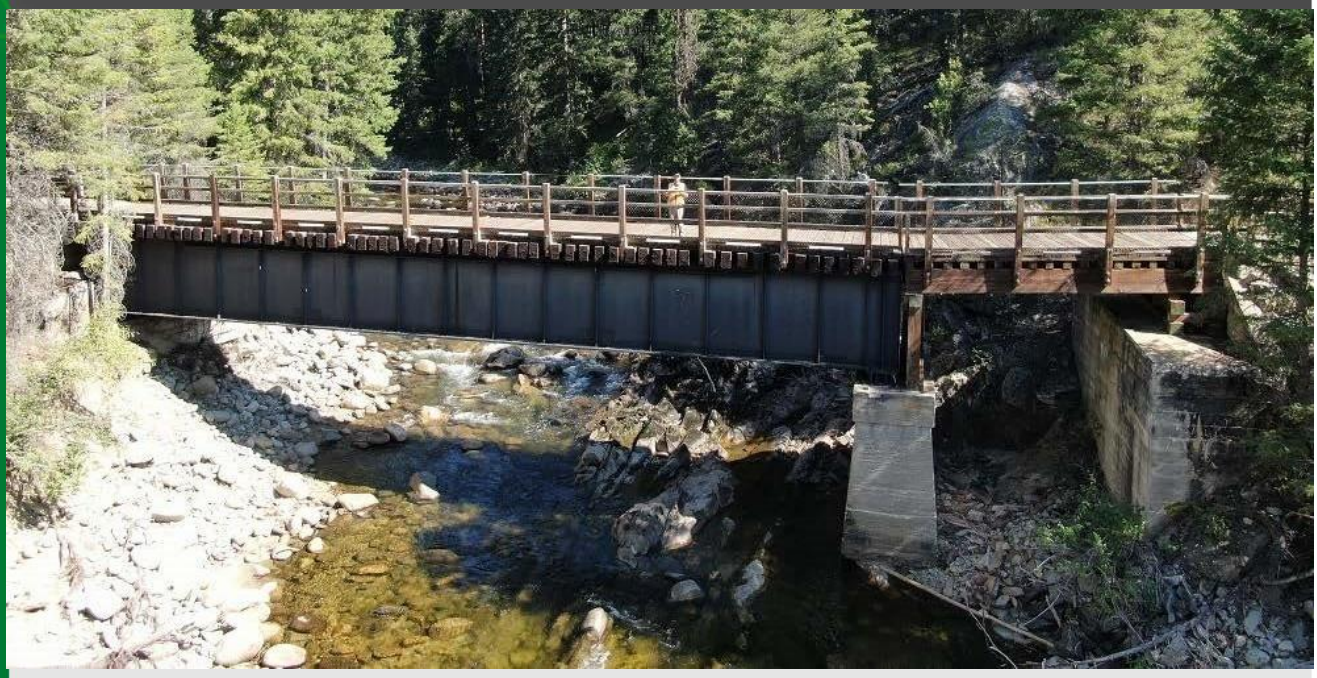
DWB Consulting Services Ltd.

Construction Environmental Management Plan

KV-005 West Kettle River Bridge-Crossing Repair



Engineering | Environmental | Forestry

Prepared for: Recreation Sites and Trails BC
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BRITISH COLUMBIA
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Date: 2023.04.14 | DWB file: 22634-498 (LB) | Revision: A

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SIGNATURE PAGE

DWB Consulting Services Ltd. is pleased to submit this report for your review. This report has been prepared using sound technical and professional judgement, based on our knowledge and experience, applicable regulatory framework, industry best management practices, and current understanding of project conditions, design, and project setting.

REPORT TITLE: Construction Environmental Management Plan: KV-005 West Kettle River Bridge-Crossing Repair

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REVISION HISTORY			
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[1] Editorial Review: Reviewed for formatting, grammar, spelling, etc.
Professional Review: Reviewed for content and professional signoff
Client Review: Reviewed by client
Regulatory Review: Reviewed by regulatory agency (i.e. DFO) if necessary
Peer Review: Reviewed for content and errors by peer

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We do not represent, warrant, undertake or guarantee:

- That all project environmental-related information has been received.
- That regulations and standards of practices shall remain constant through the duration of the project.
- That the use of guidance in the report will lead to any particular outcome or result; or, in particular,
- That by using the guidance in the report, the client will be approved by the contract holder for the applied works.

TABLE OF CONTENTS

SIGNATURE PAGE I
DISCLAIMER II
TABLE OF CONTENTS III
1.0 INTRODUCTION 1
2.0 PROJECT DESCRIPTION 1
2.1 Site Location 1
2.2 Proposed Scope 1
2.3 Project Schedule 1
2.4 Roles and Responsibilities 3
2.5 Environmental Regulatory Requirements 3
2.5.1 Permitting 3
2.5.2 Timing Windows 3
2.6 Biophysical Inventory 4
2.6.1 Aquatic Habitat 4
2.6.2 Terrestrial Habitat 5
2.6.3 Fish and Wildlife 5
3.0 GENERAL CONSTRUCTION ACTIVITIES 6
3.1 Start up and Environmental Briefing 6
3.2 Site Access and Staging 6
3.3 Clearing and Grubbing 7
3.4 Site Isolation 7
3.5 Fish Salvage 7
3.6 Bridge Repair Works 7
3.7 Revegetation 8
4.0 POTENTIAL IMPACTS ON THE ENVIRONMENT 8
5.0 BEST MANAGEMENT PRACTICES 9
5.1 Best Management Practices for Stream Crossings 9
5.2 Operational Best Management Practices for Instream Works 9
5.2.1 Monitoring 10
5.2.2 Timing of Works 10
5.2.3 Deleterious Substance Control/Spill Management 10
5.2.4 Isolation of a Work Area and Fish Salvages 10
5.2.5 Sediment Control 10
5.2.6 Site Restoration 10
5.2.7 Vegetation Management 11
5.2.8 Shore Stabilization (Riprap Placement) 11
5.2.9 Concrete Works 11
6.0 ENVIRONMENTAL MONITORING 12
6.1 Work Stoppage 12
6.2 Water Quality Testing 12
7.0 EROSION AND SEDIMENT CONTROL PLAN (ESCP) 13
7.1 Contingency and Scheduling 13
7.2 Limit Site Disturbance 14
7.3 Inspecting, Monitoring and Maintaining ESC Measures 14
7.3.1 Sediment (Silt) Fence 14
7.3.2 Spoil Material / Stockpiles 14
7.3.3 Seeding and Straw Mulch Application 14
8.0 CONCRETE MANAGEMENT 15
9.0 WILDLIFE MANAGEMENT 15
10.0 INVASIVE PLANT MANAGEMENT 15
11.0 AIR QUALITY MANAGEMENT 16
12.0 WASTE MANAGEMENT 16

13.0 FUEL HANDLING 17
14.0 SPILL PREVENTION AND RESPONSE 17
14.1 Spill Prevention 17
14.1.1 Potential Spill Sources 17
14.1.2 General Measures for Spill Prevention and Containment 17
14.1.3 Spill Kit Contents 18
14.2 Spill Response 18
14.2.1 General Spill or Leak Practices and Procedures 18
14.2.2 Safety Data Sheets 19
14.2.3 Cleanup Practices and Procedures 19
14.2.4 Monitoring 19
14.2.5 Spill Investigation / Spill Report Form 19
15.0 DISTRIBUTION OF THE CEMP 20
16.0 REVISIONS TO THE CEMP 20
17.0 REFERENCES 21

FIGURES

Figure 1. Site Location Map. 2

Tables

Table 1. Reduced risk timing window for songbirds and raptors within the Northern Okanagan Basin and Northern Okanagan Highland Ecodistricts within the A1 Nesting Regions. 4
Table 2. Historical documentation of fish species in West Kettle River 5
Table 3. BC ambient water quality guidelines. 12
Table 4. Spill substances and quantities which are to be reported to the Province 20

APPENDICES

Appendix A. Site Photographs
Appendix B. Design Drawings
Appendix C. Environmental Regulatory Approvals
Appendix D. Environmental Monitoring Site Forms
Appendix E. Diagrams Illustrating Typical Environmental Protection Measures
Appendix F. Spill Report Forms

1.0 INTRODUCTION

The Ministry of Forests (MOF) and Recreation Sites and Trails BC (RSTBC) retained DWB Consulting Services Ltd. (DWB) to prepare a Construction Environmental Management Plan (CEMP) for the maintenance work on the existing bridge (KV-005) across the West Kettle River located along the Kettle Valley Rail Trail (KVR). This CEMP addresses the environmental requirements for the proposed works.

2.0 PROJECT DESCRIPTION

2.1 SITE LOCATION

The project site is located south of Kelowna and accessed from Highway 33 and Chenier Lake Road. The site is located along the KVR at 11U 351996E, 5461344N (49.28691°N, -119.03528°W) as shown on Figure 1. Photos of the site are provided in Appendix A.

2.2 PROPOSED SCOPE

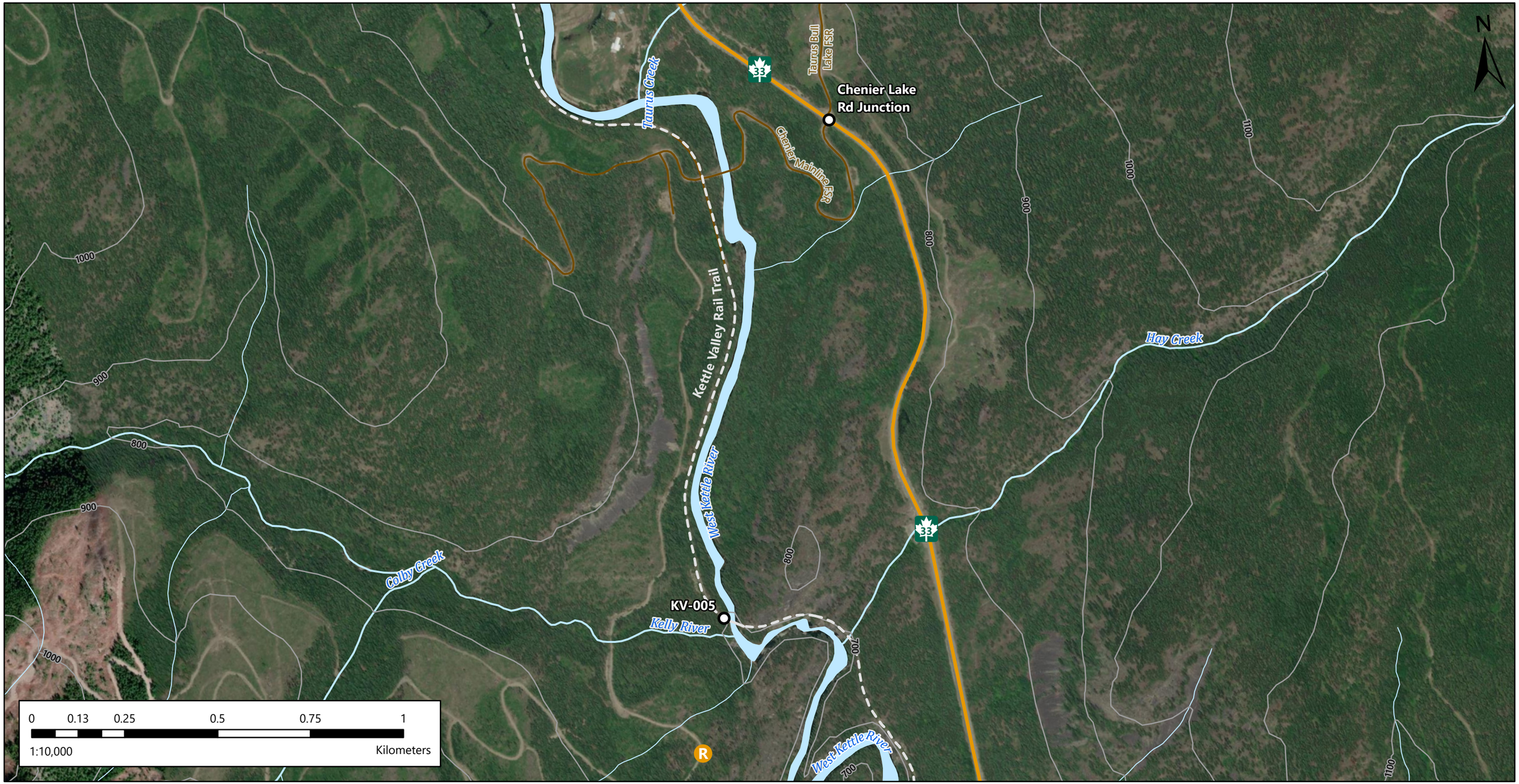
The West Kettle River (watershed code: 320-520100) flows beneath the Bridge KV-005 at the site location. DWB understands that the current right bank bridge abutment and pier is to be repaired. As such, the anticipated construction activities related to the repairs will include, but not necessarily be limited to, the following works:

- Implementation of temporary erosion and sediment control measures;
- Minimal clearing and grubbing;
- Site isolation and fish salvage (if required);
- Repairing of the erosion around the right bank concrete abutment;
- Riprap installation; and
- Site remediation.

