

REPORT

Ministry of Transportation and Infrastructure

Highway 1 Crazy Creek Bridge Scour Remediation Environmental Assessment



MAY 2023

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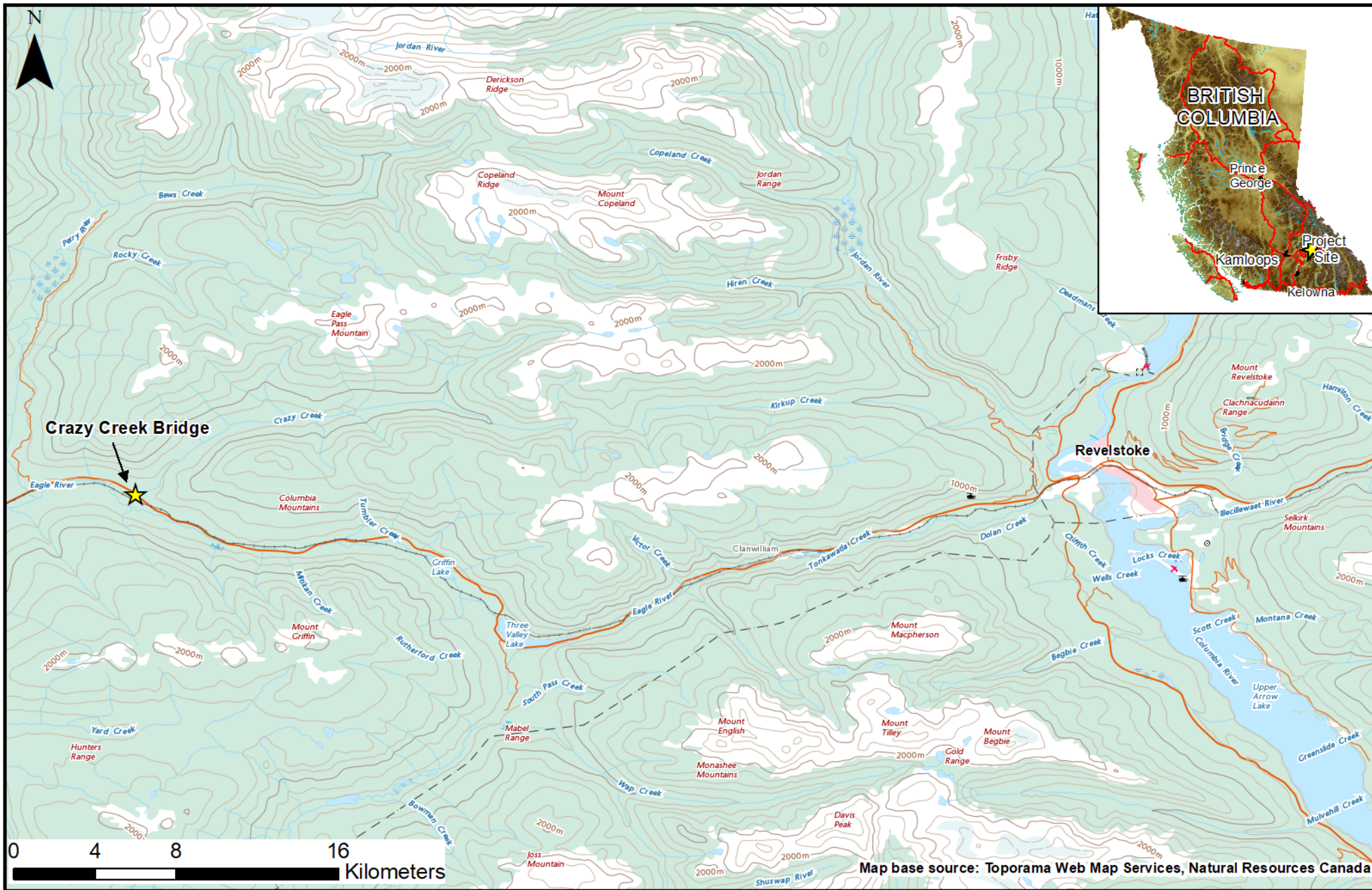
1 INTRODUCTION

Associated Environmental Consultants Inc. (Associated) has been retained by the BC Ministry of Transportation and Infrastructure (MoTI) to provide this environmental assessment (EA) for the scour remediation works located at the Crazy Creek Bridge (the Project) on Highway 1 Trans-Canada, west of Revelstoke, BC. (Figure 1-1) (11U 384624 m E, 5650683 m N). This document includes a description of the Project works, environmental conditions, potential project effects and mitigation measures recommended to reduce or eliminate potential impacts of the works on the aquatic and terrestrial environment within the Project Area. MoTI has proposed completing the Project work during the instream work window for 2023.

1.1 Project Description

The proposed scour remediation works will take place within the MoTI Right-of-Way along Crazy Creek and will include the installation of rip rap along both stream banks under the Crazy Creek bridge, located along Highway 1 Trans-Canada, approximately 40 km west of Revelstoke, BC. Site investigations completed by MoTI, determined that the existing rip rap along the stream was no longer present and the right bridge abutment showed visible scour with exposed rebar (Photograph 1, Appendix A). To remediate the scouring, proposed works include placing 500 kg class rip rap along both bridge abutments to prevent erosion and maintain infrastructure integrity (Figure 1-2). The rip rap placed within the channel banks will be underlain with non-woven Class 1 geotextile.

