown areas will require approval from the assigned MRG Field Unit Environmental Surveillance Officer (ESO);
- Contain spill response procedures, including appropriate containment, storage, security, handling, and transportation of applicable materials/substances, spill kit requirements, and emergency response contacts. The Material Safety Data Sheets (MSDS) for all chemicals used will be made available on-site;
- Include an Emergency Response Plan that outlines procedures to follow in case of emergency (e.g., wildlife encounter, equipment malfunction/failure, fire, avalanche);
- Detailed environmental monitoring and rehabilitation;
- Erosion and sediment control plan, including measures to appropriately winterize the site;
- Include provisions to reduce human-wildlife interactions;
- In-stream works plan including culvert design; and
- Include a traffic safety or management plan.

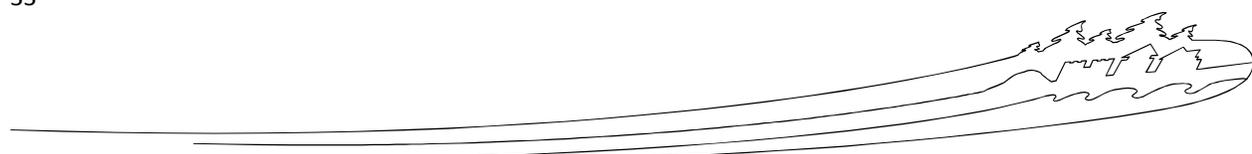
Further details will likely be required in the EPP depending on final design. The MRG Field Unit will be consulted throughout the design phase of the project and in the development of the EPP.

All staff employed at the construction sites shall be instructed by the ESO during an Environmental Briefing regarding their individual and collective responsibilities to ensure that an avoidable adverse environmental impact does not arise from their activities and/or personal decisions. The ESO, assigned by MRG Field Unit, will conduct periodic visits to ensure project operations are being conducted in accordance with identified environmental protection measures. The ESO maintains the right to halt work if required.

All spills (e.g., hydraulic fluids) will be reported immediately according to the Mount Revelstoke-Glacier spill response protocol. In the event of any fluid spills or leaks exceeding 5 litres or any spill quantity in or near water, the Spill Response Plan must be followed including immediate containment, cleanup/mitigation, and immediate reporting to Park's Canada Dispatch and the ESO. Any absorbent materials used in the clean-up or soils contaminated by the spill will be disposed of in the appropriate facilities and transported in accordance with the Transportation of Dangerous Goods Regulations. All spills, regardless of size or location, will be reported to the ESO.

Wildlife are likely to be observed or encountered during construction and the following will be adhered to:

- Notify the ESO immediately of any dens, litters, nests, carcasses (road kills or other), wildlife encounters (for species of interest as directed by the ESO), or carnivore (bears, wolves or cougars) observations on or around the worksite.
- If wildlife is observed at or near the work site, allow the animal(s) the opportunity to leave the work area to the surrounding habitat and away from areas of potential conflict.





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- If potentially dangerous wildlife (e.g., bear, cougar, wolf, coyote, deer, elk, moose, mountain goat) persistently enter the work area or display aggressive behaviour, the contractor will immediately notify Jasper Dispatch (877-852-3100), will stop work and safely evacuate the area.
- The contractor will ensure that all workers receive a wildlife awareness briefing, including the use of bear spray. Bear spray will be mandatory on site.
- Secure all materials that might attract wildlife (e.g. petroleum products, human food, recyclable food and drink containers and garbage).
- No feeding, baiting or luring of any wildlife (including bears, small mammals, birds); do not approach or harass wildlife in any way. Notify the ESO immediately if wildlife obtain garbage or human food. If wildlife get into attractants that have been intentionally or accidentally left out, individuals or the contractor could be charged under the Canada National Parks Act Regulations.

## **Soil and Landforms**

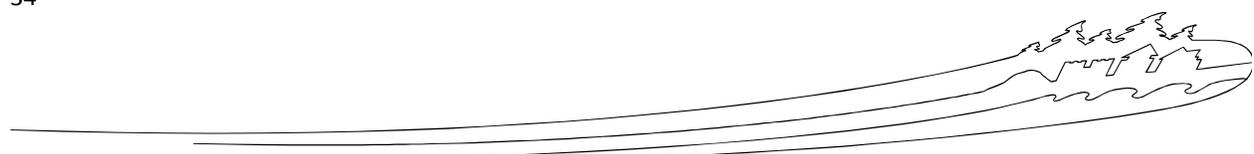
### Soil Quality

#### Construction

- Soil stripping will be minimized. If present, topsoil will be retained to facilitate recovery.
- All fuels, gasses, or harmful substances will be contained within the appropriate and approved containers, and transported according to the Transportation of Dangerous Goods Regulations.
- Prior to use on the work areas, all equipment will be inspected for leaks of any kind. Any detected leaks will be addressed immediately. Inspections will be done daily and recorded. Equipment stored overnight will be stored on tarps with appropriate containment if required.
- In areas where contaminated soils are identified during construction activities, the area will be managed for human and ecological health risks. This may include collecting soil samples to submit to a lab, additional excavations to attempt delineation and consultation with contaminated sites risk management specialists.
- Soil from known contaminated sites will be characterized prior to removal and then sent for disposal to an appropriate waste management facility outside the Park.
- If workers encounter contaminated soils, workers will wear the necessary Personal Protective Equipment to eliminate exposure risk.

#### Operation

- No additional mitigation measures are required as a result of the project.





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## **Water**

### Surface Water Quality

#### Construction

- Work will be undertaken in such a manner as to prevent the release of sediment-laden water, raw concrete or concrete leachate, or any other deleterious substance into a watercourse, tributary or drainage ditch which leads to fish habitat.
- Fuels, gases, or other deleterious substances will not be stored where leaks and spills have the potential to travel down gradient and enter any watercourse.
- Effective sediment and erosion control measures will be installed before starting work near watercourses. Sediment and erosion control measures will be inspected regularly during the course of construction and repairs shall be made as necessary.
- The site will be secured against erosion during any periods of construction inactivity or shutdown.
- Work within a 30 m buffer of watercourses requires the close oversight of a Qualified Environmental Professional (QEP) and the HES Departmental Representative. Soils disturbed as a result of vegetation clearing within the 30 m buffer of watercourses should be stabilized in as timely a manner as possible to prevent mobilization of sediment to the watercourse.
- Machinery, equipment, and construction personnel will not enter any watercourse associated with the project. All work will occur above the high water mark and in a manner that minimizes disturbances to the natural materials and vegetation that contribute to fish habitat or stream channel stability.
- The clearing of riparian vegetation will be minimized where practical. Riparian vegetation will be re-established as soon as possible. The MRG Fire/Vegetation specialist will be consulted regarding appropriate reclamation measures, including but not limited to rates of reseeding, live-staking and on-going site monitoring.
- Machinery washing and fuel storage is to be at least 100 m away from any watercourse.
- Refueling and servicing (e.g., equipment lubrication) will ideally be at least 100 m away from any watercourse. Because very little of the project area is more than 100 m from a watercourse, locations within 100 m of a watercourse may be required and determined in consultation with the ESO.
- In the event of any fluid spills or leaks exceeding 5 litres or any spill quantity to water all other work shall be stopped and all personnel devoted to spill containment and cleanup.

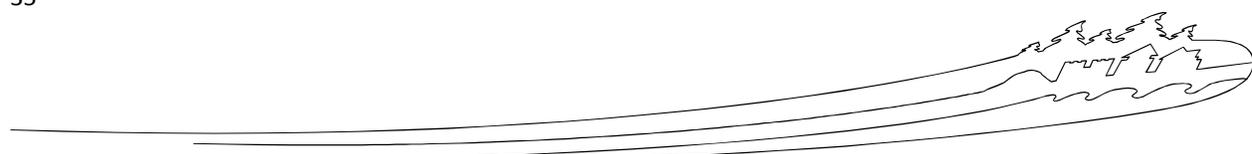
#### Operation

- No additional mitigation measures are required as a result of the project.

### Fish

#### Construction

- Direct effects of sediment on fish will be minimized by using the practices specified under Water Quality.





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- Work will be conducted according to BC Ministry of Environment's Guidebook for Instream Work (<http://www.env.gov.bc.ca/wld/instreamworks/index.htm>) and Department of Fisheries and Oceans Canada (DFO) guidance on projects near water (<http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html>).
- For watercourses known or expected to support fish, instream work will be conducted during periods of least risk to fish if possible. The DFO reduced risk window is July 1 to July 31 for Bull Trout. For Mountain Whitefish, it is June 1 to September 15. Therefore, in-stream work outside July 1 to July 31 will only be conducted if approved by MRG Field Unit and DFO.
- All in-stream work will be conducted in isolation of water and fish will be salvaged during dewatering. Full details regarding in-stream works, including but not limited to identifying number of pumps, pump capacity, dam designs, screen size and monitoring will be provided in the EPP.
- All existing culverts that are in poor condition or not to current standards will be replaced to improve water connectivity and fish passage. Culvert specifications will be provided in the EPP.

#### Operation

- No additional mitigation measures are required as a result of the project.

#### Fish Habitat

##### Construction

- Removal, rehabilitation and installation of culverts will be conducted in such a manner to minimize the disturbance footprint.
- Direct effects of sediment on fish will be minimized using the practices specified under Water Quality.

##### Operation

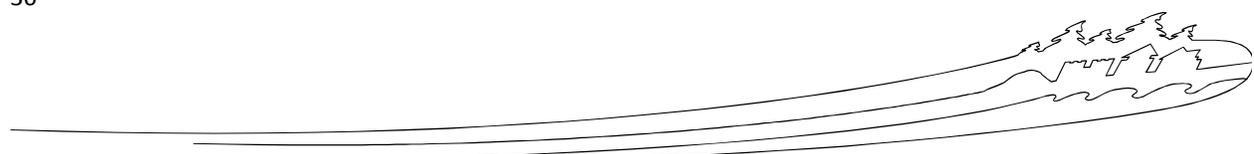
- No additional mitigation measures are required as a result of the project.

#### **Flora**

#### Vegetation

##### Construction

- Staging equipment, parking for vehicles, materials, etc. must be kept to existing hardened surfaces.
- If vegetation clearing is to occur within the bird breeding window (April 1 to August 31), approval must be obtained by the MRG FUS and pre-clearing bird nest surveys completed by a QEP will be required to ensure that no active nests are destroyed. If an active nest of any bird species is found, a no-disturbance zone will be established and the area will remain undisturbed until young have fledged.





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- All areas to be cleared will be clearly marked and no vegetation will be cut or cleared without the direct approval of MRG Field Unit.
- The Contractor is responsible for all construction equipment that could transport invasive plants into the Project zone. Vehicles must be thoroughly cleaned and free of soil and weed seeds prior to arrival on site. Contractor's equipment should be cleaned regularly, with additional attention to movement between sites to minimize spread of invasive plants. Contractor's equipment and vehicles should avoid staging, parking and turning around at sites where invasive plant infestations exist.
- To prevent the spread of invasive plants, the contractor will ensure that soils, seeds, and debris attached to clothing, footwear and construction equipment to be used on the Project Sites have been removed outside GNP, prior to arrival on the work site, and before leaving the area. Vehicle undercarriages, wheels, blades/buckets and footwear will receive special attention.
- Prior to work commencement, the MRG Fire/Vegetation specialist will be consulted to identify if any pre-work control of invasive species is required.
- If invasive non-native species are identified on-site, MRG Field Unit will be notified to determine appropriate measures of treatment. The Environmental Monitor on site will be trained and qualified to identify invasive non-native plant species.
- The Contractor is responsible for seeding all disturbed areas and exposed soils with MRG approved seed mixes to help prevent invasive plant infestations. Seeds must be worked into the soil to improve germination.  
MRG FU staff shall monitor sensitive sites and wetlands adjacent to project works for potential invasive plant spread. Where found, the MRG FU will control weeds appropriately according to site restrictions (i.e., mechanical control/ hand-pulling in wetland areas).
- The Project will provide for the cost of monitoring seed germination, native plant establishment (including native shrub planting) and remediation of invasive plants at a rate of \$1000/ha of disturbed area per year over a period of three years. Native shrub staking will occur at disturbed sites where shrub establishment is required to accelerate re-vegetation and reclamation to prevent invasive plant establishment.
- The contractor will develop a fire prevention plan as part of the EPP. The fire prevention plan will comply with applicable Parks Canada fire prevention policies.
- During clearing activities, trees will be felled towards the project to avoid disturbing adjacent vegetation outside of the project area clearing limits.

#### Operations

- No additional mitigation measures are required as a result of the project.





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## Listed Plant Species

### Construction

- The location of the record of the Blue-listed (sensitive) species St. John's Wort located near the project footprint will be determined. If present within the footprint, the MRG Field Unit will be contacted to discuss management options, such as transplanting.

### Operations

- No additional mitigation measures are required as a result of the project.

## Wildlife

### Coeur d'Alene Salamander

#### Construction

- Although there is a rock cut that may provide suitable habitat for Coeur d'Alene Salamander located between km 24+000 to km 24+200, it will not be within the work areas and no surveys are required.
- It is possible Coeur d'Alene Salamander may be present in other riparian areas. To minimize possible effect on salamanders in these areas, coarse woody debris will be left or restored during culvert repair and replacement to reduce alteration to habitat, wherever possible.
- To prevent direct mortality from blasting, use pry bars or s-mite and not dynamite.
- Do not dump waste materials including sediment closer than 50 m from any rocky formation, boulder pile or stream banks.
- During culvert repair and maintenance, maintain water flow and minimise disturbance to site.
- Move debris to downstream of culvert. Do not remove the material from site.

#### Operation

- Ditching will be conducted in consultation with MRG. It will occur as minimal and as infrequent as possible in areas where Coeur d'Alene salamander are likely to occur.
- At the base of rock walls, do not disturb until temperatures are less than 4 degrees, and only disturb ½ m deep.
- If mitigations for alien and invasive plants are required, use biological control for knapweed and use hand or mechanical removal for other species.
- If safety allows, apply gravel and minimise salt use.





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### Western Toad

#### Construction

- Western Toads may potentially breed in water bodies and wetlands in the project sites. They may also breed in temporary pools and tire ruts within the work areas. If pools, wetlands and water-filled tire ruts are present in areas directly impacted by construction activities in spring and summer, the proponent will conduct pre-work Western Toad surveys. If toads are present, MRG Field Unit will be contacted to discuss options to relocate toads to other locations.
- High numbers of western toadlets are often observed migrating from the lagoon towards the apartment buildings within the maintenance compound and toward the TransCanada Highway in the fall. If any toadlets are observed, MRG Resource Conservation will be contacted for advice on how to move forward.
- The final surface will have good drainage and be left in a smooth condition to avoid creating puddles that attract toads to lay eggs but which later dry out to kill the eggs or tadpoles.

#### Operation

- No additional mitigation measures are required as a result of the project.

### Barn Swallow

#### Construction

- Clearing and Grubbing should occur outside of the Nesting Bird Window, as per the Nesting Bird Windows Mt Revelstoke & Glacier National Parks (MRG 2012a) and Best Management Practice 01.00 – Vegetation Removal (MRG 2015);
- If active Barn Swallow nests are present on structures that will be affected by construction activities, MRG Resource Conservation will be contacted to determine the appropriate action.
- Environment and Climate Change Canada recommends setbacks from active Barn Swallow nests up to 100 m, depending on the nature of adjacent disturbance.

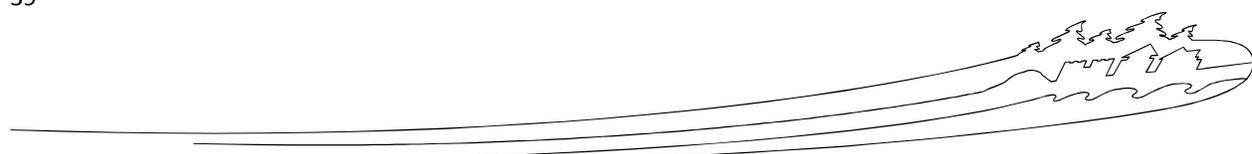
#### Operation

- If active Barn Swallow nests are present on structures that will be affected by maintenance activities, MRG Resource Conservation will be contacted to determine the appropriate action.

### Olive-sided Flycatcher

#### Construction

- Clearing and Grubbing should occur outside of the Nesting Bird Window, as per the Nesting Bird Windows Mt Revelstoke & Glacier National Parks (MRG 2012a) and Best Management Practice 01.00 – Vegetation Removal (MRG 2015);





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- If vegetation clearing is to occur within the bird breeding window (April 1 to August 31), approval must be obtained by the MRG FUS and pre-clearing bird nest surveys completed by a QEP will be required to ensure that no active nests are destroyed. If an active nest of any bird species is found, a no-disturbance zone will be established and the area will remain undisturbed until young have fledged.
- If nesting behaviour is observed outside of the Besting Bird Window, MRG Resource Conservation will be contacted to determine the appropriate action.
- Environment and Climate Change Canada recommends setbacks from active Olive-sided Flycatcher nest up to 300 m, depending on the nature of adjacent disturbance.

#### Operation

- No additional mitigation measures are required as a result of the project.

#### Bats

##### Construction

- Tree clearing in the spring and summer (April 1 to August 31) may impact roosting bats or maternal colonies. An assessment of the need for bat roost surveys will be conducted if clearing occurs during this period.

##### Operation

- No additional mitigation measures are required as a result of the project.

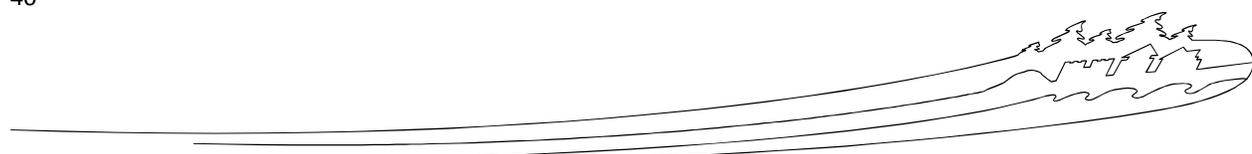
#### Woodland Caribou

##### Construction

- In the unlikely event that caribou are present in the Rogers Pass area during construction, they may be displaced as a result of increased noise and human presence, resulting in temporary disruption or impediment of wildlife movement or use near the work areas. Most work will occur during daylight hours and there will often be at least eight hours per day without construction activity. This will provide caribou and other wildlife that are looking to cross the TCH an opportunity to do so without construction noise and human presence.
- If caribou are present in any active work area, work will be temporarily halted until the animal has left the area.

##### Operation

- Other wildlife mitigations may need to be considered as wildlife movements and crossing change due to new TCH barriers or other obstructions. For example, construction of jump outs on shoulders and in median/jersey barriers, temporary holding of traffic, implementation of wildlife detection system and associated signage.





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- Construction of a wildlife overpass in this area would likely mitigate adverse effects related to reducing the permeability of the highway. The preliminary design of a wildlife overpass is being carried out as part of this project. MRG FU is actively pursuing the construction of a wildlife overpass as a separate project.

### Grizzly Bear

#### Construction

- Most work will occur during daylight hours and there will often be at least eight hours per day without construction activity. This will provide Grizzly Bears and other wildlife that are looking to cross the TCH an opportunity to do without construction noise and human presence.
- If bears are present in any active work area, work will be temporarily halted until the animal has left the area.

#### Operation

- Other wildlife mitigations may need to be considered as wildlife movements and crossing change due to new TCH barriers or other obstructions. For example, construction of jump outs on shoulders and in median/jersey barriers, temporary holding of traffic, implementation of wildlife detection system and associated signage.
- Construction of a wildlife overpass in this area would likely mitigate adverse effects related to reducing the permeability of the highway. The preliminary design of a wildlife overpass is being carried out as part of this project. MRG Field Unit is actively pursuing the construction of a wildlife overpass as a separate project.

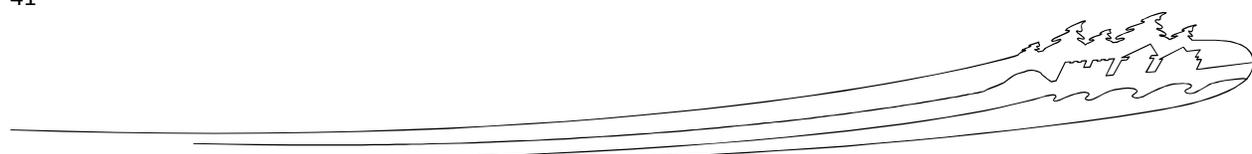
### Mountain Goat

#### Construction

- Most work will occur during daylight hours and there will often be at least eight hours per day without construction activity. This will provide goats and other wildlife that are looking to cross the TCH an opportunity to do without construction noise and human presence.
- If goats are present in any active work area, work will be temporarily halted until the animal has left the area.

#### Operation

- Other wildlife mitigations may need to be considered as wildlife movements and crossing change due to new TCH barriers or other obstructions. For example, construction of jump outs on shoulders and in median/jersey barriers, temporary holding of traffic, implementation of wildlife detection system and associated signage.





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### Seed-eating Birds

#### Construction

- The seed-eating bird-vehicle collision issue relates to highway operation and there are no mitigation measures specific to the construction phase, because construction will not occur in winter.

#### Operation

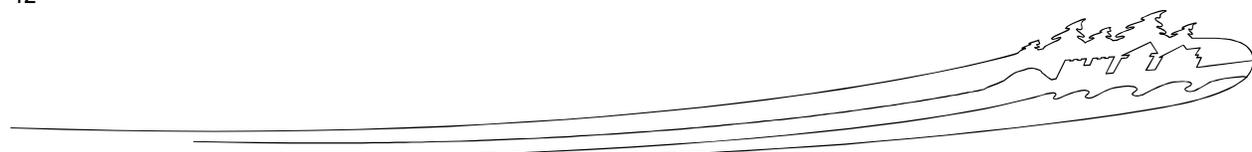
- Use of signage warning motorists to slow down and honk to avoid hitting seed-eating birds feeding on the roads in the winter is recommended.
- Ongoing dialogue between MRG Field Unit, HES and the Highway Operations Unit will be required to develop strategies to further mitigate effects to seed-eating birds.

### Cultural Resources

#### Archaeological Resources

#### Construction

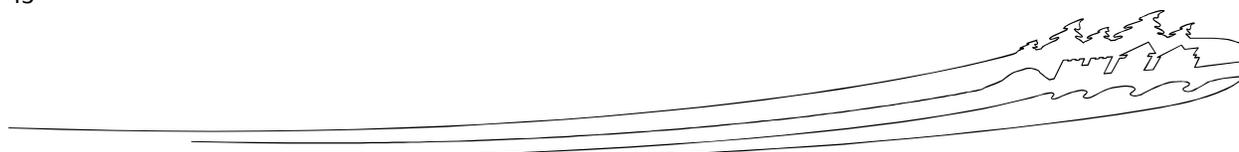
- The archaeological mitigation measures described in the Archaeological Overview Assessment include a requirement for Archaeological Impact Assessments in select areas and for close monitoring during construction in other areas (Table 4).
- The most sensitive areas are within the second phase of work, from the summit monument area north and east to the snowsheds. The Archaeological Impact Assessments will be completed in the late spring/early summer of 2016, in advance of clearing and grubbing activities that are scheduled for September and October 2016. Additional mitigations may arise from the AIAs.
- For all areas, even if not in areas identified as high priority, a chance find protocol will be developed and will include the following (adapted from the AOA):
  - If significant features (i.e., structural remains and/or high artifact concentrations) are encountered, work will stop in the immediate area.
  - Photographs and a GPS coordinates will be recorded, and the site manager and HES informed.
  - The site manager will then contact the MRG Field Unit and Parks Canada's Terrestrial Archaeology section for advice and assessment of significance that will in turn determine what will be required to mitigate the chance find.





**Table 4: Archaeological Mitigation Measures for the Illecillewaet Curve Safety Improvements Project.**

Km	Known Site Names	Concern	Mitigation action
20+840 – 22+375 Map sheets 3, 4 and 5.	411T44, Rogers Pass Station #2 on south side of TCH, 1886 – 1899 and includes up to archaeological site 411T5, Rogers Pass Station and yards.	Immediately south of TCH; probably impacted by original TCH construction; while no vegetation clearing is shown on project plans, any expansion of current alignment to the south will impact the site; new Hermit Hut trailhead road and parking on north side of TCH may impact resources associated with site. There is a strong probability of scatter of historic artefacts and features, relating to Rogers Pass siding and stations between the Hermit Hut trail parking area and the Rogers Pass operations centre at 22+375.	Monitor during clearing and grubbing, and during construction of Hermit Hut trailhead and parking on north side of highway
22+375-23+100 Map sheets 5 and 6	Rogers Pass stations 3 and 4, summit siding (411T5, 1247T)	Dense concentration of rail grades, sidings, structures, refuse deposits associated with two different sidings and stations; proposed vehicle ponding area has not been well surveyed ever, and it will have cultural resources; even if surface is currently disturbed by paving, there may well be buried resources; hydrocarbon contamination from industrial use	AIA needed before project begins, to flag known features, and particularly to assess ponding area





**Table 4: Archaeological Mitigation Measures for the Illecillewaet Curve Safety Improvements Project.**

<b>Km</b>	<b>Known Site Names</b>	<b>Concern</b>	<b>Mitigation action</b>
23+100 – 23+500 westbound Map sheets 6 and 7	Site 411T6, snowshed on 1885 grade	Shed and grades clearly visible; grubbing and clearing line comes very near to east edge of snowshed feature, which is too close and could damage the feature; removal of vegetation exposes remains to erosion and snow load. Park developing an interpretive trail through these features.	Do not clear vegetation right up to snowshed and abandoned grade, maintain a wider buffer. An AIA needed before clearing begins, to clearly flag the resources
23+500 – 23+700 westbound Map sheet 7	None; snowsheds that were in this area have been destroyed by mudslide	No concerns	None
23+700 – 24+250 westbound Map sheets 7 and 8	Site 411T8, snowshed on 1885 grade immediately north of monument and crossing over to south of highway.	Shed and grades clearly visible; grubbing and clearing line comes right up to east edge of snowshed feature, which is too close and could damage the feature; removal of vegetation exposes remains to erosion and snowload. Park developing an interpretive trail through these features.	Do not clear vegetation right up to snowshed and abandoned grade, maintain a wider buffer. An AIA needed before clearing begins, to clearly flag the resources.
24+160 – 24+250 westbound	TCH monument parking lot, 1885 grade passed under this, probably destroyed	Traces of old grade visible on north and south edges	Monitor and document before any repaving or work on access roads
24+250-26+600 Map sheets 8,9,10,11,12	Section between summit and Glacier siding and Glacier Warden Station.	Old railgrade on the east side of highway. No concerns.	None.
26+700-27+000 Map sheet 12	Glacier warden station, 23T, and beginning of Glacier House Tally-ho road	Structural features and levelled platforms very near current highway cutbank	Monitor before construction, record current condition; avoid





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**Table 4: Archaeological Mitigation Measures for the Illecillewaet Curve Safety Improvements Project.**

<b>Km</b>	<b>Known Site Names</b>	<b>Concern</b>	<b>Mitigation action</b>
26+800-28+000 Map sheets 12, 13, and 14	Glacier siding, 411T42, west portal work camp	Scatter of artefacts, structural remains	AIA required to determine whether any structural or artifacts are present in this area prior to vegetation removal. Monitor during clearing and grubbing. Depending on results of AIA, archaeological monitoring may be required.
28+000 – 27+800 Map sheet 14	-	New turnaround construction	Monitor during clearing and grubbing
28+000-29+100, east and west bound except for area noted below for Cambie siding. Map sheets 14 and 15	-	No concerns	None
28+960-29+100. East and west bound Map sheet 16	Cambie siding 411T31 and 411T50, construction work camp (continues W of project area)	Scatter of structural remains, historic artefacts	Monitor during clearing and grubbing, both sides TCH

**Operation**

- No additional mitigation measures, beyond what is already in place, are required as a result of the project.





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## Historic Viewscapes

### Construction

- Prior to construction, recording of current conditions in relation to the historic viewscapes will be conducted by the MRG Field Unit in collaboration with National Office to document the cultural and spiritual beliefs related to the mountain landscapes theme. This recording will contribute to conveying the history of the CP railway as well as the TCH, both part of the commemorative intent of Roger Pass designation. This work will be conducted in conjunction with mitigations that have already approved under the Avalanche Mitigations project (a separate project in MRG).

### Operation

- No additional mitigation measures are required as a result of the project.

## **Visitor Experience**

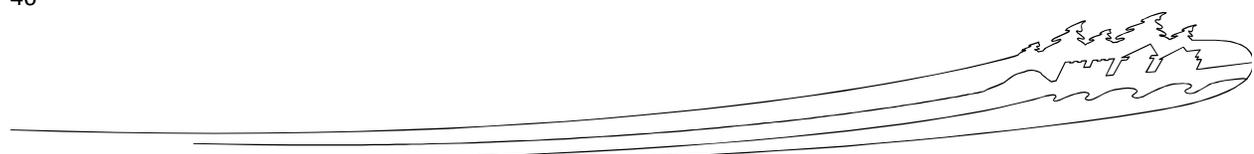
### Recreational Opportunities

#### Construction

- Access to all facilities will be maintained throughout project construction.
- The MRG Field Unit will be kept apprised of timelines, work periods, and construction activities so that their staff (e.g., Discovery Centre and media) can provide information to the public to ensure no additional safety risks are imposed on recreational users in the vicinity of the project work areas during construction.
- Construction activities will take place within the designated hours which will be determined in consultation with MRG Field Unit. No work will be permitted on Civic Holidays or long weekends unless prior written approval is granted. A traffic accommodation plan must be approved prior to construction.
- Road closures during peak traffic times will be avoided.
- To reduce noise and air pollution, construction equipment will be turned off when not in use, all equipment and vehicles will be operated at optimal/efficient performance, and carpooling of personnel will be encouraged as much as possible.

#### Operation

Park recreational facilities will remain unchanged, with the exception of Hermit Trailhead, which will be enhanced through provision of additional parking and opportunity for additional day use amenities, and traffic access changes to Illecillewaet campground, Asulkan parking lot and the Discovery Centre.





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### Viewscapes and Soundscapes

#### Construction

- All construction equipment will be maintained to ensure they operate at optimal performance to reduce noise and air emissions.
- Staging and laydown areas and the office trailer area will be kept in a tidy condition.

#### Operation

- After construction is complete, the project area viewscapes and soundscapes will be similar to the pre-construction condition at most locations. At the Abandoned Rails Trail, a forest buffer must be left in place along the east side of the original trail, to provide some attenuation of highway traffic noise and to reduce the intrusion of traffic into the historic environment viewscape.

### Visitor Safety and Health

#### Construction

- Dust generated by project activities will be controlled by covering stockpiles and, if necessary, use of a water truck to wet down dusty areas.
- No motor vehicles or other equipment should idle when not in use, unless required under extenuating circumstances, in order to reduce air emissions and noise pollution.
- A traffic accommodation strategy or management plan will be prepared to address contractor and public safety around the site.
- The contractor is responsible for posting road signage (e.g., trucks turning, or reduced speed) to ensure public safety.

#### Operation

- No additional mitigation measures, beyond what is already in place, are required as a result of the project.

## **9. PUBLIC/STAKEHOLDER ENGAGEMENT & ABORIGINAL CONSULTATION**

**9 a)** Indicate whether public/stakeholder engagement was undertaken in relation to potential adverse effects of the proposed project:

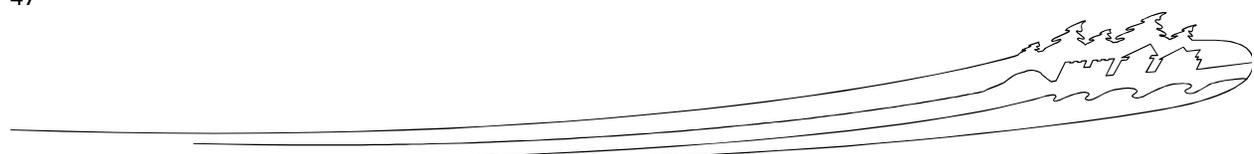
No

Yes (describe the process to involve relevant parties and indicate how comments were taken into consideration).

**9 b)** Indicate whether Aboriginal consultation was undertaken in relation to potential adverse effects of the proposed project:

No

Yes (describe the process to involve relevant parties and how the results were taken into consideration).



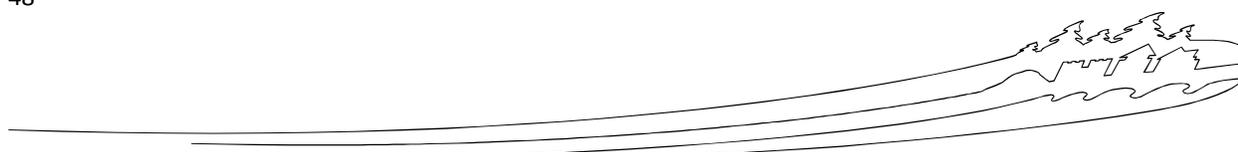


### 10. SIGNIFICANCE OF RESIDUAL ADVERSE EFFECTS

Residual effects are those effects resulting from the project after application of the mitigation measures. Factors that were considered in the determination of residual effects included spatial scale, duration, ecological/cultural context and likelihood of occurrence.

**Table 5: Summary of Residual Effects Resulting from the Illecillewaet Curve Safety Improvements Project**

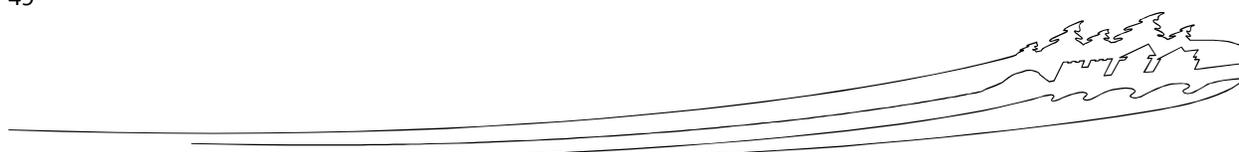
Valued Component	Residual Effect
Soil Quality	With proper soil management and spill prevention and management, no significant residual adverse effects are anticipated.
Surface Water Quality	With proper spill prevention and management and erosion and sediment control measures, no significant residual adverse effects are anticipated.
Fish	Direct fish mortalities are unlikely with application of mitigation. No significant residual adverse effects are anticipated.
Fish Habitat	There will be a small incremental decrease in fish habitat due to culvert extensions; however repair of existing culverts that are impeding fish passage will result in a net habitat increase. Loss of riparian vegetation during construction is temporary and reversible. No significant residual adverse effects as a result of the project are anticipated.
Vegetation	There will be a loss of native vegetation. However, because the loss is small relative to the overall cover of natural vegetation in the Rogers Pass area, no significant residual adverse effects are anticipated.
Listed Plant Species	There will be no impacts to legally protected plant species. Impacts to the Blue-listed (sensitive) Western St. John’s Wort (if present in the footprint) may be mitigated through salvage and relocation. There are other known locations of this plant in Rogers Pass. No significant residual adverse effects as a result of the project are anticipated.
Coeur d’Alene Salamander	The highest potential habitat in the project area will be avoided. Mitigation measures to mitigate impacts to fish habitat will also mitigate impacts to Coeur d’Alene Salamander riparian habitat. No significant residual adverse effects as a result of the project are anticipated.





**Table 5: Summary of Residual Effects Resulting from the Illecillewaet Curve Safety Improvements Project**

Valued Component	Residual Effect
Western Toad	<p>Work in areas of potential Western Toad breeding is unavoidable. Pre-work toad surveys conducted by the contractor will reduce potential impacts.</p> <p>Western toad breeding habitat is available elsewhere in Rogers Pass.</p> <p>No significant residual adverse effects as a result of the project are anticipated.</p>
Barn Swallow	<p>Clearing outside the bird breeding season or conducting of pre-clearing bird surveys, will minimize potential for impacts to nesting birds.</p> <p>No significant residual adverse effects as a result of the project are anticipated.</p>
Olive-sided Flycatcher	<p>Clearing outside the bird breeding season or conducting of pre-clearing bird surveys, will minimize potential for impacts to nesting birds.</p> <p>No significant residual adverse effects as a result of the project are anticipated.</p>
Bats	<p>Clearing outside the bat breeding season or conducting pre-clearing roost surveys (if potential roost trees are present) will minimize potential for residual effects.</p> <p>No significant residual adverse effects as a result of the project are anticipated.</p>
Woodland Caribou	<p>Caribou do not normally occur in the project area and there is no designated Critical Habitat there. Potential construction impacts on caribou (if present) are short duration. After project completion, the wider highway may affect crossing behaviour or increase risk of collision. The magnitude of this effect may be low to moderate.</p> <p>With application of mitigations, residual adverse impacts are likely to be low to moderate.</p>
Grizzly Bear	<p>Potential construction impacts on grizzly bear are short duration.</p> <p>After project completion, the wider highway may affect crossing behaviour or increase risk of collision. The magnitude of this effect may be moderate.</p> <p>With application of mitigations, residual adverse impacts are likely to be low to moderate.</p>





**Table 5: Summary of Residual Effects Resulting from the Illecillewaet Curve Safety Improvements Project**

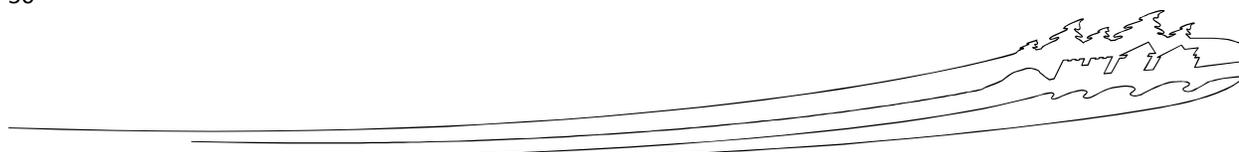
Valued Component	Residual Effect
Mountain Goat	Potential construction impacts on mountain are short duration. After project completion, the wider highway may affect crossing behaviour or increase risk of collision. The magnitude of this effect may be low to moderate. With application of mitigations, residual adverse impacts are likely to be low to moderate.
Seed-eating Birds	The project is designed to enhance traffic flow through the Rogers Pass area, allowing traffic to more consistently maintain highway speed and possibly resulting in an incremental increase in mortality of seed-eating birds. The incremental effects are predicted to be small. No significant residual adverse effects as a result of the project are anticipated.
Archaeological Sites	With completion of AIAs and application of mitigation, no significant residual adverse effects are expected.
Historic Viewscapes	Prior to construction, visual documentation of current conditions will be conducted. There will no permanent change to identified historic viewscapes.
Recreational Opportunities	No significant residual adverse effects on recreational opportunities are expected.
Viewscapes and Soundscapes	No significant residual adverse effects on viewscapes and soundscapes are expected.
Visitor Safety and Health	The project will increase visitor safety.

**11. SURVEILLANCE**

- Surveillance is not required
- Surveillance is required

**Site Inspection Program Details**

An Environmental Monitor will be provided by the contractor to oversee the construction activities and ensure that all project operations are conducted in accordance with all identified mitigation measures, including in-stream works and work in riparian areas. Support will be required to conduct nest surveys if clearing is to be carried out in the bird nesting window. Additional support may be required for bat roost and amphibian surveys.





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A certified archeologist will be required for archeological impact assessment work and on site monitoring during construction – namely clearing, grubbing and any excavation within high risk areas. This work will be conducted in collaboration with the FU CRM advisor.

### 12. FOLLOW-UP MONITORING

Follow-up monitoring is:

- not required
- legally required (e.g. under the *Species at Risk Act* or *Fisheries Act*)
- required in accordance with the *Parks Canada Cultural Resource Management Policy*
- required as identified in mitigation measures.

### 13. SARA NOTIFICATION

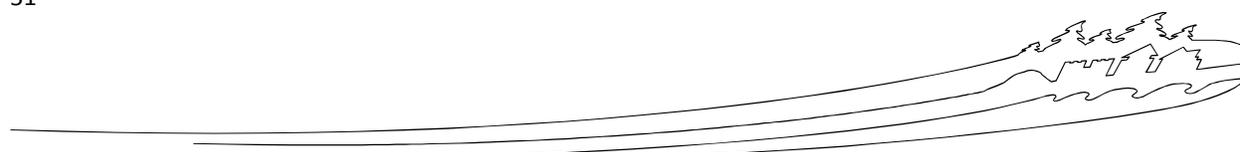
Notification is:

- not required
- required under the *Species at Risk Act*

### 14. EXPERTS CONSULTED

Department/Agency/Institution: <b>Parks Canada Agency</b>	Date of Request: 2015-11-27
Expert's Name & Contact Information: Trevor Kinley Highway Engineering Services, Radium BC <a href="mailto:Trevor.kinley@pc.gc.ca">Trevor.kinley@pc.gc.ca</a>	Title: Environmental Assessment Scientist
Expertise Requested: Provided information about wildlife occurrences in GNP. Guidance on BIA requirements.	
Response: Provided information about caribou critical habitat and other data and information.	

Department/Agency/Institution: <b>Parks Canada Agency</b>	Date of Request: 2015-12-08
Expert's Name & Contact Information: Sarah Boyle Mount Revelstoke and Glacier National Parks <a href="mailto:Sarah.Boyle@pc.gc.ca">Sarah.Boyle@pc.gc.ca</a>	Title: Ecologist Team Leader
Expertise Requested: Biophysical information for project area. Guidance on BIA scope.	
Response: Provided biophysical information for project area. Guidance on BIA scope.	





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Department/Agency/Institution: <b>Parks Canada Agency</b>	Date of Request: 2015-12-08
Expert's Name & Contact Information: Alexandra Taylor Mount Revelstoke and Glacier National Parks alexandra.taylor@pc.gc.ca	Title: A/ EIA Coordinator, Contaminated Sites and Environmental Management
Expertise Requested: Biophysical information for project area. Guidance on BIA scope.	
Response: Provided biophysical information for project area. Guidance on BIA scope.	