This CEMP was developed to provide guidance to the contractor on environmental management during construction. This plan was developed and prepared with in put from DWB Professional Biologists. Design drawings for the proposed works have not yet been completed. However, upon their completion they will be included in a revised copy of this CEMP in Appendix B.

2.3 PROJECT SCHEDULE

RSTBC proposes to complete the proposed works in 2023. Consideration to ensure the proposed work window is within the reduced risk timing window for fish and bird nesting will be undertaken (Section 2.5.2).



LEGEND

- Point of Interest
- Rock Source
- Kettle Valley Rail Trail
- Highway
- Gravel Road
- Contour (m)
- River
- Named Stream
- Unnamed Stream

Esri Canada, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, NRCan, Parks Canada, Esri, CGIAR, USGS, Maxar

BRITISH COLUMBIA

DWB Consulting Services Ltd.

DATUM: **North American 1983**

PROJECTION: **NAD 1983 BC Environment Albers**

PREPARED BY: **DWB GIS**

PROJECT: **KV-005 RSTBC KVR**

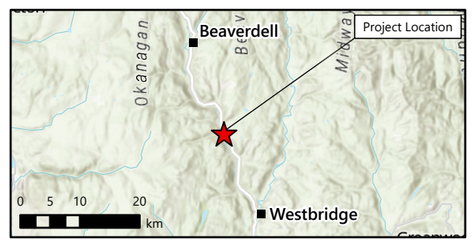
TITLE: **Site Map**

DATE: **2022/11/18**

PROJECT #: **MOF_22634-498**

MAP NAME: **MOF_22634-498_SiteMap**

FIGURE 1



2.4 Roles and Responsibilities

RSTBC will ensure an Environmental Monitor (EM) is retained to be responsible for oversight of the Contractor's compliance with regulatory requirements and environmental obligations as set out in this CEMP. The EM will conduct environmental monitoring of the work and document the implementation of mitigation measures as outlined in the CEMP.

2.5 Environmental Regulatory Requirements

2.5.1 Permitting

This CEMP is designed to provide measures that will serve to guide the RSTBC in the process of working in compliance with relevant environmental requirements, guidelines and standards, and generally accepted construction BMPs.

- A Provincial Section 11 Notification under the *WSA* for Changes in and About a Stream will not be required as the works fall under *FRPA*. However, a Federal Request for Review (RfR) pursuant to the *Fisheries Act* will be required and submitted by DWB.
- A Provincial Scientific Fish Collection Permit will be applied for in order to compete the fish salvage works expected to be undertaken as part of this project. As there is no historical documentation of anadromous salmonids within West Kettle River, a DFO Scientific fish salvage permit will not be obtained.
- Speckled dace are currently listed as endangered under Schedule 1 of the federal *Species At Risk Act (SARA)*, and as such a permit under *SARA* may be required.

Copies of any approved permits or approvals must be kept on the work site during construction (Appendix C). The Contractor shall be responsible for acquisition of any additional permits or authorizations required for this project.

2.5.2 Timing Windows

Reduced Risk Timing Windows for fish and wildlife are intended to provide specific timing windows to reduce the risk of impact to fish and wildlife; they do not authorize anyone to conduct or participate in activities that are contrary to any statute.

2.5.2.1 Fisheries Timing Window

Fisheries Timing Windows apply to all fish bearing streams and watercourses which have direct connectivity to fish-bearing waters downstream. The reduced risk work window based on the known fish species present in West Kettle River is **July 22 – September 30** as specified for streams throughout the Okanagan region with known occurrences of rainbow trout and mountain whitefish (Province of BC).

Should instream works will occur outside of the reduced risk fish timing window, deviation from the CEMP must be pre-approved by the EM and the RSTBC Representative and additional mitigation measures may be required.

2.5.2.2 Vegetation Clearing (Bird Nesting) Window

Vegetation clearing should be undertaken during the period of **August 15 – March 25** (ECCC, 2018) for the A1 nesting region in order to avoid contravening Canada's *Migratory Bird Convention Act* and **September 5 – February 20** to avoid contravening Section 34 of the BC *Wildlife Act*, which prohibits disturbance to

most birds, eggs, and active nesting areas during the nesting period. The second timing window of reduced risk is based on raptors as per the below table (Table 1).

TABLE 1. REDUCED RISK TIMING WINDOW FOR SONGBIRDS AND RAPTORS WITHIN THE NORTHERN OKANAGAN BASIN AND NORTHERN OKANAGAN HIGHLAND ECODISTRICTS WITHIN THE A1 NESTING REGIONS.

Species Group/Common Name	Latin Name	Reduced Risk Timing Window*
Songbirds	*N/A*	August 15 – March 25
Bald Eagle	*Haliaeetus leucocephalus*	September 5 – March 21
Golden Eagle	*Aquila chrysaetos*	August 10 – February 20
Great Blue Heron	*Ardea herodias*	August 10 – March 28
Gyrfalcon	*Falco rusticolus*	July 18 – March 1
Northern Goshawk	*Accipiter gentilis*	July 28 – March 28
Osprey	*Pandion haliaetus*	September 5 – March 21
Peregrine Falcon	*Falco peregrinus*	August 15 – April 1
Red-Tailed Hawk	*Buteo jamaicensis*	July 25 – March 25
Comprehensive Reduced Risk Work Window		**September 5 – February 20**

*Reduced Risk Timing Windows for Songbirds are based on the ECCC, 2018. However, the timing window for all other species identified was determined based on MFLNRORD, 2014 and refined by Birds Canada, 2022.

Minimal vegetation removal is anticipated to gain access to complete the proposed works. If vegetation clearing is required outside of the comprehensive reduced risk bird nesting window (**September 5 – February 20**), active bird nest surveys must be conducted by qualified personnel, prior to the removal of any vegetation in the area. Any cleared areas must be surveyed a minimum of three times over a five-day period. Works completed in the winter may require additional surveys for non-passerine species that have different seasonal nesting windows (e.g., owls and raptors) if the EM determines there is high nesting potential for non-passerine species onsite. In addition, nests belonging to an eagle, peregrine falcon, gyrfalcon, osprey, or heron are protected year-round regardless of occupancy in accordance with Section 34 of the BC *Wildlife Act*; if a tree with one of these nests requires removal, authorization by the province will be required.

If active nests are identified, the work plan shall be modified to establish a no-work buffer area around the nest, until such time that the nest is confirmed vacated by an appropriately qualified EM.

2.6 BIOPHYSICAL INVENTORY

2.6.1 Aquatic Habitat

The West Kettle River (watershed code: 320-520100) was surveyed up- and down-stream of the KV-005 bridge. The river had an average channel width of 15-20 m, and a gradient of 1%. The stream was characterized by riffle pools, overhanging vegetation with, small and large woody debris. The substrate was predominantly comprised of boulders with cobbles and gravels. The left and right banks were sloped, and vegetated by shrubs and a mature mixed forest.

The West Kettle River had good overwintering habitat (deep pools present, perennial flow), moderate rearing habitat (deep pools and cover present), poor to nil spawning habitat (minimal gravels at the crossing, except for in eddies along the banks), and good migration habitat (perennial flows).

The fish habitat surveyed within the site is classified as Important, based on criteria in the Fish-stream Crossing Guidebook with moderate rearing, overwintering, and spawning potential for trout (MFLNRO, 2012).

2.6.2 Terrestrial Habitat

The project site is located within the Kettle (1) dry, mild (dm) subzone of the Interior-Cedar Hemlock (ICH) Biogeoclimatic (BEC) zone. The ICH BEC zone occurs a low-mid level elevations between 800 – 1500 m and is dominated by cool, wet winters and warm, dry summers. The ICHdm is dominated by western red-cedar *(Thuja plicata),* hybrid white spruce *(Picea glauca x engelmanii)*, with subalpine fir *(Abies lasiocarpa)*, Douglas-fir *(Psuedotsuga menzeisii)*, and lodgepole pine *(Pinus contorta*; BC Forest Service, 2022*)*. During the November 14, 2022 site visit Douglas fir, spruce, lodgepole pine and falsebox (*Paxistima myrsinites*) were observed.

No invasive species were observed or documented within 500 m of the project location by the BC Invasive Alien Plant Program (BC IAPP, 2022) or in the field due to the presence of approximately 0.2 m of snow.

2.6.3 Fish and Wildlife

Multiple fish species are historically documented in the West Kettle River (Table 2; Province of BC, 2022a).

TABLE 2. HISTORICAL DOCUMENTATION OF FISH SPECIES IN WEST KETTLE RIVER.

Common Name	Latin Name	Province-Wide Designation
Bridgelip sucker	*Catostomus columbianus*	Yellow-listed[1], N/A[2]
Brook trout	*Salvelinus fontinalis*	Exotic[1], N/A[2]
Longnose Sucker	*Catostomus catostomus*	Yellow-listed[1], N/A[2]
Mountain whitefish	*Prospium williamsoni*	Yellow-listed[1], N/A[2]
Northern pikeminnow	*Ptychocheilus oregonensis*	Yellow-listed[1], N/A[2]
Rainbow trout	*Oncorhynchus mykiss*	Yellow-listed[1], N/A[2]
Redside shiner	*Richardsonius balteatus*	Yellow-listed[1], N/A[2]
Slimy sculpin	*Cottus cognatus*	Yellow-listed[1], N/A[2]
Speckled dace	*Rhinichthys osculus*	Blue[1], Endangered[2]
Western pearlshell mussel	*Margaritifera falcata*	Yellow-listed[1], N/A[2]

Table References: Province of British Columbia, 2022a

Notes: [1.] Provincial listing, [2.] *SARA* listing.

There is no critical habitat or SARA-listed species at risk present according to Fisheries and Oceans Canada (DFO) Aquatic Species at Risk Map (DFO, 2022).

A desktop level review was conducted to determine the presence and/or range of any species of concern that would occur within 3 km of the project site (BC CDC, 2022). The Conservation Data Centre (CDC) was queried for ecosystems and wildlife species which had a documented historical occurrence within 3 km of the project location. There were was two provincially listed wildlife species within 3 km of the project location; the speckled dace *(Rhinichthys osculus)* and Williamson's sapsucker *(Sphyrapicus thyroideus)*.

The speckled dace is a fish which grows to be between 45-80 mm. They are typically located within rocky habitat with a slow-moderately strong current. In the spring they have been observed in deeper habitats than in the fall. The dace is an omnivore and primarily predate upon benthic insects, algae and detritus.

Between 1956 and 2010 speckled dace have been captured within the West Kettle River. A reach approximately 2300 m north of the bridge KV-005, from Westbridge to Beaverdell, has been historically identified as ideal habitat for the dace (BC CDC, 2022). The area identified had a channel width of 5-15m wide, gravels with cobbles, a swift current, an instream vegetation. Based on the habitat where the speckled dace have been observed, and the characteristics of the West Kettle River observed during the

site visit on November 15, 2022, it is probable that the speckled dace is present within proximity of the project location.

Williamson's sapsucker is a migratory woodpecker, typically present within BC between March and September. Preferred habitat for the sapsucker is within middle- high elevation mixed forests. In BC, they are predominately found within forests dominated by western larch. The sapsucker consumes sap, insects and fruits. The observation was of an adult and a nest made along the edge of a clearcut west of Highway 33. Although the observation was made in 2004, it is possible for the sapsucker to be present within proximity of the site.

Any wildlife or sensitive wildlife features encountered during the works, such as amphibians, bird nests, beehives, or snake hibernacula, must be immediately reported to the EM. In accordance with the BC *Wildlife Act*, it is an offence to harm, harass, handle, or deliberately run-over wildlife if detected within an active project area. Breeding birds and their nests, eggs, and young will not be disturbed in accordance with federal *Migratory Bird Convention Act* (MBCA). Timing windows that minimize the risk of disturbing wildlife for specific project activities are outlined in Section 2.5.2.

3.0 GENERAL CONSTRUCTION ACTIVITIES

Detailed descriptions regarding environmental management as they relate to each of the construction activities for the proposed works are provided in the following sections.