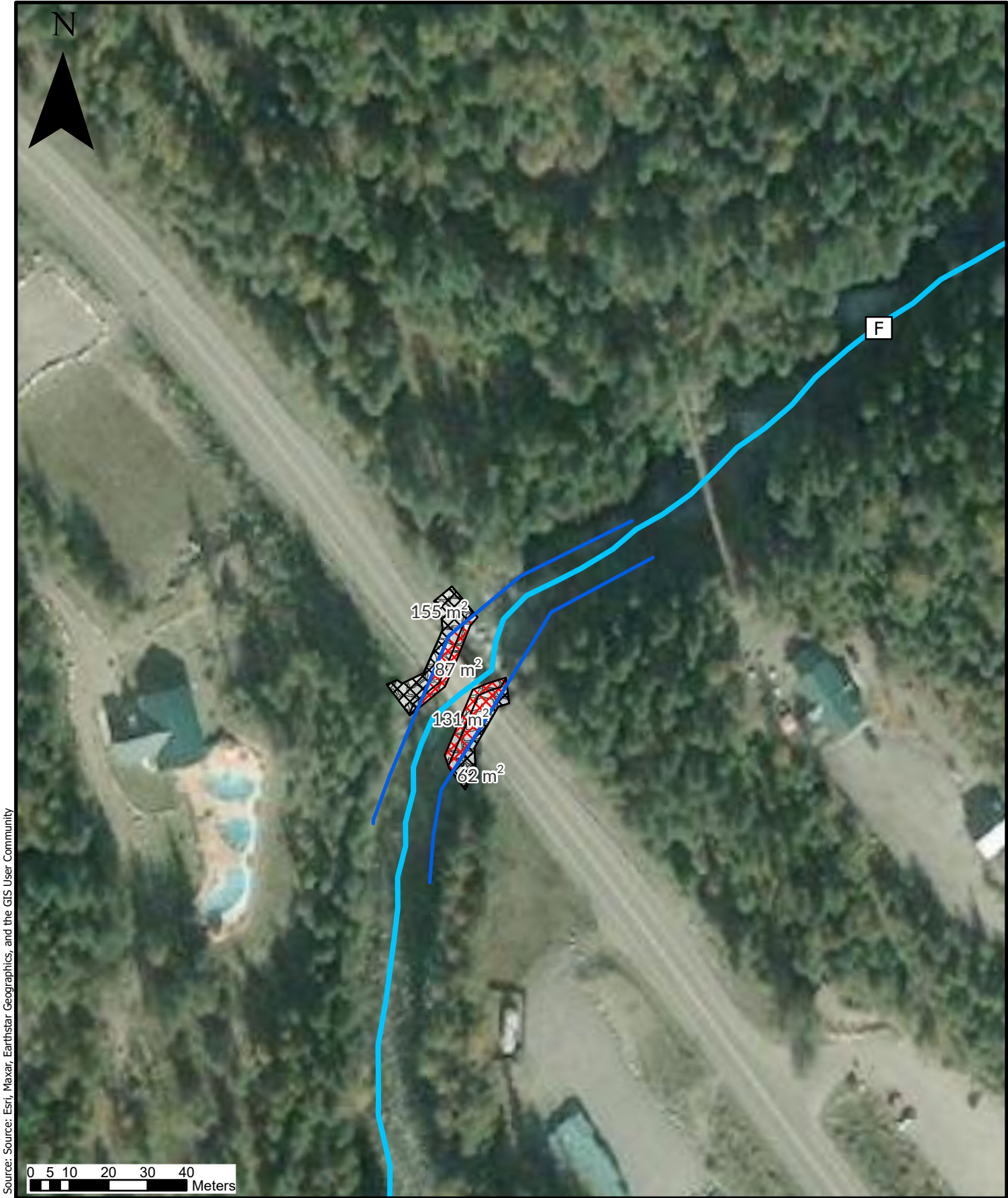
Instream work will be completed in isolation from flows during the instream work window of August 7 to October 21 (ENV 2022). Fish passage will be maintained during construction and a qualified environment professional (QEP) will remain on site to monitor compliance with project permits. Some riparian vegetation removal will be required upstream and downstream of the bridge for worker safety, equipment access, and riprap placement. Following construction, the Project will remediate the scouring of the bridge abutments and provide protection for 200-year peak discharge events.



AE PROJECT No. 2022-8348
SCALE 1:250,000
DATE 2023JAN27

FIGURE 1-1: PROJECT LOCATION

BC MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
 HIGHWAY 1 CRAZY CREEK BRIDGE SCOUR REMEDIATION



Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



-  Permanent Riparian Loss
-  Permanent Instream Loss
-  Highwater Mark
-  Crazy Creek
-  Crazy Creek Falls (barrier)

AE PROJECT NO. 2022-8348.000
SCALE 1:1,300
COORD.SYSTEM NAD 1983 UTM Zone 11N
DATE 2023-03-23
REV 02
DRAWN BY RL
CHECKED BY SG

FIGURE 1-2: PROJECT FOOTPRINT
 BC MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
 HIGHWAY 1 CRAZY CREEK BRIDGE SCOUR REMEDIATION

1.2 Assessment Methods

This Environmental Assessment was developed following a comprehensive desktop review of available information and a site visit to confirm the findings of the review. Searches of publicly available databases were conducted to gather known information of the Project location, and the site visit was to document the biophysical condition of the project site. Data sources that contributed to the development of this EA include:

- BC Conservation Data Centre Species and Ecosystems Explorer (CDC 2022);
- Google Earth online imagery;
- DataBC iMapBC spatial data tool (iMapBC 2022);
- Habitat Wizard (DataBC 2022);
- Available reports, existing mitigation documents, site photographs, and construction drawings and documents.

The Government of British Columbia Natural Resource Best Management Practices (BMPs) were reviewed to develop mitigation measures presented in this EA. Project specific mitigation measures were developed and are included in Section 4.

The environmental assessment focused on the natural environment and did not assess the effects of the Project on archaeological, cultural, or socio-economic values.

1.2.1 Spatial Boundaries

The effects on the biophysical condition from the Project were assessed at the following spatial scales:

- **Project Footprint** – The area that will be subjected to direct, physical disturbance from Project related (Figure 1-2). The Project Footprint is defined by the area of riprap on either bank of Crazy Creek. Based on the current design of the riprap work, this area is approximately 435 m².
- **Project Right-of-Way** – The area cleared of vegetation outside the toe of fill that may be intermittently modified by mowing or brushing during long-term maintenance of Highway 1 Trans-Canada.
- **Project Area** – A 100 m buffer surrounding the Project Footprint. This area is 52,957 m² and include the Project Footprint and Project Right-of-Way. The Project Area will be subject to direct and indirect effects from the Project on the environment.