Department/Agency/Institution: <b>Parks Canada Agency</b>	Date of Request: 2015-12-22
Expert's Name & Contact Information: Gwyn Langemann and Bill Perry, HCCD <a href="mailto:Bill.Perry@pc.gc.ca">Bill.Perry@pc.gc.ca</a> <a href="mailto:Gwyn.Langemann@pc.gc.ca">Gwyn.Langemann@pc.gc.ca</a>	Title: Archaeologists
Expertise Requested: Requested information about heritage data near Illecillewaet Curve.	
Response: Provided an Archaeological Overview Assessment	

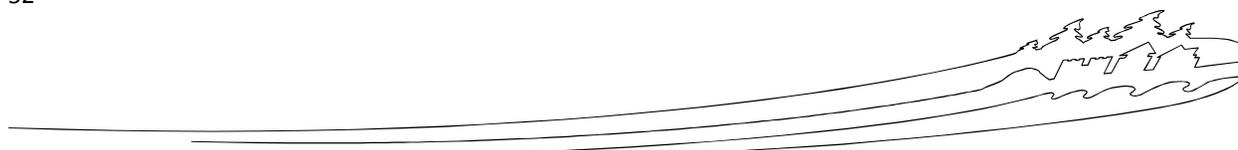
Department/Agency/Institution: <b>Parks Canada Agency</b>	Date of Request: 2015-12-08
Expert's Name & Contact Information: Rick Reynolds Mount Revelstoke and Glacier National Parks <a href="mailto:Rick.Reynolds@pc.gc.ca">Rick.Reynolds@pc.gc.ca</a>	Title: Visitor Experience
Expertise Requested: Input on design relating to visitor experience.	
Response: Provided visitor experience input in to design at design review meetings.	

Department/Agency/Institution: <b>Parks Canada Agency</b>	Date of Request: 2016-01-16
Expert's Name & Contact Information: Gwénaëlle Le Parlouër 819-420-9220	Title: Policy Advisor, Cultural Resources Management
Expertise Requested: Request made by MRG field Unit.	
Response: Indicated that the construction and operation of the TCH is of historic significance and that artifacts associated with historic highway construction be protected. Provided a list of preliminary historic viewsapes associated with the TCH and Rogers Pass.	

## 15. DECISION

Taking into account implementation of mitigation measures outlined in the analysis, the project is:

- not likely to cause significant adverse environmental effects.
- likely to cause significant adverse environmental effects.





**FOR SARA REQUIREMENTS:**

- There are no residual adverse effects to species at risk and therefore the SARA-Compliant Authorization Decision Tool was not required

OR, the SARA-Compliant Authorization Decision Tool ([Appendix 2](#)) was used and determined:

- There is no contravention of SARA prohibitions
- Project activities contravene a SARA prohibition and CAN be authorized under SARA
- Project activities contravene a SARA prohibition and CANNOT be authorized

**16. RECOMMENDATION AND APPROVAL**

Recommendation and approval are based on the 60% drawings current as of January 2016. Any significant design changes in the Right of Way alignment or disturbance area must be identified prior to work initiation to ensure any changes are adequately mitigated.

<p><b>Prepared by:</b></p> <p>Authors:                  Jeff Matheson, M.Sc., P.Biol., R.P.Bio., Senior Scientist                  Kristen Mancuso, M.Sc., P.Biol., R.P.Bio., Junior Terrestrial Ecologist.</p> <p>Reviewers:                  Nigel Cavanagh, M.Sc., P.Biol., R.P.Bio., Senior Aquatics &amp; Fisheries Biologist                  Jason Jones, Ph.D., P.Biol., R.P.Bio., Senior Scientist</p>	<p>Date: 2016-02-16</p>
<p><b>Recommended by:</b></p> <p>Functional manager of the project (name):  <i>Bruno DUBESALLE, Resource Conservation Manager</i></p>	<p>Date: YYYY-MM-DD  <i>2016-03-15</i></p>
<p><b>Approved by:</b></p> <p>Nick Irving, Field Unit Superintendent, Mt. Revelstoke and Glacier National Parks</p> 	<p>Date: YYYY-MM-DD                  MAR 15 2016</p>
<p>Signature:</p>	





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## 17. ATTACHMENTS

### Figures

Figure 1: Project Location

Figure 2: CDC Occurrences

### Appendices

Appendix 1: Environmental Impact Analysis Tools: Effects Identification Matrix

Appendix 2: SARA-Compliant Authorization Decision Tool

Appendix 3: Design Drawings (January 15, 2016)

Appendix 4: Vegetation Elements of Management Concern with Potential to Occur Near the Project

Appendix 5: Wildlife Species of Management Concern Potentially Found Within 1 Kilometre of Illecillewaet Curve

Appendix 6: Archaeological Overview Assessment, Trans Canada Widening Project, Illecillewaet Curve, Glacier National Park

## 18. NATIONAL IMPACT ASSESSMENT TRACKING SYSTEM

- Project registered in [tracking system](#)
- Not yet registered (*CEAA 2012 requires PCA submit a report to Parliament annually. EIAs must be entered in the tracking system **by the end of April** to enable reporting.*)

**\*\*\*Ensure that all required mitigation measures and conditions (e.g. follow-up monitoring requirements) are included in project permits and authorizations\*\*\***

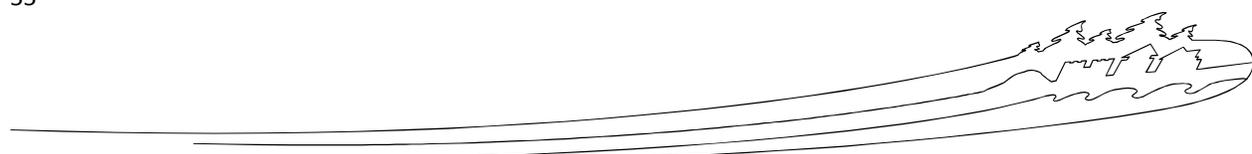




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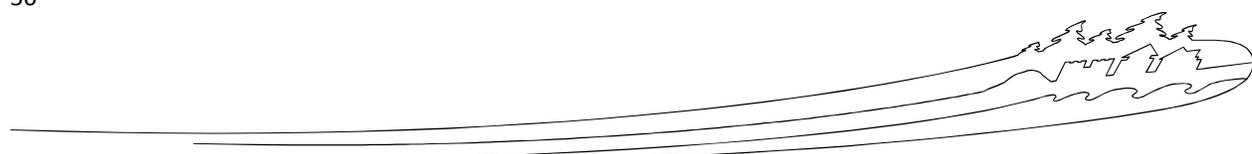
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March 2016

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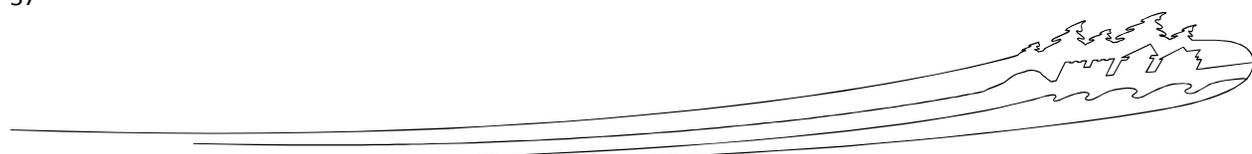
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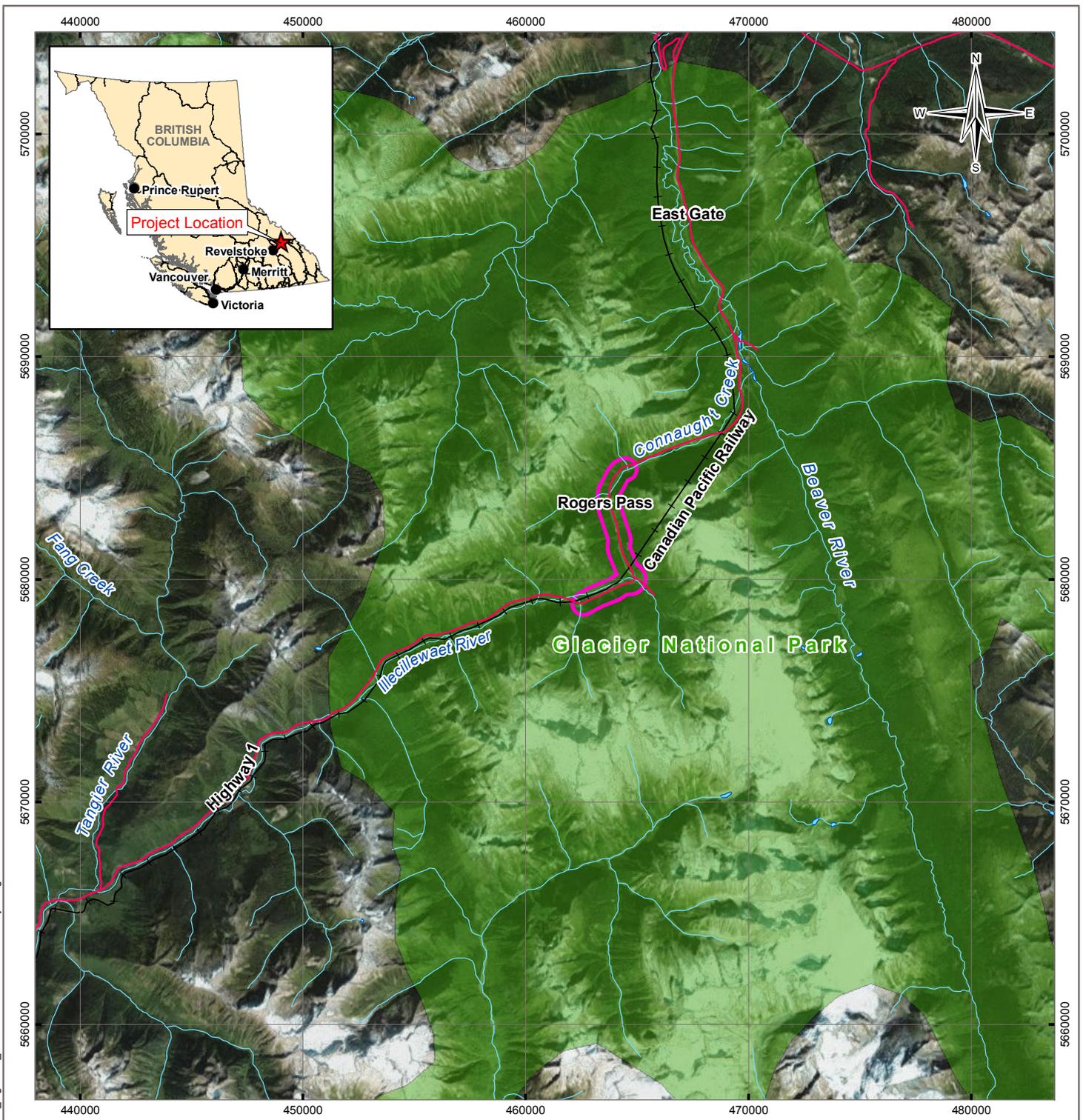
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**LEGEND**

- Project Area
- Road
- Railway
- Glacier National Park
- ~ Watercourse
- Waterbody

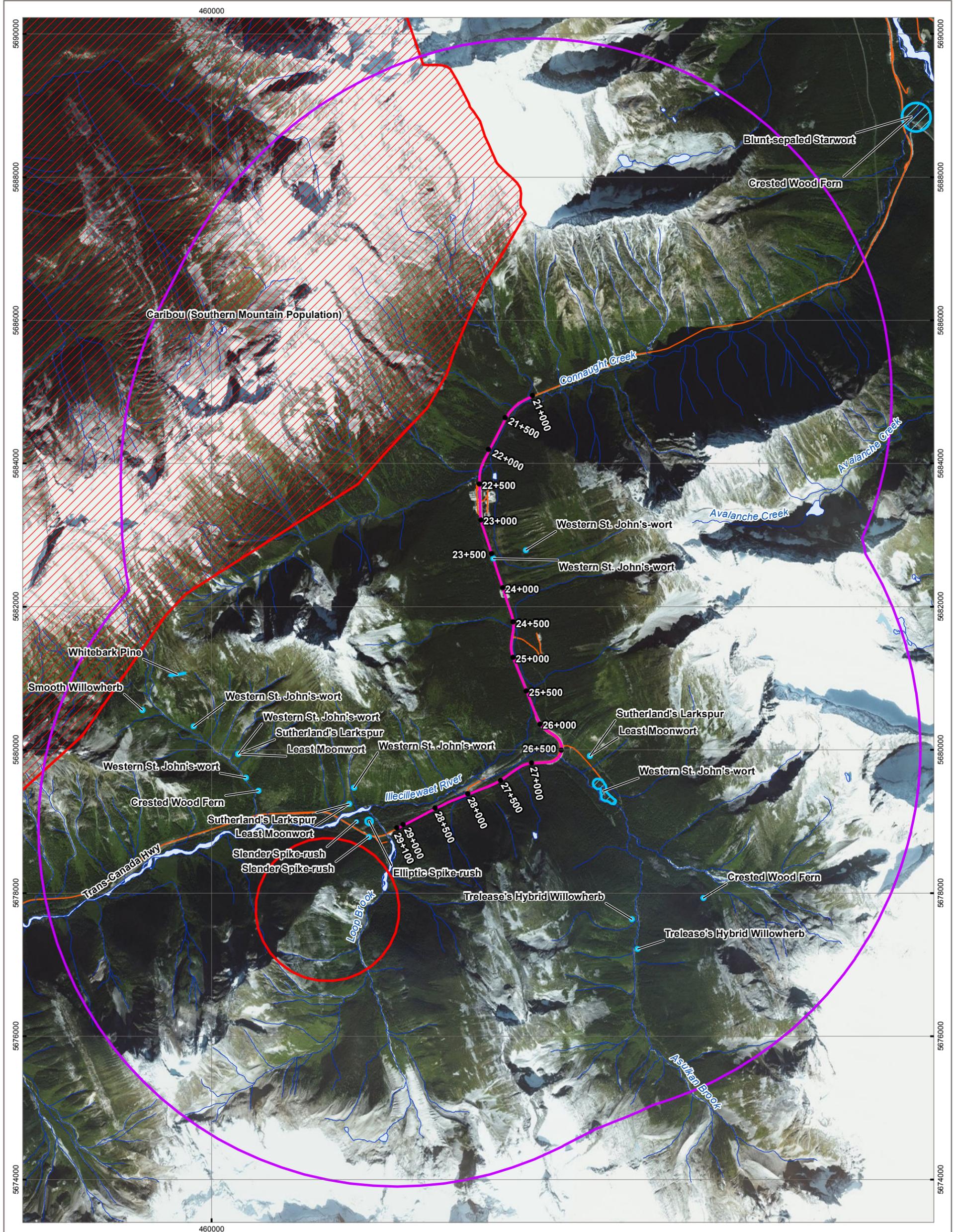
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 Imagery from ESRI; CNES/Airbus DS (2009)  
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**STATUS**  
 ISSUED FOR USE

**TCH WIDENING - ILLECILLEWAET CURVE  
 GLACIER NATIONAL PARK**

**Project Location**

<b>PROJECTION</b> UTM Zone 11		<b>DATUM</b> NAD83		<b>CLIENT</b>	
Scale: 1:250,000 5      2.5      0      5  Kilometres		 Parks Canada    Parcs Canada			
<b>FILE NO.</b> IND04067-01_Figure01_Site.mxd					
<b>PROJECT NO.</b> ENVIND04067-01	<b>DWN</b> MEZ	<b>CKD</b> SL	<b>APVD</b> KM	<b>REV</b> 0	<b>Figure 1</b>
<b>OFFICE</b> Tl EBA-VANC		<b>DATE</b> February 2, 2016			



**LEGEND**

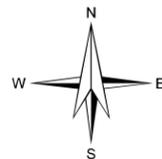
- Project Area
- 5 km Buffer
- Road
- Watercourse
- Waterbody

**Conservation Data Centre**

**Non-Sensitive Occurrences**

- 🌿 Red-Listed Nonvascular Plant
- 🌿 Blue-Listed Vascular Plant
- 🐾 Red-Listed Vertebrate Animal

**NOTES**  
 Base data source:  
 Imagery from ESRI; DigitalGlobe (2011)  
 Conservation Data Centre Occurrences  
 downloaded from DataBC (July 23, 2015)  
 CanVec 1:50,000  
 Study Area provided by McElhanney (2015)



**TCH WIDENING - ILLECILLEWAET CURVE  
 GLACIER NATIONAL PARK**

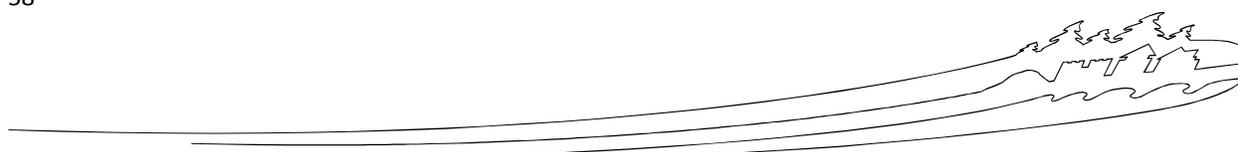
**CDC Occurences**

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Scale: 1:50,000		
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<b>PROJECT NO.</b> ENVIND04067-01		
<b>OFFICE</b> TlEBA-VANC	<b>DATE</b> February 2, 2016	<b>Figure 2</b>
<b>STATUS</b> ISSUED FOR USE		



## Appendix 1 Environmental Impact Analysis Tools: Effects Identification Matrix

A. Direct Effects												
		Valued components potentially directly affected by the proposed project										
		Natural Resources					Cultural Resources		Visitor Experience			
		Air	Soil & landforms	Water (surface, ground, crossings, etc.)	Flora including SAR	Fauna (including SAR)	Historical Value	Archaeological Artifacts	Recreational Opportunities	Viewscapes and Soundscapes	Visitor Safety	
Phase	Activities											
Project Components	Preparation / Construction / Operation / Decommissioning	Waste Disposal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Use/Removal of temporary facilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Supply and storage of materials	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Clearing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Rock Blasting	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Drilling	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Paving	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Grading	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		Use of machinery	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Transport of materials/equipment	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Use of Chemicals	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		





A. Direct effects continued												
		Valued components potentially affected by the proposed project										
		Natural Resources					Cultural Resources		Visitor Experience			
		Air	Soil & landforms	Water (surface, ground, crossings, etc.)	Flora (specify, including SAR)	Fauna (specify, including SAR)	Historical Value	Archaeological Artifacts	Recreational Opportunities	Viewscapes and Soundscapes	Visitor Safety	
Phase	Activities											
Project Components	Operation	Regular Use	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Snow and Ice Management	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		Maintenance	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		Vehicle Traffic	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>





B. Indirect Effects (all phases)							
		Impacts as a result of changes to the environment					
		With respect to non-Aboriginal peoples:		With respect to Aboriginal peoples:		With respect to visitor experience	
		Health and socio-economic conditions	Health & socio-economic conditions	Current use of lands and resources for traditional purposes	Access & services	Recreation & accommodation opportunities	Safety
Phase	Natural resource components affected by the project						
Preparation /construction /operation/implementation/decommissioning	Could impacts to <u>air</u> lead to adverse effects on...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Could impacts to <u>soils and landforms</u> lead to adverse effects on...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Could impacts to <u>water</u> (e.g. surface, ground water and water crossings) lead to adverse effects on...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Could impacts to <u>flora</u> (including SAR) lead to adverse effects on...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Could impacts to <u>fauna</u> (including SAR) lead to adverse effects on...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Other...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>





March 2016

## Appendix 2: SARA-Compliant Authorization Decision Tool

There are no residual adverse effects to species at risk and therefore the SARA-Compliant Authorization Decision Tool was not required.





March 2016

### Appendix 3: Design Drawings (January 15, 2016)





**McElhanney**

for / pour



Parks Canada  
Agency  
Western and  
Northern Region

L'Agence Parcs  
Canada  
Ouest et Nord  
Région

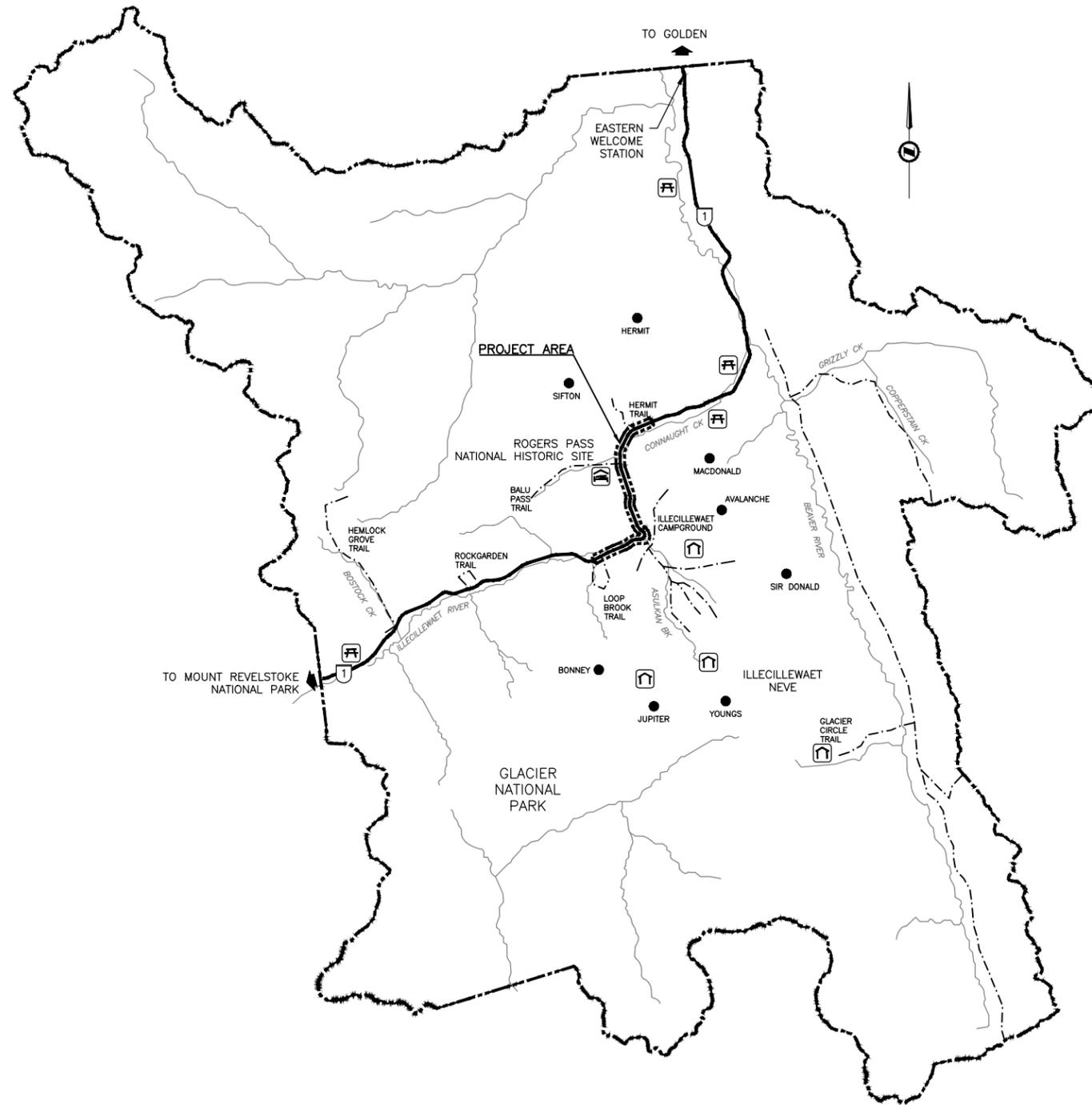
TCH WIDENING  
ILLECILLEWAET CURVE

ROGERS PASS  
GLACIER NATIONAL PARK, BC

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LOCATION PLAN  
NOT TO SCALE

DRAWING INDEX	
SHEET	DRAWING TITLE
000	COVER
001	LOCATION PLAN & INDEX
002	LEGEND
003	PLAN & PROFILE - STA 20+650 TO STA 21+300
004	PLAN & PROFILE - STA 21+300 TO STA 21+950
005	PLAN & PROFILE - STA 21+950 TO STA 22+600
006	PLAN & PROFILE - STA 22+600 TO STA 23+250
007	PLAN & PROFILE - STA 23+250 TO STA 23+900
008	PLAN & PROFILE - STA 23+900 TO STA 24+550
009	PLAN & PROFILE - STA 24+550 TO STA 25+200
010	PLAN & PROFILE - STA 25+200 TO STA 25+850
011	PLAN & PROFILE - STA 25+850 TO STA 26+500
012	PLAN & PROFILE - STA 26+500 TO STA 27+150
013	PLAN & PROFILE - STA 27+150 TO STA 27+800
014	PLAN & PROFILE - STA 27+800 TO STA 28+450
015	PLAN & PROFILE - STA 28+450 TO STA 29+100
016	PLAN & PROFILE - HERMIT ACCESS ROAD
017	TYPICAL SECTIONS
018	TYPICAL SECTIONS
019	INTERSECTION DETAIL - ROGERS PASS SUMMIT
020	INTERSECTION DETAIL - MONUMENT / EAST TURNAROUND
021	INTERSECTION DETAIL - ILLECILLEWAET / ASULKAN
022	INTERSECTION DETAIL - CP RAIL / WEST TURNAROUND

PA	2016.01.11	60% REVIEW	FM	DL	DL
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Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé

A B C	detail number numéro de détail source drawing no. de dessin no. detail on drawing no. détail sur dessin no.	A B C
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Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
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Client/client	Parks Canada Agency Western and Northern Region	L'Agence Parcs Canada Ouest et Nord Région
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TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

LOCATION PLAN AND INDEX

Surveyed by / Arpenté par	Drawn by / Dessiné par FM	Date 2016.01.11
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Designed by / Conçu par DL	Reviewed by / Révisé par DL	Scale / Échelle N.T.S.
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Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
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Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. / No. de la feuille 001
Drawing Reference No. / No. de référence du dessin DRAWING_NUMBER		

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Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé

	A detail number numéro de détail B source drawing no. de dessin no. C detail on drawing no. détail sur dessin no.	
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**TCH WIDENING  
 ILLECILLEWAET CURVE  
 KM 21.0 TO KM 29.1  
 ROGERS PASS  
 GLACIER NATIONAL PARK, BC**

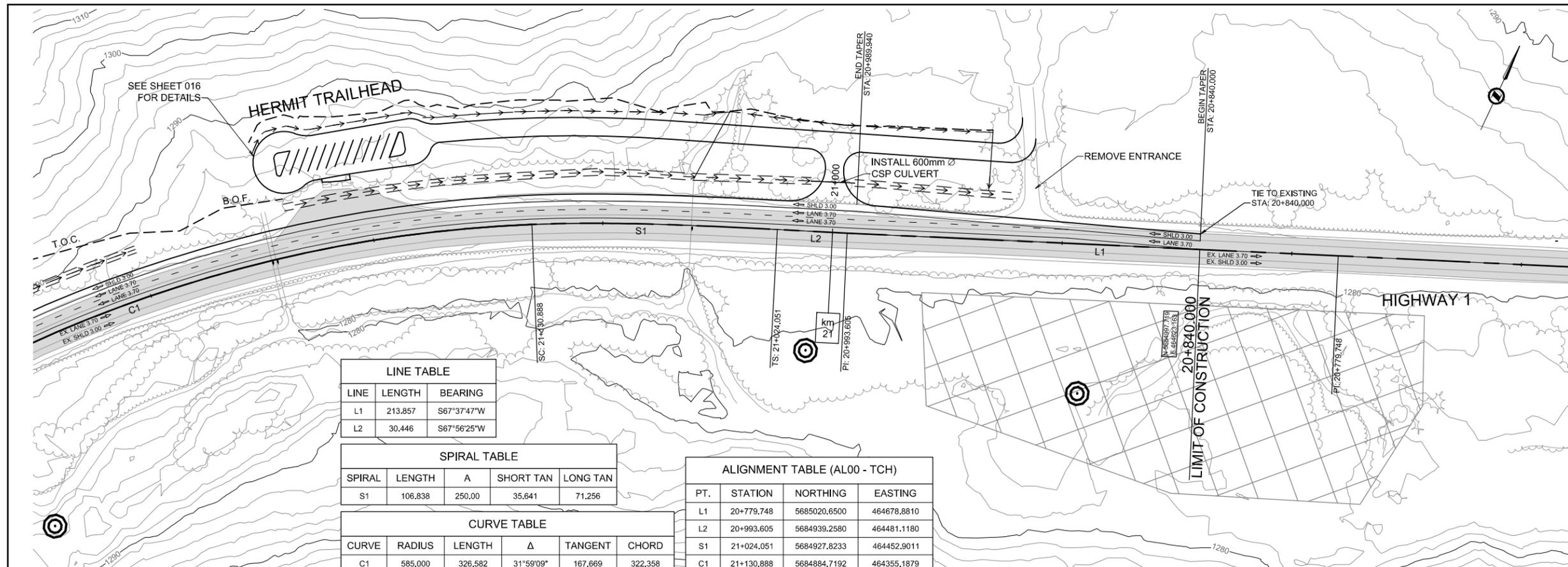
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Designed by / Conçu par DL	Reviewed by / Revisé par DL	Scale / Échelle N.T.S.

Parks Canada Project Manager / Administrateur de Projets Parcs Canada	
Client Acceptance / Acceptation du client	Approved by / Approuvé par
Parks Canada Responsible Officer / Agenc Responsable Parcs Canada _____	Parks Canada Project Manager / Administrateur du Projets Parcs Canada _____

Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. / No. de la feuille <b>002</b>
Drawing Reference No. / No. de référence du dessin DRAWING_NUMBER		





LINE	LENGTH	BEARING
L1	213.857	S67°37'47"W
L2	30.446	S67°56'25"W

SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S1	106.838	250.00	35.641	71.256

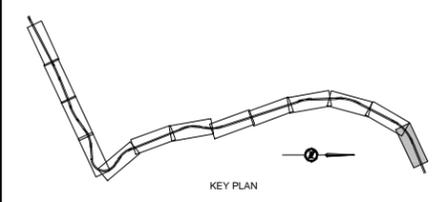
CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C1	585,000	326,582	31°59'09"	167,669	322,358

PT.	STATION	NORTHING	EASTING
L1	20+779.748	5685020.6500	464678.8810
L2	20+993.605	5684939.2580	464481.1180
S1	21+024.051	5684927.8233	464452.9011
C1	21+130.888	5684884.7192	464355.1879

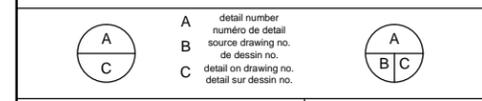
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Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé
PA	2016.01.11	60% REVIEW	NJ	DL	DL



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McElhanney Consulting Services Ltd.

**TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1**  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

**PLAN AND PROFILES  
STA 20+650 TO STA 21+300**

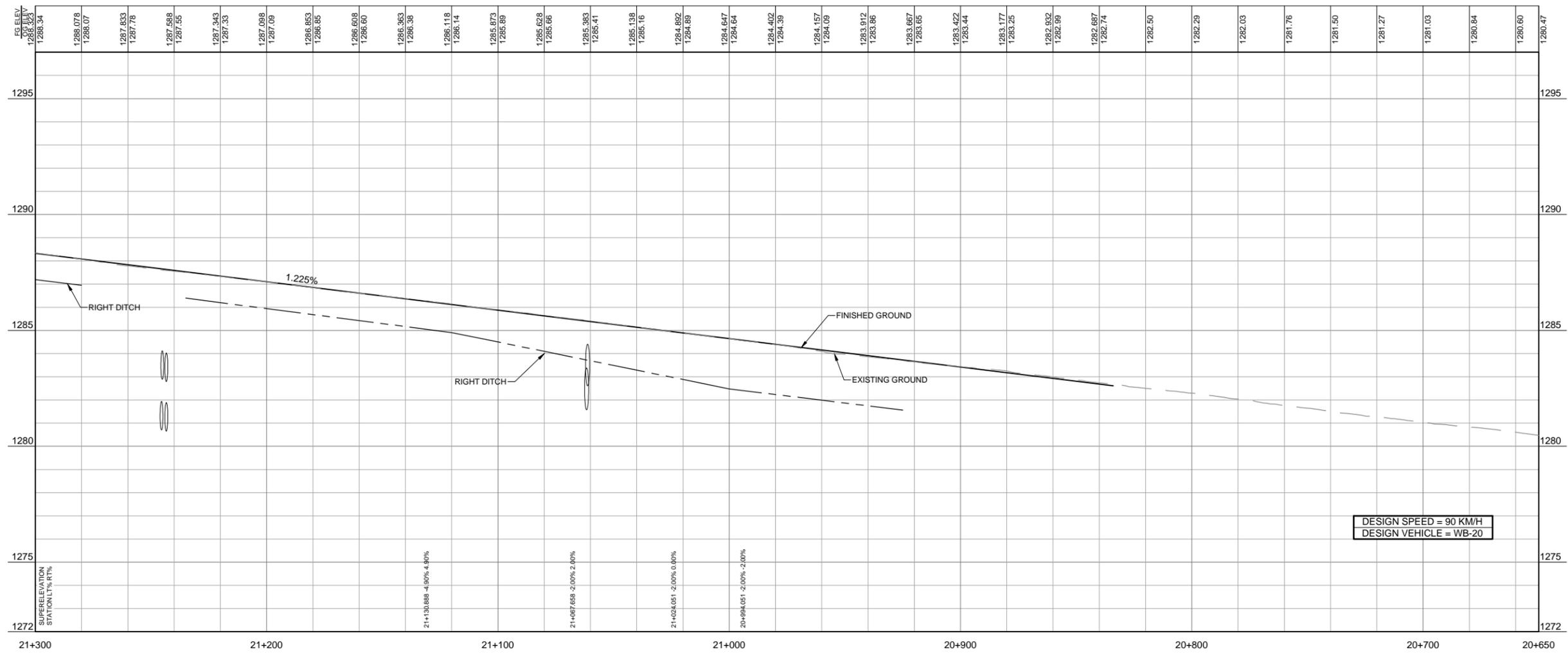
Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Revisé par NSJ	Scale / Échelle 1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client

Approved by / Approuvé par

Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. No. de la feuille <b>003</b>
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DESIGN SPEED = 90 KM/H  
DESIGN VEHICLE = WB-20

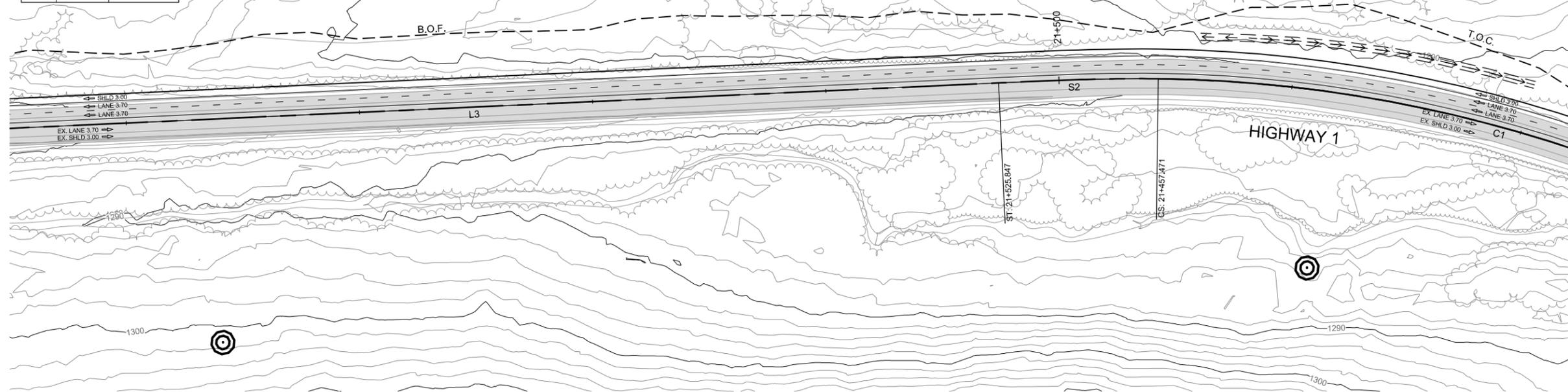


ALIGNMENT TABLE (AL00 - TCH)			
PT.	STATION	NORTHING	EASTING
C1	21+130.888	5684684.7192	464355.1879
S2	21+457.471	5684663.7028	464120.5256
L3	21+525.847	5684603.6161	464087.9148

SPIRAL TABLE				
SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S2	68.376	200.00	22.799	45.592

CURVE TABLE					
CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C1	585.000	326.582	31°59'09"	167.669	322.358

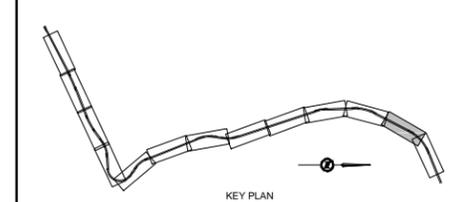
LINE TABLE		
LINE	LENGTH	BEARING
L3	467.995	S27°22'26"W



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Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé
PA	2016.01.11	60% REVIEW	NJ	DL	DL

A B C	A detail number B source drawing no. C detail on drawing no. detail sur dessin no.	A B C
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Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
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Client/client	Parks Canada Agency Western and Northern Region	L'Agence Parcs Canada Ouest et Nord Région
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**TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1**  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

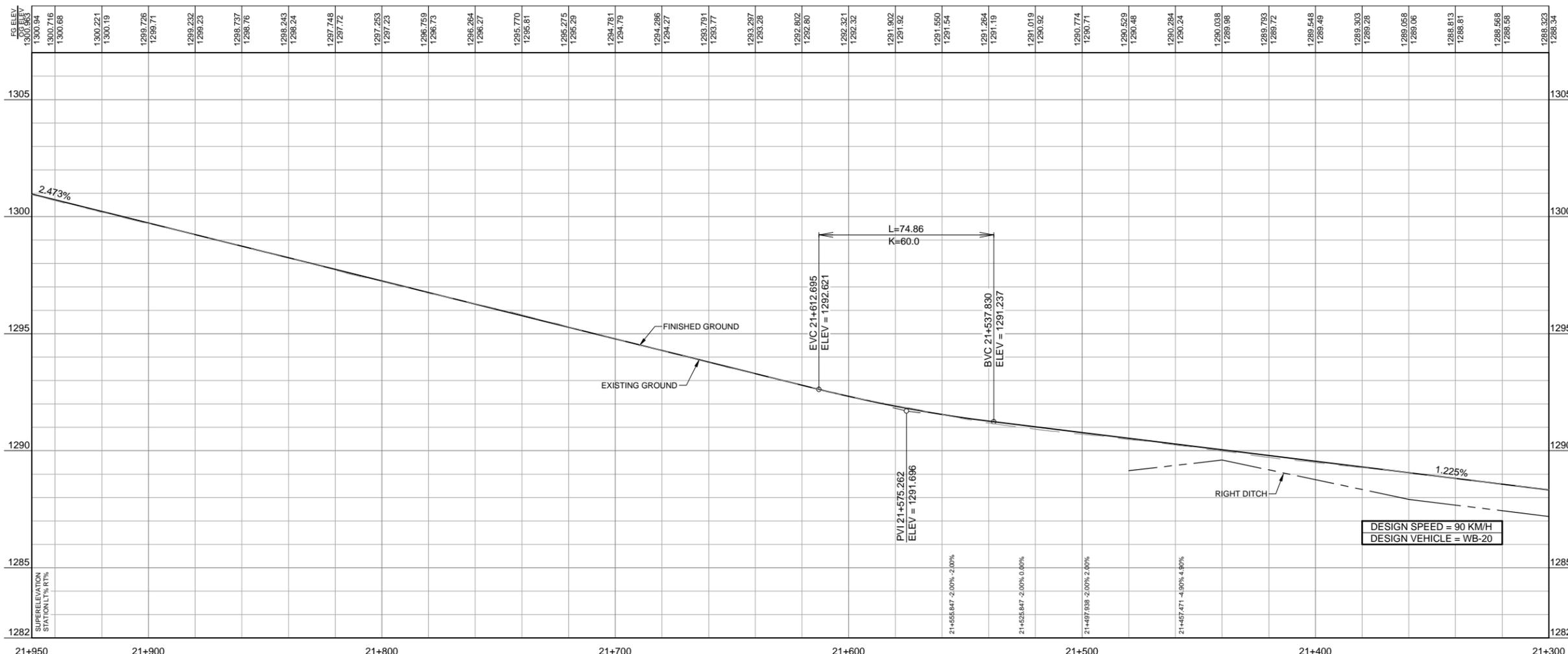
**PLAN AND PROFILES  
STA 21+300 TO STA 21+950**

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Révisé par NSJ	Scale / Echelle 1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
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Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. / No. de la feuille <b>004</b>
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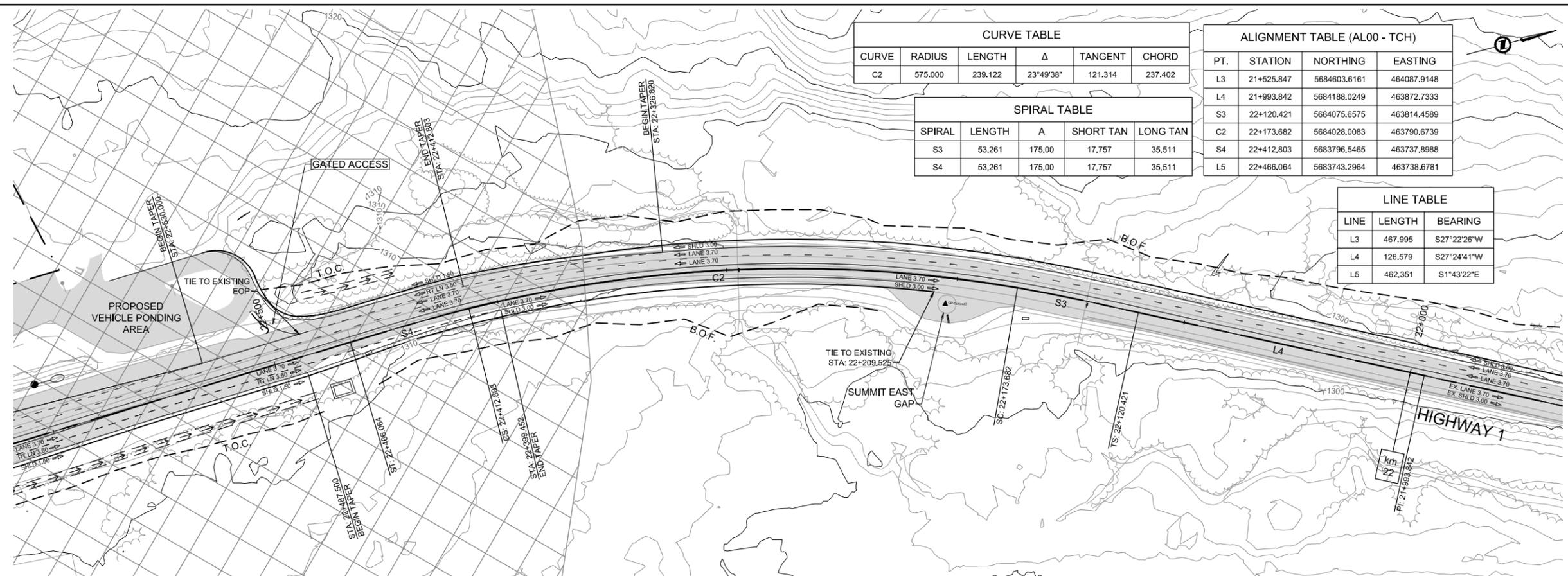