3.1 START UP AND ENVIRONMENTAL BRIEFING

A pre-work orientation with all individuals who will be involved in the project will be held on site at the beginning of the project. This meeting will have the following components:

- A review of this CEMP to ensure that all parties involved understand the objectives of the plan, and what environmental protection measures are to be implemented.
- During this review, any additional ideas for project execution methods will be discussed. It is recognized that alternative methods for achieving the desired objectives are available, and these may be incorporated provided that they are more effective means to achieving the overall objectives of the plan.
- A review of additional mitigation measures outlined by regulatory agencies. Copies of relevant approval documents (e.g., orders, permits) will be kept on site and it is important that all persons involved in construction works understand these regulatory requirements.
- A review of other site environmental management issues, including fuel storage, equipment maintenance and spill response.

Any new contractors or employees arriving at the work site after the initial meeting will be briefed in subsequent meetings on an as needed basis by the site supervisor or EM. An environmental orientation record (EOR) sign-off shall be kept on site and updated as employees receive environmental briefings.

3.2 SITE ACCESS AND STAGING

Staging and laydown areas have not yet been confirmed. Storage of equipment and machinery will be limited to designated staging areas to be pre-determined by the contractor's Site Supervisor and/or EM. Refer to Section 13.0 for fuel storage guidelines. The staging area at the site should be at least 30 m from the stream channel and prepared in a manner that minimizes the possibility of sediment or spilled material from migrating into West Kettle River. There is a landing on the low chain side, just before the bridge, that can potentially be utilized for staging of equipment.

3.3 Clearing and Grubbing

Clearing and/or grubbing of vegetation (e.g., trees, stumps, shrubs, etc.) should extend only to the extents defined and marked on site. There are four immature Douglas fir trees beside the bridge on the upstream side bank. These trees may need to be removed to allow equipment to access the abutment. The trees range between 10-12 m tall. Any Willow *(Salix spp.)*, Alder *(Alnus spp.)* or juvenile deciduous vegetation within the road/trail Right-of-Way (ROW) can be trimmed, leaving root masses intact to reduce disturbance and associated sediment mobilization to the stream. Prior to commencing operations, marked limits will be inspected by the EM who may amend them if deemed necessary. Clearing and grubbing within 30 m of the stream will be minimized and will only be conducted under the direct supervision of the EM.

3.4 Site Isolation

The proposed works includes the repair of the right bank erosion around the existing concrete abutment and placement of riprap for scour protection along the right bank, with riprap placement below the high-water mark required. Concrete repair works will also be required around the right bank abutment and instream pier (see design drawings, RSTBC 2023). As such, site isolation will be required. As the West Kettle River is perennial, the contractor will be responsible for consulting with the EM to determine the most appropriate means of diverting flow around the area during construction. A passive diversion would be anticipated and would include the partial isolation of the area to be impacted by the instream works, and a pump system to remove the water from the isolated area so works may occur within the dry. Throughout construction, flows and water quality must be maintained downstream at all times. Wherever possible, works requiring site isolation will be completed within a single working day. Once the instream works have been completed the diversion system will be removed to allow flow through the isolated area.

3.5 Fish Salvage

The EM will salvage fish from within any isolated areas prior to any dewatering. Dip nets, minnow traps, and an electrofisher will be used (method dependent on weather conditions). Although alternate methods may be substituted due to varying salvage conditions, a minimum of three capture methods must be conducted during the salvage as permit requirements. All fish captured will be identified, measured, and released downstream of the site in similar, suitable habitat. A fish collection permit authorizing the salvage is required to be obtained by the EM and must be kept on site. Information from the fish salvage must be reported to MOF and DFO as permit requirements.

3.6 Bridge Repair Works

Work to repair bridge KV-005 includes armouring and repair of the scouring around the right bank abutment and pier. To access the damage four juvenile Douglas fir trees will need to be removed from the bank. There are two spots where the right bank abutment has become exposed. The first is on the top of the upstream side where the exposure is 2 m tall by 0.4 m wide by 0.8 m deep. The second is on the upstream bottom corner and is approximately 0.6 m tall by 2 m long by 1 m deep. A large steel pole will need to be removed it is laying on the down stream right bank and is partly in the stream.

A potential riprap source, within 2 km of the site, has been identified by a representative from the Ministry of Forests. This site will need to be confirmed in the field by an engineer. This CEMP will be updated with the information supplied when the design drawings are finalized.

3.7 REVEGETATION

Revegetation works will be completed for all disturbed areas at the site and will include hand seeding. Seed will be obtained from a certified source and will meet quality assurance standards (e.g., weed free). At this time the specific seed-mix has not yet been determined.

Upon completion of the abutment repair works, any compacted ground will be loosened using an excavator prior to revegetation efforts. Loosening of the ground will help increase the chance of establishing vegetation cover that can reduce the risk of surface erosion in the short term and have the potential to enhance riparian habitat at the crossings over the long term.

All areas of disturbed ground at the site will be seeded with a regionally appropriate seed mix approved by the RSTBC Representative. The recommended seeding rate is 47 kg/ha (approximately 2500 pure live seed [PLS]/m^2). The rate is intended to provide adequate erosion control while reducing the risk of establishing a competitive herbaceous cover. Establishing a non-competitive cover crop will provide opportunities for native plant species to establish through natural dispersal vectors (e.g., wind, animals, surface water) and will reduce competition for planted tree and shrubs seedlings.

According to the BC Forest Practices Code Forest Fertilization Guidebook (BCMOF, 1995) a 10 m fertilizer-free zone must be maintained around any flowing stream that is observable from the air in a community watershed. Most of the anticipated disturbance at the project sites where seeding will be required will be within 10 m of a stream. As a result, no fertilizer will be applied during seeding near the stream.

Following seeding, any disturbed areas will be mulched with straw at the discretion of the RSTBC Representative or EM. Straw is an excellent mulch material. Due to its length and bulk, straw is highly effective in reducing the impact by precipitation and moderating the microclimate of the soil surface. Straw mulch should be applied no more than 2 inches (5 cm) deep on seeded sites and should cover at least 80 % of the soil. To maximize effectiveness, crimping or anchoring the straw is recommended.

4.0 POTENTIAL IMPACTS ON THE ENVIRONMENT

Most potential impacts associated with construction can be mitigated through the use of standard environmental construction best management practices (BMPs); however, there is the potential for the following environmental impacts if appropriate measures are not in place:

- Surface hardening and compaction of soils.
- Introduction of sediment, concrete, and/or hydrocarbon fluids into water features that could affect downstream water quality. Improper fuel storage and/or poorly maintained equipment could create a spill potential that could negatively impact fish, wildlife and associated habitats.
- Harmful and deleterious spills on land.
- Soil disturbance (e.g., rutting, exposure) that can contribute to erosion.
- Creation of slope instability along the banks of the river.
- Harm to wildlife or wildlife habitat.
- Introduction and spread of invasive plants.

The likelihood of these negative impacts the river and surrounding areas are anticipated to be minimized by following appropriate procedures for maintaining site isolation and/or dewatering, implementing erosion and sediment control (ESC) measures, adhering to wildlife management procedures, and ensuring best spill management practices as outlined in this document. The potential for the introduction of deleterious materials stems from the use of machinery near water features, including fuel and fluid spills from machines, and sediment input from earth works.

The primary environmental concerns associated with this project are the introduction of sediment, or other deleterious substances, to the stream channel which could impact fish and other aquatic species. The proposed work also has the potential to disturb vegetation and wildlife. Appropriate environmental guidelines will be followed during any instream works, as outlined within this document. The potential for introduction of harmful sediments is present through various stages of construction, including repair of the right bank abutment and the placement of riprap. The potential for sediment mobilization from any cleared or disturbed areas on site will be mitigated through BMPs for erosion and sediment control, including seeding and mulching of the areas and installation of sediment fencing where appropriate (Section 3.7).

Instream works that occur within the wetted perimeter of the channel will be completed under site isolation (Section 5.2.4) while the EM monitors water quality throughout (Section 6.2). The project area is an existing crossing and, therefore, no permanent or negative impacts to fish habitat are anticipated once the project is complete.

The use of machinery near the stream channel increases the potential risk for introducing deleterious substances, including fuel and fluid spills. Spills and leaks will be managed with regular inspections, the training of personnel in spill response, and access to spill kits within each machine on site (Section 14.0). All construction waste will be captured and removed off site for disposal at an approved facility (Section 12.0).

Disturbance to vegetation and wildlife is possible during clearing and grubbing, which may be required during the abutment repair and riprap placement, will be mitigated by following the best management practices in the clearing and grubbing plan (Section 5.2.8), and by conducting active bird nest surveys prior to any clearing or grubbing outside of the reduced risk vegetation clearing window (Section 2.5.2.2).

Negative human and wildlife interactions will be avoided by removing all wildlife attractants from site daily and reporting all encounters to the EM (Section 8.0). If any at-risk species are found within the project area, a temporary work stoppage may be implemented until the EM can assess the risk to wildlife and habitat.

5.0 BEST MANAGEMENT PRACTICES

The following Best Management Practices (BMPs) will be undertaken to reduce sedimentation, impacts to the riparian habitat, and/or instream habitat throughout the duration of the proposed works and following the extension of the bridge crossing. The following BMPs are the minimum general objectives provided by the Ministry for the construction, modification and deactivation of stream crossings throughout the province (Province of BC, 2022b).

5.1 Best Management Practices for Stream Crossings

As per the Instream Works BMPs for Replacement Crossings the proposed bridge repairs will maintain access along the roadways. Additionally, the proposed works shall not result in the degradation of aquatic or riparian habitat. The following BMPs for stream crossings will be followed:

- The proposed works will be compliant with Federal, Provincial and Municipal Legislation.
- Equipment used for site preparation, removal and installation of all bridge repairs will be situated in a dry stream channel or operated from the top-of-bank.

5.2 Operational Best Management Practices for Instream Works

Operational BMPs for instream works will be applied to the Project in order to reduce risk to fish and fish habitat throughout the duration of the work.

5.2.1 Monitoring

- Full-time monitoring by a QEP will be undertaken during any instream or sensitive works.
- A pre-construction meeting will be held between the EM and the contractor undertaking the work to ensure understanding of the BMPs for the project.
- Within 60 days of the projects completion an EM will complete and submit at least one copy of a monitoring report to the Ministry.

5.2.2 Timing of Works

- Works should be undertaken works during favourable weather and low water conditions.
- Works will be undertaken and completed as quickly as possible once started.

5.2.3 Deleterious Substance Control/Spill Management

- Effort to prevent the release of silt, sediment, sediment-laden water, grout, raw concrete, concrete leachate, paraseal or any other deleterious substances into the stream will be undertaken.
- All equipment and machinery will be in good operational condition and free of leaks and grease.
- No equipment will be refuelled within 30m of any watercourse.
- Hydraulic machinery working in and about the stream are recommended to use environmentally sensitive hydraulic fluids that are non-toxic to aquatic life and inherently biodegradable, unless required to do so by regulators.
- A spill containment kit will be readily accessible onsite in the event of the release of a deleterious substance.
- If a spill occurs it will be immediately reported to the Provincial Emergency Program (Section 14.0).

5.2.4 Isolation of a Work Area and Fish Salvages

- If site isolation is undertaken, water must not be cut off from downstream portions of the watercourse. Throughout construction, **flows and water quality must be maintained downstream at all times.**
- Water will only be temporarily diverted, enclosed or pumped around the worksite.
- Complete the fish salvage before the start of works if any portion of the wetted channel will be isolated to complete the proposed works.
- Any pump or intake withdrawing water from fish bearing waters is screened in accordance with the Interim code of practice for end-of-pipe fish protection screens for small water intakes in freshwater (DFO, 2022).

5.2.5 Sediment Control

- Ensure machinery is operated from the bank of the stream and not within any wetted channel to minimize sedimentation.
- Minimize disturbance to existing vegetation and adjacent stream banks.
- Sediment control measures should be installed prior undertaking any construction works onsite.
- All materials removed from the site should be moved as far away from the active stream or high-water mark as possible.
- Material removed from the site will be disposed of in a manner which prevents its entry into any watercourse.

5.2.6 Site Restoration

- Disturbed areas should be regraded to a stable angle of repose once work is completed.

- All disturbed areas will be revegetated or seeded to prevent surface erosion and subsequent siltation of the watercourse.
- Disturbed soils will be protected with heavy mulch, straw or by installing an erosion blanket to prevent erosion.
- ESC measures (i.e. silt fencing) will be removed upon completion of the works.