2 REGULATORY CONTEXT

Legislation and regulations relevant to the Project are provided in the following subsections.

2.1.1 Water Sustainability Act

The provincial *Water Sustainability Act* (WSA) protects the quality of water, fish and wildlife habitat and the rights of licensed water users (SBC 2014, c.15). Under Section 11 of the Act, any activities that result in “changes in or about a stream” require notification or approval.

The WSA is triggered by construction because it includes instream works below the high-water mark or works that may affect a stream bank or channel. Project works, including scour remediation, and installation of riprap may alter the channel and hydraulic flows of the stream; therefore, the Project will require a Change Approval under Section 11.

2.1.2 Fisheries Act

The *Fisheries Act* (RSBC 1985, c.F-14) is the main federal legislation for Canadian fisheries management through the conservation and protection of fish and fish habitat. Fish habitat is defined under the Act as “spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly to carry out their life processes.” Subsection 35 (1) states that “no person shall carry on any work, undertaking an activity that results in the harmful alteration, disruption or destruction of fish habitat.” Subsection 36 (3) stipulates that “no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish.” A deleterious substance under the Act is defined as “any substance that, if added to any water, would degrade or alter or form part of a process of degradation or alteration of the quality of water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat.”

No spawning habitat upstream of the Project was previously documented or observed during the field assessment. Spawning habitat does exist downstream of the Project Area, and connectivity with the Eagle River, suggests Crazy Creek has the potential to support the spawning of adult pacific salmon and other salmonids. To prevent impacts to fish and fish habitat within the Project Area, a fish salvage will be conducted prior to works if required. The Project work will be completed with a clean flow of water maintained to ensure no impacts to fish or fish habitat will occur during construction.

2.1.3 Species at Risk Act

The federal *Species at Risk Act* (SARA) provides legal protection of wildlife and their habitats designated under Schedule 1 of SARA (SC 2002, c.29). The purpose of SARA is to prevent Canadian indigenous species, subspecies, and distinct populations from becoming extirpated or extinct, to provide for the recovery of endangered or threatened species, and to encourage the management of other species to prevent them from becoming at risk. SARA makes it an offence in Sections 32 and 33 to kill, harm, harass, capture or take an individual of a listed species that is extirpated, endangered or threatened; possess, collect, buy, sell or trade an individual of a listed species that is extirpated, endangered or threatened, or its part or derivative; and damage or destroy the residence of one or more individuals of a listed endangered or threatened species or of a listed extirpated species if a recovery strategy has recommended its reintroduction. SARA protects species, their residences, and critical habitat.

No documented species at risk known to occur were observed during background research within a 5 km radius of the Project Area. A list of species at risk with the potential to occur in the Project Area was included in Section 3.3.

2.1.4 Migratory Bird Convention Act, 1995 and Migratory Birds Regulation, 2022

The federal *Migratory Birds Convention Act* (SC 1994, c. 22) protects migratory birds and their nests from indiscriminate harvesting and destruction. The Act regulates hunting (e.g., permits and possession limits), sale of migratory birds, scientific collection, and activities to minimize the damage migratory birds cause to crops or other property.

The federal *Migratory Birds Regulation* (SOR/2022-105) protects the seasonal nests of 376 migratory bird species and year-round nest protection for 18 federally listed bird species on Schedule 1, unless shown to be abandoned. Under

the regulations, nest removal requires the online registry of inactive nests, followed by species specific wait times and nest monitoring requirements before permitting for removal.

The Act and regulation largely pertain to the site preparation and construction phases of the Project, where removal and disturbance of vegetation may affect habitat used by migratory birds in migratory stop-over, staging, nesting, breeding, and summer foraging activities. The regional migratory timing window for the Project Area is from mid April to mid August.

2.1.5 Weed Control Act

The provincial *Weed Control Act* designates provincially and regionally noxious weeds (listed on Schedule A of the Act) and the associated regulations governing those plants (RSBC 1996, c. 487). The Act provides guidelines for noxious weed prevention and management, stating that it is the responsibility of the landowner to manage and prevent spread of noxious weeds. Noxious weeds are typically non-native plants that have been introduced to BC without the insect predators and plant pathogens that help keep them in check in their native habitats. For this reason and because of their aggressive growth, these alien plants can be highly destructive, competitive, and difficult to control (RSBC 1996, c. 487). Mitigation measures described in Section 5.1.7 should be followed to minimise the spread of weeds within the site.

3 ENVIRONMENTAL CONDITIONS

This document is based on a desktop background review and site visit conducted on January 12, 2023, by Samuel Grenier, RBIT., CESCL, of Associated. The following sections describes the existing environmental conditions at the Project location.

3.1 Fish and Fish Habitat

Crazy Creek is a fourth order stream originating from alpine headwaters in the Monashee Mountains to the northeast. The Project Area is located on the lower reach of Crazy Creek. Below the Project Area, Crazy Creek flows approximately 700 m southwest before flowing into the Eagle River. Directly upstream of the Project Area is a well documented fish barrier (18 m high Crazy Creek waterfall) impeding upstream migration of fish. A review of provincial databases indicates that the reach of Crazy Creek between the barrier and the Eagle River confluence have several documented observations of fish species present (Habitat Wizard 2022). The connectivity and lack of migration barriers between the Project Area and the confluence with the Eagle River suggests the potential for the seasonal presence of three species of adult pacific salmon (*Oncorhynchus spp.*) and rearing of juvenile fish. Fish species document and known to occur in Crazy Creek are listed in Table 3-1.

The fish habitat in Crazy Creek within the Project Area is characterized by a steep step-pool morphology upstream with a gradient of 6.5%, then transitioning to a riffle-pool morphology downstream at a gradient of 3.5% (Photograph 2, 3). The channel substrate is predominantly boulders and cobbles with a channel width ranging between 16-25 m within the Project Area. The absence of deep pools in combination with moderate gradient suggests the overwintering capabilities of this reach of Crazy Creek is poor. The channel complexity created by the large boulders and cobbles in the substrate within the riffles offers high quality habitat for rearing juvenile salmonids. The riparian habitat upstream and downstream of the Project Area appears intact, dominated by mature stands of coniferous and deciduous trees with understorey shrubs providing stream shading and nutrient input (Photograph 4, 5, Appendix A).