CURVE TABLE					
CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C2	575.000	239.122	23°49'38"	121.314	237.402

ALIGNMENT TABLE (AL00 - TCH)				
PT.	STATION	NORTHING	EASTING	
L3	21+525.847	5684603.6161	464087.9148	
L4	21+993.842	5684188.0249	463872.7333	
S3	22+120.421	5684075.6575	463814.4589	
C2	22+173.682	5684028.0083	463790.6739	
S4	22+412.803	5683796.5465	463737.8988	
L5	22+466.064	5683743.2964	463738.6781	

SPIRAL TABLE				
SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S3	53.261	175.00	17.757	35.511
S4	53.261	175.00	17.757	35.511

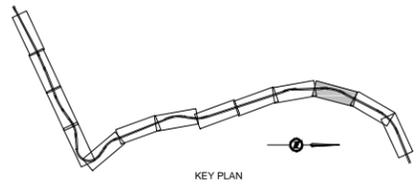
LINE TABLE		
LINE	LENGTH	BEARING
L3	467.995	S27°22'26"W
L4	126.579	S27°24'41"W
L5	462.351	S1°43'22"E



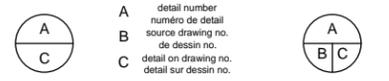
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Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé
PA	2016.01.11	60% REVIEW	NJ	DL	DL

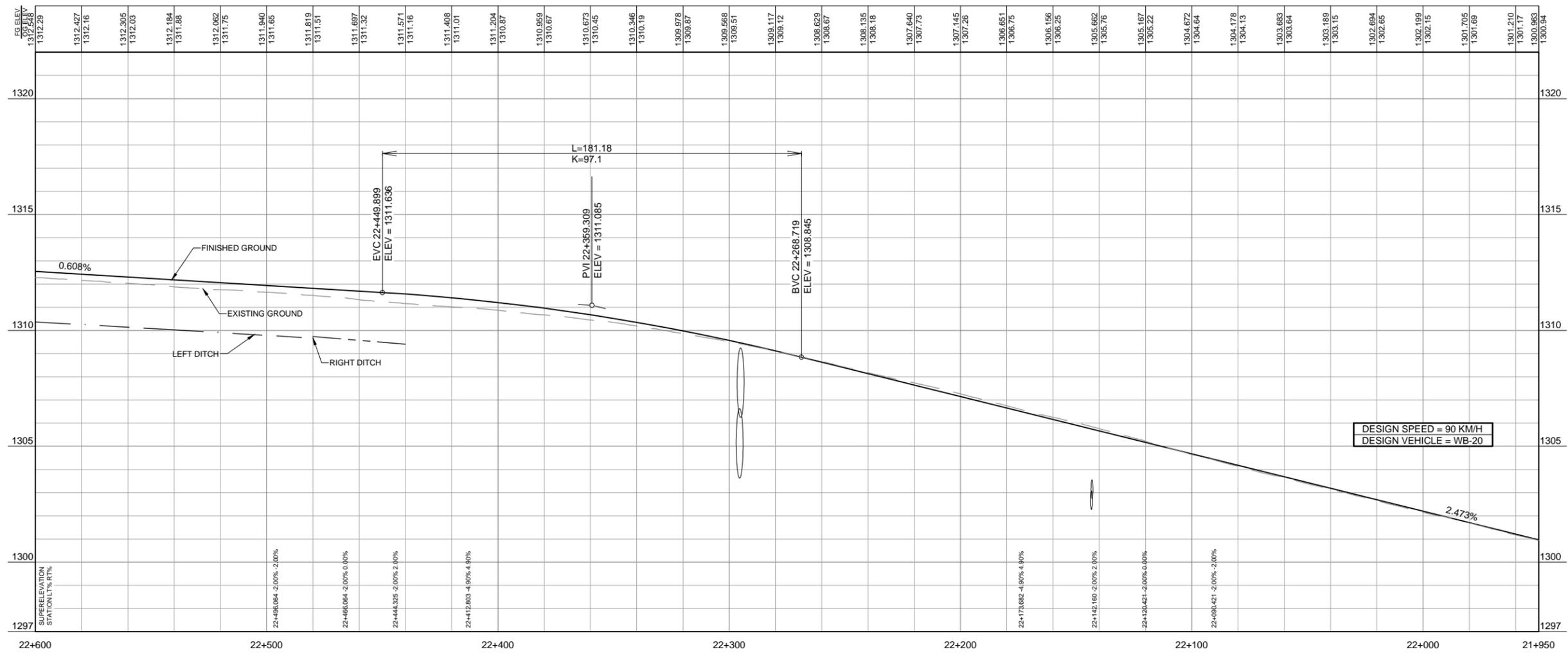


Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
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Client/client

**TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1**  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

**PLAN AND PROFILES  
STA 21+950 TO STA 22+600**



DESIGN SPEED = 90 KM/H  
DESIGN VEHICLE = WB-20

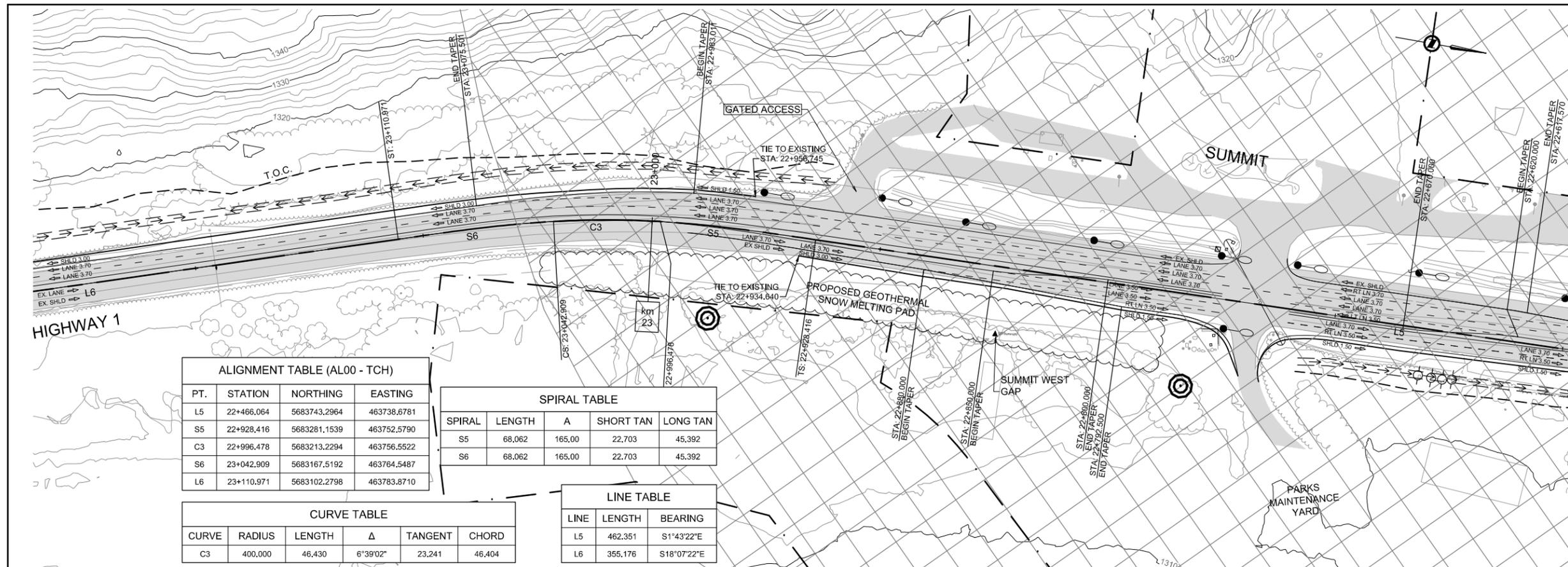
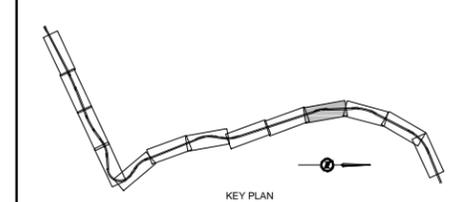
Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Révisé par NSJ	Scale / Échelle 1:1000
Parks Canada Project Manager / Administrateur de Projets Parcs Canada		
Client Acceptance / Acceptation du client	Approved by / Approuvé par	
Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. / No. de la feuille 005
Drawing Reference No. / No. de référence du dessin PP-03		



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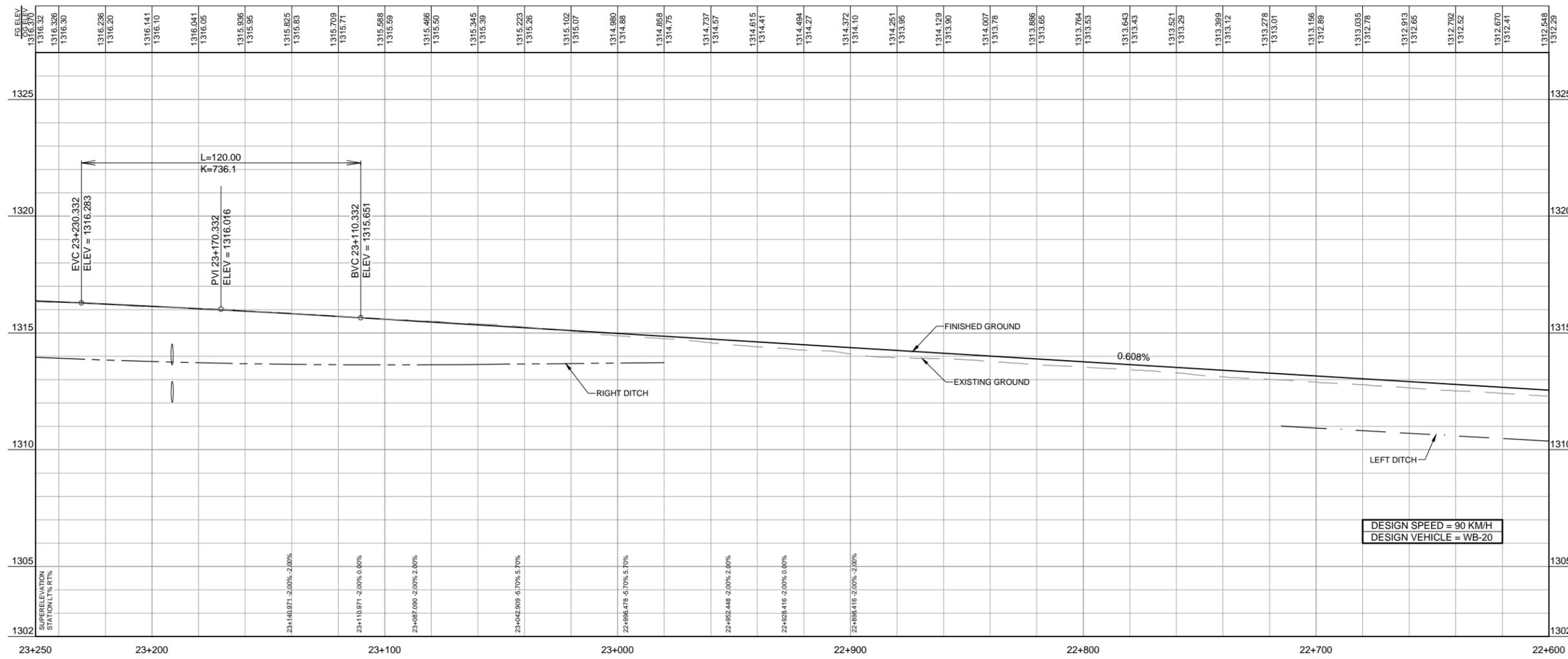


PT.	STATION	NORTHING	EASTING
L5	22+466.064	5683743.2964	463738.6781
S5	22+928.416	5683281.1539	463752.5790
C3	22+996.478	5683213.2294	463756.5522
S6	23+042.909	5683167.5192	463764.5487
L6	23+110.971	5683102.2798	463783.8710

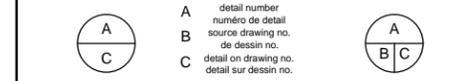
SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S5	68.062	165.00	22.703	45.392
S6	68.062	165.00	22.703	45.392

LINE	LENGTH	BEARING
L5	462.351	S1°43'22"E
L6	355.176	S18°07'22"E

CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C3	400.000	46,430	6°39'02"	23,241	46,404



PA	Date	Description	Drawn	Designed	Approved
2016.01.11	2016.01.11	60% REVIEW	NJ	DL	DL



Consultant's Stamp  
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Eng. Stamp  
Sceau de l'ingénieur

Client/client

Parks Canada Agency  
Western and Northern  
Region

L'Agence Parcs  
Canada  
Ouest et Nord Région



TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

PLAN AND PROFILES  
STA 22+600 TO STA 23+250

Surveyed by / Arpenté par  
MCSL

Drawn by / Dessiné par  
NJ

Date  
2016.01.11

Designed by / Conçu par  
DL

Reviewed by / Révisé par  
NSJ

Scale / Echelle  
1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client

Approved by / Approuvé par

Project No. / No. du projet  
2511-00581-0

Asset No. / No. du bien

Sheet No.  
No. de la feuille  
006

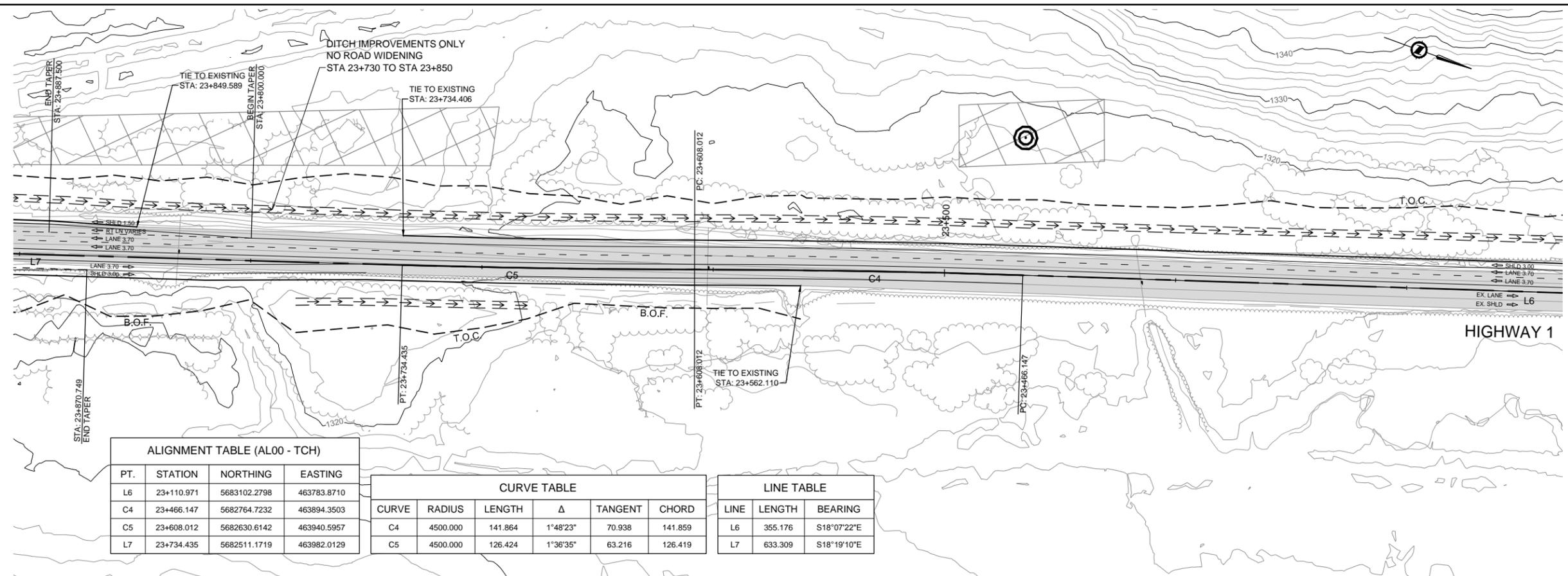
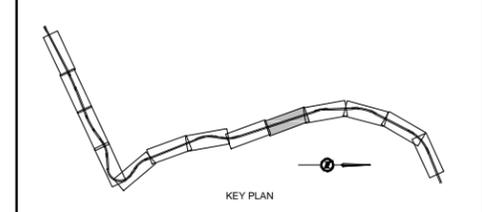
Drawing Reference No. / No. de référence du dessin  
PP-04



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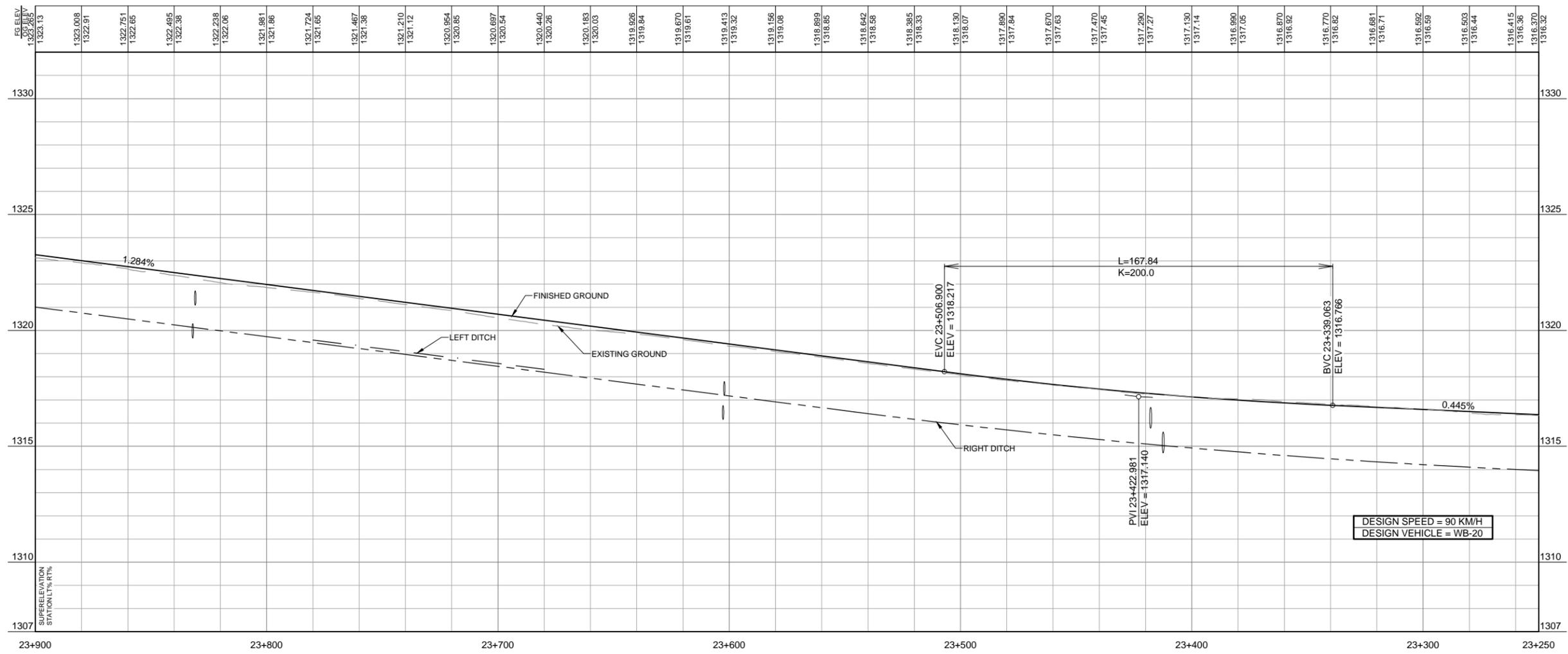
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PT.	STATION	NORTHING	EASTING
L6	23+110.971	5683102.2798	463783.8710
C4	23+466.147	5682764.7232	463894.3503
C5	23+608.012	5682630.6142	463940.5957
L7	23+734.435	5682511.1719	463982.0129

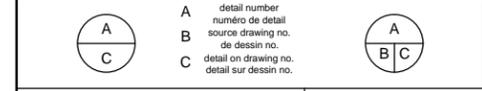
CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C4	4500.000	141.864	1°48'23"	70.938	141.859
C5	4500.000	126.424	1°36'35"	63.216	126.419

LINE	LENGTH	BEARING
L6	355.176	S18°07'22"E
L7	633.309	S18°19'10"E



DESIGN SPEED = 90 KM/H  
DESIGN VEHICLE = WB-20

Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé
PA	2016.01.11	60% REVIEW	NJ	DL	DL



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Eng. Stamp  
Sceau de l'ingénieur

Client/client

Parks Canada Agency  
Western and Northern  
Region

L'Agence Parcs  
Canada  
Ouest et Nord Région



TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

PLAN AND PROFILES  
STA 23+250 TO STA 23+900

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Révisé par NSJ	Scale / Echelle 1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
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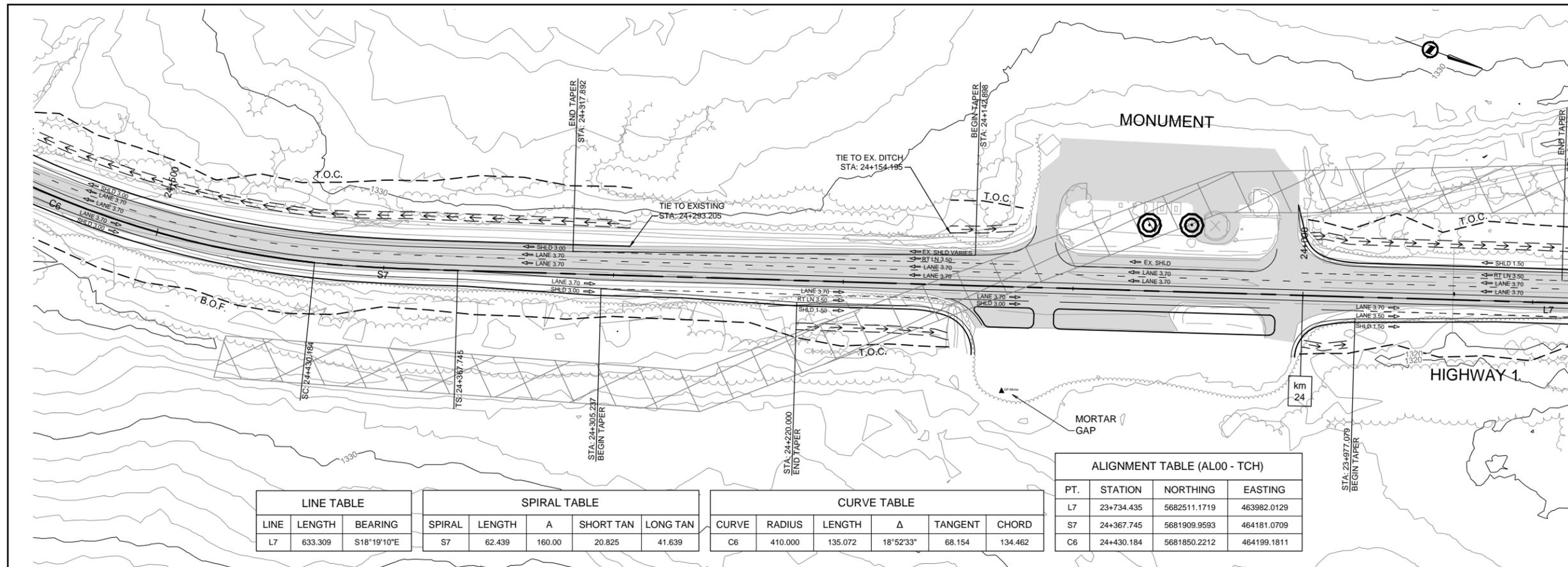
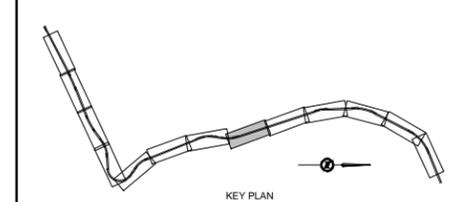
Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. / No. de la feuille 007
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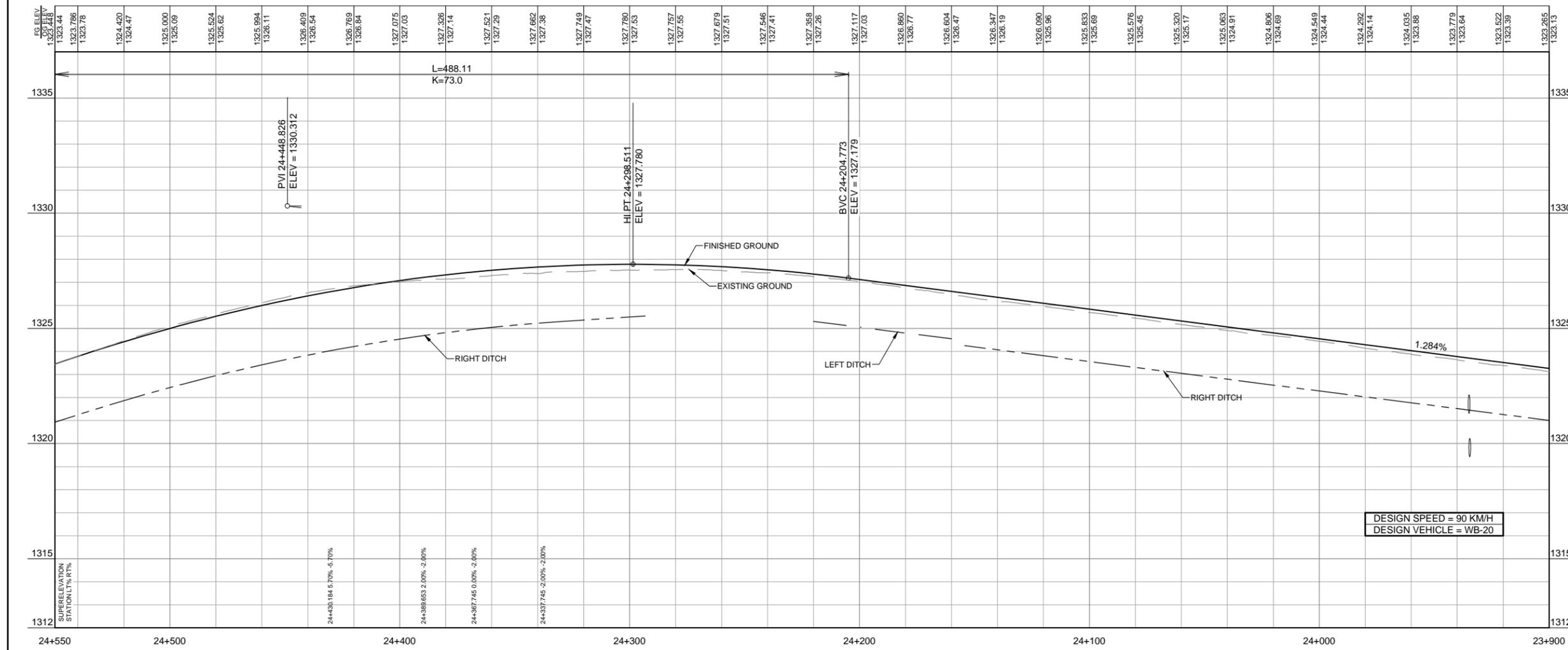


LINE	LENGTH	BEARING
L7	633.309	S18°19'10"E

SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S7	62.439	160.00	20.825	41.639

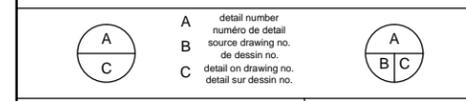
CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C6	410.000	135.072	18°52'33"	68.154	134.462

PT.	STATION	NORTHING	EASTING
L7	23+734.435	5682511.1719	463982.0129
S7	24+367.745	5681909.9593	464181.0709
C6	24+430.184	5681850.2212	464199.1811



DESIGN SPEED = 90 KM/H  
DESIGN VEHICLE = WB-20

Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé
PA	2016.01.11	60% REVIEW	NJ	DL	DL



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Western and Northern  
Region

L'Agence Parcs  
Canada  
Ouest et Nord Région



TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

PLAN AND PROFILES  
STA 23+900 TO STA 24+550

Surveyed by / Arpenté par  
MCSL

Drawn by / Dessiné par  
NJ

Date  
2016.01.11

Designed by / Conçu par  
DL

Reviewed by / Révisé par  
NSJ

Scale / Échelle  
1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client

Approved by / Approuvé par

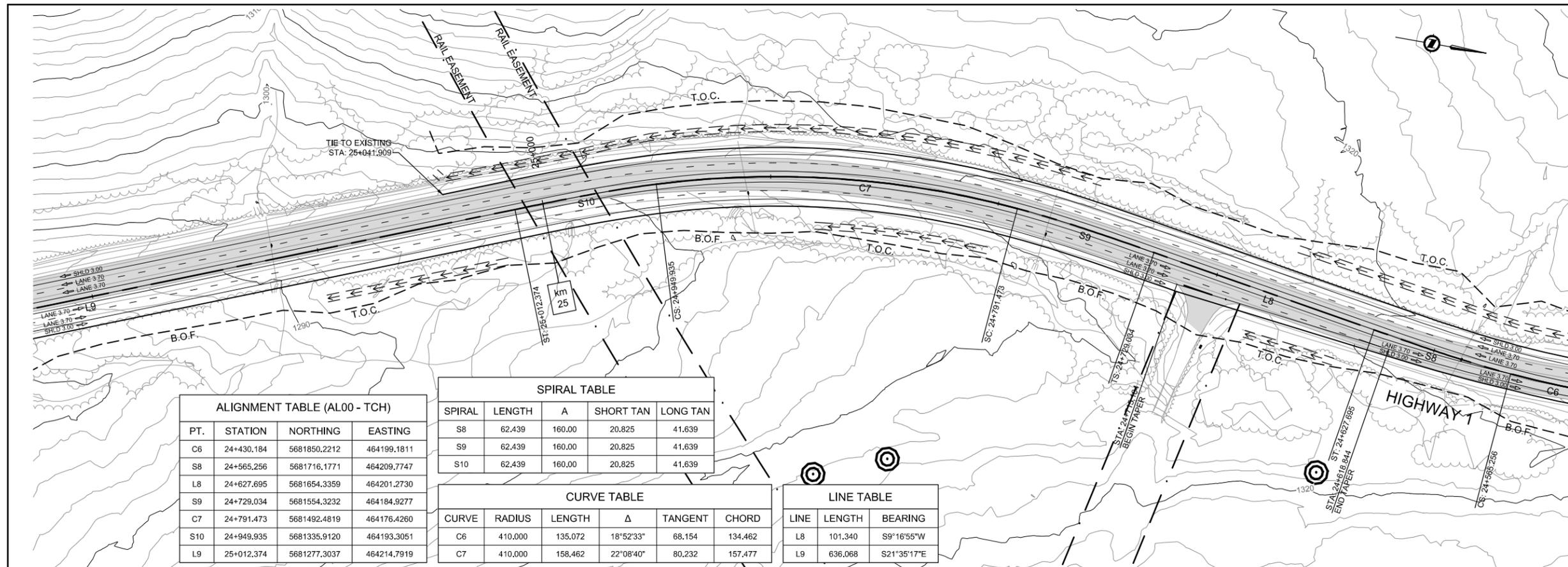
Project No. / No. du projet  
2511-00581-0

Asset No. / No. du bien

Sheet No. / No. de la feuille  
008

Drawing Reference No. / No. de référence du dessin  
PP-06





PT.	STATION	NORTHING	EASTING
C6	24+430.184	5681850.2212	464199.1811
S8	24+565.256	5681716.1771	464209.7747
L8	24+627.695	5681654.3359	464201.2730
S9	24+729.034	5681554.3232	464184.9277
C7	24+791.473	5681492.4819	464176.4260
S10	24+949.935	5681335.9120	464193.3051
L9	25+012.374	5681277.3037	464214.7919

SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S8	62.439	160.00	20.825	41.639
S9	62.439	160.00	20.825	41.639
S10	62.439	160.00	20.825	41.639

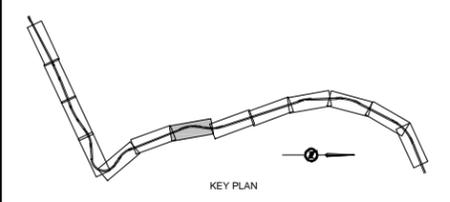
CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C6	410.000	135.072	18°52'33"	68.154	134.462
C7	410.000	158.462	22°08'40"	80.232	157.477

LINE	LENGTH	BEARING
L8	101.340	S9°16'55"W
L9	636.068	S21°35'17"E

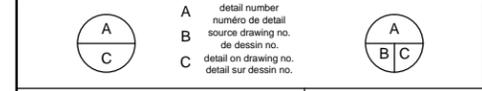
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PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé



Consultant's Stamp  
Sceau de l'expert-conseil

Eng. Stamp  
Sceau de l'ingénieur

Client/client

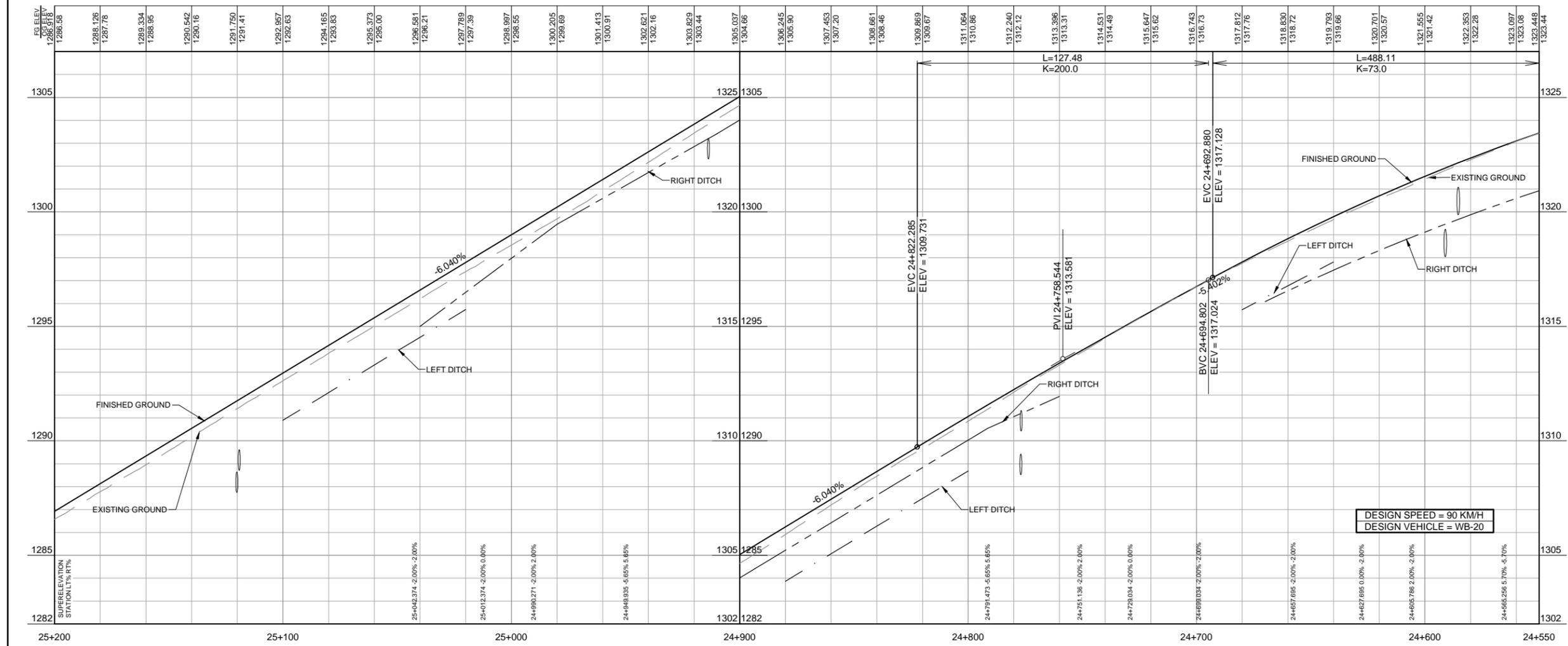
Parks Canada Agency  
Western and Northern  
Region

L'Agence Parcs  
Canada  
Ouest et Nord Région



TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

PLAN AND PROFILES  
STA 24+550 TO STA 25+200

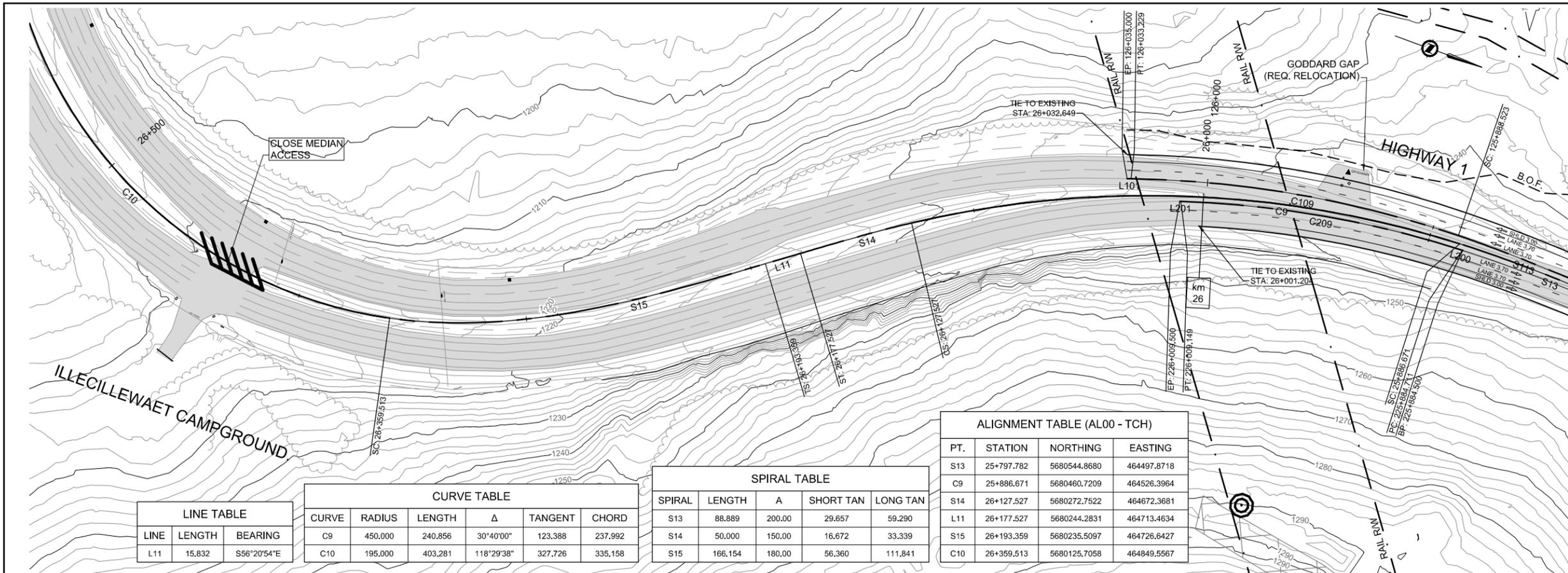


DESIGN SPEED = 90 KM/H  
DESIGN VEHICLE = WB-20



Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Révisé par NSJ	Scale / Échelle 1:1000
Parks Canada Project Manager / Administrateur de Projets Parcs Canada		
Client Acceptance / Acceptation du client	Approved by / Approuvé par	
Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. / No. de la feuille 009
Drawing Reference No. / No. de référence du dessin PP-07		

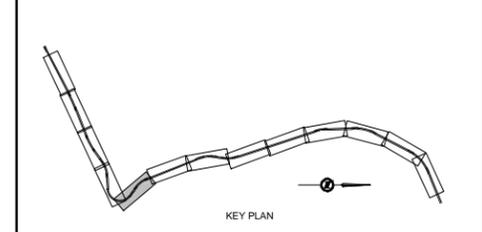




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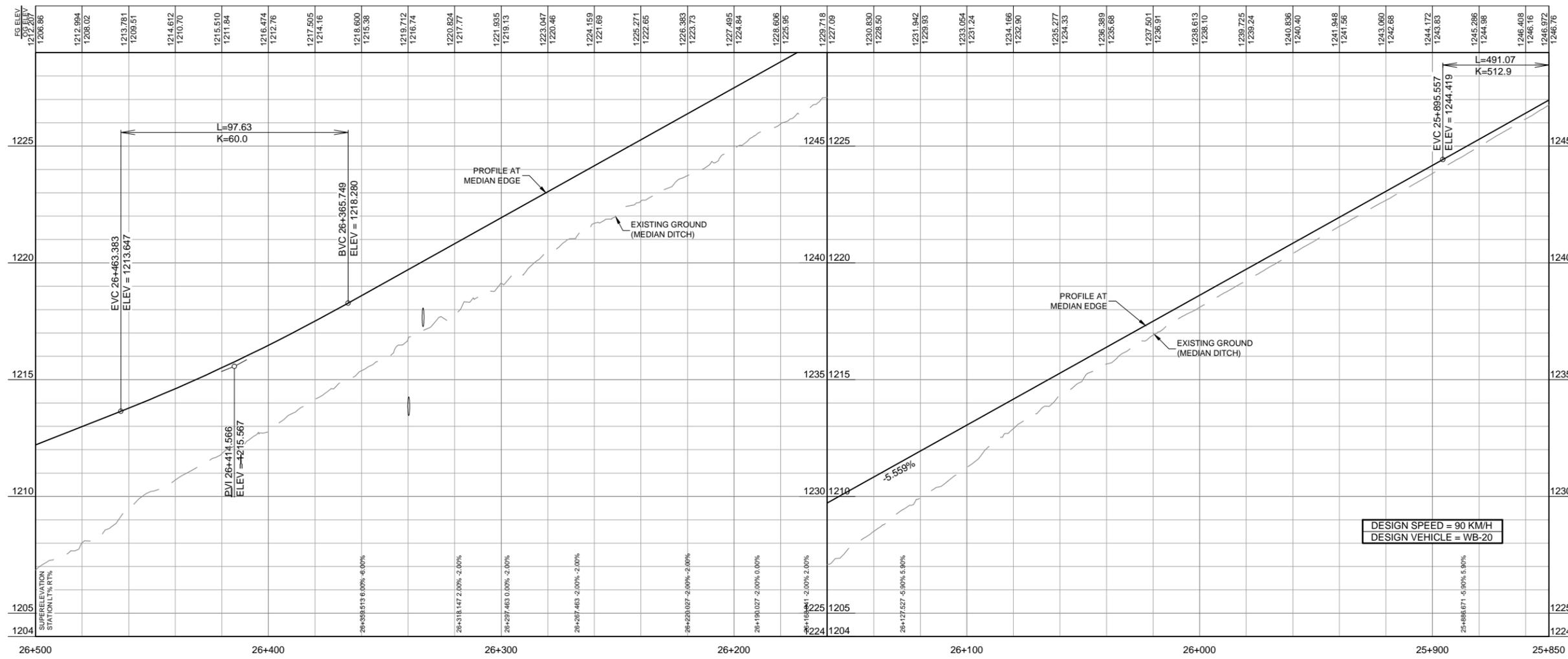