5.2.7 Vegetation Management

- The extent of vegetation clearing will be limited to what is required for access to the site and completion of the proposed works.
- Section 34(b) of the *Wildlife Act* protects Eagle, Peregrine Falcon, Gryfalcon, Osprey, Heron and Burrowing Owl nests. Therefore, any trees or structures containing nests for the aforementioned species may not be felled, even outside the breeding season.
- Large woody debris should be retained where is safe to do so. This provides habitat for fish and wildlife populations.
- Trees should not be topped or felled into the watercourse. If branches do end up in the stream they should be removed so as not to disturb aquatic organisms.
- Fall the tree away from the stream unless there is no other method of removal possible. Remove instream material during the instream work window.
- Vegetation removal should occur under dry weather conditions.

5.2.8 Shore Stabilization (Riprap Placement)

- The riprap source should be confirmed Acid Rock Drainage and Metal Leachate-free by a professional engineer or geoscientist prior to use.
- Material shall comply with all engineered specifications.
- All riprap will be free of overburden material, debris or other deleterious substances.
- All riprap will be underlain with geotextile in accordance with the final engineered drawings.
- Rocks will be positioned individually using a bucket with a thumb attachment, ensuring that they are secure before proceeding. Rocks are not permitted to be end dumped into the stream.
- Appropriate erosion and sediment control measures (Section 7.0) will be implemented and maintained throughout installation works.

5.2.9 Concrete Works

- All works using concrete, cement, or lime-containing construction materials will not deposit (directly or indirectly) sediments, debris, wash or fines into the stream.
- Concrete materials cast in place must remain sealed inside formed structures and must not come into contact with water after cast for 48 hours if the ambient temperature is above 0°C and 72 hours if it is below 0°C.
- A CO_2 tank with regulator, hose, and gas diffuser must be readily available in the event of a concrete spill to neutralize the pH levels of the water.
- Any spills will immediately be reported as required.
- The pH downstream of any instream concrete works will be monitored until the works are completed. Emergency measures will be implemented and a stop work order issued should the pH change more than 1.0 pH unit.
- Water will be prevented from coming in contact with uncured or partially cured concrete to prevent contamination of the stream.

6.0 ENVIRONMENTAL MONITORING

The EM will be on site during all in stream works (isolation, flow diversion) or during stages of construction which are deemed to be sensitive by the QEP (such as concrete pours). The EM will inspect conditions in the vicinity of the project and ensure compliance with the CEMP and all other environmental permits and regulations. The EM will also attend all key meetings at which environmental protection measures are to be discussed.

The EM will be an experienced environmental technician, with appropriate training and experience, working under direct supervision of a qualified environmental professional (QEP). Daily environmental reports will be completed by the EM (Appendix D). A final post-construction report will be prepared by the EM and reviewed by the QEP once the project is completed for submission to FLNRORD.

6.1 WORK STOPPAGE

The Contractor and the EM have the authority to suspend or alter work in response to an environmental emergency, unfavourable work conditions, or failure to comply with project environmental requirements. Work stoppage can often be associated with periods of extreme weather conditions and may extend for several days.

6.2 WATER QUALITY TESTING

Water quality monitoring is required during instream works, which will include placing riprap along the bank. The EM will record water quality in West Kettle River during all instream works and inspect the installed site isolation facility.

Water testing frequency shall be appropriate to the level of activity on the site, degree of water quality impact, and the consequence of impact. **Full time water quality monitoring will be conducted during any instream works**. Measurements will be taken upstream (background) and downstream of the work area. Additional locations may be determined by the EM.

During construction, if turbidity levels are found to be above acceptable standards, additional mitigation measures and/or temporary work suspensions will be required. Water quality monitoring will be completed on the basis of the British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture (MOECCS, 2019; Table 3).

Additional to the turbidity monitoring, pH levels of West Kettle River downstream of the project location will be monitored during concrete works. Emergency measures will be implemented and a stop work order issued should the pH change more than 1.0 pH unit. Should pH levels change by more than 1.0 pH unit, CO2 Carbon Dioxide diffusers (CO_2 cylinders with appropriate application devices) will be placed instream as close to the source of contamination as possible.

TABLE 3. BC AMBIENT WATER QUALITY GUIDELINES.

Clear Water (background < 8 NTU) Induced turbidity should not exceed background levels by more than 8 NTU during any 24-hour period (hourly sampling preferred). For sediment inputs that last between 24 hours and 30 days (daily sampling preferred) the mean turbidity should not exceed background by more than 2 NTU. Turbid/High Flow (background > 8 NTU)

Induced turbidity should not exceed background levels by more than 5 NTU at any time when background turbidity is between 8 and 50 NTU. When background exceeds 50 NTU, turbidity should not be increased by more than 10% of the measured background level at any one time. The accepted pH range in freshwater is 6.5- 9.0.

7.0 EROSION AND SEDIMENT CONTROL PLAN (ESCP)

The following Erosion and Sediment Control (ESC) Plan measures identify environmentally acceptable construction practices for ESC at specific sites. This ensures that water quality parameters are maintained at all times throughout the entire construction phase and that the minimum standards outlined in Section 5.0 are being met. Additional measures and/or modifications to the following plan may be required, to reflect unforeseen conditions such as extreme weather, construction delays, etc.

This ESC plan is recognized as a living document and may be improved during the project if unforeseen circumstances arise. All parties will be notified of any changes and approvals that are required.

All ESC measures will be constructed/installed as per the standard specifications found in the Fisheries and Oceans Land Development Guidelines for the Protection of Aquatic Habitat (DFO, 1992). The general principles of ESC that will be followed include:

- Planning the development to the existing terrain and site conditions.
- Scheduling development to minimize the risk of erosion.
- Retaining existing vegetation wherever possible.
- Re-vegetating/protecting denuded areas and bare soils.
- Directing runoff away from denuded areas.
- Minimizing the length and steepness of slopes where possible.
- Minimizing runoff velocities and erosive energy.
- Retaining eroded sediments on site.
- Planning, inspecting and maintaining sediment and erosion control structures.

The preceding principles or their intent have been incorporated throughout this CEMP. Refer to the appropriate sections for detailed descriptions of timing and measures. The contractor will incorporate all permanent erosion control BMPs into the project at the earliest practicable time. Typical ESC measure installation details are provided in Appendix E.

7.1 CONTINGENCY AND SCHEDULING

All ESC measures will be installed at the earliest practicable time to increase efficiency and functionality of the plan. Furthermore, works will be concentrated during periods of favourable weather and completed as soon as possible to reduce exposure of erodible soil and minimize erosion potential at the site.

If adverse weather conditions occur, contingency plans will be implemented. Contingency plans may include installation of additional ESC measures and/or halting operations if heavy or persistent rainfall is encountered. The EM will document all measures and will inspect the site on a regular basis during any extended work stoppages.

The contractor should consider having the following supplies readily available at the project location as contingency ESC measures:

- Sediment fence
- Flagging tape
- Wood Stakes
- Nonwoven geotextile
- Poly sheeting
- Sandbags
- Straw Bales or synthetic check dams are acceptable (e.g., Georidge or Spring Berms)
- At least two, 2" or 3" pumps with 150' of hose each. The pumps and hose should be sufficient to handle dewatering.

7.2 Limit Site Disturbance

The work site limits will be delineated before any phase of construction commences. This work boundary will be clearly outlined with stakes or ribbon and thus limit disturbance within the work area. Equipment, tools, and personal gear should be stored appropriately on site and away from any area that could result in sedimentation or damage to the stream channel.

7.3 Inspecting, Monitoring and Maintaining ESC Measures

All ESC measures will be regularly inspected and assessed by the EM for their effectiveness. Monitoring will correspond with environmental conditions and will be more frequent during unfavourable weather. Maintenance of any ESC measures will be completed as required.

7.3.1 Sediment (Silt) Fence

Sediment fences (also known as silt fences) allow water to pond and sediment particles to settle. They are to be installed where sheet flow run-off is expected or is occurring, but should not be used within drainage channels or ditches.

Sediment fences may also be utilized as a sediment control measure around all temporary stockpiles, along the perimeter of the abutment excavations, and at the base of cut/fill slopes of the new road alignment. At the discretion of the EM, sediment fences will be installed along any temporary access construction and at any location where sedimentation is of concern.

7.3.2 Spoil Material / Stockpiles

Spoil material associated with excavation of fill will be end-hauled and placed in an approved designated location where it cannot erode and enter any stream. Once transported to the location, the spoil material will be contoured and seeded. Additional sediment control measures will be implemented (i.e., installation of sediment fence, mulching) if required.

Erodible stockpiles with potential to mobilize sediment into nearby drainages will be covered with tarps or otherwise contained with earth berms or sediment fences if the piles are not required for use for an extended period, during periods of severe weather, extended work shutdowns, or at the discretion of the EM.

7.3.3 Seeding and Straw Mulch Application

All disturbed areas containing exposed soils will be hand or hydroseeded with the prescribed seed mix and mulched with straw as outlined in Section 3.7.

8.0 CONCRETE MANAGEMENT

Concrete works will be required to repair the abutment and pier. Mitigation procedures will be implemented to reduce the potential for environmental damage when using concrete near water, as it is known to be toxic to the aquatic environment. All concrete works adjacent to streams will be monitored by the EM. If required, water quality (including pH) will be monitored to compare to background levels.

The following measures may be implemented during onsite concrete pours, depending on project design:

- Carbon Dioxide diffusers (CO_2 cylinders with appropriate application devices) should be onsite during grouting within 15 m of flowing water and will be deployed in an attempt to neutralize any concrete leachate that is inadvertently discharged into the stream.
- Tarps or sheets of poly will be installed around forms around the structure requiring concrete work to catch any uncured concrete before it reaches the stream.
- All forms and work areas will be dewatered prior to concrete pour and remain dry for 48 hours following pour.
- All wastewater from cleaning or mixing is considered toxic to aquatic species and will be prevented from entering any stream for 48 to 72 hours (see section 5.2.9) to allow the water to reach a neutral pH.
- All waste concrete will be collected and disposed of at an approved facility at the discretion of the EM, the supplier, and the MFLNRORD Representative.
- Surplus concrete will be disposed of in an environmentally approved manner.

9.0 WILDLIFE MANAGEMENT

Wildlife is protected under the BC *Wildlife Act* from harassment and harm. To minimize the potential for interaction with wildlife on site, wildlife attractants will be removed from site daily in order to minimize the potential for negative interactions. The Contractor will ensure that all employees on site receive applicable Wildlife Awareness training to avoid negative encounters with potentially dangerous animals, including bears, cougars, moose, wolves and coyotes.

Any medium or large mammal wildlife sightings on site are to be reported to the EM immediately. Wildlife observations and/or incidents during the work will be recorded, primarily for species-at-risk, medium/large mammals, and active nest/den sites. If any amphibians are noted on site, these will require management by the EM during construction activities as it is an offence under the BC *Wildlife Act* to pick-up, capture, handle, move, or kill amphibians without a permit (MFLNRO, 2012).

10.0 INVASIVE PLANT MANAGEMENT

Care should be taken to prevent the introduction and spread of any noxious weeds during construction works. Invasive plants/noxious weeds are typically non-native plants that are responsible for reductions in crop yield and quality and lead to environmental degradation through destruction of native plant and animal habitat. Measures to ensure that invasive plant seeds are not spread or propagated throughout the construction zone include:

- Management of noxious weeds and invasive plants will be discussed during the kick-off meeting.
- All equipment will be washed clean of soil, seeds and plant parts prior to entering the project site for the first time.
- All equipment will be manually cleaned with shovels and brooms to remove excessive vegetation and soil and inspected by the EM before leaving site.

- Avoid parking, turning around, or staging equipment in invasive plant infested areas.
- Minimize roadside disturbance and retain desired vegetation where possible.
- Use only clean fill material from an "invasive plant free" source. Dispose of soil containing invasive plants in an approved spoil pile. Regularly inspect all material sources to ensure they are invasive plant free.
- Re-seed as quickly as possible to prevent the establishment of invasive species.
- Re-seed with grass mixtures that are free of weeds, locally adapted, non-invasive, and quick to establish.
- Any observation of an invasive plant or noxious weed is to be reported to the EM. Coordinates will be taken and these sites will be flagged.
- The contractor is responsible for inspecting any mulch supplies, should they be used, to ensure that it is certified weed-free.

11.0 AIR QUALITY MANAGEMENT

The contractor will implement dust control measures to maintain air quality in the project area at or near ambient levels, address health and safety and to avoid significant deposition of airborne particulates into any stream. Measures to be implemented include the following:

- Maintain and regularly inspect vehicles and equipment in accordance with manufacturer's specifications.
- Control dust and debris by wetting down dry materials and access roads as required.
- Locate staging zones at least 100m from receptors sensitive to the emissions from combustion engines (e.g., occupied residences and livestock).
- Limit idle times on site during periods of inactivity.