Table 3-1 Fish Species in Crazy Creek (BC FIDQ 2023)

Common Name	Scientific Name	Provincial*/Federal Listing**
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>	NA
Sockeye/Kokanee Salmon	<i>Oncorhynchus nerka</i>	NA
Coho Salmon	<i>Oncorhynchus kisutch</i>	NA
Rainbow Trout	<i>Oncorhynchus mykiss</i>	NA
Cutthroat Trout	<i>Oncorhynchus clarkii</i>	Blue/Special Concern
Bull Trout	<i>Salvelinus confluentus</i>	Blue/SC
Mountain Whitefish	<i>Prosopium williamsoni</i>	Yellow/-
Longnose Sucker	<i>Catostomus Catostomus</i>	Yellow/-
Sculpin (General)	<i>Cottus spp.</i>	-

* Red-listed species are indigenous species that are Extirpated, Endangered, or Threatened in BC. Blue-listed species are indigenous species considered to be of Special Concern in BC.

** E = Endangered: species facing imminent extirpation or extinction; T = Threatened: species that is likely to become endangered if limiting factors are not reversed; SC = Special Concern: species of special concern because of its sensitivity to human activities.

Mitigation measures presented in [Section 5](#) are expected to avoid, reduce, or compensate for any potential effects on fish and fish habitat.

3.2 Vegetation and Ecosystems

The project occurs in the Thompson Moist Warm Interior Cedar – Hemlock variant (ICHmw3) (iMapBC 2022). The ICH is the most productive interior forest zone with a great diversity of tree species, including western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), and hybrid spruce (*Picea engelmannii x glauca*) in moist areas. Devil's club (*Oplopanax horridus*) and skunk cabbage (*Lysichiton americanus*) dominate in wetter sites. It is characteristic of cool, long, snowy winters and warm, dry summers. The ICHmw3 occurs at elevations between 400-1400 m elevation and is frequently found along the valley bottoms between Revelstoke to Galena Bay and west along Highway 1 (Meidinger D. and Pojar, J. 1991).

The native vegetation in the Project Area includes willow (*Salix spp.*), red-osier dogwood (*Cornus sericea*), alder (*Alnus spp.*), trembling aspen (*Populus tremuloides*), paper-birch (*Betula papyrifera*), western redcedar, Engelmann spruce, Douglas-fir (*Pseudotsuga menziesii*), and western white pine (*Pinus monticola*).

Within 5 km of the Project Area, there are no records of known occurrences of provincially Red or Blue-listed ecological communities or plants.

3.2.1 Rare Ecological Communities and Plants

Based on a search of the BC CDC Species and Ecosystems Explorer for the ICHmw3 subzone variant, one provincially Red-listed ecological community and two provincially Red and Blue-listed plant species at risk have the potential to occur within the Regional Area (CDC 2022) (Appendix B). The environmental conditions within the Project Area would

indicate that the ecological community of western hemlock/velvet-leaved blueberry – falsebox (*Tsuga heterophylla* / *Vaccinium myrtilloides* - *Paxistima myrsinites*) may occur, however, no suitable conditions occur within the Project Right-of-Way and Project Footprint, suggesting any interaction with this community is unlikely. Both provincially listed plants, the purple spike-rush (*Eleocharis atropurpurea*) (Red-listed) and the brown beak-rush (*Rhynchospora capillacea*) (Blue-listed) are not likely to occur due to the absence of suitable conditions within the Project Area.

3.2.2 Existing Disturbance and Land Uses

Within the Project Area occurs several existing disturbances that have altered and impacted the biophysical conditions. The disturbance on the landscape includes the Trans-Canada Highway 1, Crazy Creek campground, and Crazy Creek recreational and touring suspension bridge with paved parking lots. The Highway 1 Right-of-Way includes a buffer on either side of the paved road, that is regularly disturbed by mowing in the summer and snow and salt accumulation in the winter. The recreational and tourism activities along Crazy Creek within the Project Area likely deter wildlife from the noise and traffic, and further fragment the ecosystem functionality.

Just outside the Project Area is the CP rail line paralleling the Eagle River to the east. The noise and vibration disturbance from the trains is likely a contributing factor to deterrence of wildlife including mammals and birds within the Project Area.

3.2.3 Invasive Plants

Invasive plants reduce ecosystem quality and function. Invasive plants, including some noxious weeds, are known to occur along the existing road right-of-way for Highway 1 Trans-Canada, and less so outside of the highway right-of-way in naturally vegetated areas. The edges of the road right-of-way is mowed regularly to manage vegetation growth, resulting in stunted trees and shrubs and regular disturbance that improves the chance for invasive plants to germinate. Table 3-5 includes the invasive plants that have been document near the Project Area along Highway 1.

Table 3-1 Invasive plants known to occur around the Project Area

Common Name	Scientific Name
Bohemian Knotweed	<i>Reynoutria x bohemica</i>
Japanese Knotweed	<i>Reynoutria japonica</i>
Sulphur Cinquefoil	<i>Potentilla recta</i>
Spotted Knapweed	<i>Centaurea stoebe spp. australis</i>
Chicory	<i>Cichorium intybus</i>
Hoary Alyssum	<i>Berteroa incana</i>

Mitigation measures presented in Section 5 are expected to avoid, reduce, or compensate for any potential effects on vegetation and ecosystems.

3.3 Wildlife and Wildlife Habitat

The wildlife potentially present in the Project Area include birds, ungulates, large mammals, and small mammals. Suitable habitat for reptiles such as lizards or skinks also occurs in the Project Area. The following subsections identify habitat and species that may occur in the Project Area based on the habitat conditions observed during the field assessment on January 12, 2023.