LINE TABLE		
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L11	15,832	S56°20'54"E

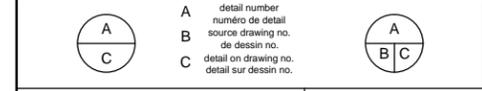
CURVE TABLE						
CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD	
C9	450,000	240,856	30°40'00"	123,388	237,992	
C10	195,000	403,281	118°29'38"	327,726	335,158	

SPIRAL TABLE					
SPIRAL	LENGTH	A	SHORT TAN	LONG TAN	
S13	88,889	200,00	29,657	59,290	
S14	50,000	150,00	16,672	33,339	
S15	166,154	180,00	56,360	111,841	

ALIGNMENT TABLE (AL00 - TCH)				
PT.	STATION	NORTHING	EASTING	
S13	25+797.782	5680544.8680	464497.8718	
C9	25+886.671	5680460.7209	464526.3964	
S14	26+127.527	5680272.7522	464672.3681	
L11	26+177.527	5680244.2831	464713.4634	
S15	26+193.359	5680235.5097	464726.6427	
C10	26+359.513	5680125.7058	464849.5567	



Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé
PA	2016.01.11	60% REVIEW	NJ	DL	DL



Consultant's Stamp  
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Eng. Stamp  
Sceau de l'ingénieur

Client/client

Parks Canada Agency  
Western and Northern  
Region

L'Agence Parcs  
Canada  
Ouest et Nord Région



TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

PLAN AND PROFILES  
STA 25+850 TO STA 26+500

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Révisé par NSJ	Scale / Échelle 1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client

Approved by / Approuvé par

Project No. / No. du projet  
2511-00581-0

Asset No. / No. du bien

Sheet No. / No. de la feuille  
011

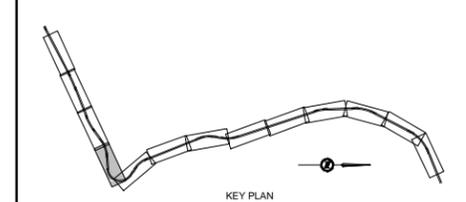
Drawing Reference No. / No. de référence du dessin  
PP-09



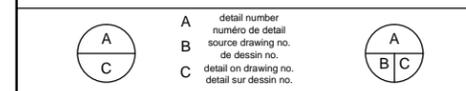
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PA	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé
2016.01.11	2016.01.11	60% REVIEW	NJ	DL	DL



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Eng. Stamp  
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Ouest et Nord Région

**McElhanney**  
McElhanney Consulting Services Ltd.

**TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1**  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

**PLAN AND PROFILES  
STA 26+500 TO STA 27+150**

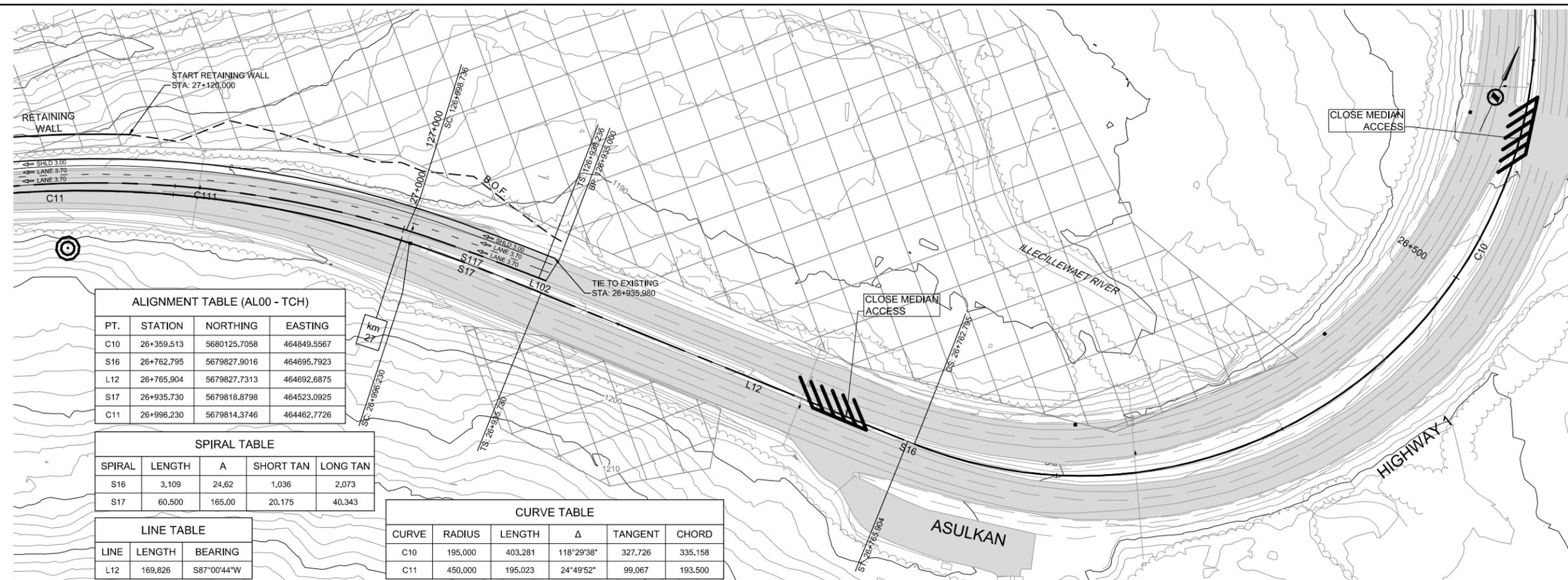
Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Revisé par NSJ	Scale / Echelle 1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
Parks Canada Responsible Officer / Agenc Responsable Parcs Canada	Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. / No. de la feuille <b>012</b>
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Drawing Reference No. / No. de référence du dessin  
PP-010

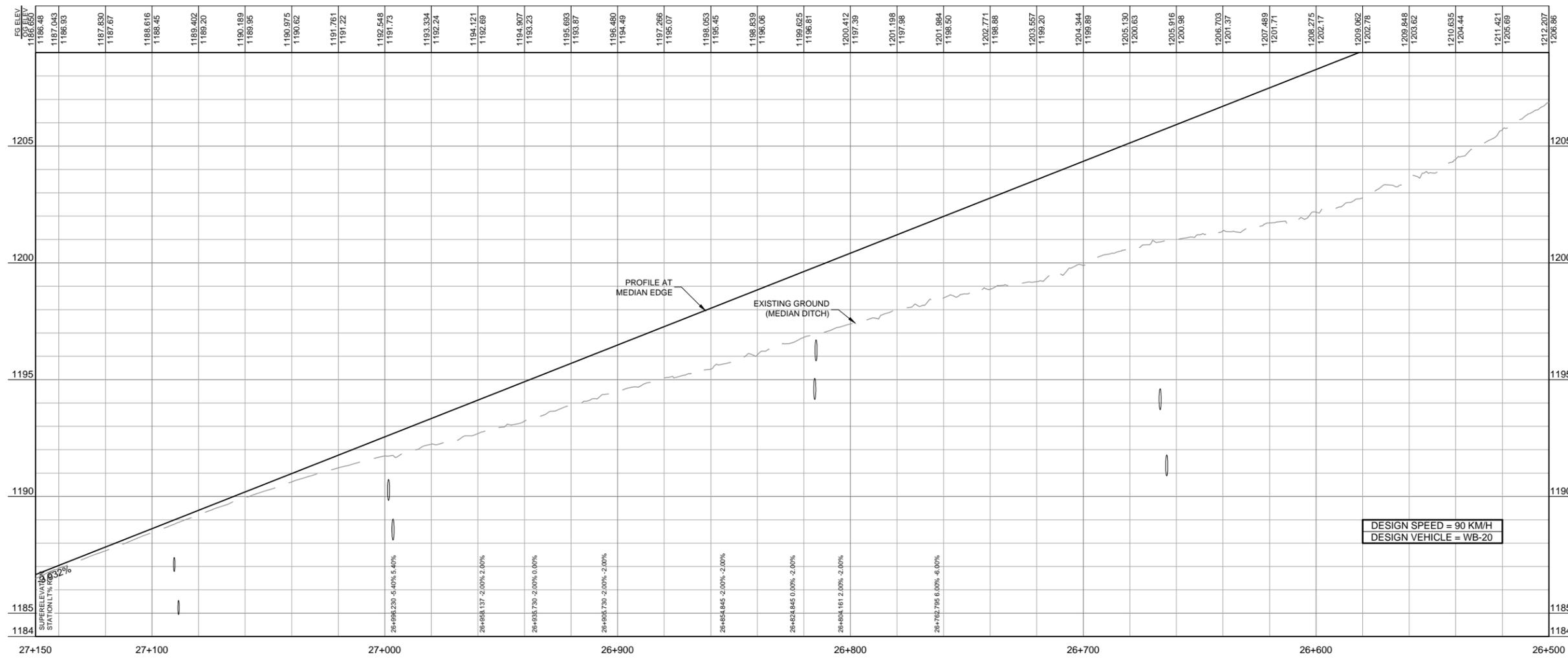


PT.	STATION	NORTHING	EASTING
C10	26+359.513	5680125.7058	464849.5567
S16	26+762.795	5679827.9016	464695.7923
L12	26+765.904	5679827.7313	464692.6875
S17	26+935.730	5679818.8798	464523.0925
C11	26+996.230	5679814.3746	464462.7726

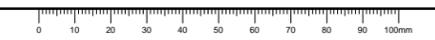
SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S16	3.109	24.62	1.036	2.073
S17	60.500	165.00	20.175	40.343

LINE	LENGTH	BEARING
L12	169.826	S87°00'44"W

CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C10	195,000	403.281	118°29'38"	327.726	335.158
C11	450,000	195.023	24°49'52"	99.067	193.500



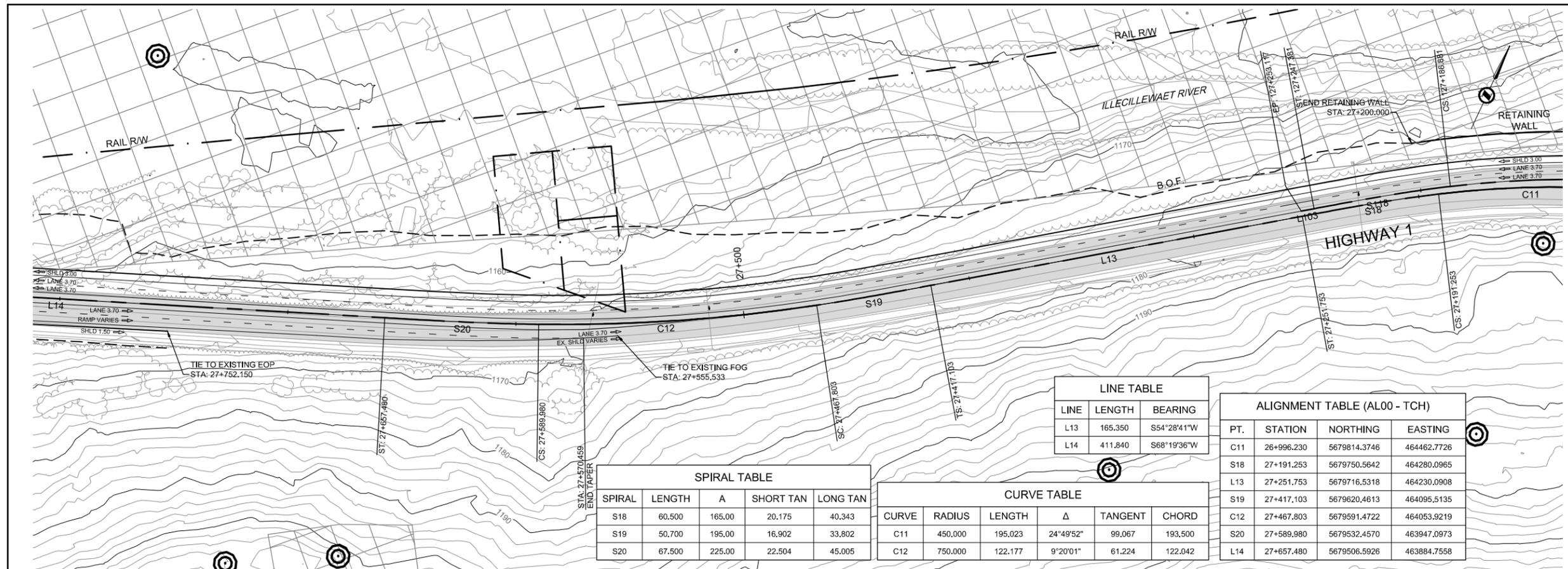
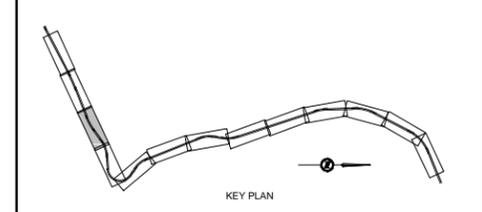
DESIGN SPEED = 90 KM/H  
DESIGN VEHICLE = WB-20



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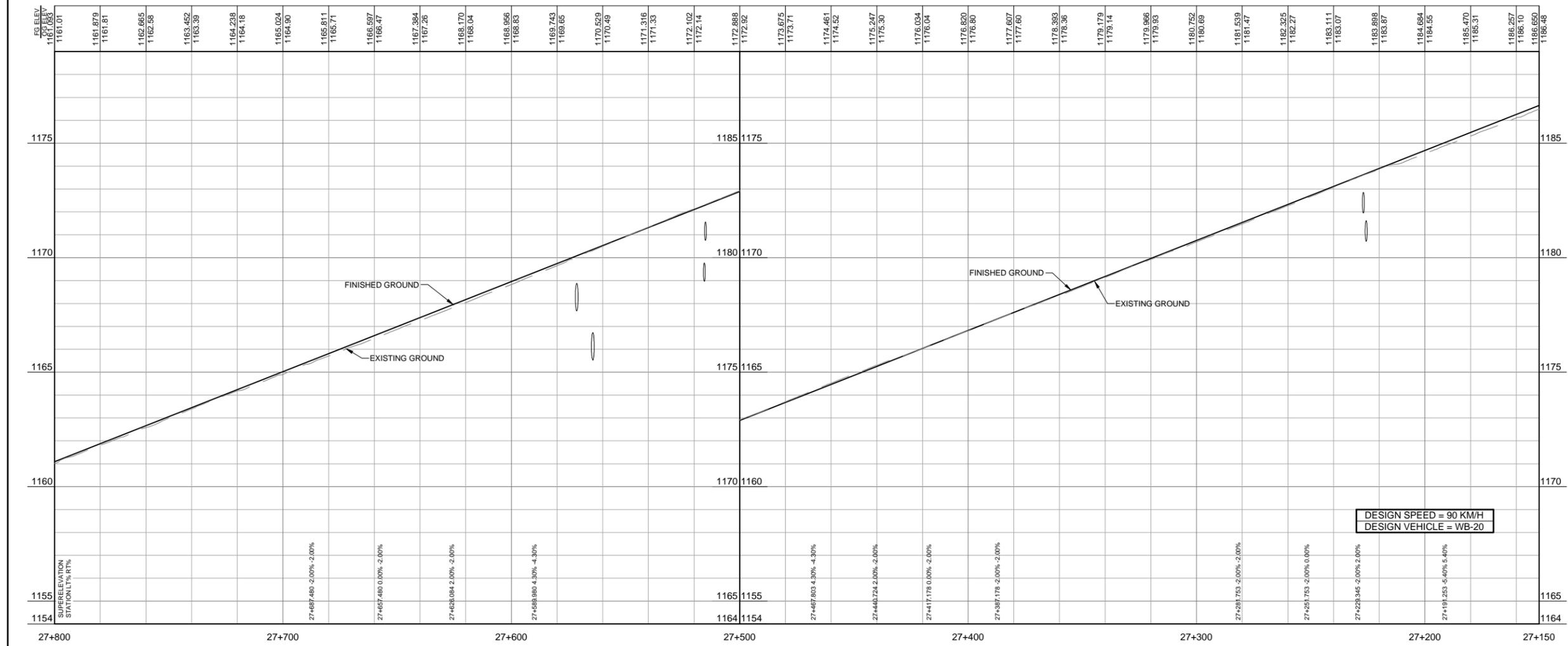


SPIRAL TABLE				
SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S18	60.500	165.00	20.175	40.343
S19	50.700	195.00	16.902	33.802
S20	67.500	225.00	22.504	45.005

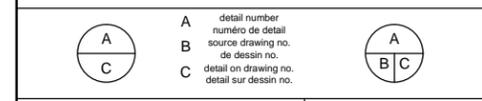
CURVE TABLE					
CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C11	450.000	195.023	24°49'52"	99.067	193.500
C12	750.000	122.177	9°20'01"	61.224	122.042

LINE TABLE		
LINE	LENGTH	BEARING
L13	165.350	S54°28'41"W
L14	411.840	S68°19'36"W

ALIGNMENT TABLE (AL00 - TCH)			
PT.	STATION	NORTHING	EASTING
C11	26+996.230	5679814.3746	464462.7726
S18	27+191.253	5679750.5642	464280.0965
L13	27+251.753	5679716.5318	464230.0908
S19	27+417.103	5679620.4613	464095.5135
C12	27+467.803	5679591.4722	464053.9219
S20	27+589.980	5679532.4570	463947.0973
L14	27+657.480	5679506.5926	463884.7558



PA	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé
2016.01.11	2016.01.11	60% REVIEW	NJ	DL	DL



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Canada  
Ouest et Nord Région

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McElhanney Consulting Services Ltd.

**TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1**  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

**PLAN AND PROFILES  
STA 27+150 TO STA 27+800**

Surveyed by / Arpenté par  
MCSL

Drawn by / Dessiné par  
NJ

Date  
2016.01.11

Designed by / Conçu par  
DL

Reviewed by / Révisé par  
NSJ

Scale / Échelle  
1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client

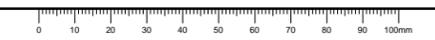
Approved by / Approuvé par

Project No. / No. du projet  
2511-00581-0

Asset No. / No. du-bien

Sheet No. / No. de la feuille  
**013**

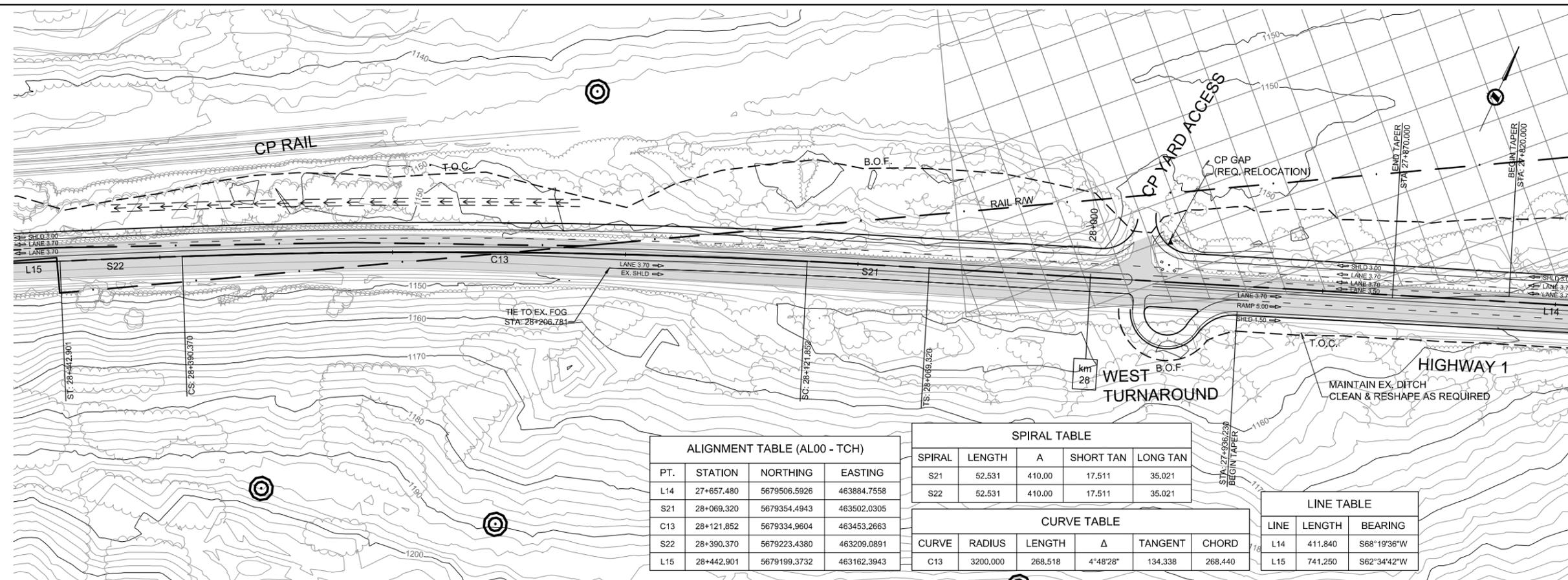
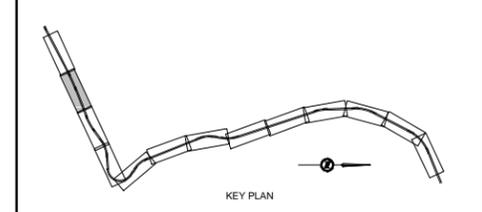
Drawing Reference No. / No. de référence du dessin  
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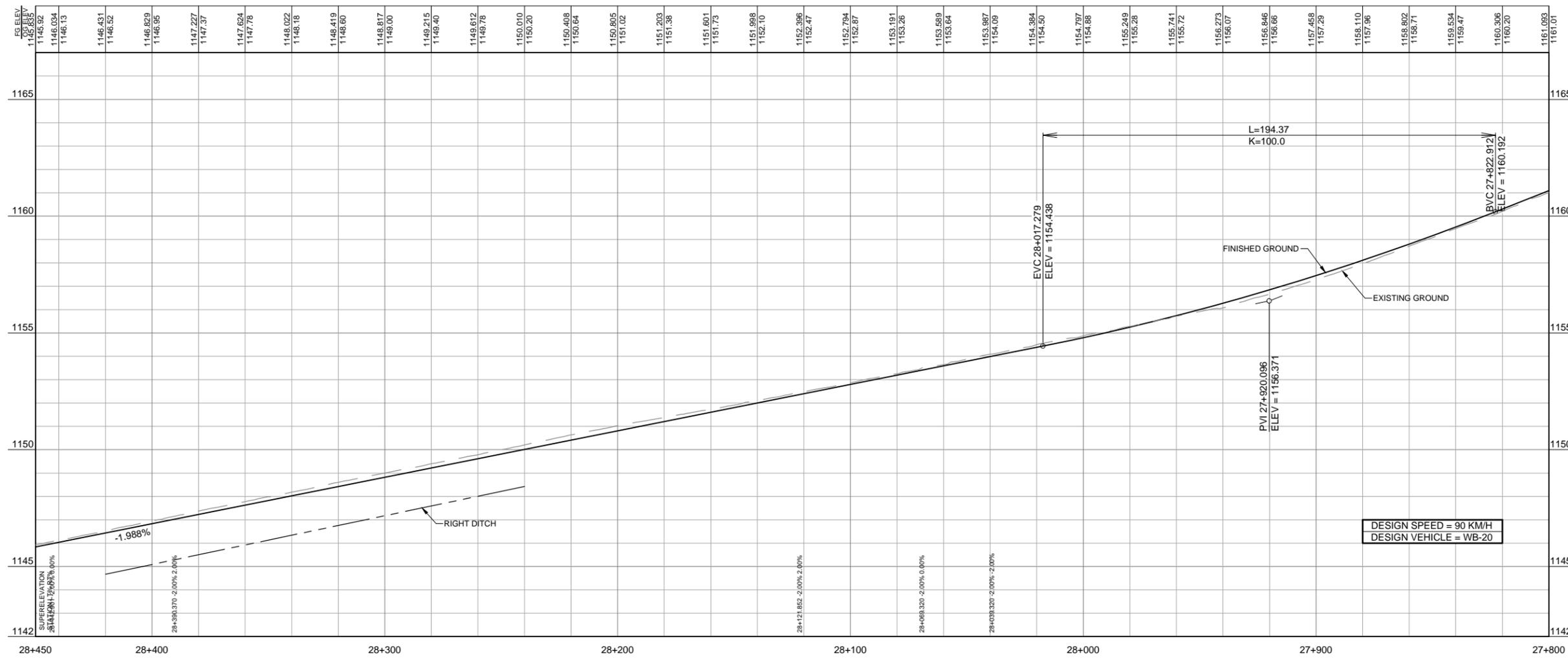


ALIGNMENT TABLE (AL00 - TCH)			
PT.	STATION	NORTHING	EASTING
L14	27+657.480	5679506.5926	463884.7558
S21	28+069.320	5679354.4943	463502.0305
C13	28+121.852	5679334.9604	463453.2663
S22	28+390.370	5679223.4380	463209.0891
L15	28+442.901	5679199.3732	463162.3943

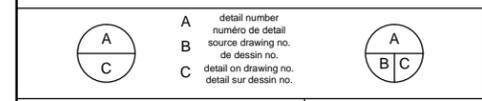
SPIRAL TABLE				
SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S21	52.531	410.00	17.511	35.021
S22	52.531	410.00	17.511	35.021

CURVE TABLE					
CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C13	3200.000	268.518	4°48'28"	134.338	268.440

LINE TABLE		
LINE	LENGTH	BEARING
L14	411.840	S68°19'36"W
L15	741.250	S62°34'42"W



Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé
PA	2016.01.11	60% REVIEW	NJ	DL	DL



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Sceau de l'ingénieur

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Canada  
Ouest et Nord Région



TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

PLAN AND PROFILES  
STA 27+800 TO STA 28+450

Surveyed by / Arpenté par  
MCSL

Drawn by / Dessiné par  
NJ

Date  
2016.01.11

Designed by / Conçu par  
DL

Reviewed by / Révisé par  
NSJ

Scale / Echelle  
1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client

Approved by / Approuvé par

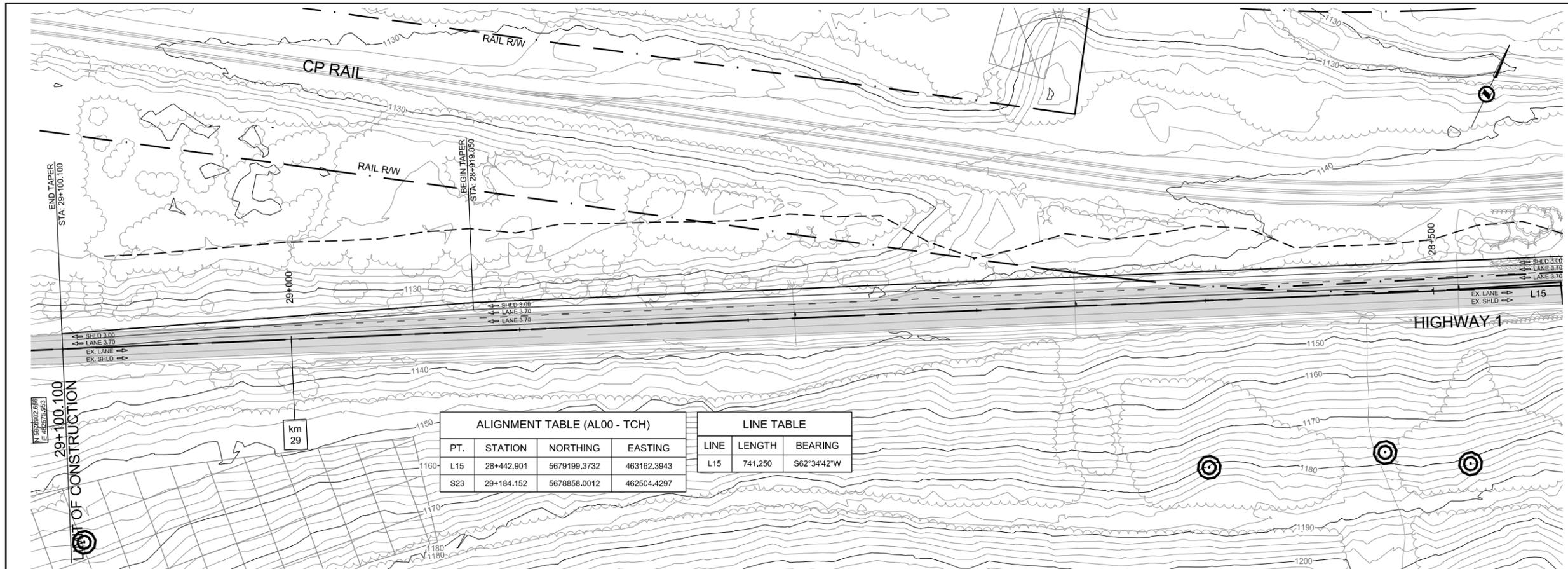
Project No. / No. du projet  
2511-00581-0

Asset No. / No. du bien

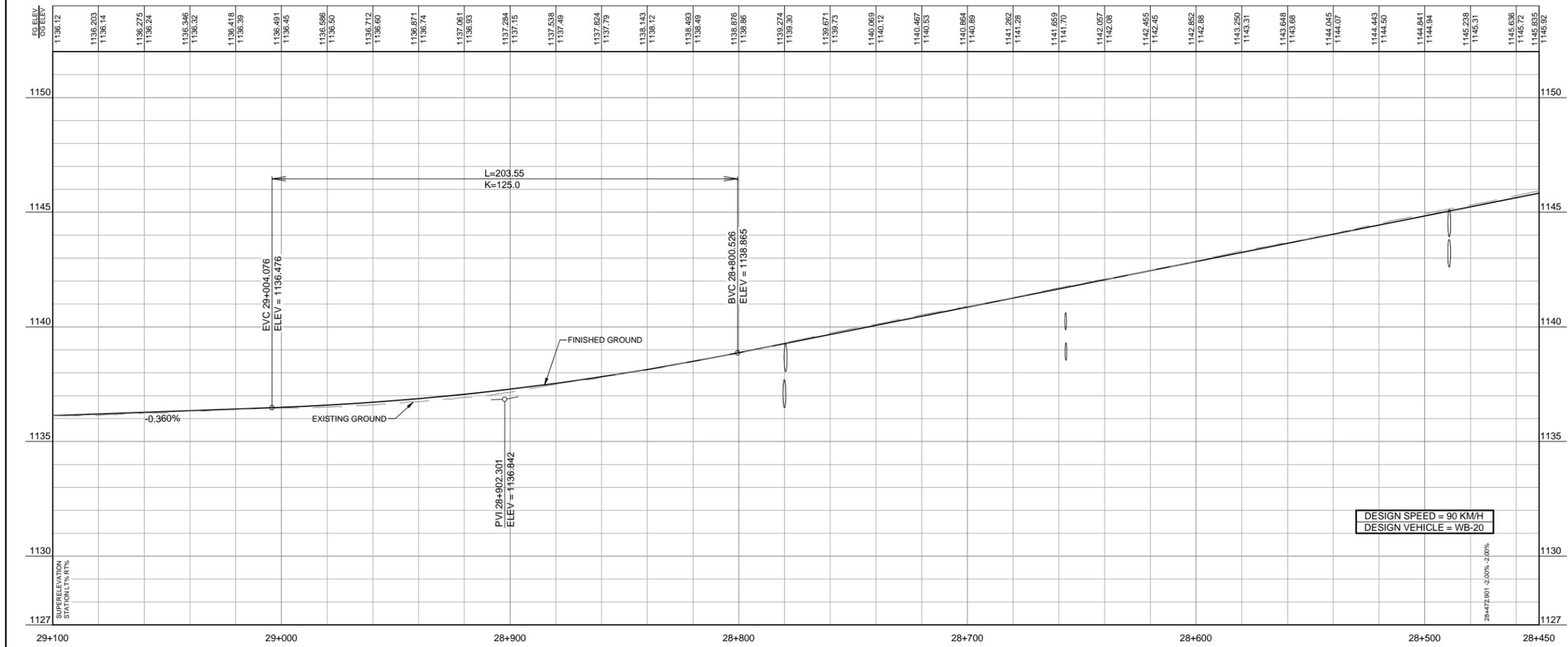
Sheet No. / No. de la feuille  
014

Drawing Reference No. / No. de référence du dessin  
PP-012





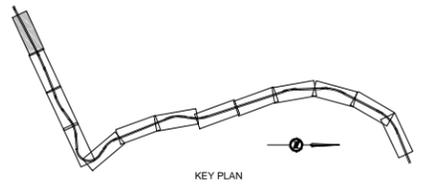
ALIGNMENT TABLE (AL00 - TCH)				LINE TABLE		
PT.	STATION	NORTHING	EASTING	LINE	LENGTH	BEARING
L15	28+442.901	5679199.3732	463162.3943	L15	741.250	S62°34'42"W
S23	29+184.152	5678858.0012	462504.4297			



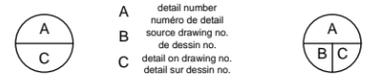
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PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé



Consultant's Stamp  
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Client/Client

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**TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1**

ROGERS PASS  
GLACIER NATIONAL PARK, BC

**PLAN AND PROFILES  
STA 28+450 TO STA 29+100**

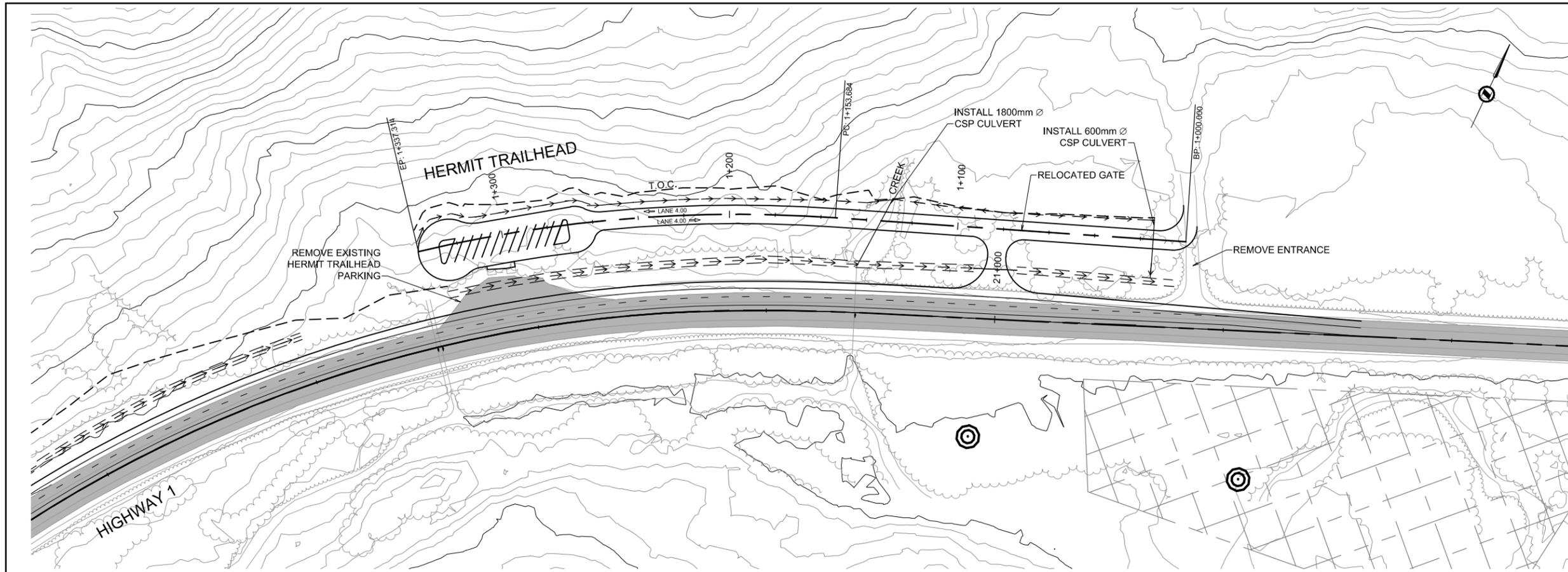
Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Révisé par NSJ	Scale / Echelle 1:1000

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
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Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. / No. de la feuille <b>015</b>
Drawing Reference No. / No. de référence du dessin PP-013		

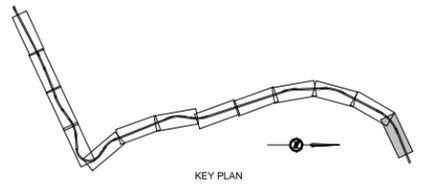




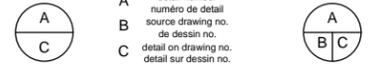
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Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé
PA	2016.01.11	60% REVIEW	NJ	DL	DL



Consultant's Stamp  
Sceau de l'expert-conseil

Eng. Stamp  
Sceau de l'ingénieur

Client/client

Parks Canada Agency  
Western and Northern  
Region

L'Agence Parcs  
Canada  
Ouest et Nord Région



TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

PLAN AND PROFILES  
HERMIT ACCESS ROAD

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Révisé par NSJ	Scale / Echelle 1:1000

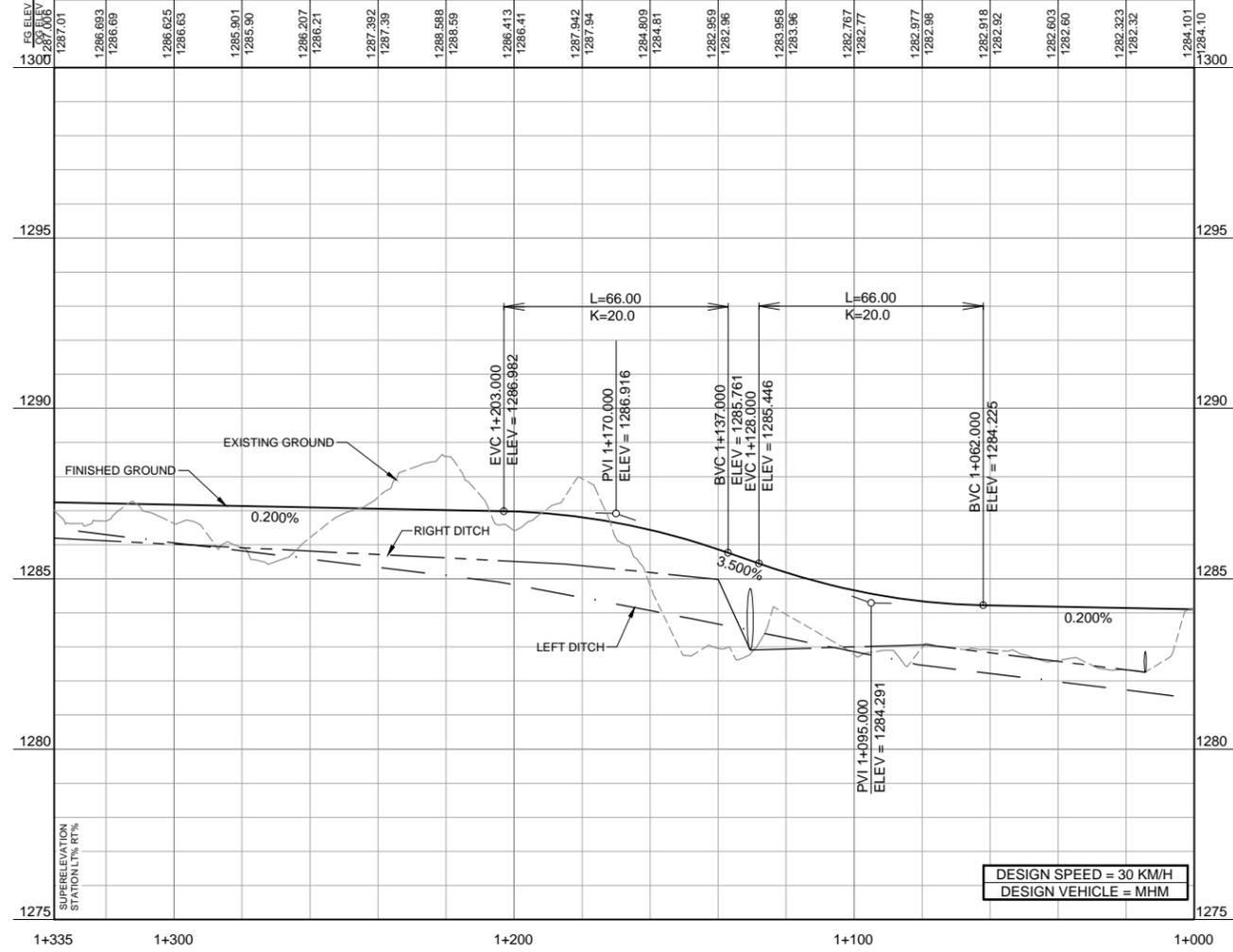
Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client