12.0 WASTE MANAGEMENT

Construction and other waste materials will be managed to prevent adverse effects to aquatic and terrestrial environments, as well as human health and safety. The management, removal and disposal of waste materials will be in accordance with the BC *Environmental Management Act*, the BC Hazardous Waste Regulation and the *Transportation of Dangerous Goods Act*. The contractor will:

- Discuss appropriate waste management with workers during the environmental briefing.
- Reduce, reuse and recycle materials.
- Provide a secure storage location for all waste and recycling bins and include appropriate signage.
- Pickup general refuse daily. No domestic refuse, including food wastes, shall be allowed to remain on-site overnight unless stored in bear-proof containers approved by the EM.
- Dispose of all construction wastes at an approved disposal facility that complies with applicable legislation and regulations.
- Do not permit any burning or burial of general refuse.

The contractor will dispose of all hazardous waste discovered or generated on site in compliance with the BC Hazardous Waste Regulation *(*HWR*)* and per the *Environmental Management Act* (EMA*)*. Types of hazardous waste that may be generated during the works include but are not limited to:

- Fuel and Lubricants
- Greases

- Used spill cleanup materials
- Oils
- Paints
- Solvents
- Batteries
- Rags soiled with hazardous waste

13.0 FUEL HANDLING

The Contractor will follow their corporate fuel handling and management procedures, available under separate cover. Fuel handling practices and procedures at the site will comply with the requirements of relevant permits/approvals and the BMPs outlined in *A Field Guide to Fuel Handling, Transportation and Storage* (MWLAP, 2002). Biodegradable hydraulic fluids are recommended to be used in all equipment working within the isolated work area, unless required to do so by a regulator.

Refuelling will only be allowed within the designated staging area or greater than 30 m from the river. **No refuelling is allowed at or within 30m of any stream.** Contractor storage and transportation of hydrocarbons must be in accordance with the *Transportation of Dangerous Goods Act* and the OHS (e.g., no smoking near fuel storage). Drip trays will be stored at the refuelling area and are to be utilized as necessary during refuelling events to capture any spills. All small quantities of fuel, oils, and antifreeze shall be stored in separate drip trays and secured in animal-proof containers to prevent attracting wildlife.

14.0 SPILL PREVENTION AND RESPONSE

Accidental spills of deleterious substances may occur during all phases of the project. This section will be used to guide spill prevention and emergency response activities on site, and is supplemental to the contractor's standard corporate spill procedures.

As per Section, effort to prevent the release of deleterious substances into the watercourse should be undertaken. However, in the event of an environmental incident, the incident is to be report reported to the site supervisor and EM immediately. An environmental incident is defined as:

- An emergency;
- Any leakage, spill, or release of hazardous liquid or gas;
- All wildlife encounters;
- Actions that lead to the spread of noxious weeds;
- Actions other than what was included in a plan that requires environmental remediation;
- Actions that result in an exceedance or non-compliance circumstance with applicable environmental regulations and/or permits.

14.1 SPILL PREVENTION

14.1.1 Potential Spill Sources

The following are the primary potential sources of spills that could occur during construction activities:

- Leaking or ruptured fuel tanks.
- Spills during refuelling of vehicles and equipment.
- Leaks from equipment or ruptured hoses.
- Accidents on the roadway.

14.1.2 General Measures for Spill Prevention and Containment

Primary protection measures for works in or near streams or riparian areas will include:

- All equipment working within 5m of the wetted perimeter of any stream will be equipped with appropriate spill prevention and spill response measures (i.e., spill kits and spill trays), and all personnel will be adequately trained in response procedures.

Additionally, the following controls will be implemented and maintained on top of the minimum BMP's outlined in Section 5.2.3:

- Hazardous or toxic products will not be stored within 30 m of any stream and no washing of equipment will be allowed within the riparian zone of any stream.
- Standard spill kits will be present at all refuelling, lubrication, and repair locations as well as within heavy equipment to allow immediate response to spills. These spill kits will be capable of capturing 125% of potential spill volumes.
- All on site staff will be trained in hazardous material storage, handling requirements, and spill kit location and deployment.
- All vehicles and machinery will be refuelled at a designated refuelling location outside the riparian area (30m) of any stream.
- All on site fuel must be properly stored within tidy-tanks or in approved secondary containment facilities, with contents marked appropriately.
- Fuel or lubricant containers will be stored with the lids secured in the tool crib/seacan.
- To prevent vandalism during periods of inactivity all fuels, lubricants and toxic substances will be stored in locked structures.
- All waste fuel or products such as filters will be secured in spill-proof containers and discarded as per the environmental regulations.
- The contractor will ensure that all subcontractors are aware of their spill response procedures and will take responsibility for all spills should they occur. The contractor is responsible for all environmental procedures and practices.

14.1.3 Spill Kit Contents

Spill response kits will be stocked by commercial vendors and include standard kit contents for fuel and oil spills, as well as an aquatic boom of sufficient length (i.e., greater than the width of the stream), in the event of a spill in water. Spill response kits will be kept fully stocked, and replacement materials will be added as required.

14.2 Spill Response

14.2.1 General Spill or Leak Practices and Procedures

The following general spill or leak practices should be implemented in the event of a spill or leak:

- Do not touch or walk-through spilled material.
- Stop the flow safely and quickly (if possible).
- Shut off all machinery, pumps, valves etc.
- Plug leaks (if possible).
- Remove containers or place them in an upright position.
- Do not smoke or use cell phones in the spill area.
- Prevent spilled materials from flowing away from the initial spill site or from flowing into a stream, creek or any drainage ditches (if possible).
- Eliminate all ignition sources.
- Flag/delineate area of spill.

- If possible, turn leaking container so that gas escapes rather than liquid.

14.2.2 Safety Data Sheets

The contractor will ensure that a copy of the Safety Data Sheets (SDS) for all chemical substances being used on site will be maintained on site in a clearly marked binder. These sheets identify: product information; hazardous ingredients; physical data; fire and explosion hazard; reactivity data; toxicological properties; preventative measures; first aid measures; and preparation information, as required by the Workers' Compensation Board of British Columbia.

The SDS will be consulted in the event of a spill or leak to determine any potential human health and environmental risks associated with the product.

14.2.3 Cleanup Practices and Procedures

In the event of a spill the following Spill Response Procedures will be implemented: *Note: Procedures will vary depending on the product and the location of the spill*.

- Consult the EM as required.
- Consult SDS to determine potential human health and environmental risks.
- Ensure appropriate personal protective equipment is worn during spill clean-up work.
- **SOIL:** For product spills and leaks on soil, liquid will be collected using absorbents and the soiled absorbent materials will then be transferred into a drum or other sealed container. The contaminated soil will then be excavated and also drummed or otherwise contained. Drums of waste will be labeled to identify their contents and be stored in a spill containment area prior to being hauled off-site for disposal by a certified hauler to an authorized dumpsite for contaminated materials.
- **WATER:** For product spills into a stream, an absorbent boom will be placed across the surface of the drainage to prevent the spilled product from flowing downstream. Absorbent materials will then be used to recover floating product.
- Pictures will be taken of the clean-up activities for filing/reporting purposes.
- Ensure replacement of all used spill kits and associated materials on the job site as soon as possible.

14.2.4 Monitoring

Monitoring will be conducted on an as needed basis in the event of a spill. The monitoring will take place within the spill area, and of the surrounding receiving environment (e.g., nearby streams) to determine appropriate remedial action.

14.2.5 Spill Investigation / Spill Report Form

If the spill is a reportable emergency, an investigation report and spill report form (refer to Appendix F) must be completed and forwarded to the Emergency Management BC (1-800-663-3456) within 24 hours of the incident occurring. The company responsible for the spill must prepare the investigation and spill report. Information that shall be collected in the event of a spill includes:

- A general description of the incident.
- A drawing of site showing the area of the spill.
- Pictures of the spill, damages (if any) and clean-up efforts.
- Source and cause of the incident.
- Description of the response effort.
- Quantity of the spill and percent recovered.

- Itemized cleanup costs.
- Recommendations for preventative and mitigation measures.
- Plans for upgrading emergency preparedness and response plans.

All spills, regardless of how minor, must be reported to the EM. Additionally, spills of the following substances and quantities are required to be reported to the Province as well as the EM (Table 4).

TABLE 4. SPILL SUBSTANCES AND QUANTITIES WHICH ARE TO BE REPORTED TO THE PROVINCE.

SUBSTANCE	REPORTABLE QUANTITY
Any hydrocarbon substance or liquid including: • Diesel Fuel • Gasoline • Grease • Hydraulic Oil • Lubricating Oil • Solvents • Flammable Liquids of Class 3 as defined in section 3.12 of the Federal Regulations • Waste Oil as defined in section 1 of the Special Waste Regulation	100 L
Explosives	Any
Flammable Gases, (other than natural gas as defined in Section 3.11 (a) of the Federal Regulations)	10 kg
Flammable Liquids of Class 3 as defined in Section 3.12 of the Federal Regulations	100 L
Antifreeze	5 L
Corrosive liquid acids and caustics – i.e., battery acid	5 kg or 5 L
Environmental hazardous substances – i.e., PCBs	1 kg or 1 L
A substance not covered by the above listed items that can cause pollution (e.g., concrete)	200 kg
Any quantity of deleterious substance released to a watercourse or waterbody must be reported to Emergency Management BC immediately	**Any**

15.0 DISTRIBUTION OF THE CEMP

This CEMP will be provided to the Contractor, and their subcontractors. The Contractor's site supervisor will ensure that a copy of this CEMP is on site at all times. All team members will be aware of the plan and how it works. The CEMP will also be provided to regulators upon request, or as necessary to obtain environmental regulatory approvals.

16.0 REVISIONS TO THE CEMP

It is recognized that this CEMP is a living document and may be revised as the project progresses. Revisions to this CEMP can be made on site by mutual agreement between EM and Contractor provided that all relevant regulatory approvals/permits are followed; however, all changes must be recorded and result in an improvement to the plan. Any revisions and the corresponding rationale should be stated by the monitor in the post-construction report and be relayed to the appropriate environmental agencies.

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Appendix A

Site Photographs

Photo 1. Erosion under abutment on right bank, upstream side.

Photo 2. Erosion behind abutment on right bank, upstream side.

Photo 3. Overview of erosion behind the abutment on the right bank.

Photo 4. Low chain approach to the crossing.

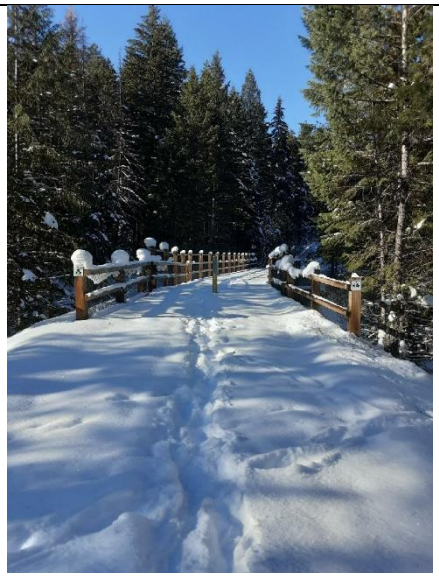


Photo 5. High chain approach to the crossing.

Photo 6. Four small Douglas fir trees that may need to be removed to access the work area.

Photo 7. Downstream of the crossing.

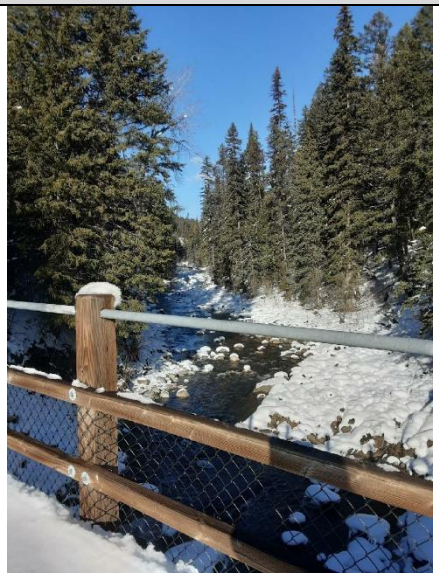


Photo 8. Upstream of the crossing.

Photo 9. Metal bar and rachet straps to be removed or dealt with accordingly.