Birds

The Project Area consists of mature forest, comprised of coniferous and deciduous trees, and riparian ecosystems, which provide nesting and perching habitat for numerous bird species. Based on available forage, cover, perching opportunities, habitat features (i.e., mature, and dead or decaying trees, grass, shrubs, and access to water) exist within Project Area are suitable for small passerine birds and birds of prey (i.e., raptors and owls) during all life stages. Abundant trees of similar or better value to raptors and owls were also noted outside the Project Area.

Mammals

Large and medium-bodied mammals that may use habitats within and adjacent to the Project Area include grizzly bear (*Ursus arctos*), black bear (*Ursus americanus*), moose (*Alces alces*), elk (*Cervus elaphus*), mule and white-tailed deer (*Odocoileus hemionus* and *O. virginianus*), and coyote (*Canis latrans*). The vegetated riparian area of Crazy Creek provides suitable forage, security, and movement habitat for all mammals with potential to occur, although the amount of ongoing disturbance caused by Highway 1 and the Crazy Creek campground may reduce the likelihood of these species using habitats in the Project Area.

Small Mammals

The forested and riparian ecosystems in the Project Area provide forage and cover for small mammals, such as mice, voles, and squirrels. Suitable habitat features, such as large diameter, decadent, or standing dead trees and coarse woody debris, were observed in the Project Area.

Reptiles

The forested and riparian ecosystems in the Project Area provide cover, forage, and resting habitat for reptiles and lizards. Important reptile overwintering habitat (i.e., rocky features with crevices that descend below the frost line) was observed in the Project Area. Listed reptile species that have potential to occur near the Project are presented in Table 3-2.

Amphibians

Riparian ecosystems in the Project Area may provide suitable terrestrial habitat for amphibians (Photograph 6, Appendix A). Important amphibian breeding or overwintering habitat (e.g., ponds or wetlands) was not observed in the Project Area. No listed amphibian species have been reported to occur within the 5 km of the Project Area.

3.3.1 Wildlife Species at Risk

No wildlife of species at risk have been reported to occur within 5 km of the Project Area. The following subsections identify wildlife species with the potential to occur based on the environmental conditions and suitable habitat for each species in the Project Area. A list of wildlife species at risk with potential to occur within the Project Area are presented in Table 3-2.

Table 3-2 Listed Wildlife Species with the Potential to Occur in the Project Area.

Common Name	Scientific Name	Species Group	BC List*	SARA List**
Western Tiger Salamander	<i>Ambystoma mavortium</i>	Amphibian	Red	E
Coeur d'Alene Salamander	<i>Plethodon idahoensis</i>	Amphibian	Blue	SC
Western Skink	<i>Plestiodon skiltonianus</i>	Reptile	Blue	SC
Grizzly Bear	<i>Ursus arctos</i>	Large Mammal	Blue	SC
Western Screech-Owl	<i>Megascops kennicottii macfarlanei</i>	Bird	Blue	T
Barn Owl	<i>Tyto alba</i>	Bird	Blue	T

* Red-listed species are indigenous species that are Extirpated, Endangered, or Threatened in BC. Blue-listed species are indigenous species considered to be of Special Concern in BC.

** E = Endangered: species facing imminent extirpation or extinction; T = Threatened: species that is likely to become endangered if limiting factors are not reversed; SC = Special Concern: species of special concern because of its sensitivity to human activities.

Western tiger salamander typically inhabits terrestrial habitat with connectivity or proximity to aquatic breeding areas like reservoirs, ponds, and stream pools. Suitable habitats range from warm lowlands to high mountains where they spend much of their time living in rodent burrows. Larval tiger salamanders hatch in the aquatic environment and develop by feeding on invertebrates before metamorphosing and returning to a terrestrial life-stage. The Project Area contains suitable terrestrial habitat amongst the large boulders and riprap along the banks (CDC 2022). The proximity to aquatic breeding sites and crevices for burrowing suggests this species has a potential to be present within the Project Area.

Coeur d'Alene salamander frequently occupy steep gradient streams and waterfall splash zones that offer suitable habitat. The species is nocturnal and spends much of its time underground and in interstitial spaces between rocks and boulders, feeding on invertebrates (CDC 2022). The Project Area contains suitable habitat for the Coeur d'Alene salamander and may be found to occupy the large boulders and rock along the stream.

Western skinks prefer open woodland, grassland, and rocky areas near streams for habitat. The skink's primary diet consists of a wide variety of invertebrates and insects. Reproduction activities involve laying eggs in burrows or areas excavated by females under rocks and stones (CDC 2022). Western skinks may be found in rocks and cavities along the bank of Crazy Creek and the Project Area.

Grizzly bears exhibit seasonal elevation movements from spring to fall, following food availability. They are generally found in lower elevation in the spring, moving higher towards mid-summer and winter. They are most frequently found in subalpine mountain forests but may occupy riparian woodlands as part of variation in an individual's range or territory (CDC 2022). There is a potential for grizzly bears to occur within the Project Area based on habitat suitability; however, the noise disturbance created by Highway 1 and the Crazy Creek campground and waterfall attraction may limit the overall habitat suitability for grizzly bears.

Western screech-owl habitat is defined as woodland or riparian woodland with broadleaf trees. They also inhabit moist coniferous forests and are usually found in lower elevations. They nest in tree cavities and abandoned woodpecker holes (CDC 2022). The forested riparian habitat along either bank of Crazy Creek offers suitable habitat, suggesting the potential of occurrence in the Project Area.

Barn owls are opportunistic in their selection of breeding habitat, preferring habitats comprised of dense grasses, caves, crevices, or buildings. Nesting location habitat for barn owls is predominantly open country and agricultural areas but has been documented to occur beneath bridge platforms (CDC 2022). The potential for barn owls to occur within the Project Area is limited given the dense coniferous forest surrounding the Project Area.

Mitigation measures presented in [Section 5](#) are expected to avoid, reduce, or compensate for any potential effects on wildlife and wildlife habitat.

4 POTENTIAL ENVIRONMENTAL EFFECTS

Construction of the Project may result in potential effects on the environment including:

- Disturbance to fish and fish habitat during fish exclusions and salvages,
- Disturbance to vegetation or ecosystems during clearing to provide access for machinery,
- Spread or introduction of invasive plants,
- Disturbance to wildlife or wildlife habitat,
- Changes in water quality during instream isolations and temporary stream diversion, and
- Installation of rip rap to remediate for scouring.