Approved by / Approuvé par

Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. No. de la feuille <b>016</b>
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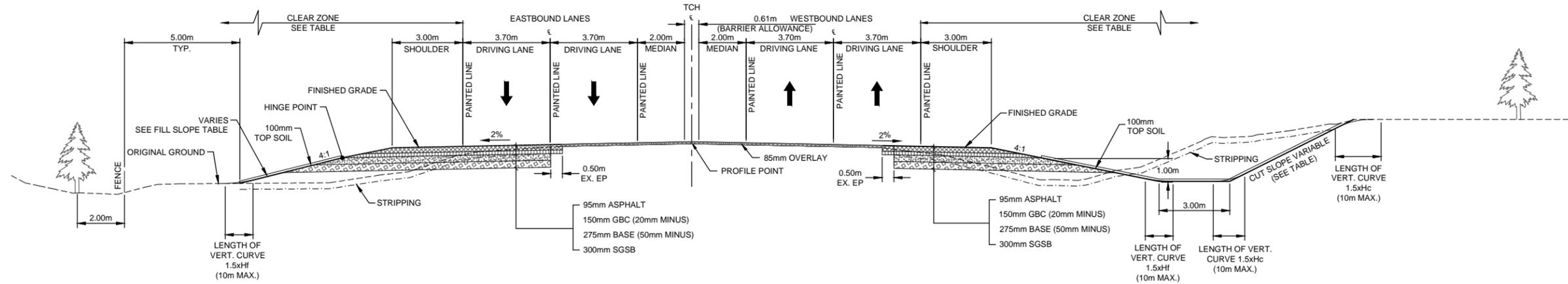
Drawing Reference No. / No. de référence du dessin  
PP-014



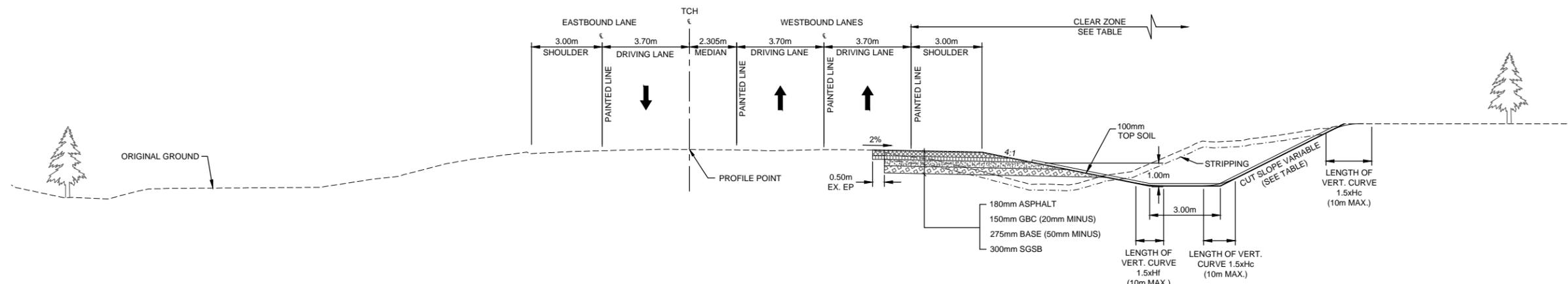
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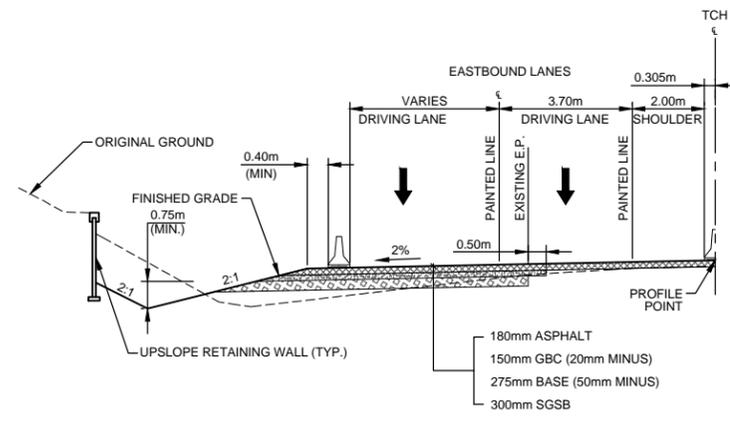
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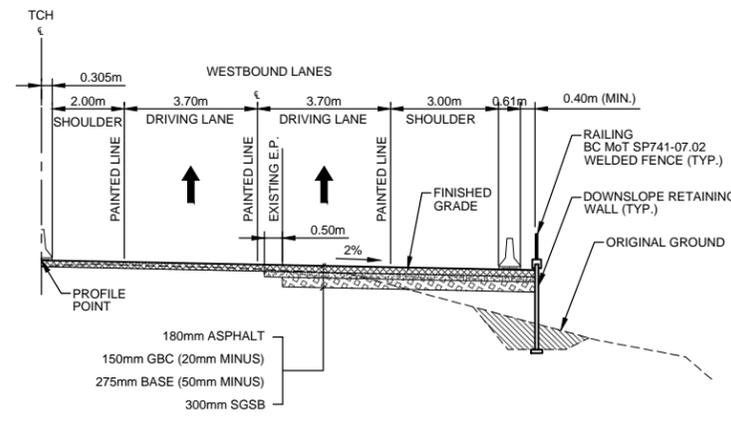
TYPICAL SECTION - WIDEN TO BOTH SIDES



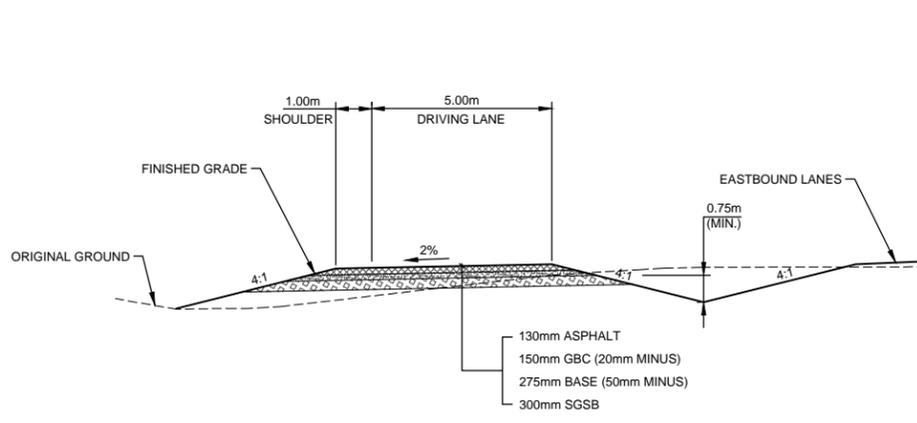
TYPICAL SECTION - WIDEN WB LANE ONLY



TYPICAL SECTION - UPSLOPE RETAINING WALL



TYPICAL SECTION - DOWNSLOPE RETAINING WALL



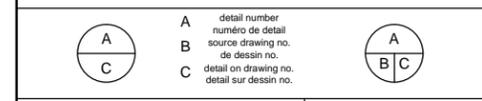
TYPICAL SECTION - TURNAROUND

CUT SLOPE TABLE	
CUT DEPTH (Hc)	SLOPE
<3.0m	4:1
3.0m - 4.0m	3:1
>4.0m	2:1
ROCK CUT	VARIABLE

FILL SLOPE TABLE	
FILL HEIGHT (Hf)	SLOPE
<2.5m	4:1
>2.5m	3:1
MOUNTAINSIDE/RIVERSIDE	2:1 WITH BARRIER

\*BENCHES 3.0m WIDE TO BE PROVIDED AT 8.0m VERTICAL INTERVALS OR AS ACCEPTED BY THE ENGINEER

PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé



Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
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Client/client

L'Agence Parcs Canada Ouest et Nord Région

TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

TYPICAL SECTIONS

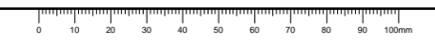
Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Révisé par NSJ	Scale / Echelle 1:100

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
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Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. / No. de la feuille 017
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Drawing Reference No. / No. de référence du dessin



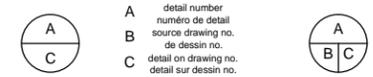
NOT INCLUDED IN 60% SET

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PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé



Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
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Client/client

 Parks Canada Agency Western and Northern Region	L'Agence Parcs Canada Ouest et Nord Région
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**TCH WIDENING  
 ILLECILLEWAET CURVE  
 KM 21.0 TO KM 29.1  
 ROGERS PASS  
 GLACIER NATIONAL PARK, BC**

**TYPICAL SECTIONS**

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Revisé par NSJ	Scale / Échelle 1:100

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
---	----------------------------

Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. / No. de la feuille <b>018</b>
Drawing Reference No. / No. de référence du dessin		

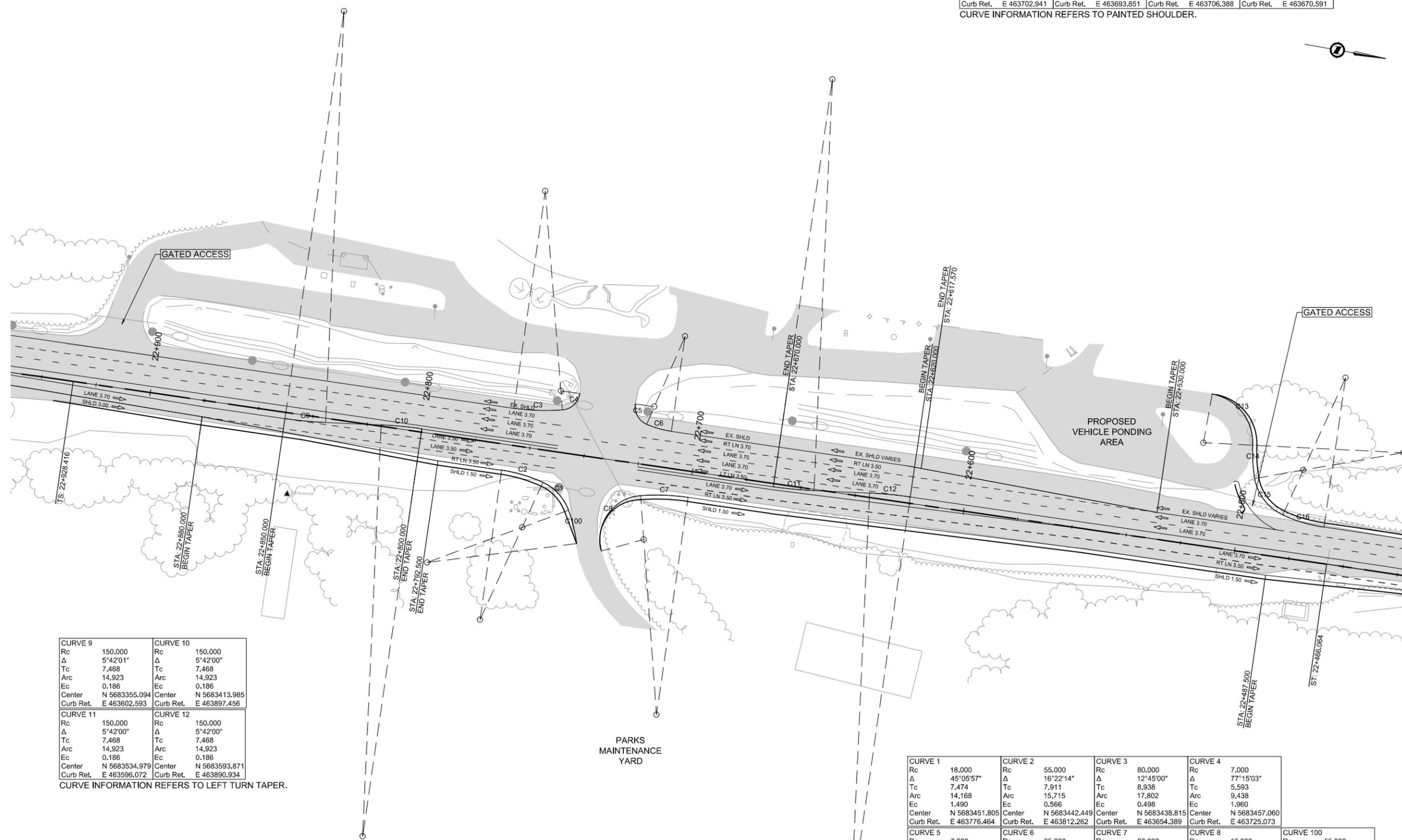
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CURVE 13	CURVE 14	CURVE 15	CURVE 16
Rc 18,000	Rc 55,000	Rc 18,000	Rc 55,000
Δ 82°50'51"	Δ 12°39'13"	Δ 55°32'47"	Δ 16°22'14"
Tc 15,862	Tc 6,098	Tc 9,480	Tc 7,911
Arc 28,027	Arc 12,147	Arc 17,450	Arc 15,715
Ec 6,005	Ec 0,337	Ec 2,344	Ec 0,566
Center N 5683691.379	Center N 5683763.810	Center N 5683728.999	Center N 5683738.355
Curb Ret. E 463702.941	Curb Ret. E 463693.851	Curb Ret. E 463706.388	Curb Ret. E 463670.591

CURVE INFORMATION REFERS TO PAINTED SHOULDER.



CURVE 9	CURVE 10
Rc 150,000	Rc 150,000
Δ 5°42'01"	Δ 5°42'00"
Tc 7,468	Tc 7,468
Arc 14,923	Arc 14,923
Ec 0,186	Ec 0,186
Center N 5683355.094	Center N 5683413.985
Curb Ret. E 463602.593	Curb Ret. E 463897.456

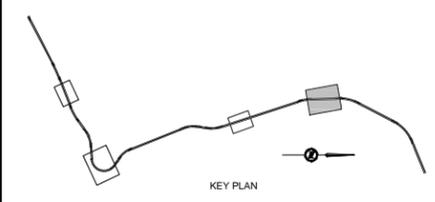
CURVE 11	CURVE 12
Rc 150,000	Rc 150,000
Δ 5°42'00"	Δ 5°42'00"
Tc 7,468	Tc 7,468
Arc 14,923	Arc 14,923
Ec 0,186	Ec 0,186
Center N 5683534.979	Center N 5683593.871
Curb Ret. E 463596.072	Curb Ret. E 463890.934

CURVE INFORMATION REFERS TO LEFT TURN TAPER.

CURVE 1	CURVE 2	CURVE 3	CURVE 4
Rc 18,000	Rc 55,000	Rc 80,000	Rc 7,000
Δ 45°05'57"	Δ 16°22'14"	Δ 12°45'00"	Δ 77°15'03"
Tc 7,474	Tc 7,911	Tc 8,938	Tc 5,593
Arc 14,168	Arc 15,715	Arc 17,802	Arc 9,438
Ec 1,490	Ec 0,566	Ec 0,498	Ec 1,960
Center N 5683451.805	Center N 5683442.449	Center N 5683438.815	Center N 5683457.060
Curb Ret. E 463776.464	Curb Ret. E 463812.262	Curb Ret. E 463654.389	Curb Ret. E 463725.073

CURVE 5	CURVE 6	CURVE 7	CURVE 8	CURVE 100
Rc 7,000	Rc 35,000	Rc 80,000	Rc 16,000	Rc 55,000
Δ 74°38'28"	Δ 15°21'32"	Δ 12°25'45"	Δ 101°03'17"	Δ 13°02'50"
Tc 5,337	Tc 4,719	Tc 8,711	Tc 19,428	Tc 6,289
Arc 9,119	Arc 9,382	Arc 17,355	Arc 28,220	Arc 12,524
Ec 1,802	Ec 0,317	Ec 0,473	Ec 9,169	Ec 0,358
Center N 5683491.668	Center N 5683498.269	Center N 5683511.915	Center N 5683496.267	Center N 5683419.844
Curb Ret. E 463724.832	Curb Ret. E 463697.621	Curb Ret. E 463835.183	Curb Ret. E 463773.126	Curb Ret. E 463795.106

CURVE INFORMATION REFERS TO PAINTED SHOULDER.



PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé

A B C	A detail number B source drawing no. C detail on drawing no.	A B C
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Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
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Client/Client	Parks Canada Agency Western and Northern Region	L'Agence Parcs Canada Ouest et Nord Région
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**TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1**  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

**INTERSECTION DETAILS  
ROGERS PASS SUMMIT**

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Révisé par NSJ	Scale / Echelle 1:500

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
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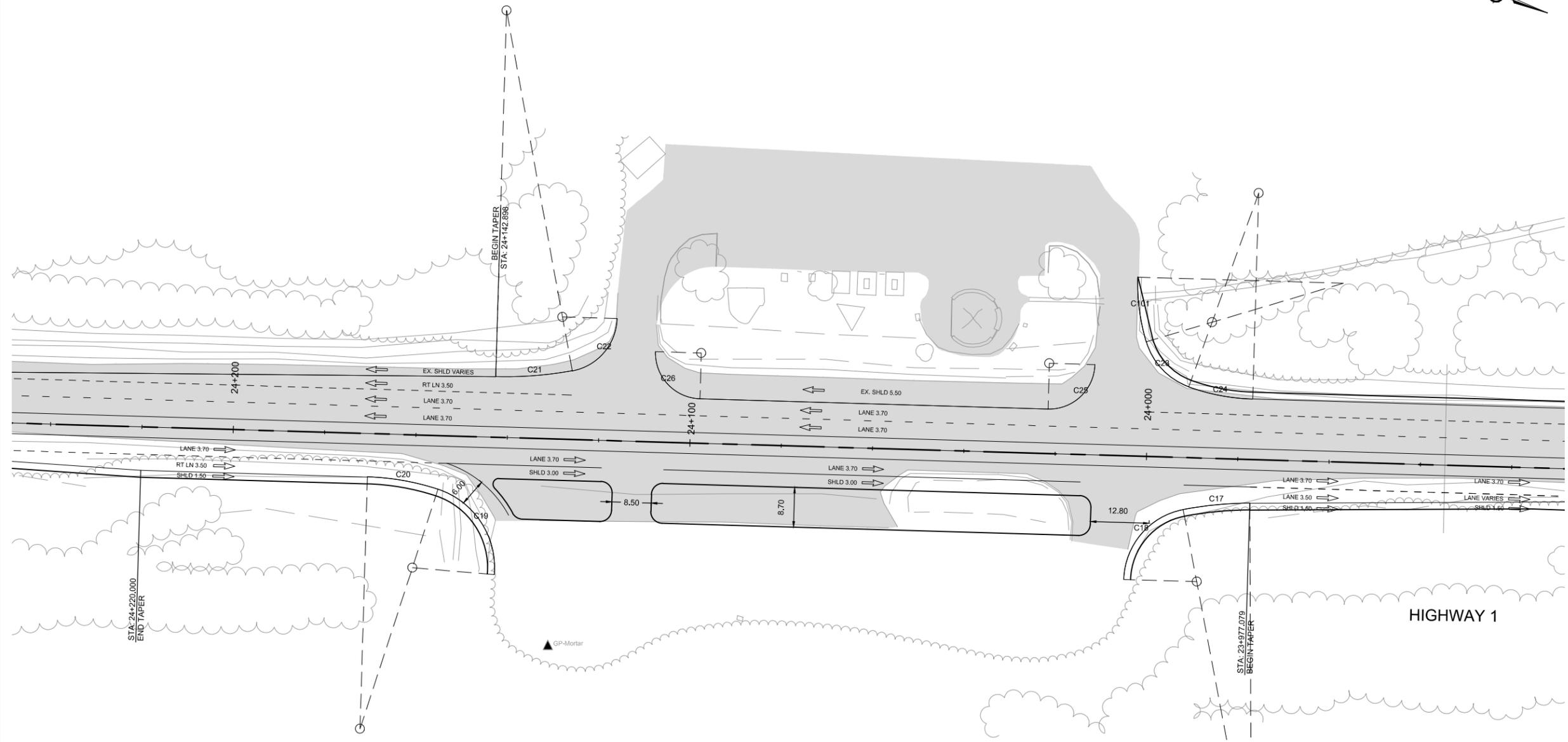
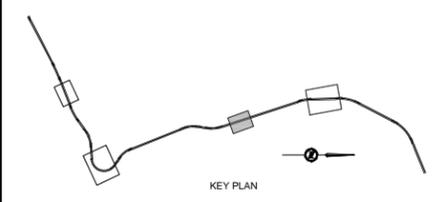
Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. / No. de la feuille <b>019</b>
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PA	2016.01.11	60% REVIEW	NJ	DL	DL
Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé

A B C	A detail number numéro de détail B source drawing no. de dessin no. C detail on drawing no. détail sur dessin no.	A B C
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Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
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Client/client	Parks Canada Agency Western and Northern Region	L'Agence Parcs Canada Ouest et Nord Région
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**TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1**  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

## INTERSECTION DETAILS MONUMENT

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Révisé par NSJ	Scale / Echelle 1:250

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
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Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. / No. de la feuille 020
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Drawing Reference No. / No. de référence du dessin

<b>CURVE 17</b> Rc 80.000 Δ 10°31'12" Tc 7.365 Arc 14.689 Ec 0.338 Center N 5682311.489 Curb Ret. E 464142.410	<b>CURVE 18</b> Rc 16.000 Δ 77°34'16" Tc 12.858 Arc 21.662 Ec 4.526 Center N 5682278.767 Curb Ret. E 464087.407	<b>CURVE 19</b> Rc 18.000 Δ 76°47'42" Tc 14.265 Arc 24.126 Ec 4.967 Center N 5682116.370 Curb Ret. E 464143.283	<b>CURVE 20</b> Rc 55.000 Δ 16°22'14" Tc 7.911 Arc 15.715 Ec 0.566 Center N 5682117.629 Curb Ret. E 464180.261	<b>CURVE 21</b> Rc 80.000 Δ 12°03'24" Tc 8.448 Arc 16.834 Ec 0.445 Center N 5682094.115 Curb Ret. E 464021.917	<b>CURVE 22</b> Rc 12.000 Δ 77°56'37" Tc 9.708 Arc 16.324 Ec 3.435 Center N 5682128.501 Curb Ret. E 464080.582
<b>CURVE 23</b> Rc 15.000 Δ 53°37'14" Tc 7.580 Arc 14.038 Ec 1.807 Center N 5682262.550 Curb Ret. E 464033.039	<b>CURVE 24</b> Rc 45.000 Δ 18°11'42" Tc 7.206 Arc 14.290 Ec 0.573 Center N 5682262.484 Curb Ret. E 464003.039	<b>CURVE 25</b> Rc 10.000 Δ 90°00'00" Tc 10.000 Arc 15.708 Ec 4.142 Center N 5682232.143 Curb Ret. E 464053.641	<b>CURVE 26</b> Rc 10.000 Δ 90°00'00" Tc 10.000 Arc 15.708 Ec 4.142 Center N 5682159.770 Curb Ret. E 464077.603	<b>CURVE 101</b> Rc 45.000 Δ 18°11'04" Tc 7.202 Arc 14.282 Ec 0.573 Center N 5682286.664 Curb Ret. E 464015.193	

CURVE INFORMATION REFERS TO PAINTED SHOULDER.



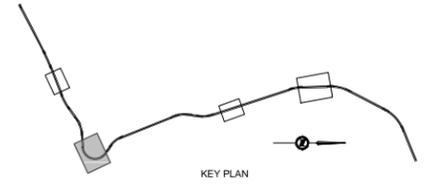
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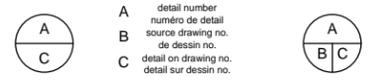
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				4DESBY	
				3DESBY	
				2DESBY	
				1DESBY	
PA	2016.01.11	60% REVIEW	NJ	DL	DL

Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé



Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur

Client/client

Parks Canada Agency  
Western and Northern  
Region

L'Agence Parcs  
Canada  
Ouest et Nord Région

**McElhanney**  
McElhanney Consulting Services Ltd.

TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

INTERSECTION DETAILS  
ILLECILLEWAET CAMPGROUND

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Revisé par NSJ	Scale / Echelle 1:250

Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par

Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. / No. de la feuille 021
Drawing Reference No. / No. de référence du dessin		

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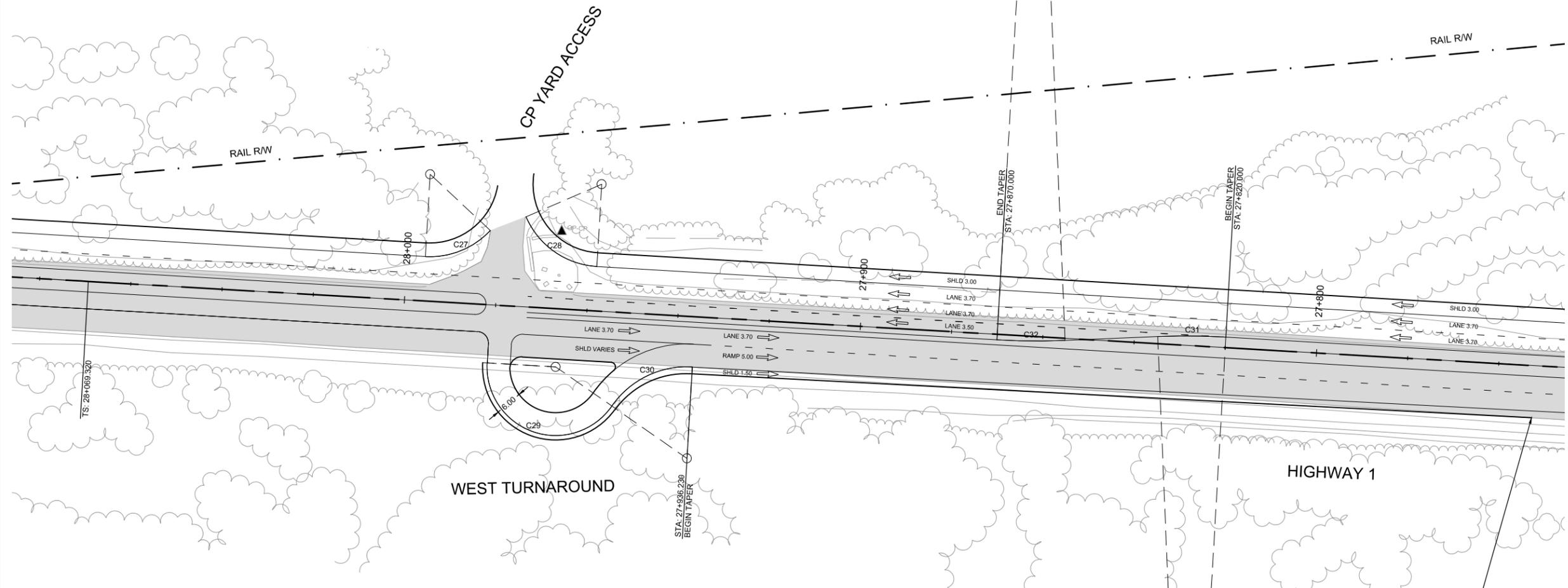
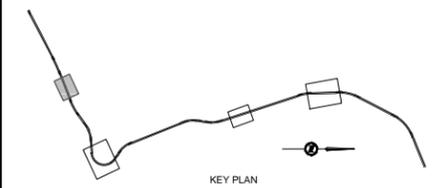
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<b>CURVE 27</b>	<b>CURVE 28</b>
Rc 18,000	Rc 18,000
Δ 50°18'56"	Δ 63°24'46"
Tc 8.454	Tc 11.120
Arc 15.807	Arc 19.922
Ec 1.886	Ec 3.158
Center N 5679407.334	Center N 5679421.222
Curb Ret. E 463559.975	Curb Ret. E 463594.920
<b>CURVE 29</b>	<b>CURVE 30</b>
Rc 15,000	Rc 20,000
Δ 143°28'32"	Δ 58°28'33"
Tc 53.142	Tc 11.195
Arc 38.871	Arc 20.412
Ec 40.219	Ec 2.920
Center N 5679380.816	Center N 5679374.828
Curb Ret. E 463602.666	Curb Ret. E 463637.150

CURVE INFORMATION REFERS TO PAINTED SHOULDER.



<b>CURVE 31</b>	<b>CURVE 32</b>
Rc 150,000	Rc 150,000
Δ 5°42'00"	Δ 5°42'00"
Tc 7.468	Tc 7.468
Arc 14.923	Arc 14.923
Ec 0.186	Ec 0.186
Center N 5679309.318	Center N 5679566.391
Curb Ret. E 463788.271	Curb Ret. E 463632.304

CURVE INFORMATION REFERS TO LEFT TURN TAPER.

PA	2016.01.11	60% REVIEW	NJ	DL	DL
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Rev.	Date	Description	Drawn Dessiné	Designed Conçu	Approved Approuvé

A B C	detail number numéro de detail source drawing no. de dessin no. detail on drawing no. detail sur dessin no.	A B C
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Consultant's Stamp Sceau de l'expert-conseil	Eng. Stamp Sceau de l'ingénieur
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Client/client	Parks Canada Agency Western and Northern Region	L'Agence Parcs Canada Ouest et Nord Région
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**TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1**  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

**INTERSECTION DETAILS  
CP RAIL / TURNAROUND**

Surveyed by / Arpenté par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
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Designed by / Conçu par DL	Reviewed by / Revisé par NSJ	Scale / Echelle 1:250
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Parks Canada Project Manager / Administrateur de Projets Parcs Canada

Client Acceptance / Acceptation du client	Approved by / Approuvé par
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Project No. / No. du projet 2511-00581-0	Asset No. / No. du bien	Sheet No. / No. de la feuille 022
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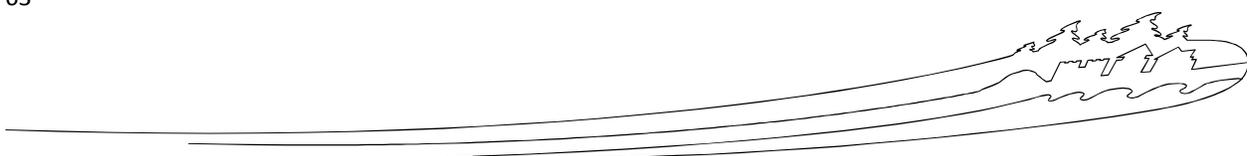
Drawing Reference No. / No. de référence du dessin





March 2016

## Appendix 4: Vegetation Elements of Management Concern with Potential to Occur Near the Project



Appendix 4 - Vegetation Elements of Management Concern with Potential to Occur Near the Project

Scientific Name	English Name	BC General <sup>1</sup>	BC Conservation <sup>2</sup>	COSEWIC <sup>3</sup>	SARA <sup>4</sup>	Habitat Subtype
<i>Allium geyeri</i> var. <i>tenerum</i>	Geyer's onion	Sensitive	Blue	-	-	Vernal Pools/Seasonal Seeps;Rock/Sparsely Vegetated Rock;Riparian Herbaceous;Garry Oak Vernal Pool
<i>Arnica longifolia</i>	seep-spring amica	Sensitive	Red	-	-	Meadow;Riparian Herbaceous;Alpine/Subalpine Meadow
<i>Atrichum tenellum</i>	-	May Be At Risk	Red	-	-	-
<i>Botrychium crenulatum</i>	dainty moonwort	Sensitive	Blue	-	-	-
<i>Botrychium lineare</i>	Linear-leaf moonwort	May Be At Risk	Blue	-	-	Pasture/Old Field;Cliff;Rock/Sparsely Vegetated Rock;Mixed Forest (deciduous/coniferous mix);Riparian Herbaceous
<i>Botrychium simplex</i> var. <i>compositum</i>	least moonwort	Sensitive	Blue	-	-	-
<i>Botrychium spatulatum</i>	spoon-shaped moonwort	May Be At Risk	Blue	-	-	Pasture/Old Field;Meadow;Alpine/Subalpine Meadow
<i>Bryum blindii</i>	-	Undetermined	Blue	-	-	-
<i>Campyllum calcareum</i>	-	May Be At Risk	Red	-	-	-
<i>Carex krausei</i>	Krause's sedge	Sensitive	Blue	-	-	Tundra;Meadow;Grassland;Sagebrush Steppe;Antelope-brush Steppe;Gravel Bar
<i>Carex lenticularis</i>	lakeshore sedge	Secure	Blue	-	-	Marsh;Lake;Riparian Herbaceous;Gravel Bar
<i>Cryptogramma cascadenis</i>	Cascade parsley fern	Sensitive	Blue	-	-	Cliff;Rock/Sparsely Vegetated Rock;Talus
<i>Delphinium sutherlandii</i>	Sutherland's larkspur	Sensitive	Blue	-	-	Rock/Sparsely Vegetated Rock;Shrub - Natural;Conifer Forest - Dry
<i>Didymodon subandreaeoides</i>	-	Sensitive	Red	-	-	-
<i>Draba lactea</i>	milky draba	Sensitive	Blue	-	-	Cliff;Rock/Sparsely Vegetated Rock;Talus;Tundra;Meadow;Alpine/Subalpine Meadow
<i>Dryopteris cristata</i>	crested wood fern	Sensitive	Blue	-	-	Swamp;Riparian Shrub;Conifer Forest - Moist/wet
<i>Eleocharis elliptica</i>	elliptic spike-rush	Sensitive	Blue	-	-	Fen;Meadow
<i>Eleocharis nitida</i>	slender spike-rush	May Be At Risk	Blue	-	-	Fen
<i>Epilobium glaberrimum</i> ssp. <i>fastigiatum</i>	smooth willowherb	Sensitive	Blue	-	-	Stream/River;Cliff;Rock/Sparsely Vegetated Rock;Talus;Tundra;Glacier/Icefield;Avalanche Track;Krummholtz;Alpine/Subalpine Meadow;Alpine Grassland;Heath;Fellfield;Nivation;Zoogenic
<i>Epilobium x treleaseianum</i>	Trelease's hybrid willowherb	Sensitive	Blue	-	-	Stream/River;Cold Spring
<i>Grimmia mollis</i>	-	Sensitive	Blue	-	-	-
<i>Hygrohypnum alpinum</i>	-	Secure	Blue	-	-	-
<i>Hypericum spouleri</i> ssp. <i>nortoniae</i>	western St. John's-wort	Sensitive	Blue	-	-	Rock/Sparsely Vegetated Rock;Meadow;Alpine/Subalpine Meadow
<i>Isoetes howellii</i>	Howell's quillwort	May Be At Risk	Blue	-	-	Vernal Pools/Seasonal Seeps
<i>Juncus albescens</i>	whitish rush	Secure	Blue	-	-	Fen;Pond/Open Water;Heath
<i>Lescuraea saxicola</i>	-	-	Blue	-	-	-
<i>Mnium arizonicum</i>	-	Sensitive	Blue	-	-	-
<i>Orthotrichum pallens</i>	-	Sensitive	Blue	-	-	-
<i>Pellaea gastonyi</i>	Gastony's cliff-brake	Sensitive	Blue	-	-	Cliff;Rock/Sparsely Vegetated Rock;Talus;Conifer Forest - Dry
<i>Pinus albicaulis</i>	whitebark pine	Sensitive	Blue	Endangered	Endangered , Schedule 1	Cliff;Rock/Sparsely Vegetated Rock;Talus;Conifer Forest - Mesic (average);Conifer Forest - Dry
<i>Pinus flexilis</i>	limber pine	Sensitive	Red	Endangered	-	Rock/Sparsely Vegetated Rock;Grassland;Conifer Forest - Dry;Krummholtz;Alpine Grassland
<i>Platyhypnidium riparioides</i>	-	Sensitive	Blue	-	-	-
<i>Pohlia elongata</i>	-	Sensitive	Blue	-	-	-
<i>Pohlia lescuriana</i>	-	Sensitive	Red	-	-	-
<i>Pohlia longicollis</i>	-	Sensitive	Red	-	-	-
<i>Pohlia melanodon</i>	-	May Be At Risk	Red	-	-	-
<i>Pyrola elliptica</i>	shinleaf wintergreen	Sensitive	Blue	-	-	Conifer Forest - Mesic (average);Conifer Forest - Dry;Conifer Forest - Moist/wet;Mixed Forest (deciduous/coniferous mix)
<i>Ranunculus pedatifidus</i> ssp. <i>affinis</i>	birdfoot buttercup	Sensitive	Blue	-	-	Rock/Sparsely Vegetated Rock;Tundra;Meadow;Deciduous/Broadleaf Forest
<i>Salix tweedyi</i>	Tweedy's willow	Sensitive	Blue	-	-	Fen;Marsh;Stream/River;Meadow
<i>Stellaria obtusa</i>	blunt-sepaled starwort	Sensitive	Blue	-	-	Riparian Forest;Riparian Shrub;Meadow;Alpine/Subalpine Meadow
<i>Tayloria splachnoides</i>	-	May Be At Risk	Red	-	-	Tundra;Meadow;Grassland;Sagebrush Steppe;Antelope-brush Steppe;Gravel Bar
-	-	-	Red	-	-	Terrestrial

Notes:  
Grey denotes species confirmed within 5 km of Project Sites

<sup>1</sup> General Status of Wild Species 2010 (Canadian Endangered Species Conservation Council 2011).

<sup>2</sup> BC Species and Ecosystems Explorer. Yellow=Secure; Red=Extirpated, Endangered or Threatened; Blue=Special Concern (B.C. Conservation Data Centre 2015a).

<sup>3</sup> Status under the Committee on the Status of Endangered Wildlife in Canada (Government of Canada 2015).

<sup>4</sup> SARA - Species at Risk Act (Government of Canada 2002).



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## Appendix 5: Wildlife Species of Management Concern Potentially Found Within 1 Kilometre of the Project



Appendix 5 - Wildlife Species of Management Concern Potentially Found Within 1 Kilometre of Illecillewaet Curve<sup>1</sup>

Common Name	Scientific Name	Period of Occurrence	Protected Under the MCBA? <sup>2</sup>	BC Conservation <sup>3</sup>	COSEWIC <sup>4</sup>	SARA <sup>5</sup>	Federal Setback <sup>6</sup>		
							Distance	Time of Year	Feature
<b>Amphibians</b>									
Coeur d'Alene Salamander	<i>Plethodon idahoensis</i>	Resident	N/A	Yellow	Special Concern	Special Concern, Schedule 1	-	-	-
Western Toad	<i>Anaxyrus boreas</i>	Resident	N/A	Blue	Special Concern	Special Concern, Schedule 1	-	-	-
<b>Birds</b>									
American Bittern	<i>Botaurus lentiginosus</i>	Migrant	Yes	Blue	-	-	-	-	-
American Kestrel	<i>Falco sparverius</i>	Migrant	No	Yellow	-	-	-	-	-
Barn Swallow	<i>Hirundo rustica</i>	Migrant	Yes	Blue	Threatened	-	100	May 1 - Aug. 31	Nest
California Gull	<i>Larus californicus</i>	Migrant	Yes	Blue	-	-	-	-	-
Common Nighthawk	<i>Chordeiles minor</i>	Migrant	Yes	Yellow	Threatened	Threatened, Schedule 1	50-200	May 1 - Aug. 31	Nest
Gyrfalcon	<i>Falco rusticolus</i>	Migrant (Winter)	No	Blue	Not at Risk	-	-	-	-
Harlequin Duck	<i>Histrionicus histrionicus</i>	Migrant	Yes	Yellow	-	-	-	-	-
Lewis's Woodpecker	<i>Meelanerpes lewis</i>	Migrant	Yes	Red	Threatened	Threatened, Schedule 1	-	-	-
Olive-sided Flycatcher*	<i>Contopus cooperi</i>	Migrant	Yes	Blue	Threatened	Threatened	50-300	May 1 - Aug. 31	Nest
Short-eared Owl	<i>Asio flammeus</i>	Migrant	No	Blue	Special Concern	Special Concern, Schedule 1	100-200	Apr. 1 - Jul. 31	Nest
Swainson's Hawk	<i>Buteo swainsoni</i>	Migrant	No	Red	-	-	-	-	-
<b>Mammals</b>									
Bighorn Sheep	<i>Ovis canadensis</i>	Resident	N/A	Blue	-	-	-	-	-
Fisher	<i>Martes pennanti</i>	Resident	N/A	Blue	-	-	-	-	-
Black Bear	<i>Ursus americanus</i>	Resident	N/A	Yellow	-	-	-	-	-
Grizzly Bear	<i>Ursus arctos</i>	Resident	N/A	Blue	Special Concern	-	-	-	-
Little Brown Myotis	<i>Myotis lucifugus</i>	Resident	N/A	Yellow	Endangered	Endangered, Schedule 1	-	-	-
Moose	<i>Alces alces</i>	Resident	N/A	Yellow	-	-	-	-	-
Mountain Goat	<i>Oreamnos americanus</i>	Resident	N/A	Yellow	-	-	-	-	-
Northern Long-eared Myotis	<i>Myotis septentrionalis</i>	Resident	N/A	Blue	Endangered	Endangered, Schedule 1	-	-	-
Spotted Bat	<i>Euderma maculatum</i>	Unknown	N/A	Blue	Special Concern	Special Concern, Schedule 1	-	-	-
Western Small-footed Myotis	<i>Myotis ciliolabrum</i>	Resident	N/A	Blue	-	-	-	-	-
Woodland Caribou - Southern Mountain population*	<i>Rangifer tarandus pop. 1</i>	Resident	N/A	Red	Endangered	Threatened, Schedule 1	-	-	-
Wolverine	<i>Gulo gulo luscus</i>	Resident	N/A	Blue	Special Concern	-	-	-	-
<b>Fish</b>									
Bull Trout	<i>Salvelinus confluentus</i>	Resident	N/A	Blue	Not at Risk	-	-	-	-
<b>Other</b>									
Benthic Invertebrates	N/A	Resident	N/A	N/A	N/A	N/A	-	-	-

**Notes:**

\* Denotes species confirmed as regularly occurring in GNP by Parks Canada Biotics Web Explorer (Parks Canada 2013).

<sup>1</sup> Species Range Data compiled from Ridgely et al., 2007; International Union for Conservation of Nature, 2014.

<sup>2</sup> *Migratory Birds Convention Act*

<sup>3</sup> BC Species and Ecosystems Explorer. Yellow=Secure; Red=Extirpated, Endangered or Threatened; Blue=Special Concern (B.C. Conservation Data Centre 2015a).

<sup>4</sup> Status under the Committee on the Status of Endangered Wildlife in Canada (Government of Canada 2015).

<sup>5</sup> Status under the Species at Risk Act (Government of Canada 2002).

<sup>6</sup> Federal Setbacks from Environment Canada 2011; P. Gregoire, personal communication August 15, 2013.