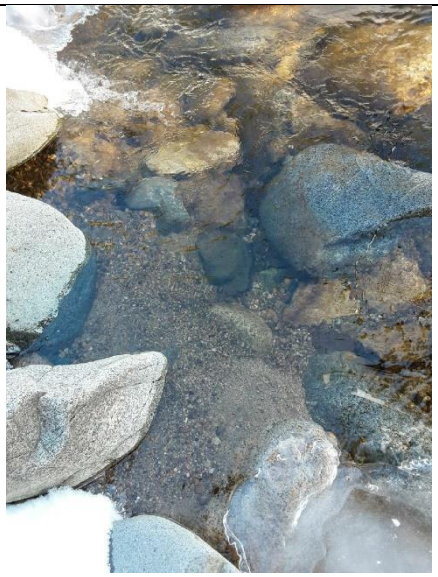


Photo 10. The substrate was dominated by boulders with gravels and fines.

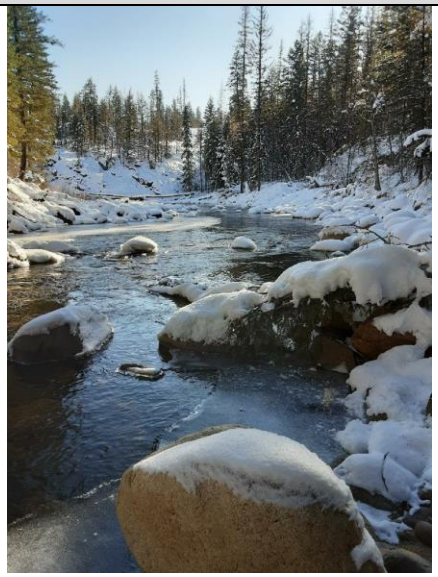


Photo 11. Downstream view of Kettle River from below the bridge.

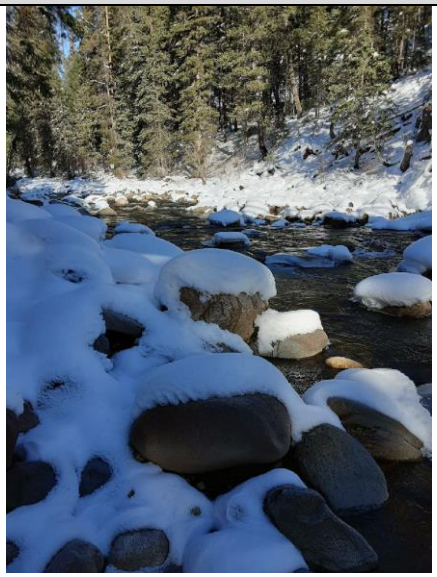


Photo 12. Upstream view of West Kettle River from below the bridge.

Appendix B

Design Drawings

BRITISH COLUMBIA

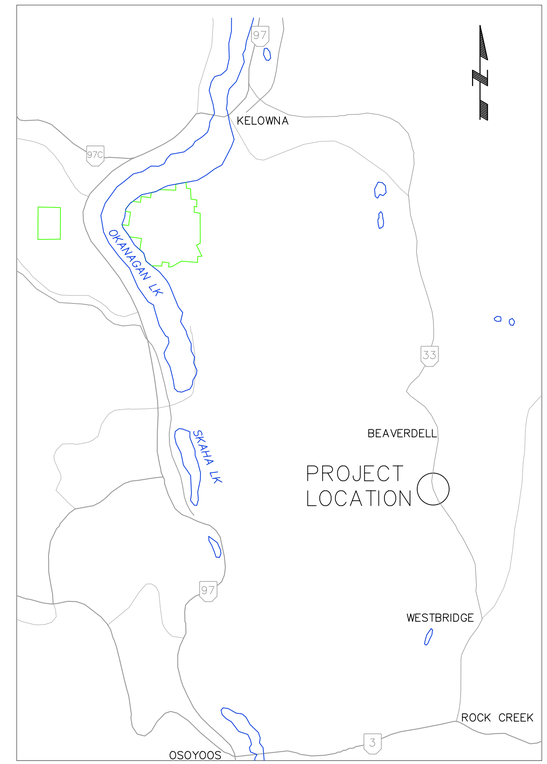
Recreation Sites and Trails BC

RECREATION SITES AND TRAILS BC

PROJECT No. P10443A01

KETTLE VALLEY RAIL TRAIL BRIDGE ASSESSMENT AND REPAIRS

Klohn Crippen Berger



KEY PLAN

N.T.S.

LIST OF DRAWINGS		
DWG. No	REV	TITLE
00	–	COVER AND KEY PLAN
01	A	GENERAL NOTES
02	A	GENERAL ARRANGEMENT AND SECTIONS
03	A	UNDERMINING REPAIR SECTION AND DETAILS
04	A	EROSION CONTROL AND SLOPE STABILIZATION PLAN
05	A	EROSION CONTROL AND SLOPE STABILIZATION SECTIONS
06	A	RETAINING WALL DETAILS
07	A	EROSION CONTROL AND SLOPE STABILIZATION PLAN (ALTERNATIVE SLOPE STABILIZATION)
08	A	EROSION CONTROL AND SLOPE STABILIZATION SECTIONS (ALTERNATIVE SLOPE STABILIZATION)
09	A	PHOTOS

GENERAL NOTES:

1. ELEVATIONS AND DIMENSION OF EXISTING BRIDGE ARE BASED ON SURVEY BY VAST RESOURCE SOLUTIONS TAKEN OCTOBER 2021 AND FIELD MEASUREMENTS TAKEN DECEMBER 2022 AND ARE APPROXIMATE ONLY.
2. TOPOGRAPHY BASED ON LIDAR INFORMATION PROVIDED BY THE MINISTRY OF FORESTS RECIEVED ON MARCH 3, 2023.
3. ALL DIMENSIONS ARE IN MILLIMETRES (mm) AND ELEVATIONS ARE IN METERS (m).
4. CRITICAL REFERENCE DIMENSIONS ARE TO BE CONFIRMED IN THE FIELD.
5. WEST KETTLE RIVER CONTAINS SENSITIVE FISH HABITAT. THE CONTRACTOR IS RESPONSIBLE FOR TAKING APPROPRIATE MEASURES TO PROTECT THE QUALITY AND LIMIT THE DISTURBANCE TO FISH HABITAT DURING CONSTRUCTION IN ACCORDANCE WITH THE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP).
6. EXISTING BRIDGE DESIGN IS BY OTHERS.
7. LOCATIONS OF UNDERGROUND UTILITIES THAT MAY BE AFFECTED SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO COMMENCING WORK.
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING THE EXISTING BRIDGE DURING EXECUTION OF THE WORK. ANY DAMAGE CAUSED TO THE EXISTING BRIDGE DURING CONSTRUCTION SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.
9. UPON COMPLETION OF THE WORK, THE CONTRACTOR SHALL SUBMIT "AS-BUILT" DRAWINGS WITH CLEARLY MARKED CHANGES FROM THE DESIGN DRAWINGS.

CONCRETE:

1. CONCRETE MIXES SHALL MEET THE FOLLOWING MINIMUM REQUIREMENTS:

CLASSIFICATION	MINIMUM COMPRESSIVE STRENGTH @ 28 DAYS (MPa)	NOMINAL MAXIMUM SIZE OF COARSE AGGREGATE	AIR CONTENT (%)	SLUMP (mm)	MAXIMUM W/Cm RATIO BY MASS
ABUTMENT AND PIER SCOUR REPAIR CONCRETE	30	20	5 ± 1	150 ± 20	0.45

2. ALL EXPOSED CONCRETE EDGES SHALL HAVE A 20 mm CHAMFER UNLESS NOTED OTHERWISE.
3. WHERE CONCRETE IS BONDED TO EXISTING CONCRETE, THE SURFACE SHALL BE THOROUGHLY CLEANED AND ROUGHENED.
4. REINFORCING STEEL SHALL BE STAINLESS STEEL AND SHALL CONFORM TO ASTM A276 AND ASTM A955M, MINIMUM GRADE 420.
5. SPECIFIED CONCRETE COVER AND TOLERANCES TO REINFORCING STEEL SHALL BE 60 ± 10.
6. CONTRACTOR SHALL STRICTLY ADHERE TO MANUFACTURER'S RECOMMENDATIONS AND PROCEDURES FOR ALL CONCRETE AND EPOXY ADHESIVE PRODUCTS.
7. ALL ORGANIC MATERIALS AND DEBRIS SHALL BE REMOVED FROM WITHIN THE UNDERMINED AREA DOWN TO COMPETENT GROUND. THE GROUND SURFACE SHALL BE EXAMINED AND ACCEPTED BY A QUALIFIED GEOTECHNICAL ENGINEER PRIOR TO INFILLING THE AREA WITH CONCRETE.

CREEK DIVERSION:

1. REPAIR OF PIER UNDERMINING AND EXCAVATION/PLACEMENT OF RIPRAP BELOW THE HIGH WATER LEVEL, AS DETERMINED BY THE ENVIRONMENTAL MONITOR, SHALL BE CARRIED OUT IN ISOLATION OF STREAM FLOWS. THE CONTRACTOR IS RESPONSIBLE FOR INSTALLING APPROPRIATE FLOW DIVERSION WORKS FOR THE DURATION OF INSTREAM WORK.
2. TEMPORARY DIVERSION WORKS SHALL BE DESIGNED, SIGNED, AND SEALED BY A REGISTERED PROFESSIONAL ENGINEER TO SAFELY PASS THE 10-YEAR RETURN PERIOD FLOOD DURING THE CONSTRUCTION PERIOD. THE CONTRACTOR SHALL SUBMIT THE PROPOSED CREEK DIVERSION DESIGN FOR REVIEW AT LEAST 14 DAYS BEFORE EXECUTING THE WORK.
3. A FISH SALVAGE SHALL BE CONDUCTED IN ACCORDANCE WITH THE CEMP PRIOR TO COMMENCEMENT OF WORK. DEWATERING PUMPS SHALL BE FITTED WITH FISH SCREENS TO PREVENT ENTRAPMENT OF FISH.

EXCAVATION:

1. ALL EXCAVATIONS SHALL COMPLY WITH THE REQUIREMENTS OF THE WORKERS' COMPENSATION BOARD OF BRITISH COLUMBIA, "INDUSTRIAL HEATH AND SAFETY REGULATIONS", OF THE CANADIAN CONSTRUCTION SAFETY CODE.
2. THE CONTRACTOR SHALL NOTIFY THE ENGINEER AT LEAST 72 HOURS BEFORE COMMENCING EXCAVATION.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PERFORMING THE CONSTRUCTION IN A SEQUENCE THAT MINIMIZES GROUND MOVEMENT OF THE SLOPES ABOVE THE EXCAVATIONS.
4. VERTICAL SOIL CUTS SHALL NOT BE ALLOWED.
5. DURING PERIODS OF HEAVY OR CONSISTENT RAINS OR SNOW THE CONTRACTOR SHALL COVER THE TEMPORARY SLOPE WITH A POLY TARP TO MINIMIZE THE AMOUNT OF WATER ON THE TEMPORARY SLOPE OVERNIGHT. THE CONTRACTOR SHALL MAKE AN EFFORT TO RE-USE THE TARP TO MINIMIZE MATERIAL WASTE.
6. ALL EXCAVATION SUPPORT SYSTEMS, IF ANY, SHALL BE REMOVED FROM SITE UPON COMPLETION OF THE WORK BY THE CONTRACTOR.
7. ALL EXCAVATION VOLUMES WILL BE MEASURED IN-BANK AT THE SOURCE.
8. ALL MATERIAL UNSUITABLE OR SURPLUS TO THE PROJECT SHALL BE REMOVED OFFSITE TO A DISPOSAL SITE PROVIDED BY THE CONTRACTOR. THE CONTRACTOR SHALL ENSURE THAT THE DISPOSAL SITE COMPLIES WITH ALL FEDERAL, PROVINCIAL AND REGIONAL BYLAWS AND REGULATIONS.

TEMPORARY ACCESS:

1. THE CONTRACTOR SHALL RESPONSIBLE FOR PROVIDING SAFE TEMPORARY ACCESS ON THE STEEP SLOPES TO THEIR PERSONNEL IN ACCORDANCE WITH THE WORKERS' COMPENSATION BOARD OF BRITISH COLUMBIA, "INDUSTRIAL HEATH AND SAFETY REGULATIONS" AND OF THE CANADIAN CONSTRUCTION SAFETY CODE.
2. PROVIDE AND MAINTAIN TEMPORARY ACCESS ONLY AT APPROVED LOCATIONS.
3. THE CONTRACTOR SHALL SUBMIT TEMPORARY ACCESS DRAWINGS A MINIMUM OF 14 DAYS PRIOR TO THE WORK. THE DRAWINGS SHALL CLEARLY SHOW THE DETAILS AND LOCATIONS OF ALL REQUIRED TEMPORARY ACCESS WORKS.
4. UNLESS OTHERWISE APPROVED, ALL TEMPORARY ACCESS ROADS AND ASSOCIATED STRUCTURES SHALL BE REMOVED UPON COMPLETION OF THE WORK AND SITE RESTORED TO THE SATISFACTION OF THE ENGINEER.
5. THE CONTRACTOR IS RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH TEMPORARY ACCESS REQUIRED TO COMPLETE THE WORK.