The Project Footprint is approximately 435m² in total and of that 218 m² is below the high-water mark of Crazy Creek. The Project Footprint will be accessed through the existing MoTI Right-of-Way along Highway 1 Trans-Canada. The following effects assessment considers potential effects of the Project during the construction and operation phases.

Disturbance to Fish and fish Habitat

Construction effects on surface water quality are expected to be contained within an isolation, separate from stream flows and fish. Permanent effects to aquatic habitat are anticipated from the rip rap installation along both stream banks and bridge abutments. The impact will reduce channel width and likely increase localized channel velocity through the Project Area. The installation of rip rap will provide increased interstitial spaces for rearing juvenile fish, but the increased velocity from channelization may increase the coarseness of the channel substrate and reduce the complexity of the existing habitat.

Based on the proposed works both riparian and instream habitat will be permanently altered. Table 4-1 outlines the aquatic habitat alteration based on the engineered drawings for the scour remediation works.

Table 4-1 Land Affected by the Project based on Ecosystem Type.

Habitat Affected	Loss (m ²)
Permanent Riparian Disturbance	328
Permanent Instream Disturbance	285
Total	613

Vegetation and Ecosystem Disturbance

The Project Footprint will result in permanent and temporary disturbance of vegetation and ecosystems as a result of vegetation removal, soil stripping, and rip rap placement within the Project Footprint. Vegetation clearing will be limited to areas that require machinery access, equipment staging, and bank excavation upstream and downstream of the bridge abutments. All vegetation removal is anticipated to be within the MoTI Right-of-Way.

Spread or Introduction of Invasive Plant

Vegetation removal is anticipated to occur within the previously disturbed MoTI right-of-way which has been documented to include invasive plants. Exposed soils from Project construction may promote the spread or germination of invasive plant species in the surrounding the Project Area. Machinery, tools, or equipment that contains vegetated material may introduce invasive plants to the site or off of the site.

Wildlife and Wildlife Habitat Disturbance

Vegetation clearing and soil grubbing in the Project Area will result in disturbance to habitat that may be used for cover, forage, or thermal regulation by all wildlife species that use the Project Area, including birds, large mammals, small mammals, reptiles, and amphibians in their terrestrial life stage. Habitat disturbance and soil grubbing may result in accidental mortality of individuals such as birds, reptiles, or terrestrial amphibians if they are not detected before work begins. The removal of mature trees will result in fewer suitable perching and nesting habitats for birds; however, abundant trees of similar or better value for raptors and other bird species exist in ecosystems outside the Project Area.

Potential indirect effects during the construction phase of the Project may produce localized noise disturbance to wildlife in the surrounding terrestrial habitat. The noise disturbance is expected last the duration of the Project construction and will not have any adverse impacts during the operational phase.

Changes in Water Quality

Instream work is not anticipated to result in adverse effects to water quality within Crazy Creek and downstream receiving streams. The establishment of the instream isolation for the work area will create short period of elevated turbidity. This work is not anticipated to exceed Canadian Council of Ministers of the Environment Water Quality Guidelines (CCME 1999). Placement of rip rap for the scour remediation and future flood protect work is expected to occur in the dry, isolated from fish and stream flow. Table 4-2 includes the water quality guidelines for the protection of aquatic life, and should act as a guide in evaluated and mitigating the effects to water quality parameters should impacts to the stream occur during construction activities.

Table 4-2 CCME Water Quality Guidelines for the Protection of Aquatic Life

Parameter	Guideline
Suspended Solids	<p>Change from background of 25 mg/L at any one time for a duration of 24 hours in all waters during clear flows or in clear waters.</p> <p>Change from background of 5 mg/L at any one time for a duration of 30 days in all waters during clear flows or in clear waters.</p> <p>Change from background of 10 mg/L at any time when background is 25 – 100 mg/L during high flows or in turbid waters</p> <p>Change from background of 10% when background is >100 mg/L at any time during high flows or in turbid waters.</p>
Turbidity	<p>Change from background of 8NTU at any one time for the duration of 24 hours in all waters during clear flows or in clear waters.</p> <p>Change from background of 2 NTU at any one time for a duration of 30 days in all water during clear flows or in clear waters.</p> <p>Change from background of 5 NTU at any time when background is 8 – 50 NTU during high flows or in turbid waters.</p> <p>Change from background of 10% when background is >50 NTU at any time during high flows or in turbid waters.</p>
pH	6.5-9

Operational effects on water quality in the Project Area are largely restricted to seasonal maintenance of Highway 1 Trans-Canada. Winter snow plowing and salt, sands, or gravels application could increase sedimentation and temporarily reduce the quality of surface water flowing to Crazy Creek. Patching and sealing pavement surfaces may result chemical compound runoff into surface water or leaching into groundwater resources. Since all these applications are followed under current practice, none of these activities are expected to result in changes to water resources in the Project Area.

Existing Water Licenses

A background review of existing water licenses within the Project Area along Crazy Creek indicated that four surface water extraction lines exist (iMapBC 2022). However, a search of the water license users provided only two licenses, CO59828 and C133221 (Water Rights Database 2023). Water License CO59828 is an abandoned license previously under the Department of Fisheries and Oceans (DFO). Water Licence C132221 is a conditional surface water license

held by the Ministry of Transportation and Infrastructure (MOTI). The additional water use lines that appear on iMap are not associated with any license number in the provincial directory (2022). The apparent surface extraction location and conduit routes do not appear to interfere with the scope of the Project work and are located upstream of the work area.

If mitigation measures presented in Section 5 are implemented and monitored for effectiveness, the Project is expected to have minimal affect on vegetation, wildlife, wildlife habitat and surface water resources.

5 MITIGATION MEASURES

Construction activities will follow mitigation recommendations described in this EMP and any permit conditions from the Ministry of Forests (MoF) and Fisheries and Oceans Canada (DFO). Taking those measures into account, the following mitigation measures will assist in planning and executing the Project works while protecting sensitive ecological components.