March 2016

## Appendix 6: Archaeological Overview Assessment, Trans Canada Widening Project, Illecillewaet Curve, Glacier National Park



**(Revised) Archaeological Overview Assessment**  
**Trans Canada Widening Project, Illecillewaet Curve, Glacier National Park**

*Prepared by Gwyn Langemann and Bill Perry, Archaeologists, HCCD*

*February 3, 2016*

**Purpose**

*This Archaeological Overview Assessment (AOA) update is to take into account project design changes outlined in the January 2016 60% review set of plans received February 2, 2016. Specifically, changes have been made to the alignment and the vegetation clearing line and the cut/fill lines to accommodate cultural resource concerns voiced over the previous set of plans. The new recommendations are highlighted below and accompanying maps have also been updated.*

The purpose of this AOA is to conduct an initial overview assessment for the Trans-Canada Highway (TCH) widening project, at the Illecillewaet Curve and the summit of Rogers Pass in Glacier National Park. This overview will identify possible impacts to archaeological resources, and provide recommendations to mitigate these impacts. This review is done for the route as a whole, and not site by site. The area is well known, and portions are highly significant archaeologically, so we are able to provide well-informed recommendations at a site specific level.

**Background**

To improve traffic safety, Highways Engineering Services (HES) plans to widen the TCH in Glacier NP through the summit of Rogers Pass and the Illecillewaet Curve, from east of the Hermit Hut parking lot to just east of Loop Brook (km 20 + 840 to km 29 + 100). This will involve widening the highway from 2 lanes to 4, installing a central barrier, widening the exit approaches to various parking lots, expanding parking areas, improving roadside drainage, and clearing and grubbing vegetation from the slopes that parallel the highway. This construction method has the potential to severely impact historic archaeological resources.

The entire project is within the boundary of Rogers Pass National Historic Site. This was commemorated for its importance in the exploration, construction, and operation of the main line of the CPR, and the engineering solutions that overcame formidable obstacles in difficult terrain. The archaeological resources include the remains of the 1885 railway grade and sidings, a series of snow sheds designed to deal with the dangers of a series of steep avalanche slopes, and the Loop Brook pillars. This grade was eventually abandoned as too dangerous, and the Connaught Diversion and Tunnel opened in 1917. The TCH was constructed in the early 1960s through Rogers Pass, and because of the constrained landscape, it was built on top of many of the railway features. The same formidable operational difficulties face the TCH today, and it too has had to build snow sheds and develop substantial avalanche control measures. The HSMBC is currently considering expanding the commemoration to include the construction and operation of the TCH through this transportation corridor. If it does, then archaeological and cultural resources related to the TCH will also be resources of national significance.

The construction will proceed in two phases: Year 1 will be from the monument west to Loop Brook, and Year 2 will be from the monument east to Hermit Hut trailhead. Vegetation and clearing will also be scheduled prior to the main construction.

## Observations

This assessment is based on our extensive knowledge of the archaeological resources in Glacier NP, gained through reviews of the archaeological records and our own extensive field work. Based on this knowledge I am able to provide the following observations.

- The entire railway route has been intensively surveyed, and the archaeological resources described and inventoried. The research is summarised in Francis and Perry (2000). The CIS (Parks Canada 1998) presents the nationally significant cultural resources and messages for the Rogers Pass NHS, including archaeological sites.
- While the railway corridor has been intensively surveyed, the valley slopes and riverbanks have not. It is possible that there are other historic sites to be found, such as remains of logging and tie camps, railway construction camps, and TCH construction camps.
- No pre-contact sites have been discovered.
- The dense concentration of historic sites in the project area relates primarily to construction and use of the railway in the period between 1885 and 1917, when the Connaught Diversion and Tunnel opened and the original route was abandoned.
- Archaeological sites include the remains of a series of wooden snow sheds, stretches of railway grade between the sheds, rail grades that parallel the sheds for summer use, construction camps at the Connaught Tunnel entrance, and railway sidings with all their associated structures and features.
- Archaeological sites are present throughout Rogers Pass, and completely cover the north end of the summit; it is not possible for the current highway project to avoid severely impacting them.

Many of these sites have already been extensively disturbed by developments such as the construction of the TCH in the early 1960s. Portions of this route crossed extant portions of the abandoned rail grade, such as at the TCH monument parking lot (km 24 + 100). Archaeological sites have also been affected by natural erosion from the Beaver and Illecillewaet Rivers, from avalanches and debris flows, and from the sheer weight of winter snows. The whole project area is subject to violent natural events. It is important to protect the remaining intact historic features, where the cumulative impact has already been so severe.

## Recommendations

The ideal stage for archaeologists to work with the project engineers and designers is before the plans are finalised. In many cases, an impact to the archaeological sites can be mitigated by a change in design to avoid the site, or to minimize construction disturbance. During the TCH twinning through Banff NP, archaeologists successfully worked with the project designers to avoid key highly significant and extensive sites at an early design stage, and we would like to build on this success. The known archaeological site locations in Glacier NP have been provided to HES, and they have considered them in their road design.

Unfortunately, given the constrained landscape, it is not possible for road construction to completely avoid the known historic archaeological sites. Therefore, mitigative measures are presented here. In many stretches, particularly in the west half of the project area, no measures are needed (*shaded in green on the attached maps*). Where there are known sites nearby, monitoring during the clearing and grubbing

phase is required (*shaded in yellow on the attached maps*). Where there are known sites directly in the project area, an Archaeological Impact Assessment (AIA) is required (*shaded in pink on the attached maps*). This will involve an archaeologist doing an inspection of the area before any disturbance and when the ground is not frozen, possibly shovel testing, and recording what is found. Depending on the results of the AIA, further monitoring during the clearing and grubbing phase may be recommended. At all times during construction, even in the “green” areas where no mitigative measures are proposed, the Accidental Finds protocol applies (see below).

**Recommendations are presented from west to east, following the order of the map sheets (January 2016-60% version).**

<b>Km</b>	<b>Known Site names</b>	<b>Concern</b>	<b>Mitigation action</b>
20+840 – 22+375 Map sheets 3, 4 and 5.	411T44, Rogers Pass Station #2 on south side of TCH, 1886 – 1899 and includes up to archaeological site 411T5, Rogers Pass Station and yards.	Immediately south of TCH; probably impacted by original TCH construction; while no vegetation clearing is shown on project plans, any expansion of current alignment to the south will impact the site; new Hermit Hut trailhead road and parking on north side of TCH may impact resources associated with site. There is a strong probability of scatter of historic artefacts and features, relating to Rogers Pass siding and stations between the Hermit Hut trail parking area and the Rogers Pass operations centre at 22+375.	Monitor during clearing and grubbing, and during construction of Hermit Hut trailhead and parking on north side of highway
22+375-23+100 Map sheets 5 and 6	Rogers Pass stations 3 and 4, summit siding (411T5, 1247T)	Dense concentration of rail grades, sidings, structures, refuse deposits associated with two different sidings and stations; proposed vehicle ponding area has not been well surveyed ever, and it will have cultural resources; even if surface is currently disturbed by paving, there may well be buried resources; hydrocarbon contamination from industrial use	AIA needed before project begins, to flag known features, and particularly to assess ponding area
23+100 – 23+500 westbound Map sheets 6 and 7	Site 411T6, snowshed on 1885 grade	Shed and grades clearly visible; grubbing and clearing line comes very near to east edge of snowshed feature, which is too close and could	Do not clear vegetation right up to snowshed and abandoned grade, maintain a wider buffer. An AIA needed

<b>Km</b>	<b>Known Site names</b>	<b>Concern</b>	<b>Mitigation action</b>
		damage the feature; removal of vegetation exposes remains to erosion and snow load. Park developing an interpretive trail through these features.	before clearing begins, to clearly flag the resources
23+500 – 23+700 westbound Map sheet 7	None; snowsheds that were in this area have been destroyed by mudslide	No concerns	None
23+700 – 24+250 westbound Map sheets 7 and 8	Site 411T8, snowshed on 1885 grade immediately north of monument and crossing over to south of highway.	Shed and grades clearly visible; grubbing and clearing line comes right up to east edge of snowshed feature, which is too close and could damage the feature; removal of vegetation exposes remains to erosion and snowload. Park developing an interpretive trail through these features.	Do not clear vegetation right up to snowshed and abandoned grade, maintain a wider buffer. An AIA needed before clearing begins, to clearly flag the resources.
24+160 – 24+250 westbound	TCH monument parking lot, 1885 grade passed under this, probably destroyed	Traces of old grade visible on north and south edges	Monitor and document before any repaving or work on access roads
24+250-26+600 Map sheets 8,9,10,11,12	Section between summit and Glacier siding and Glacier Warden Station.	Old railgrade on the east side of highway. No concerns.	None.
26+700-27+000 Map sheet 12	Glacier warden station, 23T, and beginning of Glacier House Tally-ho road	Structural features and levelled platforms very near current highway cutbank	Monitor before construction, record current condition; avoid
26+800-28+000 Map sheets 12, 13, and 14	Glacier siding, 411T42, west portal work camp	Scatter of artefacts, structural remains	AIA required to determine whether any structural or artifacts are present in this area prior to vegetation removal. Monitor during clearing and grubbing. Depending on results of AIA, archaeological monitoring may be required.
28+000 – 27+800 Map sheet 14	-	New turnaround construction	Monitor during clearing and grubbing
28+000-29+100,	-	No concerns	None

<b>Km</b>	<b>Known Site names</b>	<b>Concern</b>	<b>Mitigation action</b>
east and west bound except for area noted below for Cambie siding. Map sheets 14 and 15			
28+960-29+100. East and west bound Map sheet 16	Cambie siding 411T31 and 411T50, construction work camp (continues W of project area)	Scatter of structural remains, historic artefacts	Monitor during clearing and grubbing, both sides TCH

It is important to note that other infrastructure projects are also occurring in the Rogers Pass, and the cumulative impact of these measures must be taken into account. For example, there are also avalanche mitigation measures being considered that could impact historic snow sheds and stretches of the original 1885 rail grade, as well as traffic ponding measures.

**Accidental Finds**

As archaeological testing is by nature sampling (not 100 percent coverage) there could be a chance, however low, that features or artifact concentrations are encountered in the course of vegetation clearing and construction. If significant features (i.e., structural remains and/or high artifact concentrations) are encountered, development work should stop in the immediate area, photographs and a GIS reading should be taken, and the Parks Canada project manager informed. The project manager should then contact Parks Canada's Terrestrial Archaeology section for advice and assessment of significance that will in turn determine what will be required to mitigate the chance find.

What is a significant find? It is highly likely that a scattering of historic objects will be found throughout this historic transportation corridor. Isolated finds of such things as tin cans, bottles, or railway spikes are not reason to stop work. Concentrations of them are significant, however, and so are structural features like log cabin foundations, tent platforms, log cribbing retaining features, rail grades, or masonry. These would be stop work situations.

**Rationale**

We make the above recommendations based on these factors:

- archaeologists know the railway corridor very well, but not the valley slopes beyond
- there are nationally significant archaeological sites here
- the cumulative impact to these sites has already been high
- since they cannot be avoided, an AIA is needed for the most vulnerable sites, and monitoring is needed in many other areas
- AIA work must be done while the ground is not frozen

## References

Francis, Peter D. and John E. P. Porter

2000 *Archaeological Resource Description and Analysis, Mount Revelstoke and Glacier National Parks*. Cultural Resource Services, Western Canada Service Centre, Calgary, Parks Canada.

Parks Canada

1998 *Commemorative Integrity Statement, Rogers Pass National Historic Site*.

## Contacts

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Cell 403-701-0614

**Attachment 1:** Areas of archaeological concern drawn onto the December 2015 route plan. Known archaeological sites are shown as cross-hatched areas. On the attached map, I have marked the route in three colours.

- Green: we have no concerns with the project as currently defined, and see no need to monitor
- Yellow: we know an archaeological site is in the area, and monitoring during clearing is required
- **Pink:** it is a known and highly significant archaeological sites, or an area with high potential; an Archaeological Impact Assessment is required before work starts, and monitoring will be required afterwards during construction

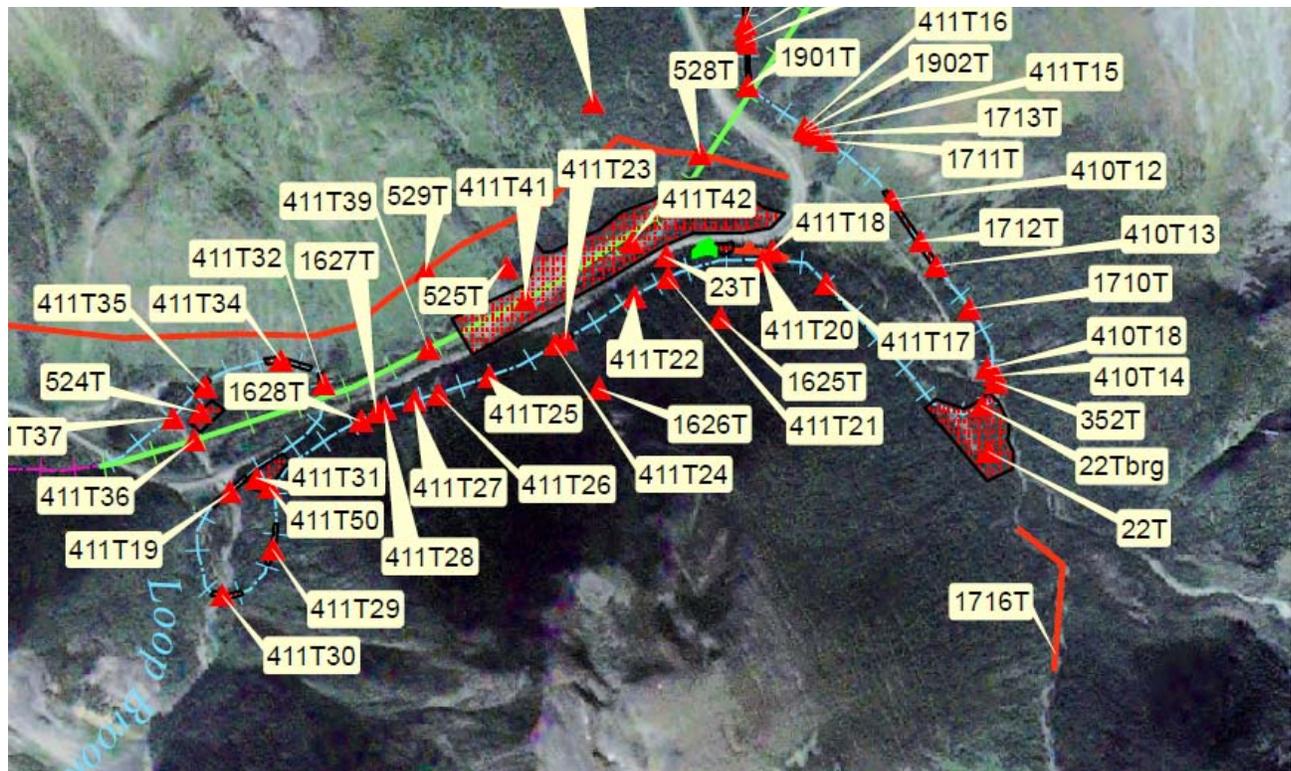


Figure 1. Known historic site locations in the southern part of Rogers Pass NHS. NB: site 23T, the Glacier warden station, should be at the green triangle. For all these figures, the blue line is the 1885 rail grade; and the green line is the current 1916 rail grade.

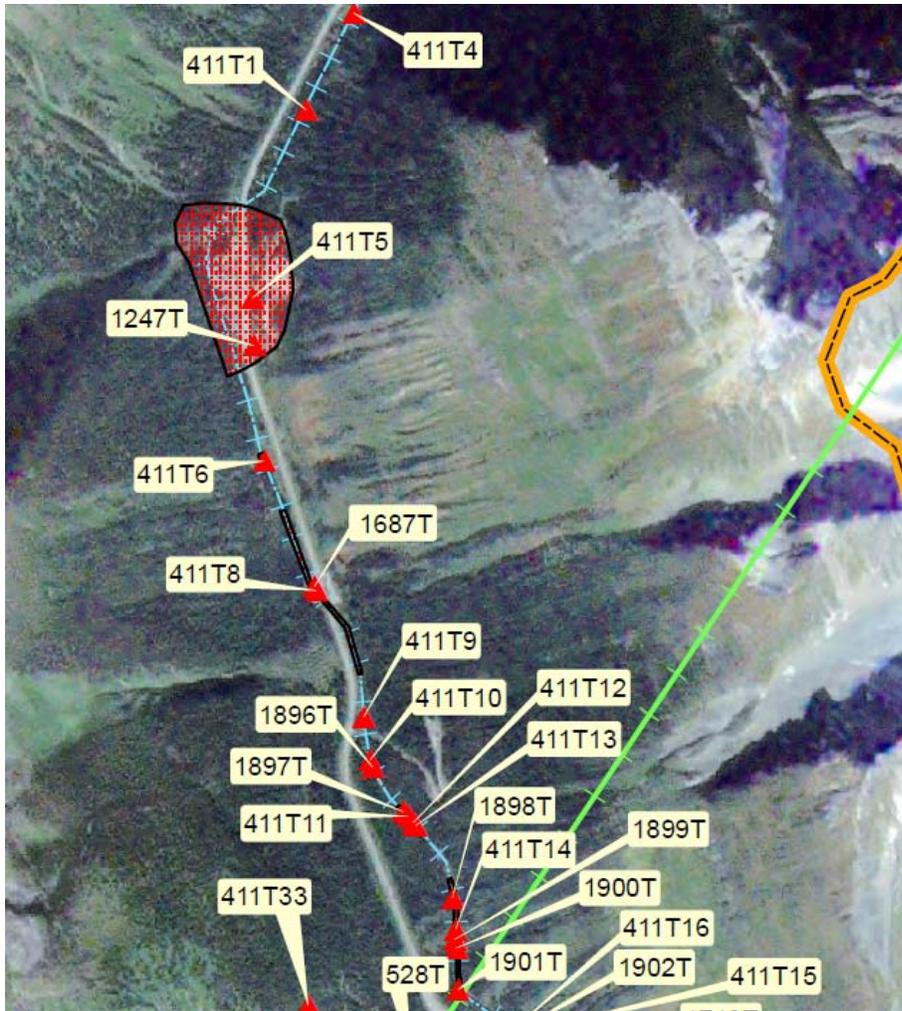


Figure 2. Known historic archaeological sites in the central portion of Rogers Pass NHS. The TCH monument is at 1687T.



Figure 3. Known historic archaeological sites in the northern portion of the Rogers Pass NHS.

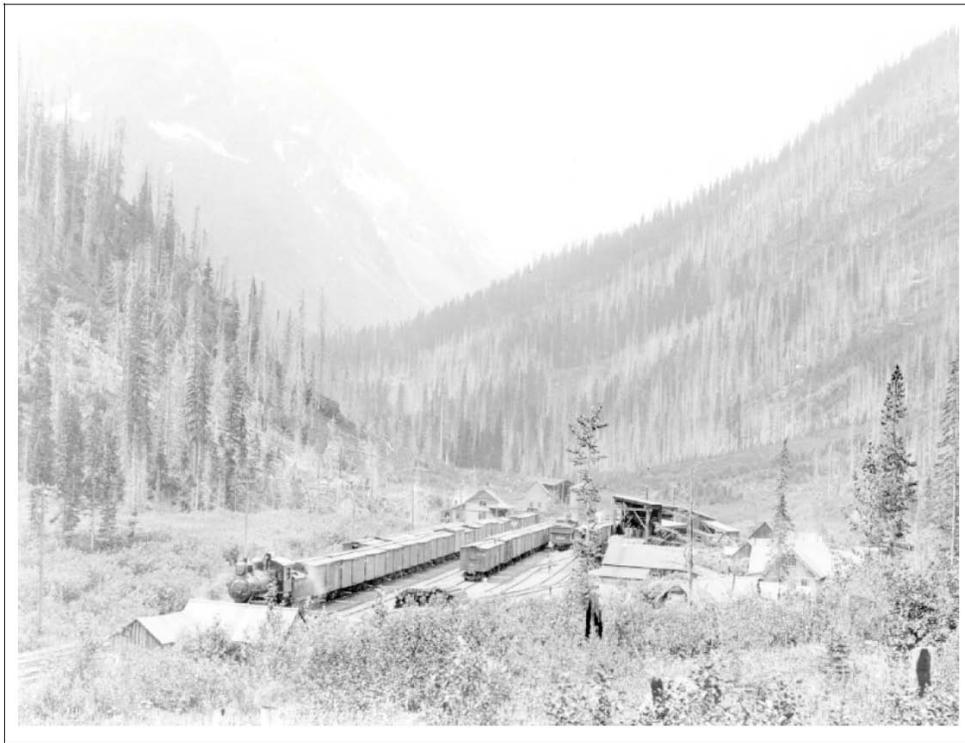


Figure 4. Site 411T44, Rogers Pass station no. 2, 1886 – 1899, view to NE. This is where the new access to Hermit Hut trailhead will leave the TCH. This photo illustrates the constrained nature of the landscape; imagine this location as it is today, with the current TCH grade passing through it along the left edge of the historic siding. You cannot go very far off the current TCH grade without impacting historic railway features.



**McElhanney**

for / pour



**Parks Canada  
Agency  
Western and  
Northern Region**

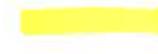
**L'Agence Parcs  
Canada  
Ouest et Nord  
Région**

**TCH WIDENING  
ILLECILLEWAET CURVE**

*Accidental finds clause  
applies throughout.*



*Known sites/high potential  
AIA + potential archaeological  
monitoring required.*



*monitoring only.*

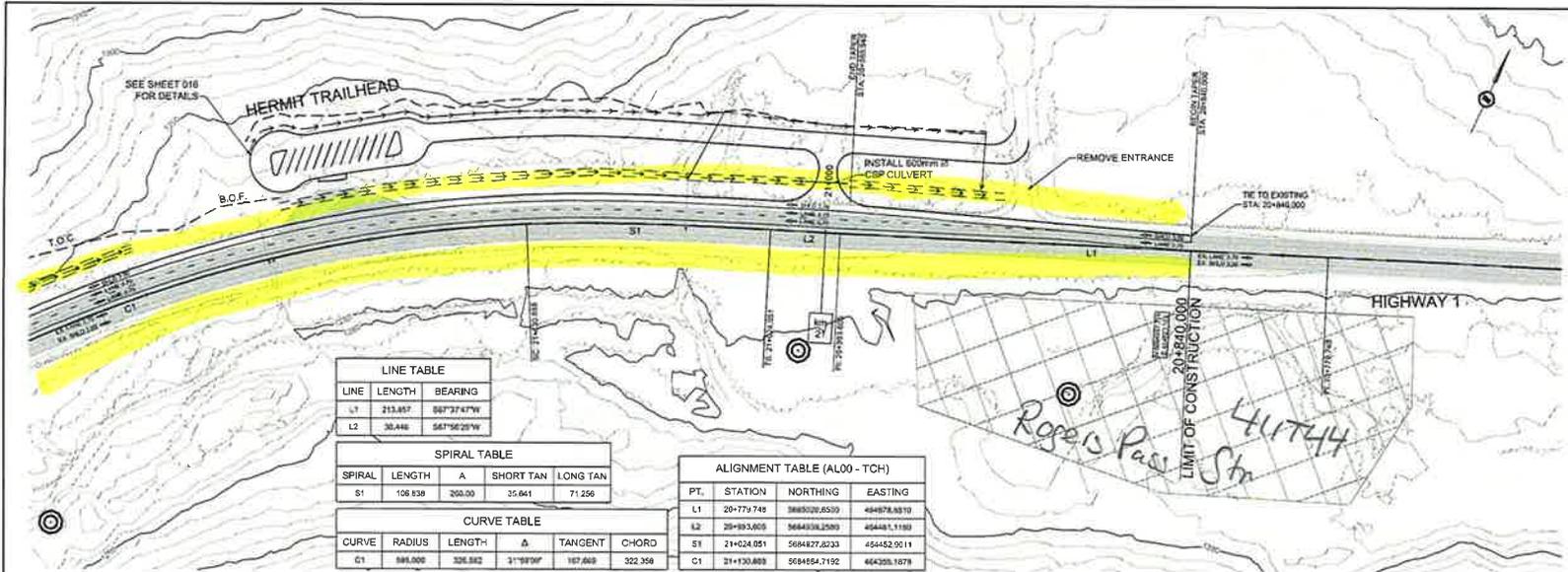
**ROGERS PASS  
GLACIER NATIONAL PARK, BC**



*No concerns ☺*

PROJECT NO. 2511-00581-0

JANUARY 2016 **60% REVIEW**

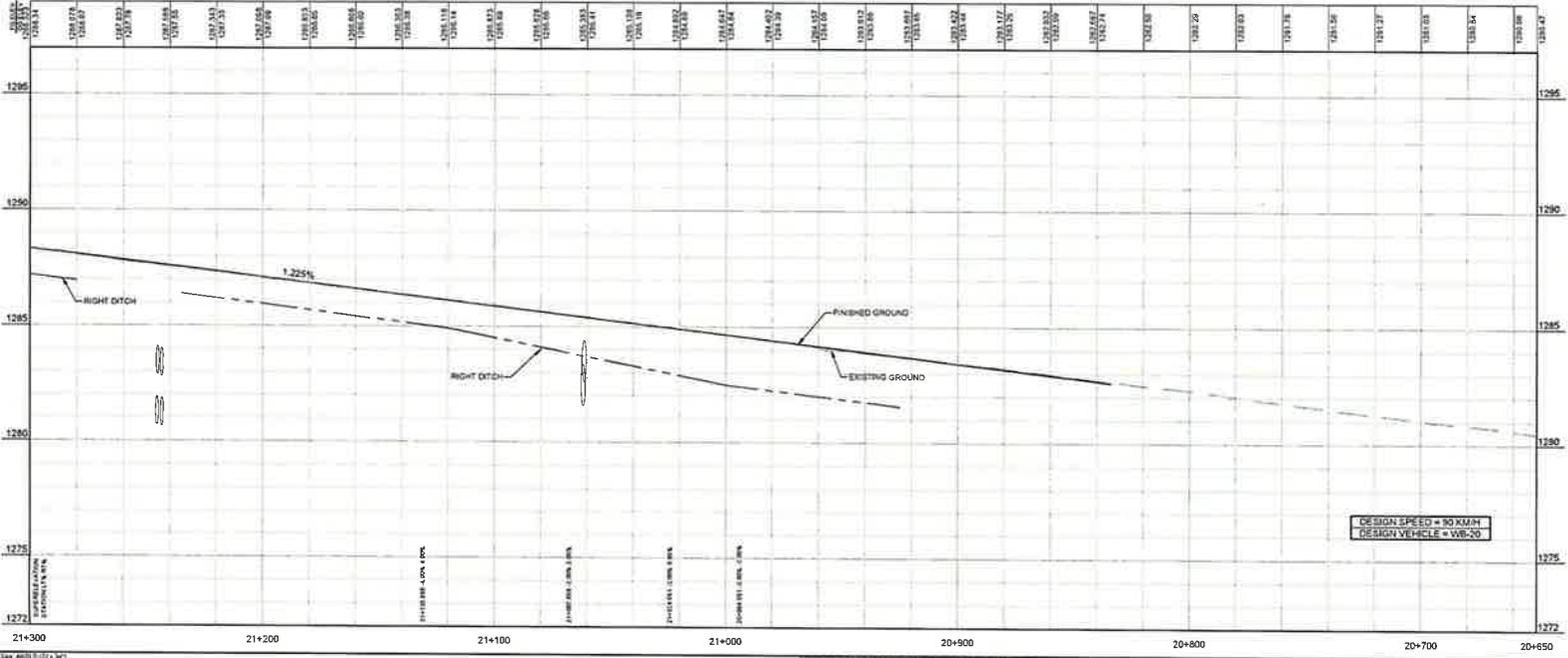


LINE	LENGTH	BEARING
L1	215.857	S87°37'47"W
L2	30.446	S67°56'29"W

SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S1	108.838	200.00	15.641	71.256

PT.	STATION	NORTHING	EASTING
L1	20+779.749	3885020.6510	484878.8310
L2	20+809.195	3864838.2580	484448.1180
S1	21+024.051	5684827.8233	454452.9011
C1	21+130.889	5684654.7192	464258.1678

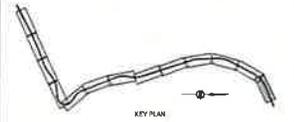
CURVE	RADIUS	LENGTH	A	TANGENT	CHORD
C1	588.000	328.582	31°59'09"	187.880	322.358



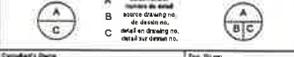
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PA.	DATE	BY	CHKD.	APP.
PA	2018.01.31	NSK/STW	NS	NS



Client's Name: **Province of Saskatchewan**  
 Eng. Name: **David M. Engstrom**

Parks Canada Agency  
 Western and Northern Region  
 L'Agence Parcs Canada  
 Ouest et Nord Région

**McElhanney**  
 McElhanney Consulting Services Ltd.

**TCH WIDENING  
 ILLECILLEWAET CURVE  
 KM 21.0 TO KM 29.1**  
 ROGERS PASS  
 GLACIER NATIONAL PARK, BC

**PLAN AND PROFILES  
 STA 20+650 TO STA 21+300**

Designed by / Approuvé par: <b>NSK</b>	Drawn by / Dessiné par: <b>NS</b>	Date: <b>2018.01.31</b>
Designed by / Dessiné par: <b>CL</b>	Reviewed by / Revisé par: <b>NSK</b>	Scale / Échelle: <b>1:5000</b>
Parks Canada Project Manager / Administrateur du Projet: <b>Parks Canada</b>		
Client Representative / Représentant du client:	Approved by / Approuvé par:	
Project No. / No. du projet: <b>2011-00581-0</b>	Issue No. / No. de version:	Sheet No. / No. de la feuille: <b>003</b>
Drawing Referred to / Révisé par: <b>PP-01</b>		

See last sheet for details.

ALIGNMENT TABLE (AL00 - TCH)			
PT.	STATION	NORTHING	EASTING
C1	21+130.889	5964584.7192	494355.1879
S2	21+457.471	5964663.7028	464120.5256
L3	21+525.847	5044603.6181	464087.9148

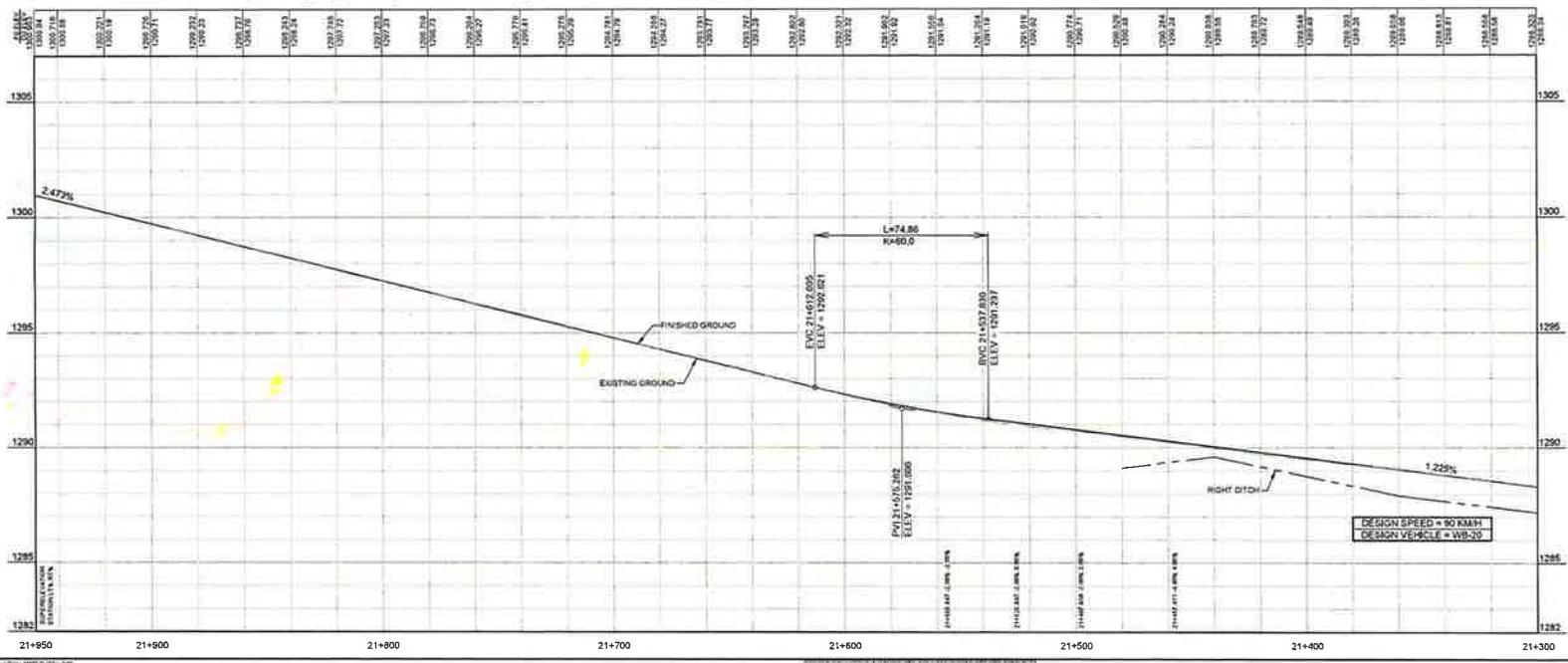
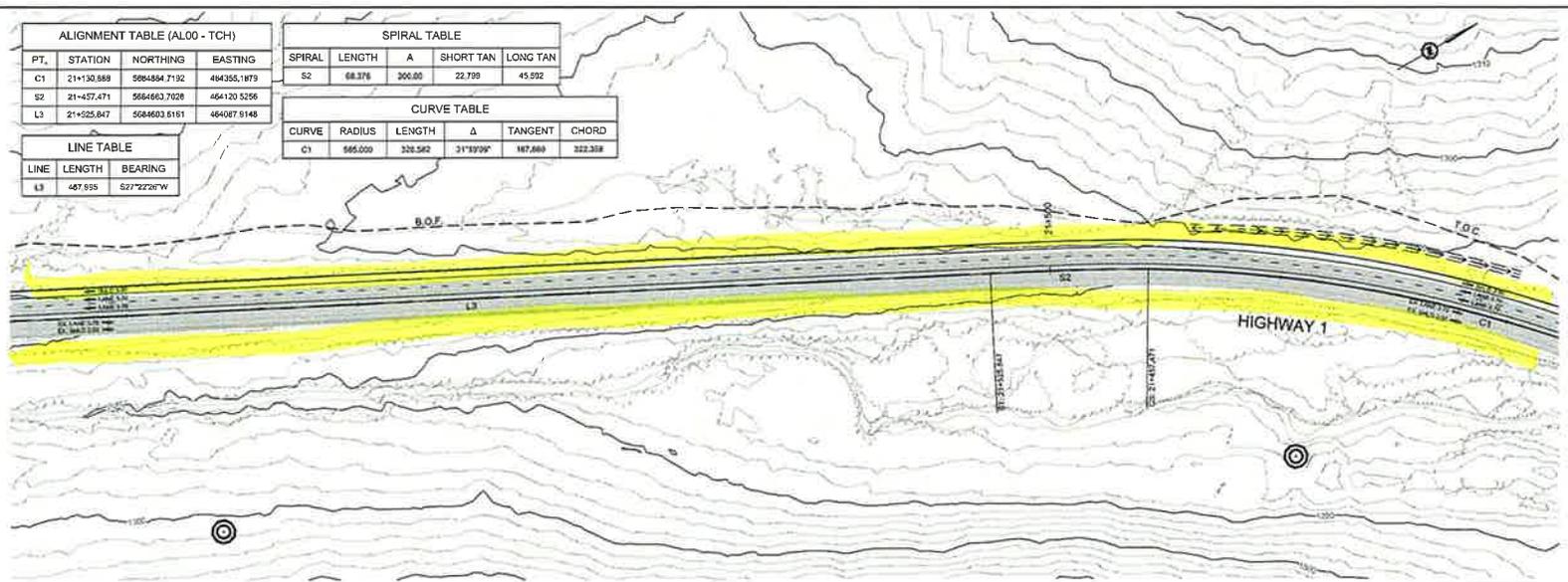
  

LINE TABLE		
LINE	LENGTH	BEARING
L3	487.935	S27°22'36"W

SPIRAL TABLE				
SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S2	68.376	300.00	22.799	45.992

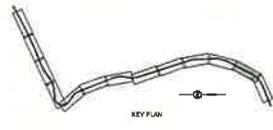
CURVE TABLE					
CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C1	865.000	326.562	31°39'59"	187.880	322.308



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Rev.	Date	Description	Drawn (Scale)	Checked	Approved
1	2018.07.11	50% REVISION	RL	SL	SL

Client's Name: **Trans Canada**  
 Client's Address: **1000 - 10th Avenue S.W. Calgary, Alberta T2C 1P5**

Eng. Name: **McEiHanney**

Client: **Trans Canada Agency Western and Northern Region**

Agency Name: **Trans Canada**  
 Client's Name: **Client of Nord Region**

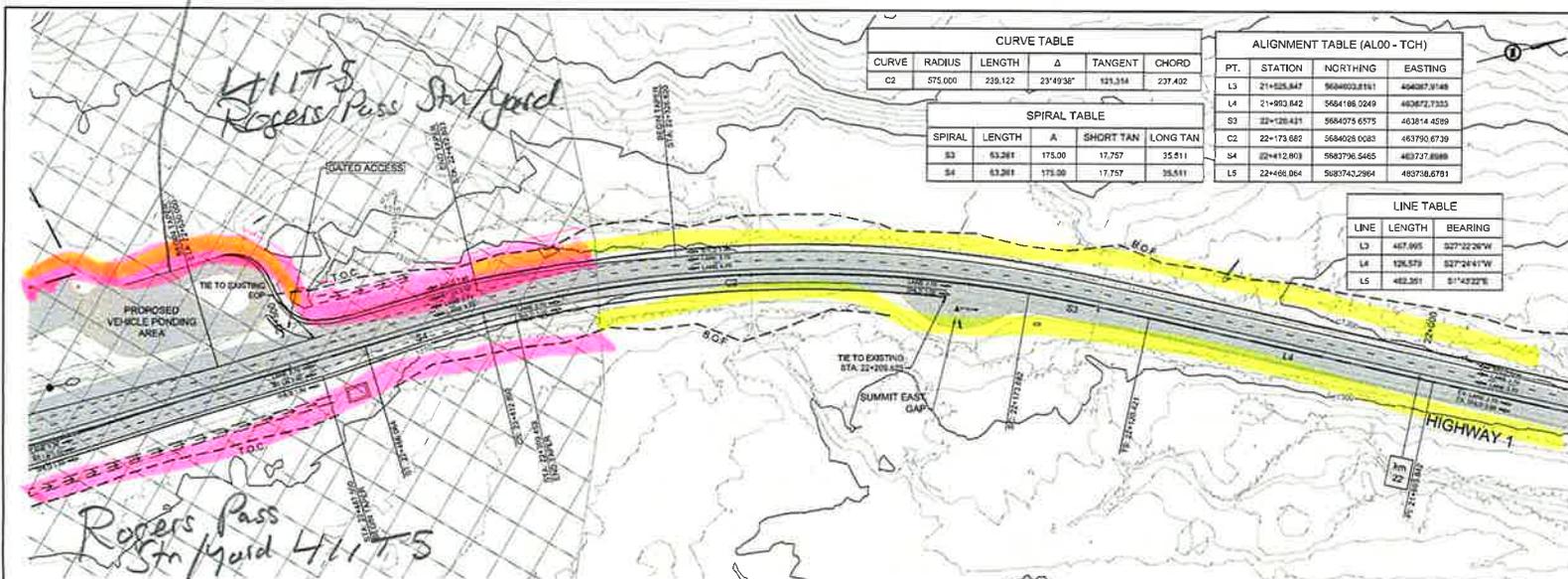
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 Consulting Services Ltd.