GRS WALL:

1. GENERAL

1.1 DESIGN

1. THE RETAINING WALL IS DESIGNED IN GENERAL ACCORDANCE WITH THE U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL HIGHWAY ADMINISTRATION (FHWA)'S PUBLICATION FHWA-NHI-10-024, DESIGN AND CONSTRUCTION OF MECHANICALLY STABILIZED EARTH WALLS AND REINFORCED SOIL SLOPES VOLUME 1 AND 2 AND CANADIAN FOUNDATION ENGINEERING MANUAL (4TH EDITION).
2. DESIGN SERVICE LIFE FOR GRS WALL IS 45 YEARS.

1.2 RESPONSIBILITIES

1. THE CONTRACTOR SHALL EMPLOY A SUPERVISOR AND PERSONNEL EXPERIENCED IN THE TYPE OF WORK DESCRIBED IN THIS SECTION.
2. WORK SHOULD BE CONDUCTED IN A WAY THAT PREVENTS ANY LOSS OF GROUND OR MOVEMENT OF ADJACENT TRAIL AND BRIDGE STRUCTURE. THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY IN THE EVENT OF ANY NON-ELASTIC GROUND MOVEMENT SUCH AS, BUT NOT LIMITED TO, SLOUGHING BEYOND THE SPECIFIED EXCAVATION FACE, OR SLOPE FAILURE. IF DEEMED NECESSARY BY THE ENGINEER, THE SLOPE SHALL BE BACKFILLED WITH A BERM OF SOIL AND WORK STOPPED IN THE AREA.

1.3 SUBMITTALS

1. THE CONTRACTOR SHALL SUBMIT A DETAILED WORK PLAN INLCUDING SCHEDULING AND WORK SEQUENCING A MINIMUM OF 14 DAYS PRIOR TO COMMENCEMENT OF WORK TO BE REVIEWED BY THE ENGINEER.
2. THE CONTRACTOR SHALL SUBMIT A DETAILED QUALITY CONTROL PLAN A MINIMUM OF 14 DAYS PRIOR TO COMMENCING THE WORK, TO BE REVIEWED BY THE ENGINEER. THE QUALITY CONTROL PLAN SHALL DESCRIBE THE LENGTH OF GEOGRID, OVERLAP THICKNESS OF GEOGRID AND BASKETS, AND FREQUENCY AND METHODOLOGY OF COMPACTION TESTING FOR THE STRUCTURAL BACKFILL OF THE WALL.
3. THE CONTRACTOR SHALL SUBMIT THE NAME AND QUALIFICATIONS OF THE COMPACTION TESTERS AND FREQUENCY OF COMPACTION TESTING AS PART OF THE QUALITY CONTROL PLAN.
4. THE CONTRACTOR SHALL PROVIDE THE ENGINEER WITH ALL PRODUCT SHEETS AND TECHNICAL SPECIFICATIONS OF THE CHOSEN PRODUCTS FOR REVIEW AND APPROVAL BY THE ENGINEER A MINIMUM OF 14 DAYS PRIOR TO START OF CONSTRUCTION.
5. THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER SIEVE TESTS AND PROCTOR TEST DATA FOR THE STRUCTURAL BACKFILL FOR REVIEW AND APPROVAL A MINIMUM OF 14 DAYS PRIOR TO THE START OF CONSTRUCTION.

2. MATERIALS

2.1 STRUCTURAL BACKFILL

1. REINFORCED SOIL SHALL CONSIST OF SELECT GRANULAR SUB-BASE (SGSB) WITH PROPERTIES IN ACCORDANCE WITH THE BC MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE (MOTI) 2020 STANDARD SPECIFICATIONS FOR HIGHWAY CONSTRUCTION (SS) SECTIONS 202.04 AND 202.05 "SGSB".

2.2 FACING
(UNLESS OTHERWISE NOTED ON THE DRAWINGS)

1. WELDED WIRE MESH FACING SHALL BE 100 mm X 100 mm (4" X 4"), 4 GAUGE POST-FABRICATION HOT DIP GALVANIZED.
2. STEEL STRUTS SHALL BE 4 GAUGE, HOT DIPPED GALVANIZED AND SIZED TO FIT BY THE SUPPLIER.
3. HOT DIPPED GALVANIZING SHALL CONFORM TO CSA G164 AND HAVE A MINIMUM COATING THICKNESS OF 600 g/m².
4. FACING UNITS SHALL OVERLAP A MINIMUM OF 100 mm.

2.3 GEOGRID
(UNLESS OTHERWISE NOTED ON THE DRAWINGS)

1. GEOGRID SHALL BE AS NOTED ON THE DRAWINGS OR AN APPROVED EQUIVALENT.
2. IF THE CONTRACTOR ELECTS TO USE AN EQUIVALENT PRODUCT, THE CONTRACTOR SHALL PROVIDE ALL SPECIFICATIONS AND PRODUCT SHEETS OF THE PROPOSED EQUIVALENT PRODUCT A MINIMUM OF 14 DAYS PRIOR TO PROCUREMENT OF THE MATERIALS, FOR REVIEW AND APPROVAL BY THE ENGINEER.
3. GEOGRID SHALL BE PLACED END-TO-END OR AS PER MANUFACTURE'S RECOMMENDATIONS.

2.4 GEOTEXTILE

1. GEOTEXTILE AT THE GRS WALL FACING SHALL BE MIRAMESH GR OR APPROVED EQUIVALENT.
2. IF THE CONTRACTOR ELECTS TO USE AN EQUIVALENT PRODUCT, THE CONTRACTOR SHALL PROVIDE ALL SPECIFICATIONS AND PRODUCT SHEETS OF THE PROPOSED EQUIVALENT PRODUCT A MINIMUM OF 14 DAYS PRIOR TO PROCUREMENT OF THE MATERIALS, FOR REVIEW AND APPROVAL BY THE ENGINEER.
3. GEOTEXTILE SHALL OVERLAP A MINIMUM 600 mm.

2.5 LEVELING PAD

1. LEVELING PAD MATERIAL SHALL CONSIST OF 25 mm MINUS CRUSHED GRAVEL, 75 mm MINUS CRUSHED GRAVEL OR AN APPROVED EQUIVALENT.

3. CONSTRUCTION

3.1 BACKFILL AND COMPACTION

1. COMPACTION OF STRUCTURAL BACKFILL SHALL BE 95% STANDARD PROCTOR AND COMPACTED WITHIN 2% OF OPTIMAL MOISTURE CONTENT. STRUCTURAL BACKFILL SHALL BE PLACED AND COMPACTED IN LIFTS OF NO GREATER THAN 150 mm.
2. ONLY HAND-HELD POWER TAMPERS AND VIBRATORS MAY BE USED FOR BACKFILL COMPACTION WITHIN 750 mm OF BASKETS.

3.2 QUALITY CONTROL

1. THE CONTRACTOR SHALL CONDUCT COMPACTION TESTING ON EVERY LIFT AT SPACING OF 10 m OVER THE LENGTH OF GRS WALLS.
2. THE CONTRACTOR SHALL PROVIDE THE ENGINEER WITH COMPACTION TESTING REPORTS FOR REVIEW AND APPROVAL PRIOR TO PLACEMENT OF THE NEXT LIFT.
3. MATERIAL TESTING AND REPORTING SHALL BE AT NO COST TO ENGINEER.
4. THE CONTRACTOR SHALL PLACE AND INSTALL MATERIAL AS PER MANUFACTURE'S SPECIFICATION AND GUIDELINES.

3.3 GEOGRID

1. TRACKED EQUIPMENT SHALL NOT BE OPERATED DIRECTLY ON ANY GEOGRID. A MINIMUM LIFT THICKNESS OF 150 mm OF STRUCTURAL BACKFILL IS REQUIRED FOR OPERATION OF TRACKED EQUIPMENT OVER THE GEOGRID. THE CONTRACTOR SHALL MINIMIZE TURNING OF TRACKED EQUIPMENT TO PREVENT THE TRACKS FROM DISPLACING THE FILL AND GEOGRID. THE CONTRACTOR SHALL FOLLOW MANUFACTURE'S RECOMMENDATIONS FOR OPERATING TRACKED EQUIPMENT OVER THE GEOGRID AND GEOTEXTILE.
2. GEOGRID SHALL BE INSTALLED ACCORDING TO THE DRAWINGS.

3.4 FIELD REVIEW

1. FIELD INSPECTIONS DURING GRS WALL CONSTRUCTION SHALL WILL BE PROVIDED BY THE ENGINEER TO REVIEW THE SUBSURFACE CONDITIONS EXPOSED IN THE CUTS AND TO CONFIRM THAT ACTUAL SOIL CONDITIONS ARE SIMILAR TO THOSE ASSUMED IN THE DESIGN OF THE GRS SYSTEM. THE CONTRACTOR SHALL NOT COMMENCE PLACEMENT OF LEVELING COURSE AND FIRST BASKET LAYER PRIOR TO APPROVAL OF BEARING SURFACE BY THE ENGINEER.

RIPRAP:

1. ROCK IS TO BE HARD, DURABLE, ABRASIVE RESISTANT AND NON-ACID GENERATING, FREE FROM SEAMS, CRACKS, LAMINATIONS, ORGANICS AND DEBRIS.
2. ROCK SOURCE TO BE APPROVED BY ENGINEER PRIOR TO PLACEMENT.
3. RIPRAP SHALL BE THE SIZE NOTED ON THE DRAWINGS WITH PROPERTIES IN ACCORDANCE WITH BC MOTI SS SECTION 205.04.
4. AREAS TO RECEIVE RIPRAP SHALL BE PREPARED AS PER MOTI SS SECTION 205.05. EXISTING RIPRAP LOCATED WITHIN THE CONSTRUCTION LIMITS SHALL BE SALVAGED AND STORED TO BE MIXED IN WITH THE SUPPLIED RIPRAP. FINAL ACCEPTANCE OF RE-USE OF MATERIAL IS AT THE SOLE DISCRETION OF THE ENGINEER.
5. ALL MATERIAL UNSUITABLE OR SURPLUS TO THE PROJECT SHALL BE REMOVED OFFSITE TO A DISPOSAL SITE PROVIDED BY THE CONTRACTOR. THE CONTRACTOR SHALL ENSURE THAT THE DISPOSAL SITE COMPLIES WITH ALL FEDERAL, PROVINCIAL AND REGIONAL BYLAWS AND REGULATIONS.
6. PLACEMENT OF RIPRAP SHALL BE IN ACCORDANCE WITH MOTI SS SECTIONS 205.06, 205.07 AND 205.08.
7. RIPRAP TO BE DISTRIBUTED EVENLY AND PLACED MATERIAL SHALL BE TAMPED OR OTHERWISE TREATED TO PROVIDE AN EVEN, DENSE SURFACE WITH A MINIMUM OF VOIDS.
8. RIPRAP PLACED ON SLOPING BANKS SHALL BE UNDERLAIN WITH CLASS 1 NON-WOVEN GEOTEXTILE.
9. NON-WOVEN GEOTEXTILE SHALL BE A PRODUCT LISTED ON THE MOTI'S CURRENT RECOGNIZED PRODUCTS LIST.
10. GEOTEXILE SHALL BE KEYED INTO THE TOP OF THE SLOPE AND LAID ALONG THE SLOPE LENGTH WITH APPROPRIATE SLACK TO PREVENT TEARING DURING PLACEMENT OF RIPRAP.

DRAWING REVISIONS

REVISION	DESCRIPTION OF REVISION	DATE (YYYY-MM-DD)	DRAWN	DESIGNED	CHECKED	APPROVED
A	ISSUED FOR TENDER	2023-03-20	J.P.	M.C.	K.M.	K.G.