5.1.1 Environmental Monitoring

The contractor must retain a QEP to provide advice and oversee all activities that may result in an effect on the environment. The QEP must be available throughout the work to represent MoTI on all matters related to protecting the environment. The QEP will present the environmental sensitivities and mitigation measures during a pre-construction meeting and will attend all key meetings during which environmental protection measures are discussed.

The QEP may appoint a suitably experienced Environmental Monitor (EM) who will work under the direct supervision of the QEP to conduct environmental monitoring and oversee the implementation of an EMP and ensure the work meets regulatory approval conditions. The EM will be on site to monitor sensitive Project works, such as instream works and vegetation removal, and will have the authority to stop works that pose a risk to the environment.

The EM must be on site during critical activities, including:

- All works below the high-water mark of Crazy Creek;
- After significant precipitation events; and
- During all times that the environmental approvals specify work activities have the potential to affect wildlife habitat.

The EM will monitor rip rap placement below the high-water mark on a full-time basis until complete to ensure that it is constructed as designed and that mitigation measures and permit conditions are followed. The EM will monitor water quality parameters and ensure the Project remains within compliance with values presented in Table 4-1. The EM will complete a final report, summarizing the Project construction activities, compliance with mitigations measures outlined and permit conditions.

5.1.2 Construction Timing of Works

Migratory and Breeding Birds

- Avoid site-preparation or vegetation clearing activities within the migratory or breeding bird window, which is between April 15 and August 15 (Table 5-1). If this is not possible, all areas slated to be cleared must have breeding bird surveys conducted by a QEP prior to clearing. If breeding birds are detected and may be

affected by the work (as determined by the EM), a species-appropriate no disturbance buffer will be established to protect the nesting birds.

- Retain large diameter (>50 cm), decaying trees (unless they pose a risk to the safety of construction workers or equipment) whenever possible to retain suitable habitat for cavity nesting species such as woodpeckers or owls.

Amphibian and Reptile Habitat

- Schedule work between March and November to avoid disturbing reptiles and amphibians during their most sensitive seasons.
- Ensure the EM sweeps areas slated for vegetation clearing immediately prior to work to ensure that no wildlife, including snakes, reptiles, or amphibians, are present. If wildlife is present, vegetation clearing work should be postponed until the individuals leave the area. If wildlife handling is required, the QEP must acquire a General Wildlife Permit from MoF to salvage wildlife.

Table 5-1 Least Risk Construction Schedule to Reduce Effects on the Environment

Wildlife	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Migratory Birds	Least Risk							Least Risk				
Amphibians and Reptiles			Least Risk									

5.1.3 Protection of Fish and Aquatic Environments

The following general mitigation measures are intended to avoid or reduce potential impacts on fish and aquatic habitat during construction:

- Complete work during periods of low water and the instream work window of August 7 to October 21.
- Isolate work areas from flowing water to prevent the movement of sediments using either pumps or temporary diversion channels.
- Provide proper site isolation, including the use of mega bags, lock blocks, sandbags, fish screens, silt curtains, or silt fence.
- Maintain clean flow of water through and downstream of the work area.
- Obtain a permit and conduct fish salvage in the isolated work area and the area where the water is diverted.
- Install isolation fencing or end of pipe screens to protect fish if they occur in the active construction area and to prevent accidental suction into pumps, if required.
- Monitor downstream turbidity during construction and compare the results to background measurements collected upstream of the site. Guidelines for turbidity values during construction work is listed in Section 4.
- Regularly inspect and immediately correct any failure of the sediment and erosion control measures to contain turbid water to the work area and document the incident.
- Gradually reintroduce water to isolated areas upon completion of the instream works, so that a large pulse of sediment is not released downstream.

5.1.4 Erosion and Sediment Control

The following erosion and sediment control measures are intended to avoid or minimize impacts during construction:

- Provide site isolation both instream and terrestrial, approved and inspected by the EM, including silt fence prior to instream works, as required.
- Tie the ends of the silt curtain or silt fence into the shoreline/bank to prevent escape of sediment-laden water.
- Restrict isolation of the instream area to only what is required for instream work.
- Inspect ESC structures on a regular basis and after major rainfalls to ensure continued effectiveness, to identify where replacement or maintenance is required, and to identify where trapped sediments need to be removed. Where erosion control structures need maintenance or repair, these works must be undertaken as soon as practicable.
- No vehicular access will occur below the high-water mark. All machinery will operate from the top of bank.

5.1.5 Protection of Vegetation

The following general mitigation measures are intended to avoid or minimize impacts during vegetation clearing works:

- Minimize vegetation removal to only the area required for the Project Footprint and to provide safe construction. Retain large diameter trees and dead standing snags where possible.
- Choose access points with least damage to terrestrial habitat.
- Revegetate, and reseed temporary access routes, and equipment laydown areas as necessary once construction is completed.

5.1.6 Protection of Wildlife

The mitigation measures to address incidental wildlife encounters are as follows:

- Schedule ground and vegetation disturbance to align with Table 5-1 in this EMP to avoid the most sensitive seasons for reptiles and amphibians.
- Prior to construction, have a QEP or an EM complete a walk-through of the area to survey for amphibians, reptiles, birds, or other wildlife species that may be affected by construction.
- Document all observations of wildlife during construction.
- Ensure the construction site and site facilities remain free of wildlife attractants to minimize human-wildlife conflicts. Manage fuel cans, lunch, and food scraps in a manner that does not attract wildlife.
- Restore wildlife habitat within Crazy Creek by covering exposed soil and revegetating with native grass or shrub species.
- Restore and revegetate with forbs, shrubs, and trees, any areas within the Project Footprint that do not need to be regularly mowed as part of regular highway maintenance.

5.1.7 Weed Management

The following measures are intended to reduce the potential of introduction, transfer, or establishment of weeds:

- Ensure all vehicles, equipment, and tools entering or exiting the sites are clean and free of weeds and any associated seeds.
- Follow the restoration plan in Section 4.1.10 to restore vegetation to disturbed areas post construction.