**TCH WIDENING ILLEGLEWAET CURVE**  
**KM 21.0 TO KM 29.1**  
 ROGERS PASS  
 GLACIER NATIONAL PARK, BC

**PLAN AND PROFILES**  
**STA 21+300 TO STA 21+950**

Drawn by / Checked by: <b>MCSL</b>	Drawn by / Checked by: <b>RL</b>	Date: <b>2018.07.11</b>
Reviewed by / Checked by: <b>DL</b>	Reviewed by / Checked by: <b>NSJ</b>	Scale / Elevation: <b>1:1000</b>
Client's Name / Address: <b>Trans Canada Agency Western and Northern Region</b>		
Approval by / Approved by: <b>RL</b>		
Project No. / File No.: <b>2511-00581-0</b>	Sheet No. / No. of Sheets: <b>10</b>	Sheet No.: <b>004</b>
Drawing Reference No. / File No. for Reference: <b>PP-02</b>		

once boundaries of ponding area is known  
-re-assess archaeological requirements



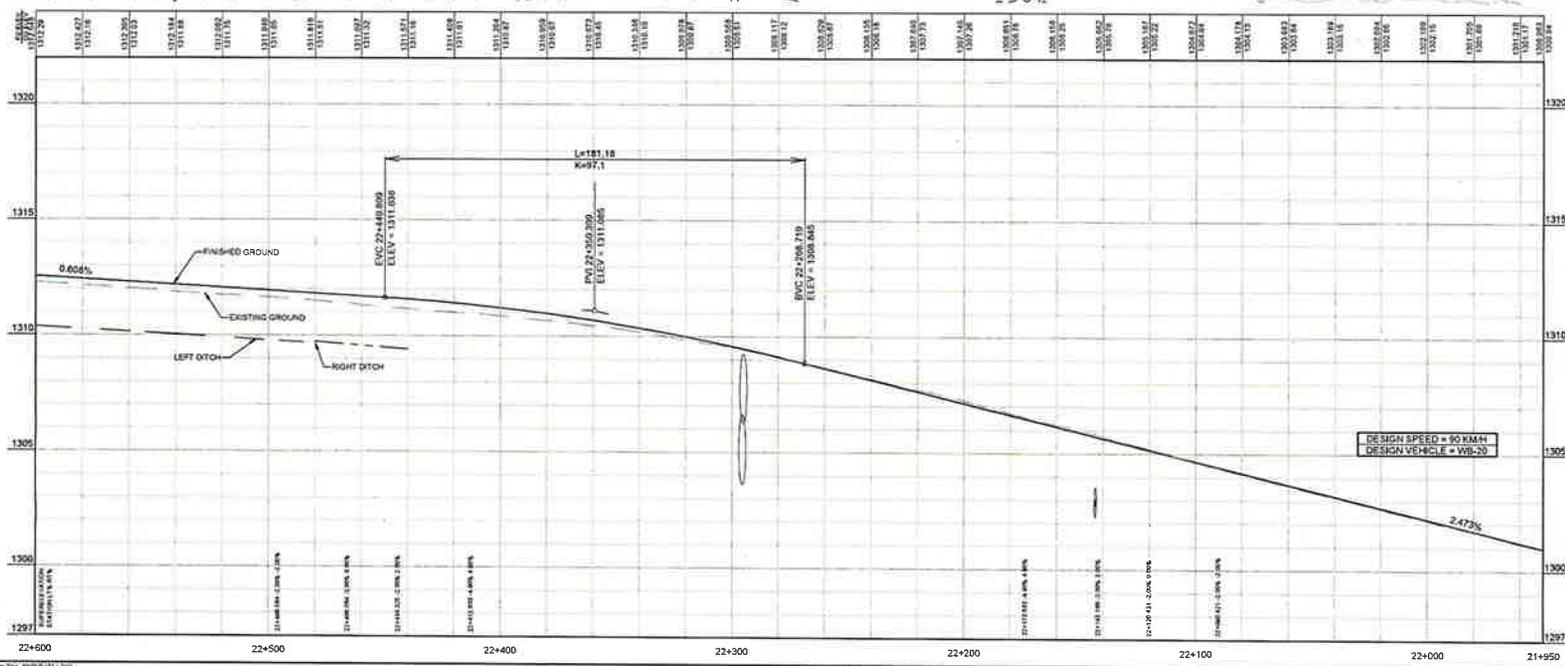
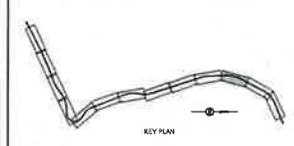
CURVE TABLE				
CURVE	RADIUS	LENGTH	Δ	TANGENT CHORD
C2	575.000	210.122	23°49'36"	193.314 237.402

SPIRAL TABLE				
SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S3	63.281	175.00	17.757	35.511
S4	63.281	175.00	17.757	35.511

ALIGNMENT TABLE (AL00 - TCH)			
PT.	STATION	NORTHING	EASTING
L3	21+525.847	5684023.8161	464287.9748
L4	21+903.842	5684188.0249	463267.1353
S3	22+128.431	5684079.6575	463814.4559
C2	22+173.062	5684025.0083	463790.6739
S4	22+412.803	5683790.5465	463727.8888
L5	22+696.064	5683743.2964	463758.6781

LINE TABLE		
LINE	LENGTH	BEARING
L3	467.895	S27°22'28"W
L4	126.579	S27°24'17"W
L5	482.301	S1°43'22"E

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PK	2018.01	DATE	BY	CHK	APP
Rev.	Date	Description	Drawn	Checked	Approved



Consultant's Name: **McElhanney Consulting Services Ltd.**  
 Client's Name: **Parks Canada Agency**  
 Engineer's Name: **L'Agence Parcs Canada**

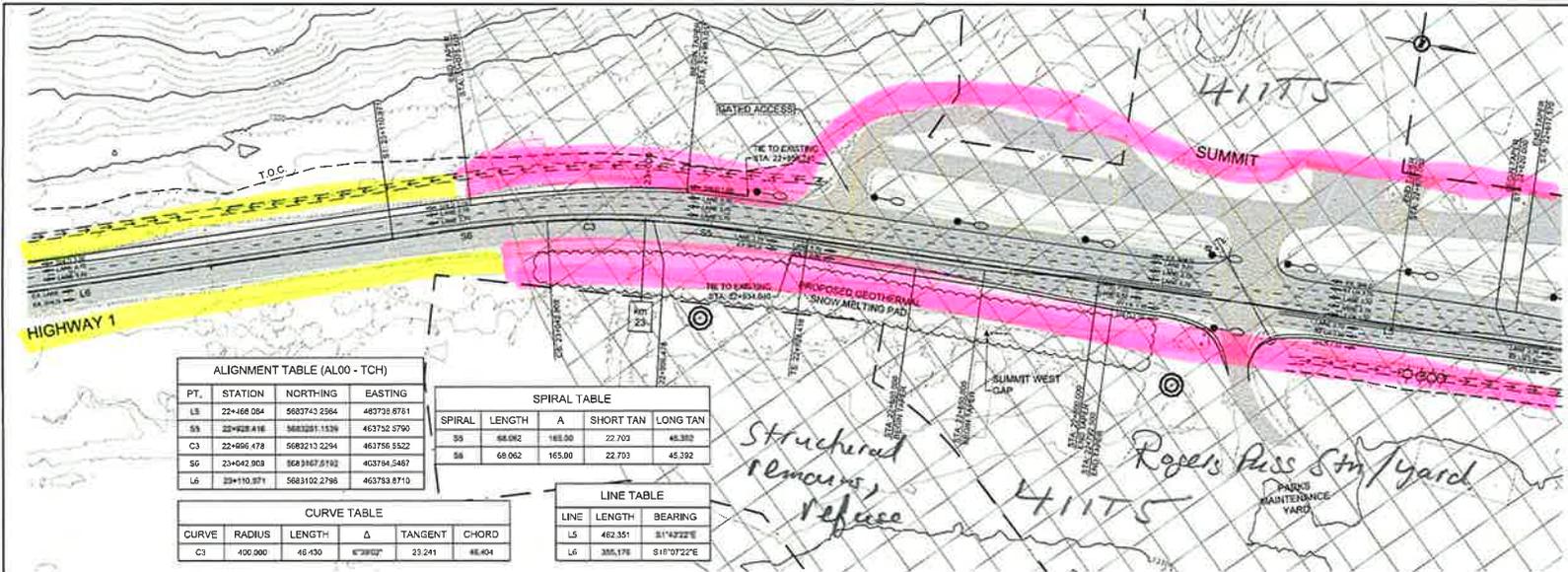
Region: **Western and Northern Region**  
 Region: **Québec et Nord Région**



**TCH WIDENING ILLECILLEWAET CURVE KM 21.0 TO KM 29.1**  
 ROGERS PASS  
 GLACIER NATIONAL PARK, BC

**PLAN AND PROFILES**  
 STA 21+950 TO STA 22+600

Designed by / Dessiné par: MCS	Drawn by / Dessiné par: NJ	Date: 2018.01.11
Designed by / Dessiné par: DJ	Reviewed by / Vérifié par: NJ	Scale / Échelle: 1:1000
Client: Parks Canada Project Manager / Gérant de projet: Parks Canada		
Project No. / No. de projet: 2511-00581-0	Sheet No. / No. de feuille: 005	Drawn by / Dessiné par: PP-23



ALIGNMENT TABLE (AL00 - TCH)			
PT.	STATION	NORTHING	EASTING
LE	22+468.064	5687743.2364	463733.8781
S5	22+428.816	5683281.1326	463752.5790
C3	22+406.478	5682213.2234	463756.5532
S6	22+042.903	5683167.0193	463754.5487
L6	23+110.871	5683102.2786	463753.8710

SPIRAL TABLE				
SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S5	48.082	143.00	22.703	48.392
S6	66.062	165.00	22.703	45.392

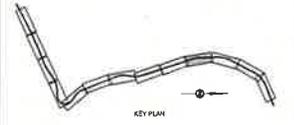
LINE TABLE		
LINE	LENGTH	BEARING
L5	462.351	S17°42'22"E
L6	355.178	S18°07'22"E

CURVE TABLE					
CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C3	400.000	45.430	6°38'02"	23.241	46.404

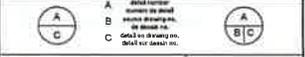
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PA	25/10/17	REV	REVISION	BY	CHK	APP
Rev	Date	Description	Drawn	Checked	Approved	Approved



Consultant's Name: **McElhanney Consulting Services Ltd.**  
 Drawn by: [Name]  
 Checked by: [Name]  
 Approved by: [Name]

Client's Name: **Trans Canada Agency Western and Northern Region**  
 Drawn by: [Name]  
 Checked by: [Name]  
 Approved by: [Name]

**McElhanney**  
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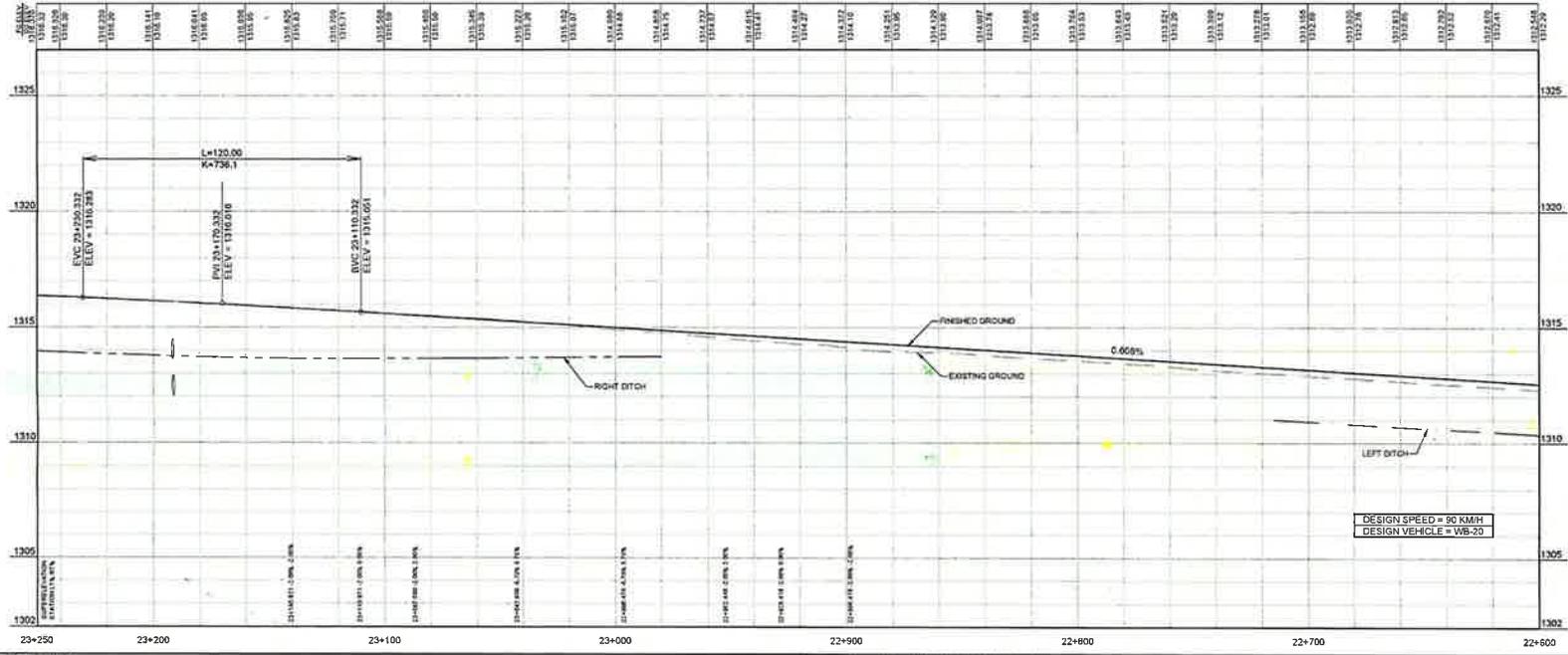
TCH WIDENING  
 ILLECILLEWAET CURVE  
 KM 21.0 TO KM 29.1  
 ROGERS PASS  
 GLACIER NATIONAL PARK, BC

PLAN AND PROFILES  
 STA 22+600 TO STA 23+250

Designed by: [Name] / Checked by: [Name] / Date: 2016.01.11  
 Drawn by: [Name] / Checked by: [Name] / Date: 2016.01.11  
 Scale: 1:5000

Client Acceptance / Acceptation de client: [Signature]  
 Approved by / Approuvé par: [Signature]

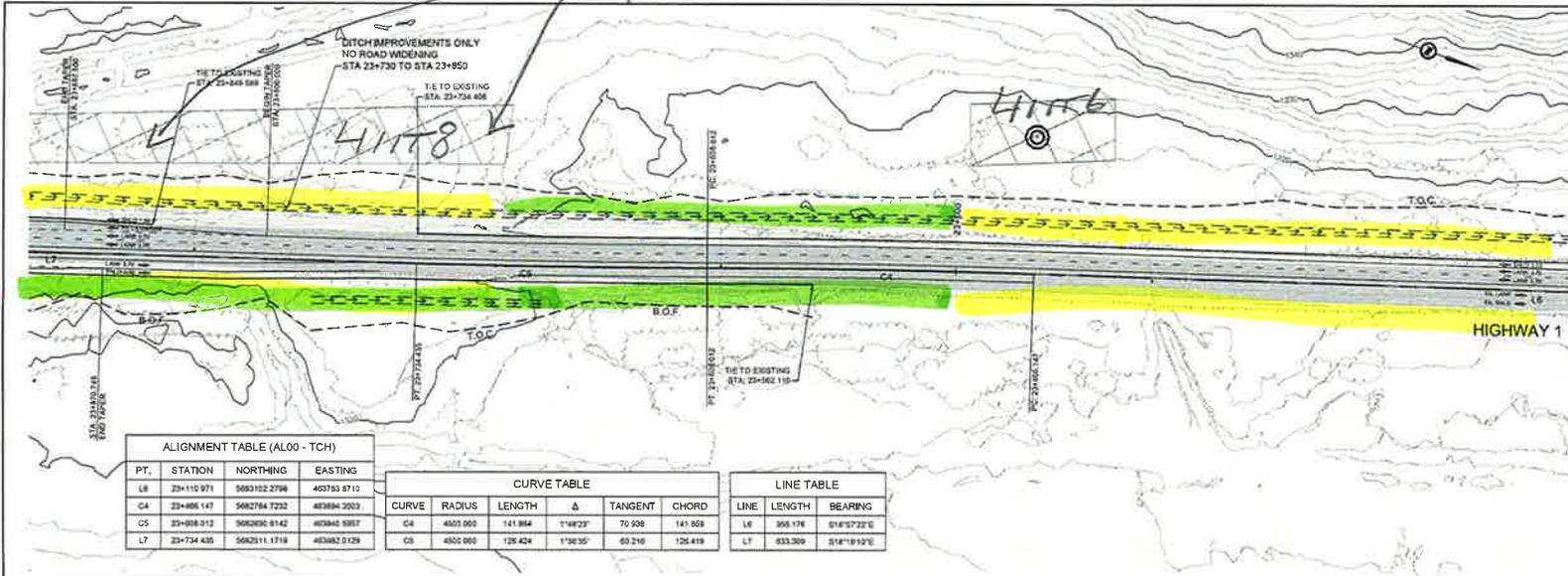
Project No. / No. du projet: 2511-05581-0  
 Sheet No. / No. de la feuille: 006  
 Drawing Reference No. / No. de référence de dessin: PP-04



DESIGN SPEED = 90 KM/H  
 DESIGN VEHICLE = WB-20



*in between snowshed  
berm & highway are summer track  
& P.C. trail. Veg. clearing to  
leave buffer*



ALIGNMENT TABLE (AL00 - TCH)

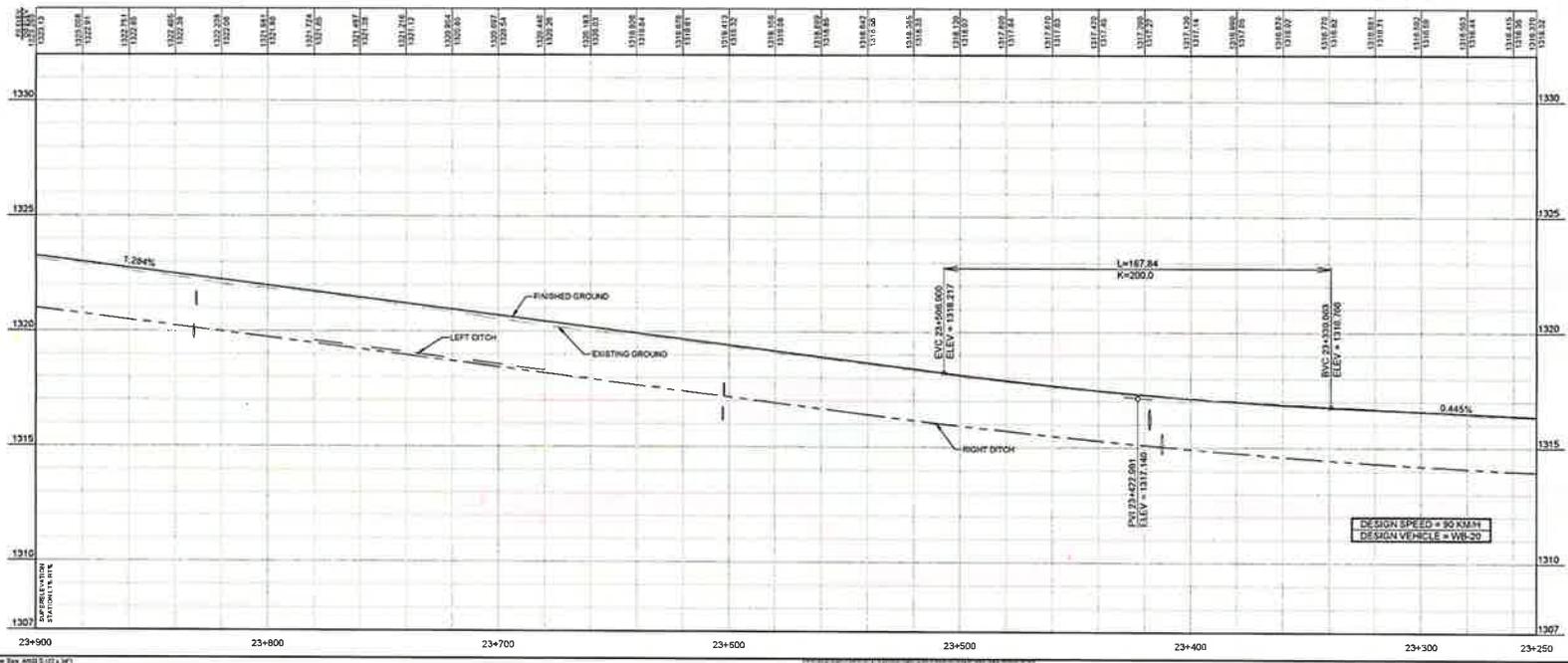
PT.	STATION	NORTHING	EASTING
L6	23+110.971	5683102.2796	453763.8710
C4	23+486.147	5682764.7222	453884.2003
C5	23+698.312	5682636.8142	453845.5887
L7	23+734.435	5682511.1718	453862.5128

CURVE TABLE

CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C4	4502.000	141.864	1°48'22"	70.930	141.809
C5	4502.000	126.424	1°56'30"	63.210	126.419

LINE TABLE

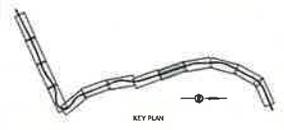
LINE	LENGTH	BEARING
L6	358.178	81°15'22"E
L7	633.309	81°19'12"E



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Rev.	Date	Description	Drawn	Checked	Approved
01	2016.03.11	Issue for Review			



Consultant's Stamp: McEiHanney Consulting Services Ltd.

Parks Canada Agency  
 Western and Northern Region  
 L'Agence Parcs  
 Canada  
 Ouest et Nord Région

**McEiHanney**  
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**TCH WIDENING  
 ILLECILLEWAET CURVE  
 KM 21.0 TO KM 29.1**  
 ROGERS PASS  
 GLACIER NATIONAL PARK, BC

**PLAN AND PROFILES  
 STA 23+250 TO STA 23+900**

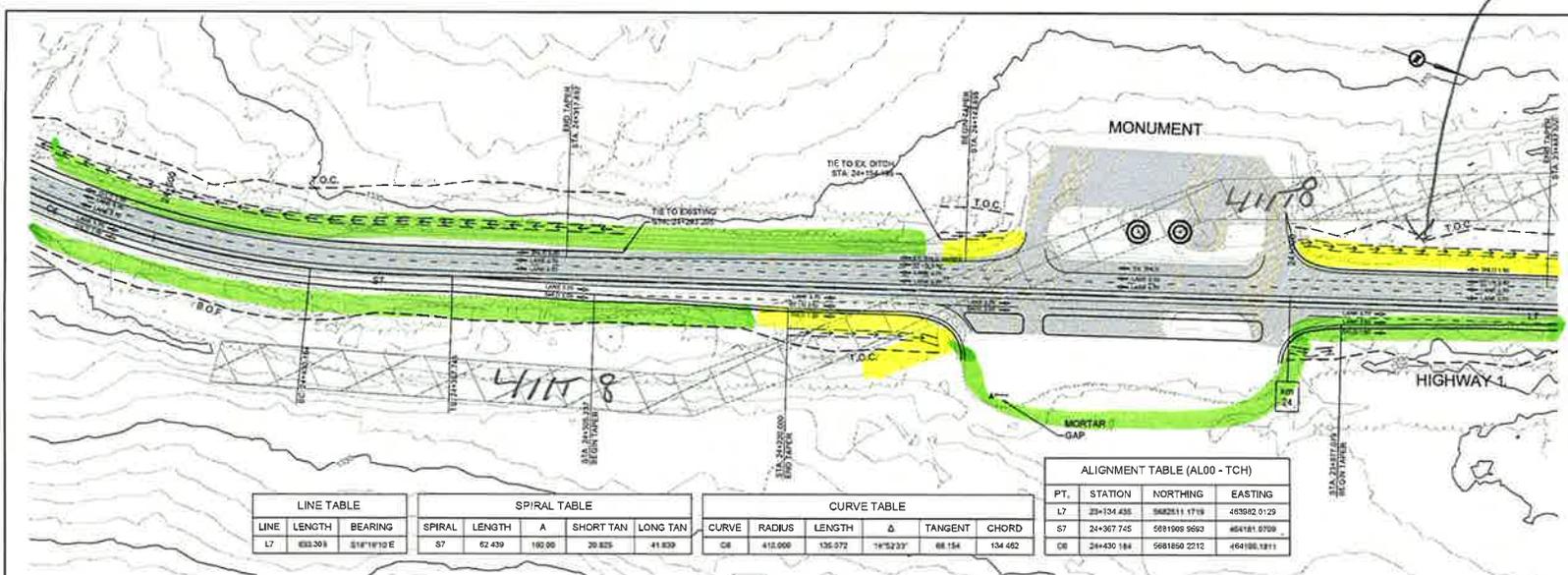
Designed by / Conçu par: MCSL	Drawn by / Dessiné par: NJ	Date: 2016.03.11
Checked by / Vérifié par: DL	Reviewed by / Revisé par: NBJ	Scale / Échelle: 1:5000

Client Acceptance / Acceptation du client: \_\_\_\_\_ Approved by / Approuvé par: \_\_\_\_\_

Project No. / No. du projet: 2511-00581-0	Sheet No. / No. de la feuille: 007
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See comments map 7.



LINE	LENGTH	BEARING
L7	633.208	S18°11'10"E

SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S7	62.439	180.00	30.825	-41.839

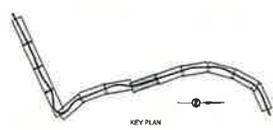
CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C6	415.000	136.072	14°52'23"	68.154	134.462

PT.	STATION	NORTHING	EASTING
L7	23+134.435	582811.1719	483992.0129
S7	24+307.745	5891009.9563	464181.6709
C6	24+430.184	5891850.2212	464186.1811

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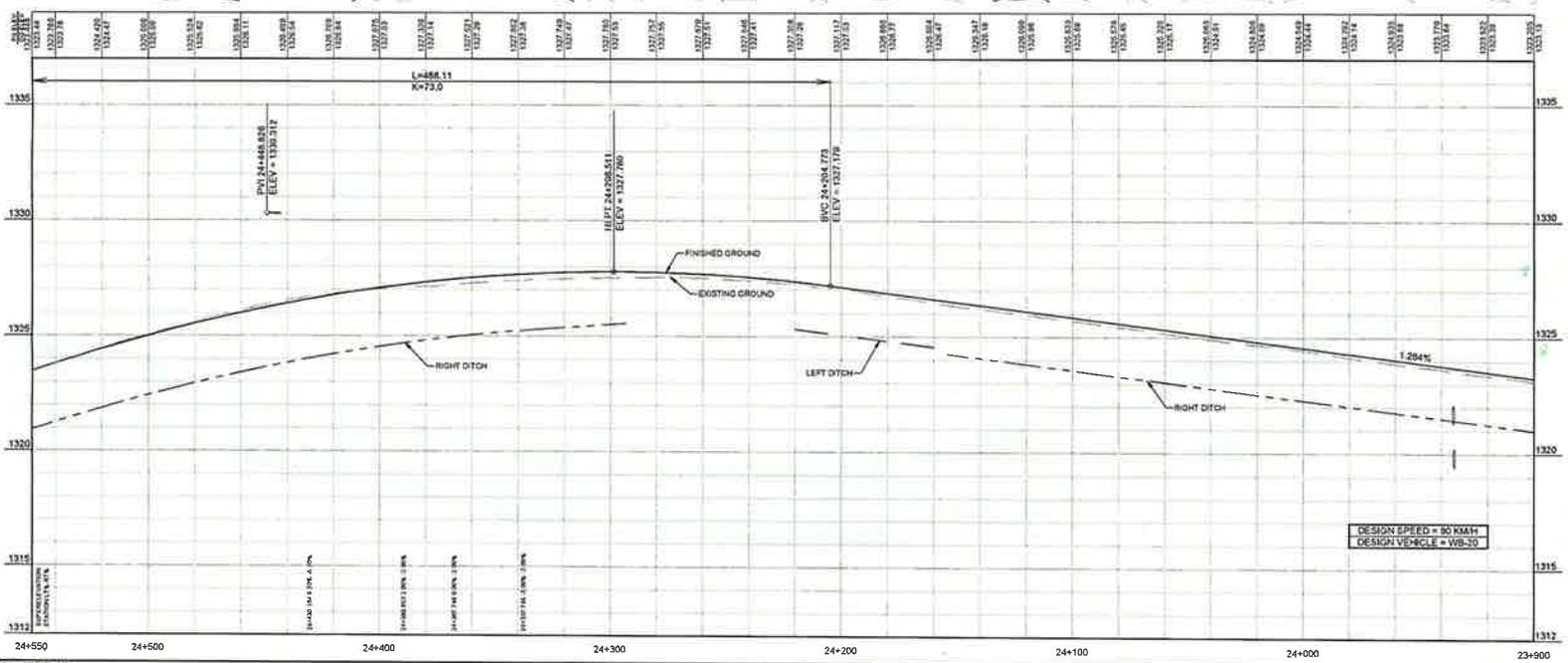
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NO.	DATE	DESCRIPTION	DESIGNER	CHECKED	APPROVED

A A: Initial number of sheet  
B B: Series drawing no.  
C C: Sheet or drawing no.



Designer's Stamp  
 Designer's Name  
 Designer's Title

Client's Name  
 Client's Address  
 Client's Contact Information

**McElhanny**  
 McElhanny Consulting Services Ltd.

**TCH WIDENING  
 ILLECILLEWAET CURVE  
 KM 21.0 TO KM 29.1**  
 ROGERS PASS  
 GLACIER NATIONAL PARK, BC

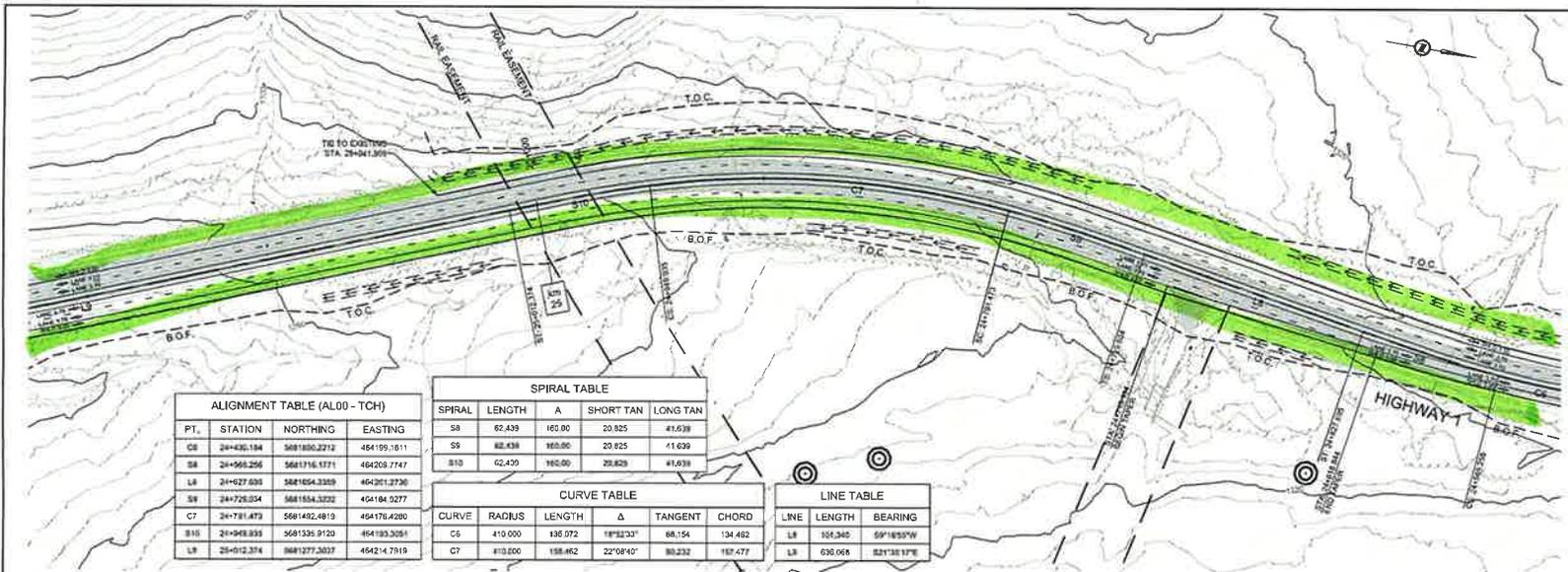
**PLAN AND PROFILES  
 STA 23+900 TO STA 24+550**

Prepared by / Préparé par: MISC  
 Drawn by / Dessiné par: AJJ  
 Date: 2018.01.11  
 Designed by / Conçu par: C  
 Reviewed by / Révisé par: KJS  
 Scale / Échelle: 1:1000

Client Acceptance / Acceptation du client  
 Approved by / Approuvé par

Project No. / No. du projet: 2811-02581-0  
 Sheet No. / No. de la feuille: 008  
 Drawing Release No. / No. de libération des dessins: PP-66

Figure Scale: 1:1000 (1" = 100')

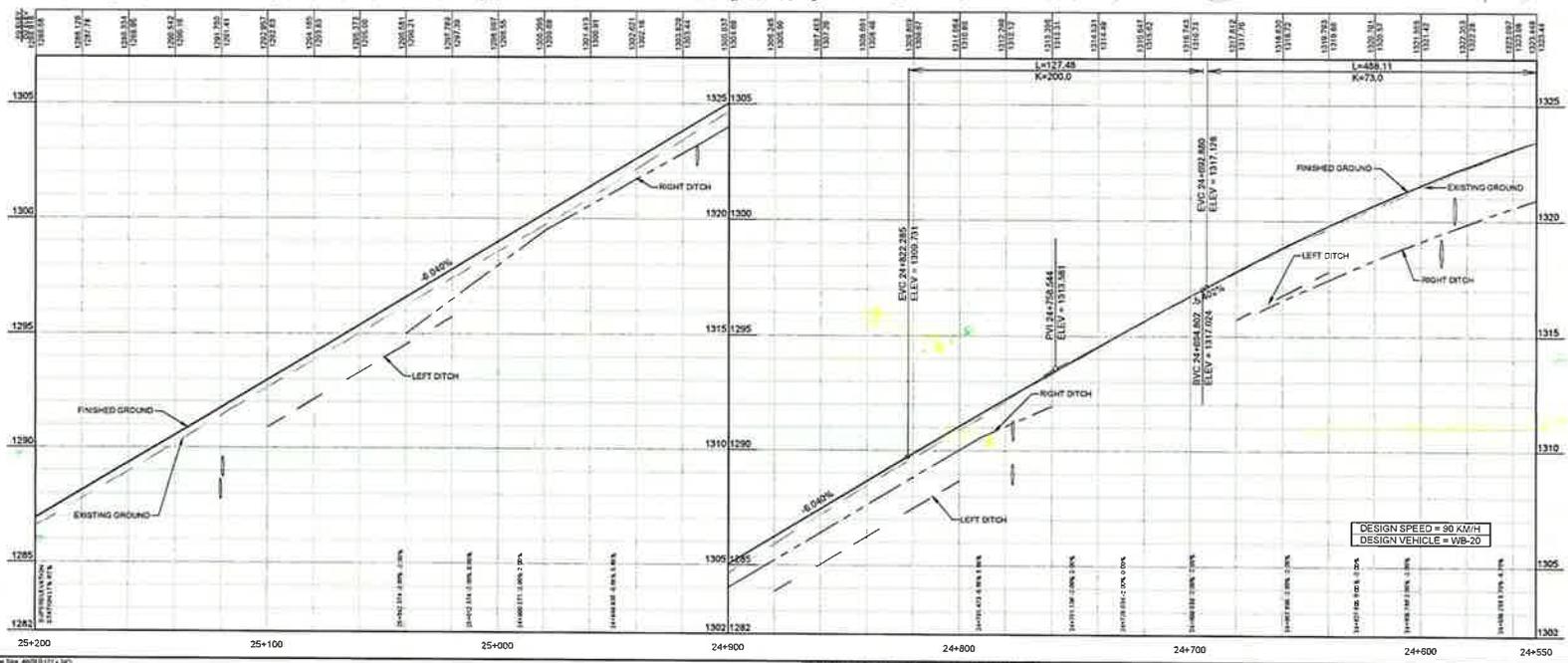


ALIGNMENT TABLE (AL00 - TCH)			
PT.	STATION	NORTHING	EASTING
CS	24+436.184	568180.2712	464199.1611
SR	24+561.256	568176.1771	464208.7747
LR	24+627.630	568165.3389	464351.3730
SR	24+728.034	568164.3222	464184.9277
C7	24+781.473	568142.4813	464176.4280
SR	24+948.333	568135.9120	464183.3081
LR	25+012.374	568127.3637	464214.7819

SPIRAL TABLE				
SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
SR	62.439	160.00	20.825	#1.638
SR	62.438	160.00	20.825	#1.639
SR	62.439	160.00	20.828	#1.638

CURVE TABLE					
CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
CS	410.000	135.072	18°52'33"	68.154	134.462
C7	#10.000	158.462	22°08'40"	80.232	167.477

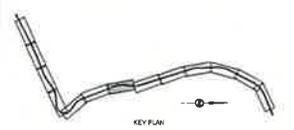
LINE TABLE		
LINE	LENGTH	BEARING
LR	166.240	S8°16'50"W
LR	636.068	S21°38'17"W



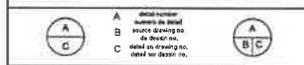
DESIGN SPEED = 90 KM/H  
DESIGN VEHICLE = WB-20

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PA	2018.01.11	DATE REVISION	NO	BY	APP
Rev.	Drawn	Description	Drawn (Date)	Checked (Date)	Approved (Date)



Client's Name: **Park Canada Agency**  
Drawn by: **McElhanney**

Project Name: **ILLECILLEWAET CURVE**  
Scale: **1:1000**

Client: **Park Canada Agency**  
Region: **Western and Northern Region**

**McElhanney**  
McElhanney Consulting Services Ltd.

**TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1**  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

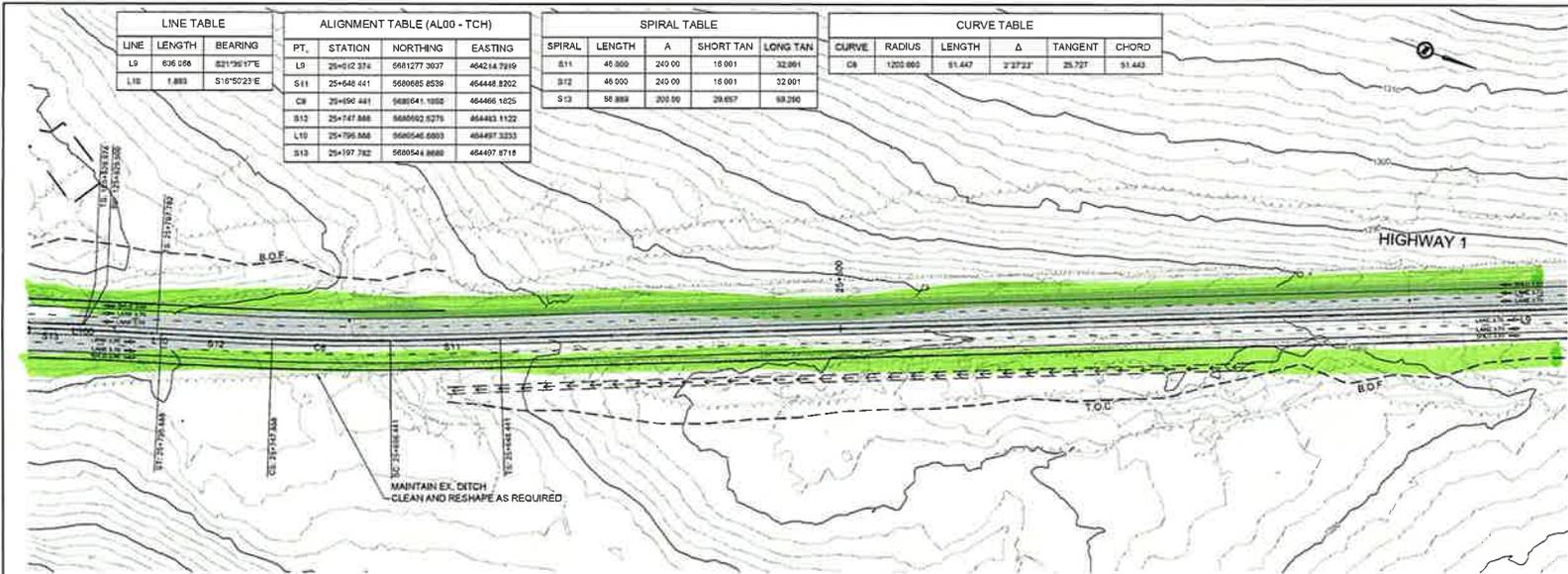
**PLAN AND PROFILES  
STA 24+550 TO STA 25+200**

Submitted by / Révisé par: **McEl**  
Drawn by / Dessiné par: **McEl**  
Date: **2018.01.11**

Checked by / Vérifié par: **DL**  
Reviewed by / Revisé par: **McEl**  
Scale / Échelle: **1:1000**

Client Acceptance / Acceptation du client: **Park Canada (Project Manager) / Administrateur du Projet, Parcs Canada**

Project No. / No. du projet: **2017-00581-0**  
Sheet No. / No. de la feuille: **009**

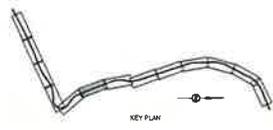


LINE TABLE			ALIGNMENT TABLE (AL00 - TCH)				SPIRAL TABLE				CURVE TABLE							
LINE	LENGTH	BEARING	PT.	STATION	NORTHING	EASTING	SPIRAL	LENGTH	A	SHORT TAN	LONG TAN	CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD	
L3	636.266	S1°59'57"E	LP	25+612.374	5651277.3037	464214.7919	S11	46.800	240.00	16.001	32.001	CA	1200.000	91.447	2°27'22"	26.727	51.443	
L10	1.883	S10°50'23"E	S11	25+648.441	5660685.8539	464448.8202	S12	46.000	240.00	16.001	32.001							
			CB	25+690.441	5688041.1800	464466.1825	S13	56.889	200.00	29.637	69.290							
			S12	25+747.888	5688062.6276	464463.1122												
			L10	25+795.888	5660546.6003	464497.3233												
			S13	25+197.782	5660544.8880	464407.8719												

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PA	2018.01.11	60% REVIEW	HJ	SL	SL
Rev	Date	Description	Drawn	Designed	Approved

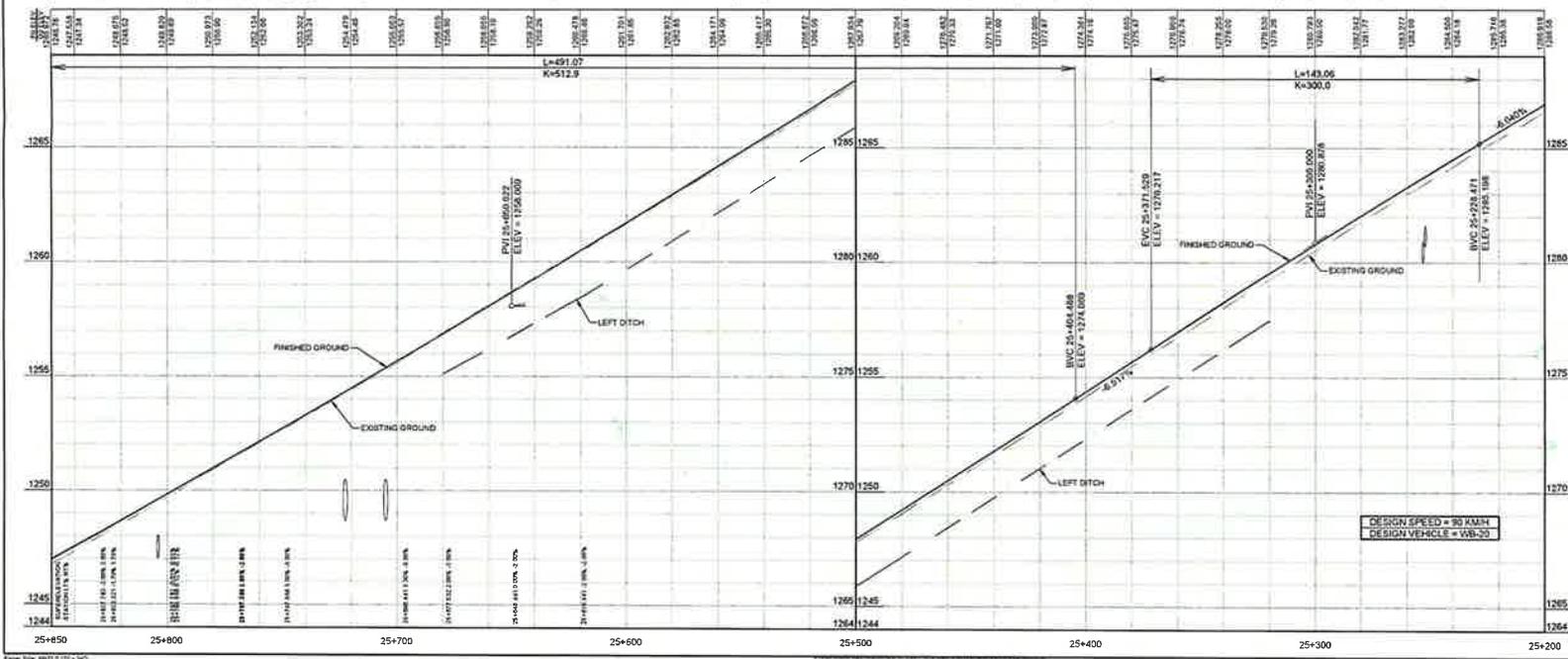
Client's Stamp	Eng. Stamp
Client's Stamp (to be completed)	Eng. Stamp (to be completed)

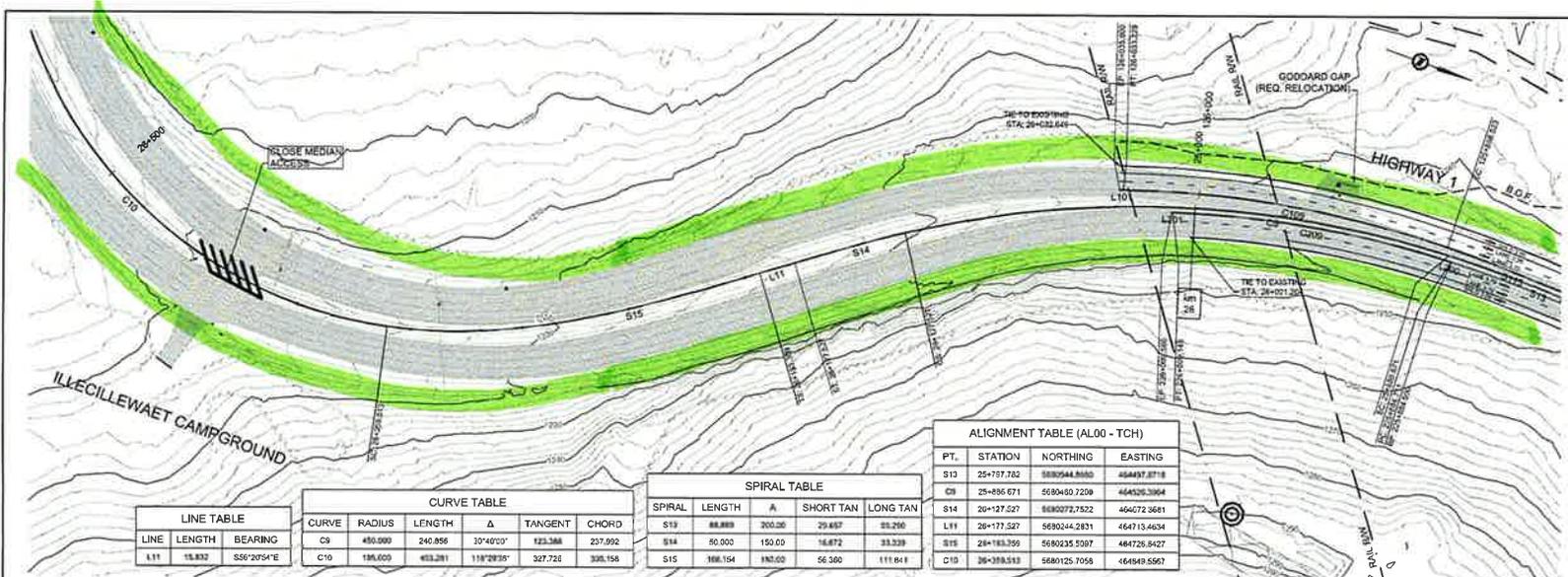
**TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 21.1**  
 ROGERS PASS  
GLACIER NATIONAL PARK, BC

**PLAN AND PROFILES  
STA 25+200 TO STA 25+850**

Designed by / Dessiné par MCSL	Drawn by / Dessiné par HJ	Date 2018.01.11
Designed by / Dessiné par DL	Reviewed by / Revisé par HJ	Scale / Echelle 1:1000

Client Acceptance / Acceptation du client	Approved by / Approuvé par
Project No. / No. du projet 2018-05681-0	Sheet No. / No. de la feuille 010
Drawing Number / No. de référence de dessin PP.05	





LINE TABLE		
LINE	LENGTH	BEARING
L11	15.832	S56°20'54"E

CURVE TABLE						
CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD	
C9	450.000	240.856	30°40'00"	123.368	237.892	
C10	190.000	453.281	118°28'35"	327.720	335.158	

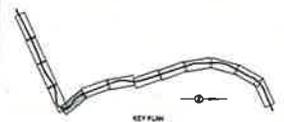
SPIRAL TABLE					
SPIRAL	LENGTH	A	SHORT TAN	LONG TAN	
S19	88.889	700.00	29.657	33.240	
S14	50.000	150.00	16.872	33.339	
S15	388.154	183.00	56.360	111.841	

ALIGNMENT TABLE (AL00 - TCH)				
PT.	STATION	NORTHING	EASTING	
S10	25+797.732	5829544.8860	464497.8718	
C9	25+896.671	5830430.7209	464526.3864	
S14	26+127.527	5830272.7522	466672.2681	
L11	26+177.527	5830244.2831	464713.4634	
S15	26+183.359	5830235.5087	464726.8427	
C10	26+359.513	5830125.7058	464849.5567	

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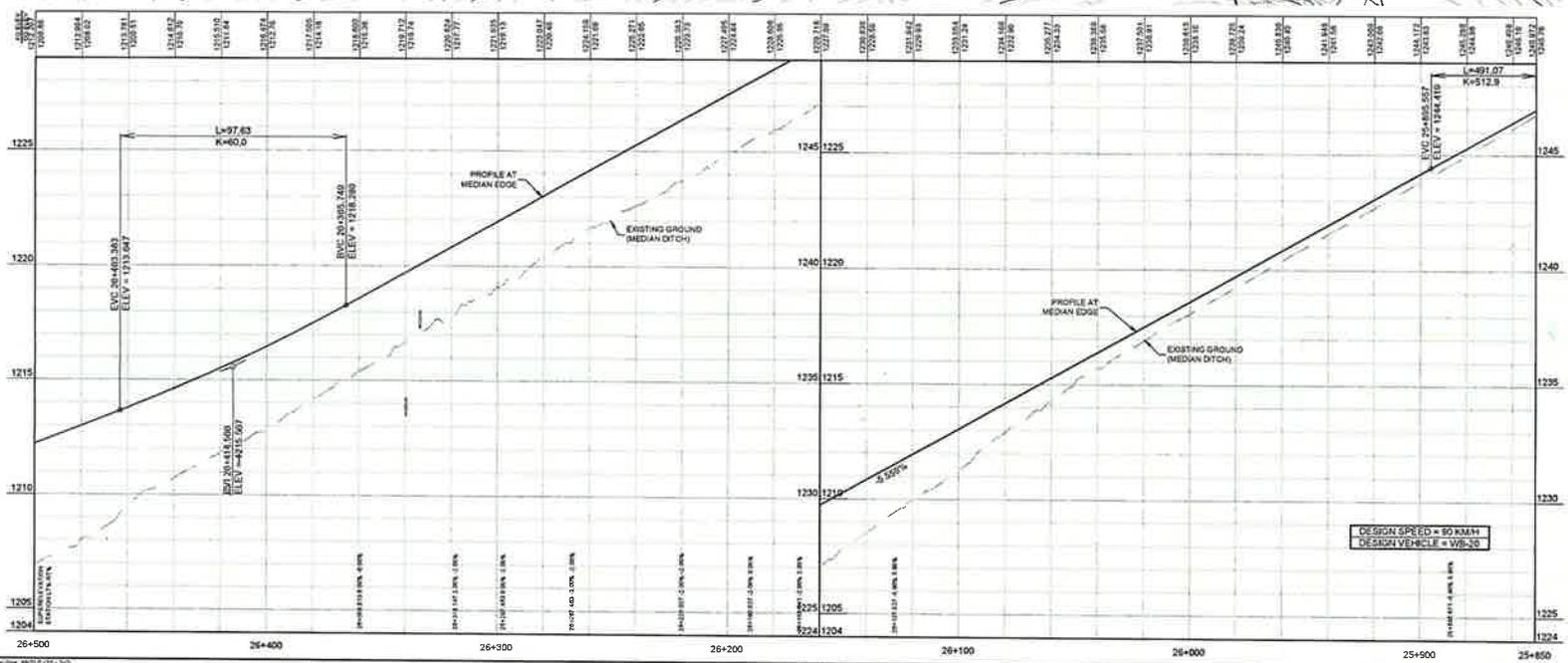
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PK	DATE	BY	CHKD	APP'D
PK	2016.03.11	MSJ	MSJ	MSJ

Rev.	Date	Description	Drawn	Checked	Approved
1					

Consultant's Stamp	Scale as Indicated	Scale as Indicated
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Consultant's Stamp	Scale as Indicated	Scale as Indicated
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**McElhanney**  
 McElhanney Consulting Services Ltd.

TCH WIDENING  
 ILLECILLEWAET CURVE  
 KM 21.0 TO KM 29.1  
 ROGERS PASS  
 GLACIER NATIONAL PARK, BC

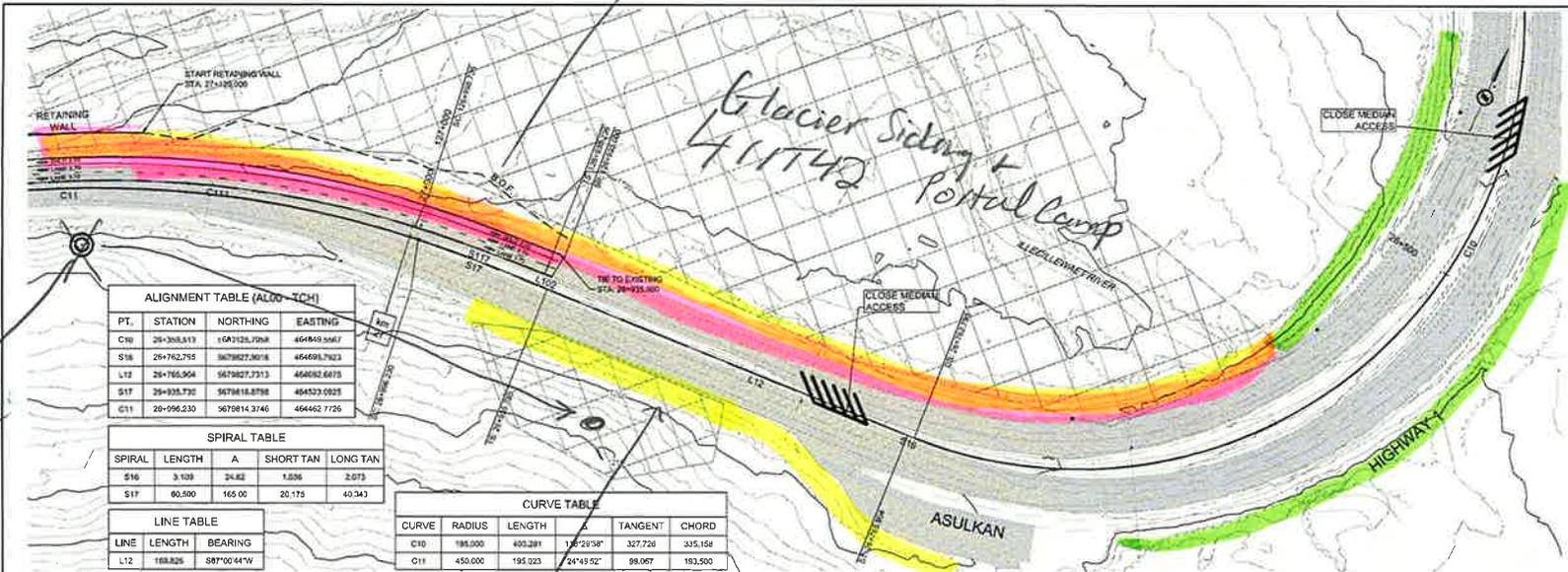
PLAN AND PROFILES  
 STA 25+850 TO STA 26+500

Prepared by / Approuvé par: MCH/MS	Drawn by / Dessiné par: MSJ	Date: 2016.03.11
Checked by / Vérifié par: MSJ	Reviewed by / Revisé par: MSJ	Scale / Échelle: 1:1000
Client Acceptance / Acceptation du client: Approved by / Approuvé par:		
Project No. / No. du projet: 251140581-0	Sheet No. / No. de la feuille: PP-08	Total No. of Sheets / Total No. de Feuilles: 011

Plan (see sheet 25+000 to 26+500)

area in orange/pink needs AIA first, then monitoring

error - noise

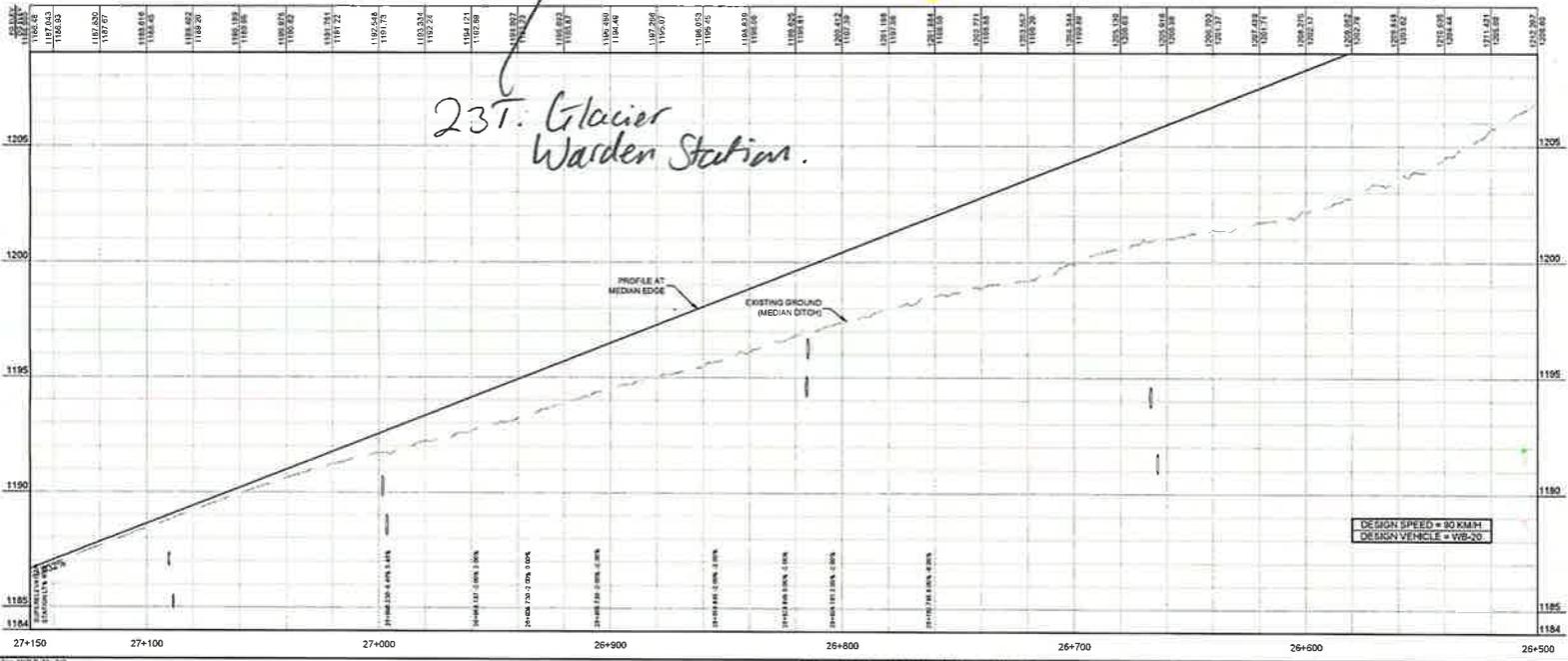


PT.	STATION	NORTHING	EASTING	km
C10	26+308.517	1093128.700R	464669.5567	
S16	26+762.755	9679827.5016	464693.7623	
L12	26+765.904	9679827.7313	464693.6878	
S17	26+935.730	9679818.8758	464523.0925	
G11	26+995.230	9679814.3746	464462.7726	

SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S16	3.103	24.82	1.036	2.073
S17	60.500	165.00	20.175	40.343

LINE	LENGTH	BEARING
L12	168.826	S87°00'44"W

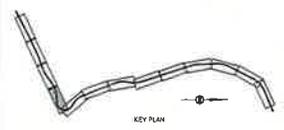
CURVE	RADIUS	LENGTH	TANGENT	CHORD
C10	195.000	400.281	136°23'38"	327.726
C11	450.000	195.023	24°49'52"	98.067



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No.	Date	Description	Drawn (Initials)	Designed (Initials)	Approved (Initials)



Client's Name	Client's Address	Eng. Stamp	Scale

Parks Canada Agency  
Western and Northern  
Region

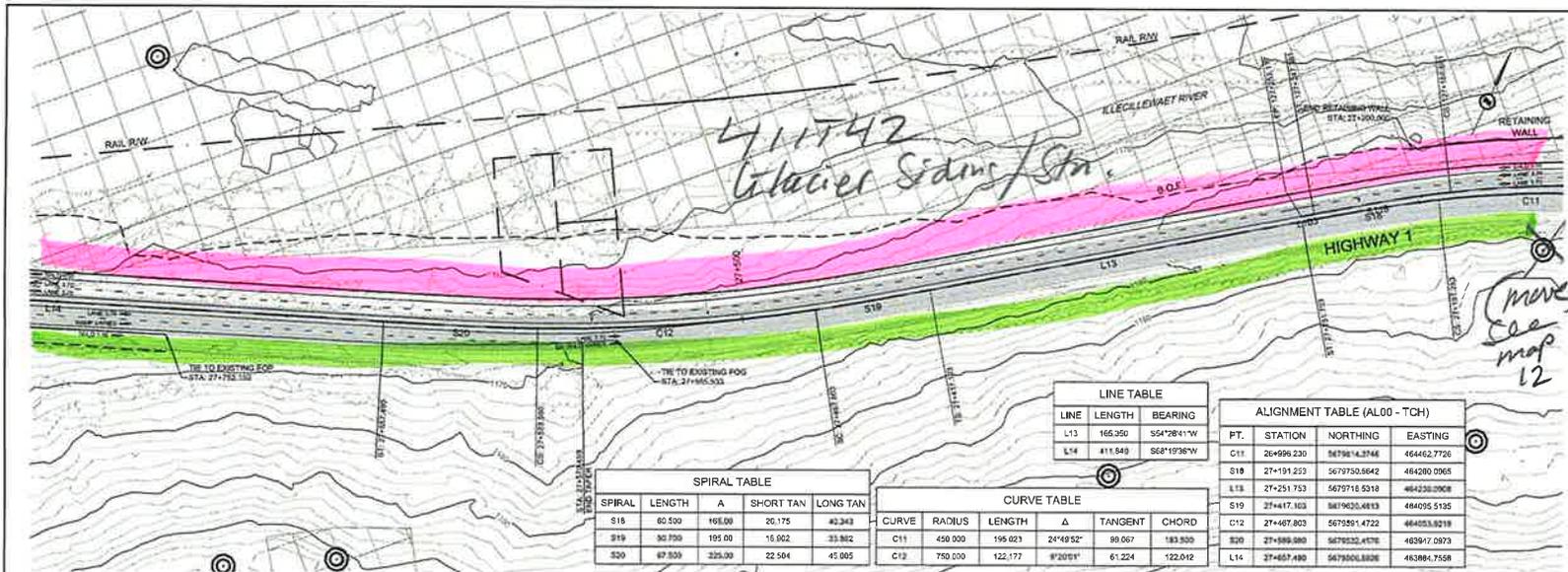
Likiepina Plaza  
Canada  
Ouest et Nord Région

**McElhanny**  
McElhanny Consulting Services Ltd.

TCH WIDENING  
ILLECILLEWAET CURVE  
KM 21.0 TO KM 29.1  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

PLAN AND PROFILES  
STA 26+500 TO STA 27+150

Designed by / Revisé par MCC	Drawn by / Dessiné par NSJ	Date 23/10/11
Checked by / Vérifié par D.	Reviewed by / Revisé par NSJ	Scale / Échelle 1:1000
Client Approval / Approbation du client		
Approved by / Approuvé par		
Project No. / No. du projet 2511-0058-1-0	Sheet No. / No. de la feuille	Sheet No. / No. de la feuille 012
Drawn by / Dessiné par / Title or Name of the Designer PP-010		

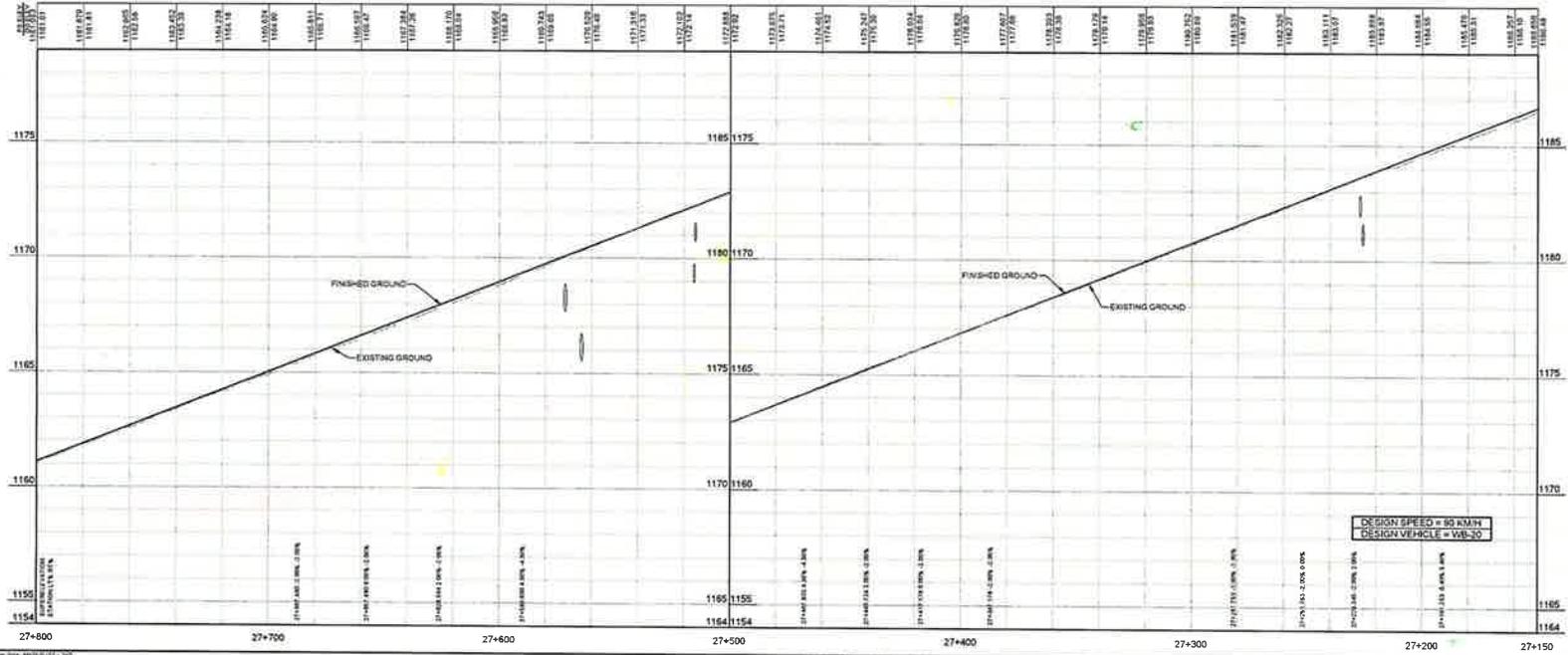


SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S18	60.500	198.00	20.175	42.243
S19	80.750	195.00	15.902	33.862
S20	87.500	225.00	22.504	45.005

CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C11	450.000	196.023	24°49'52"	89.067	183.500
C12	750.000	122.177	9°20'51"	61.224	122.012

LINE	LENGTH	BEARING
L13	165.250	S54°28'41"W
L14	411.549	S68°19'38"W

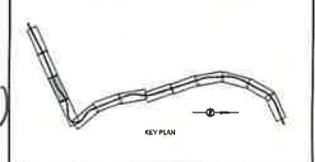
PT.	STATION	NORTHING	EASTING
C11	26+996.230	567914.2946	464462.7726
S18	27+191.223	5679750.5642	464200.0965
L13	27+251.753	5679716.5218	464238.2908
S19	27+447.103	5679620.4813	464095.5195
C12	27+467.803	5679591.4722	464053.8219
S20	27+599.080	5679532.4376	463917.0973
L14	27+667.490	5679500.8806	463884.7558



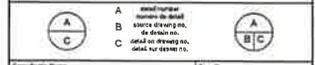
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No.	Date	By	Description	Drawn (Scale)	Checked (Scale)	Approved



Client's Name: **Parcs Canada Agency**  
 Client's Address: **Western and Northern Region**  
 Client's Contact: **L'Agence Parcs Canada / Ouest et Nord Region**

Scale: 1:1000

**McElhanney**  
 McElhanney Consulting Services Ltd.

**TCH WIDENING  
 ILLECILLEWAET CURVE  
 KM 21.0 TO KM 29.1  
 ROGERS PASS  
 GLACIER NATIONAL PARK, BC**

**PLAN AND PROFILES  
 STA 27+150 TO STA 27+800**

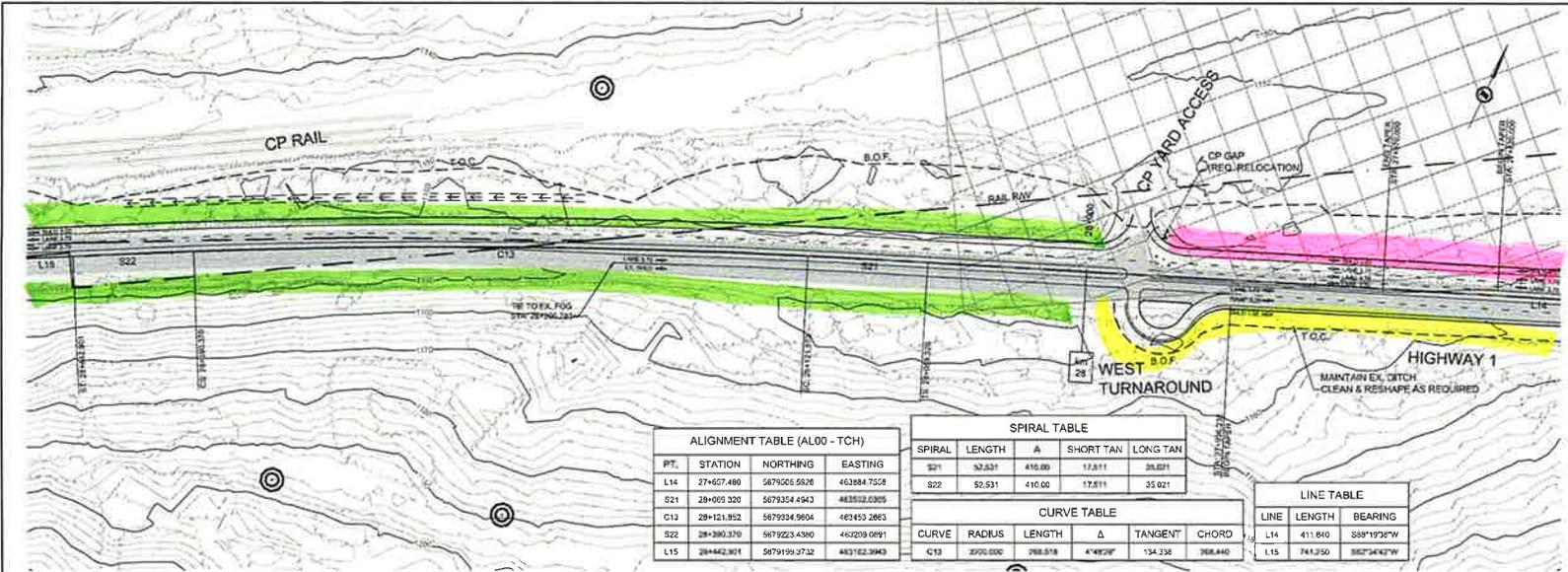
Designed by / Conçu par: MCE  
 Drawn by / Dessiné par: MCE  
 Date: 2018.01.11  
 Scale: 1:1000

Client's Name / Nom du client: **Parcs Canada**  
 Client's Address / Adresse du client: **Western and Northern Region**  
 Approved by / Approuvé par: **[Signature]**

Project No. / No. du projet: **2511-00881-2**  
 Drawing No. / No. de la feuille: **013**  
 Drawing Reference No. / No. de référence de la feuille: **PP-011**

Plan No. 111742 (2 of 2)

AL00 - TCH



PT.	STATION	NORTHING	EASTING
L14	27+627.480	5679505.5926	463884.7558
S21	28+009.320	5679354.4943	463832.0305
C13	28+121.952	5679314.9604	463453.2863
S22	28+380.370	5679223.4380	463208.0897
L15	28+442.904	5679199.9732	463182.3943

SPIRAL	LENGTH	A	SHORT TAN	LONG TAN
S21	32.531	416.80	17.611	35.021
S22	59.531	410.00	17.611	35.021

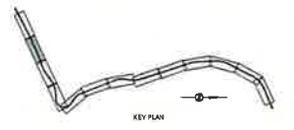
CURVE	RADIUS	LENGTH	Δ	TANGENT	CHORD
C13	3000.000	268.578	4°48'29"	134.338	268.480

LINE	LENGTH	BEARING
L14	411.840	338°19'36"W
L15	241.250	302°24'42"W

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Rev.	Date	Description	Drawn By	Designed By	Approved By
PA	2018.01.11	SIN 40-050	HL	DL	DL



Consultant's ID No. (shown on topographic map)

Draw Name (shown on topographic map)

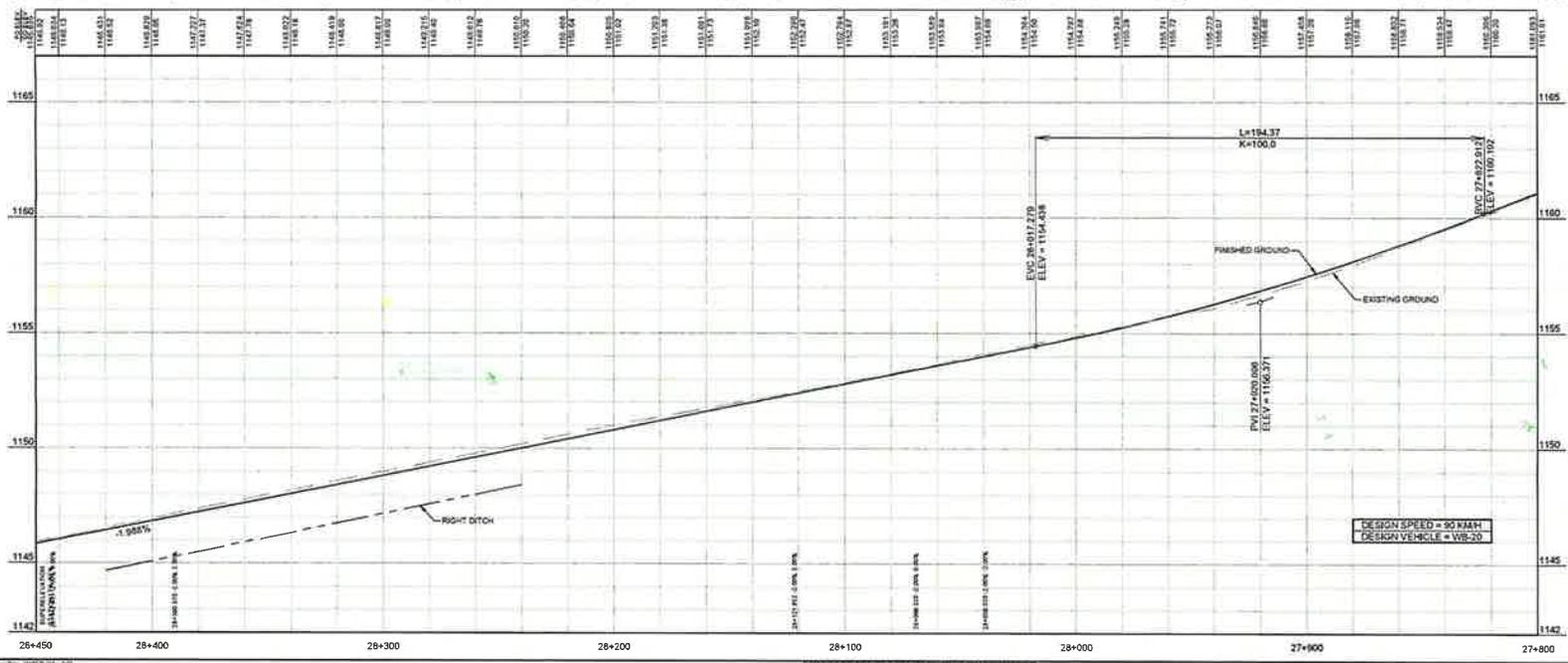
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 Western and Northern Region

L'Agence Parcs  
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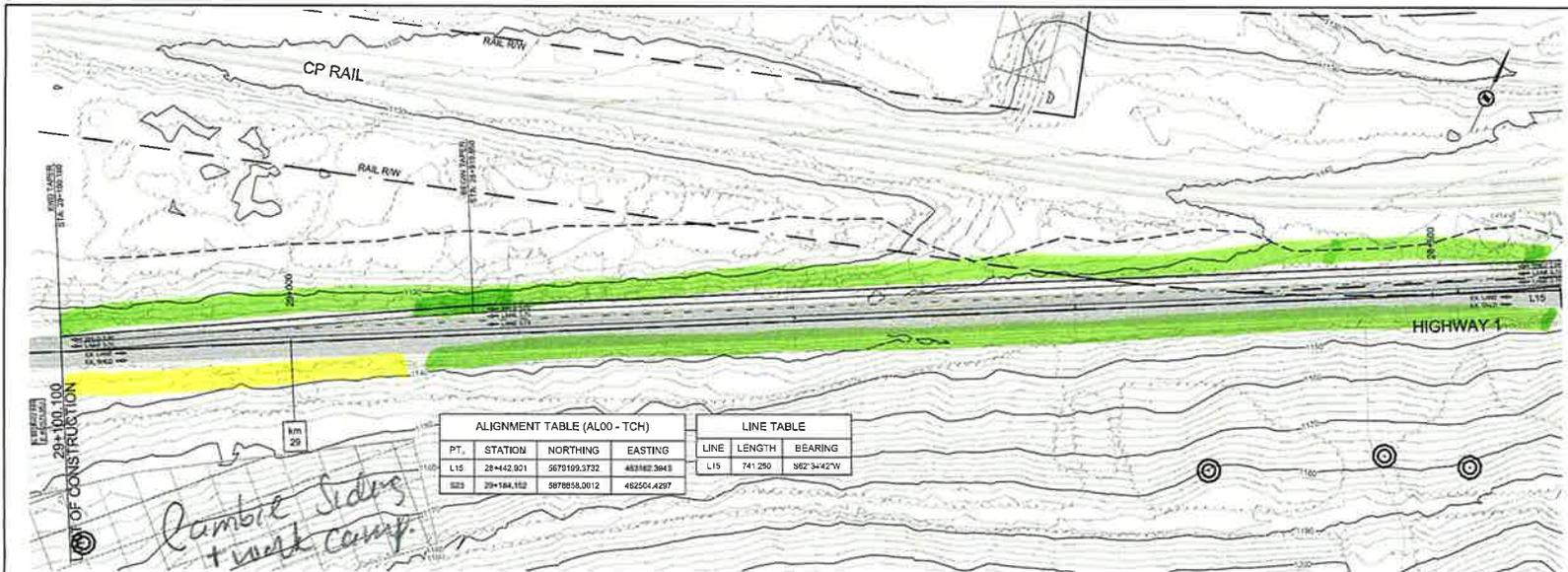
**McElhanney**  
 McElhanney Consulting Services Ltd.

TCH WIDENING  
 ILLECILLEWAET CURVE  
 KM 21.0 TO KM 29.1  
 ROGERS PASS  
 GLACIER NATIONAL PARK, BC

PLAN AND PROFILES  
 STA 27+800 TO STA 28+450



Designed by / Drawn by MCSL	Checked by / Reviewed by HL	Date 2018.01.11
Designed by / Checked by DL	Reviewed by / Revised by HSJ	Scale / Contour 1:500
Parks Canada Project Manager / Subcontractor or Project Partner Contact		
Client Acceptance / Acceptance No. (date)	Approved by / Approval no.	
Project No. / File Approval 2511-00001-0	Issue No. / No. de Rev. 0	Sheet No. / No. de Feuille 014
Drawing Reference / No. de la feuille de plan PP-012		

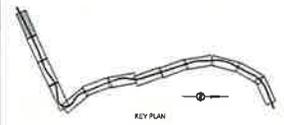


ALIGNMENT TABLE (AL00 - TCH)				LINE TABLE		
PT.	STATION	NORTHING	EASTING	LINE	LENGTH	BEARING
L15	28+442.921	5878193.3732	4831482.3643	L15	741.250	S82°34'42"W
S23	29+164.112	5878858.0012	482204.4237			

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PR.	DATE/REV.	APP. NO./REV.	BY	CHK.	DATE
Rev.	Draw	Draw/Check	Drawn	Designed	Approved
			Design	Coord.	Approval



<table border="1"> <tr> <td>A</td> <td>B</td> <td>C</td> </tr> <tr> <td>A</td> <td>B</td> <td>C</td> </tr> </table>	A	B	C	A	B	C	<p>Field number number of sheet of drawing no. date of drawing no. date of design no.</p>	<table border="1"> <tr> <td>A</td> <td>B</td> <td>C</td> </tr> <tr> <td>A</td> <td>B</td> <td>C</td> </tr> </table>	A	B	C	A	B	C
A	B	C												
A	B	C												
A	B	C												
A	B	C												

Client's Name  
Client's Address

Org. Name  
Client's Address

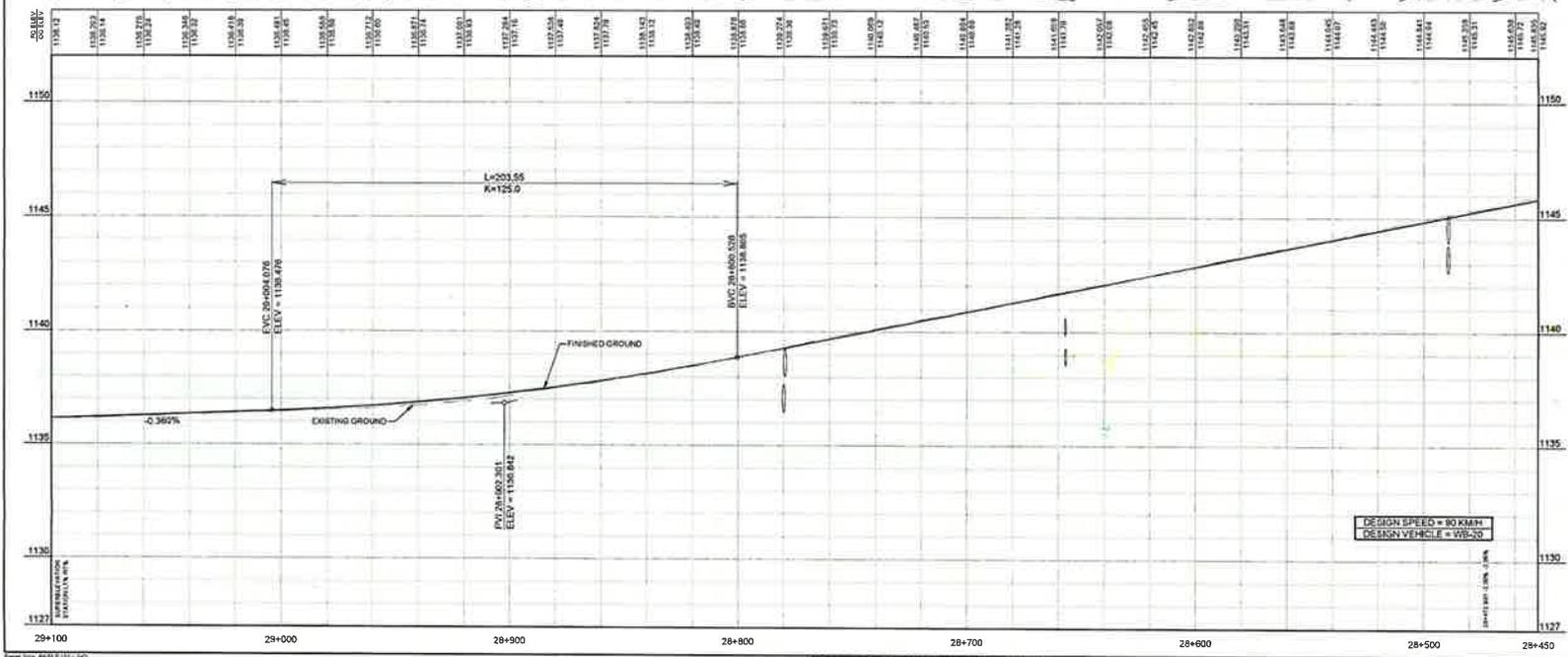
**McElhanney**  
 McElhanney Consulting Services Ltd.

TCH WIDENING  
ILLECILLEWAEET CURVE  
KM 21.0 TO KM 29.1  
ROGERS PASS  
GLACIER NATIONAL PARK, BC

PLAN AND PROFILES  
STA 28+450 TO STA 29+100

Surveyed by / Révisé par MCSL	Drawn by / Dessiné par NJ	Date 2016.01.11
Designed by / Conçu par DL	Reviewed by / Vérifié par RISJ	Scale / Échelle 1:5000

Client's Name / Nom de l'organisme	Approved by / Approuvé par
Project No. / No. du projet 2511-0581-0	Sheet No. / No. de la feuille 015
Drawn by / Dessiné par	Scale / Échelle



DESIGN SPEED = 80 KM/H  
DESIGN VEHICLE = WB-20