5.1.8 Fuel Storage and Spill Contingency Plan

Storage Facilities

- No onsite storage is expected to occur as part of this project.
- If refueling of tools or equipment must occur, all refueling activities must be conducted at least 30 m from the top of bank of Crazy Creek.

Orientation and Training

- Train all construction personnel to use spill prevention-and-control equipment prior to active construction.
- Explain the spill reporting procedures to all personnel. All personnel must be provided with the spill response and reporting guidelines in an easy-to-follow, written format.

Environmental Best Management Practices

- Ensure that a fully stocked and appropriately sized spill kit is stored nearby and ready for use.
- Refuel at least 30 m from the top of bank on Crazy Creek.
- Prevent fuel overflow or spillage by ensuring that fuel tanks have connections that shut off automatically when the container is full.
- Collect condensation siphoned from fuel tanks in a separate tank for disposal in a licensed facility.
- Ensure all equipment used on site is in sound mechanical condition. No equipment with fuel leaks or deteriorated hydraulic hoses are to be used. Other precautions to be followed are:
 - Inspect equipment daily and keep clean and free of oil, grease, coolant, or other contaminants.
 - Equip stationary equipment working on site with drip trays to contain leakage of fuel, lubricant, or any other fluid.
 - Use biodegradable hydraulic fluids, where possible.
 - Ensure all machinery complies with applicable provincial and federal regulations for operations and exhaust emissions. Exhaust systems must work well enough to control noise to normal operating levels.

Spill Response Procedures

- Ensure safety:
 - Ensure personal, public, and environmental safety.
 - Wear appropriate protective gear.
 - Identify the product spilled before clean-up.
 - Warn people in the vicinity.
 - Ensure no ignition sources are present if the spill is flammable.
- Stop the flow:
 - Act quickly to reduce the risk to the environment.
 - Close valves, shut off pumps, or plug leaks.
 - Stop the flow at its source.
- Secure the area:
 - Limit access to the area.
 - Prevent unauthorized entry onto the site.
- Contain the spill:

- Prevent the spill from entering any drainage structures.
- Use spill absorbent material to contain the spill.
- Minimize environmental contamination.
- Notify/report spills (Section 4.1.8).

5.1.9 Environmental Incident Reporting

Spills of any size are to be reported immediately to the project Ministry Representative, and written notification to be provided within two weeks. The Project Manager is responsible for designating qualified personnel to document all spills that occur on site and for preparing an incident report for the Ministry Representative. Photographs, measurements, notes, and other incident documentation will be collected and be available to relevant agencies if requested. A file containing all incident reports will be located on site at all times.

An Environmental Incident Report will be filled out for all environmental incidents and for all spills. The incident report will include:

- Name and telephone number of the person who reported the spill;
- Name and telephone number of the person who caused the spill;
- Spill location, cause, and a description of the surrounding area;
- Type (including MSDS number) and quantity of the spilled material;
- Details of the spill response, including location of disposal site;
- Names of all people on the scene, including Ministry representatives;
- Names of people and agencies notified after the spill;
- Sequence of events, including notifications and timing; and
- Comments on the handling of the incident.

The *Spill Reporting Regulation* (B.C. Reg. 263/90) requires all persons who manage hazardous materials to report any spill of any size into water immediately and to report only significant spills on land to the Provincial Emergency Program (PEP) at 1-800-663-3456. The type of materials likely to be present at the Project site and the amount of spill above which the PEP must be immediately advised include, but may not be limited to:

- Fuels, engine oils and hydraulic oils: 100 litres;
- Petroleum oils and emulsions: 100 litres;
- Antifreeze: 5 litres; and
- Propane: 10 kilograms.

Under the *Environmental Management Act* (SBC 2003, c. 53), the person who had possession, charge, or control of the substance immediately before its spill must immediately report the spill to the PEP. A report to the PEP must include, where applicable:

- Name and telephone number of the person who reported the spill;
- Name and telephone number of the person who caused the spill;
- Location and time of the spill;
- Type and quantity of the substance spilled;
- Cause and effect of the spill;

- Details of action taken or proposed;
- Description of the spill location and of the area surrounding the spill;
- Details of further action contemplated or required;
- Names of any agencies on the scene; and
- Names of other persons or agencies advised concerning the spill.

5.1.10 Project Area Restoration

Upon completion of the work, construction materials will be removed from the Project site by the contractor. The Project access route with the MoTI ROW will be revegetated with a MoTI approved grass-seed mix to prevent the propagation of invasive weeds, and to prevent surface erosion of exposed soils.

If trees were removed, planting to replace lost vegetation appropriate to site-specific conditions will be recommended by the QEP.

Following project completion, the QEP will prepare a short report that summarizes the information collected during monitoring, any actions taken on the part of the contractor, and any potential future environmental impacts that could occur on site. This report will be available to MoTI and the Ministry of Forests staff, if requested.

7 CLOSURE

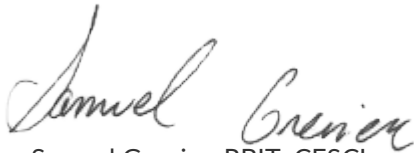
This environmental assessment was prepared for the Ministry of Transportation and Infrastructure to assess and mitigate the proposed rip rap installation along Crazy Creek Bridge along Highway 1 Trans-Canada, located 40 km west of Revelstoke, BC.

The services provided by Associated Environmental Consultants Inc. in the preparation of this EA were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

If you have any questions or concerns, please contact the undersigned.

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APPENDIX A SITE PHOTOGRAPHS

Photograph 1 Exposed rebar at the base of the western abutment of Crazy Creek Bridge.



Photograph 2 Upstream view of the channel morphology above the Project area.



Photograph 3 View of the channel morphology within the Project area.



Photograph 4 View of the riparian vegetation and channel morphology downstream of the Project area.



Photograph 5 View of the mature mixed forest vegetation below the Project area.



Photograph 6 Suitable terrestrial habitat within the Project area for amphibian and reptile.