ORIGINAL ISSUE

DRAWN:	J. PANG
DESIGNED:	M. COVENEY
CHECKED:	K. MITCHELL
APPROVED:	K. GREINACHER

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CLIENT: BRITISH COLUMBIA Recreation Sites and Trails BC

Klohn Crippen Berger
BC PERMIT TO PRACTICE No. 1000171

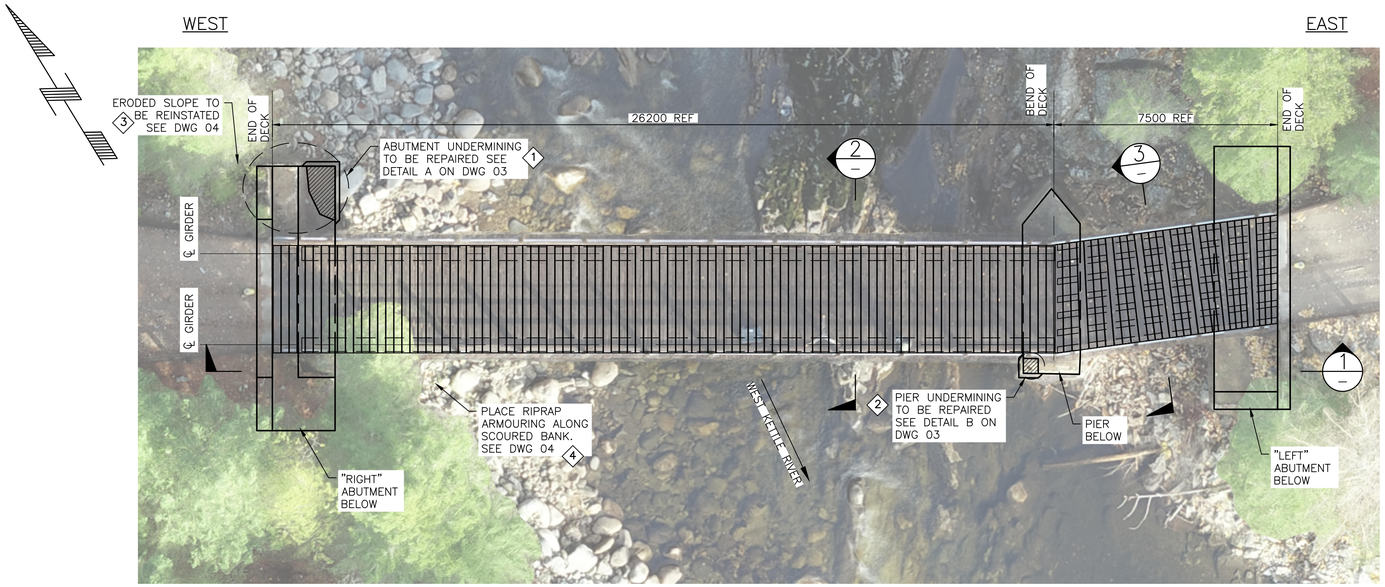
PROJECT: KETTLE VALLEY RAIL TRAIL BRIDGE ASSESSMENT AND REPAIRS

TITLE: KV-005 BRIDGE GENERAL NOTES

SCALE	PROJECT NO.	DWG. NO.	REV.
AS SHOWN	P10443A01	01	A

CANCEL PRINTS BEARING PREVIOUS REVISION

KCB-DWG-0-L



PLAN
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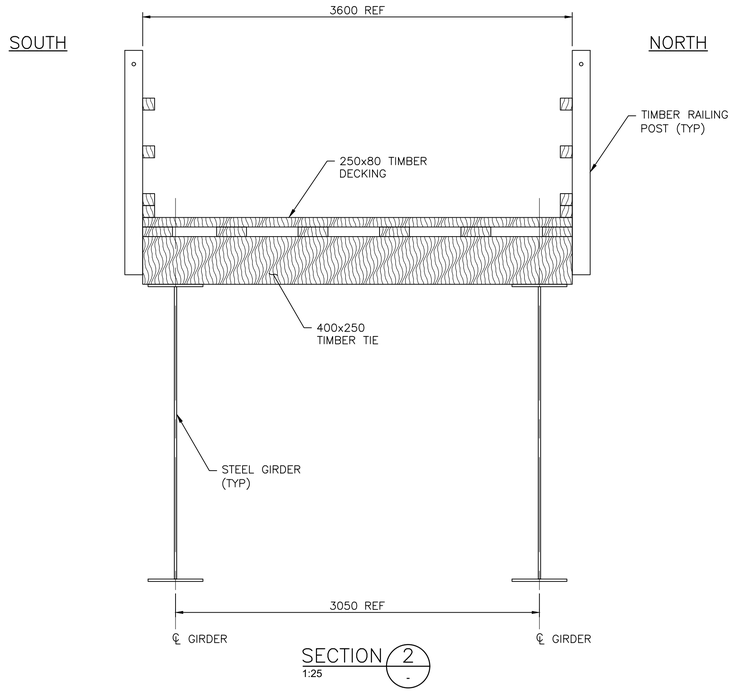

SECTION 2
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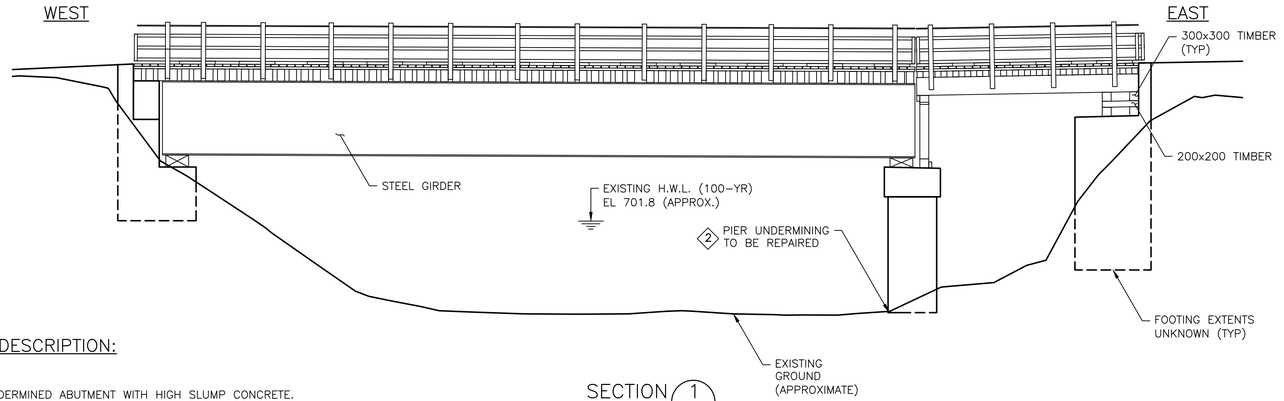
NOTE: SUPERELEVATION NOT SHOWN



SECTION 1
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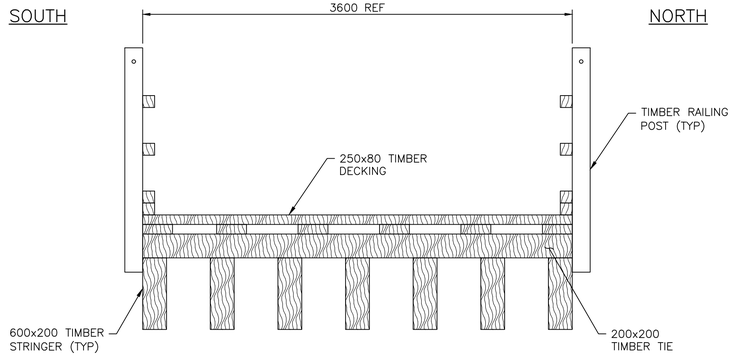

SECTION 3
1:25

NOTE: SUPERELEVATION NOT SHOWN

WORK DESCRIPTION:

1. REPAIR UNDERMINED ABUTMENT WITH HIGH SLUMP CONCRETE.
2. REPAIR UNDERMINED PIER WITH HIGH SLUMP CONCRETE.
3. REINSTATE AND STABILIZE ERODED SLOPE.
4. PLACE RIPRAP ARMOURING ALONG SCOURED RIVERBANK.

NOTES:

1. FOR GENERAL NOTES SEE DRAWING 01.

DRAWING REVISIONS						
A	ISSUED FOR TENDER	2023-03-20	J.P.	M.C.	K.M.	K.G.
REVISION	DESCRIPTION OF REVISION	DATE (YYYY-MM-DD)	DRAWN	DESIGNED	CHECKED	APPROVED

ORIGINAL ISSUE	
DRAWN:	J. PANG
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CHECKED:	K. MITCHELL
APPROVED:	K. GREINACHER

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CLIENT: BRITISH COLUMBIA Recreation Sites and Trails BC

Klohn Crippen Berger
BC PERMIT TO PRACTICE No. 1000171

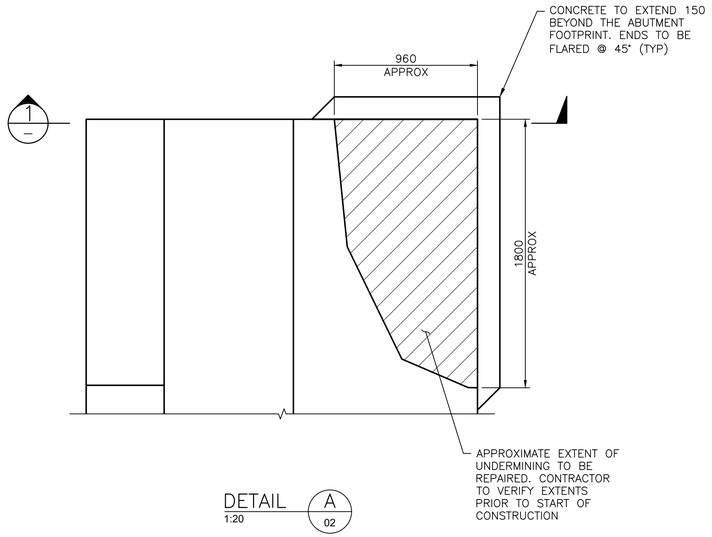
PROJECT: KETTLE VALLEY RAIL TRAIL BRIDGE ASSESSMENT AND REPAIRS

TITLE: KV-005 BRIDGE GENERAL ARRANGEMENT AND SECTIONS

SCALE	PROJECT NO.	DWG. NO.	REV.
AS SHOWN	P10443A01	02	A

KCB-DWG-D-L

CANCEL PRINTS BEARING PREVIOUS REVISION



DETAIL A
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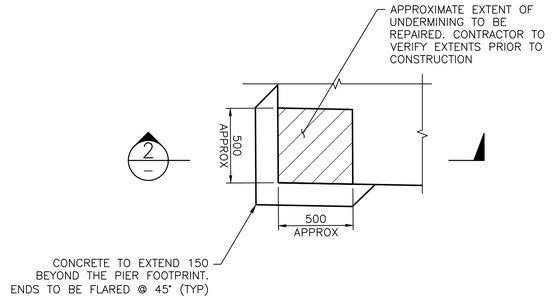

DETAIL B
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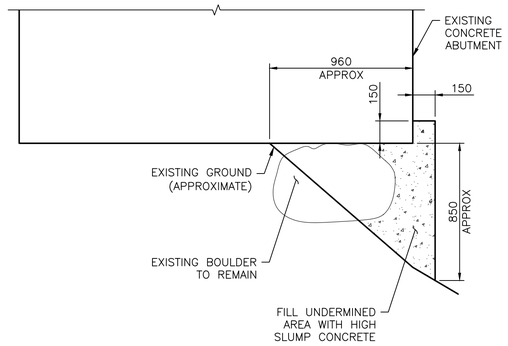

SECTION 1
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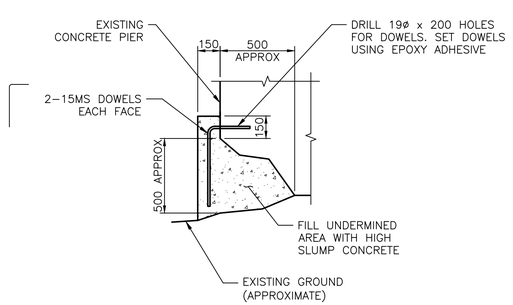

SECTION 2
1:20

TABLE OF ESTIMATED QUANTITIES		
ITEM	UNIT	QUANTITY
ABUTMENT REPAIR CONCRETE	CUBIC METRES	1
PIER REPAIR CONCRETE	CUBIC METRES	0.2
DOWELS	EACH	4

DRAWING REVISIONS

REVISION	DESCRIPTION OF REVISION	DATE (YYYY-MM-DD)	DRAWN	DESIGNED	CHECKED	APPROVED
A	ISSUED FOR TENDER	2023-03-20	J.P.	M.C.	K.M.	K.G.

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CLIENT
BRITISH COLUMBIA
Recreation Sites and Trails BC

Klohn Crippen Berger
BC PERMIT TO PRACTICE No. 1000171

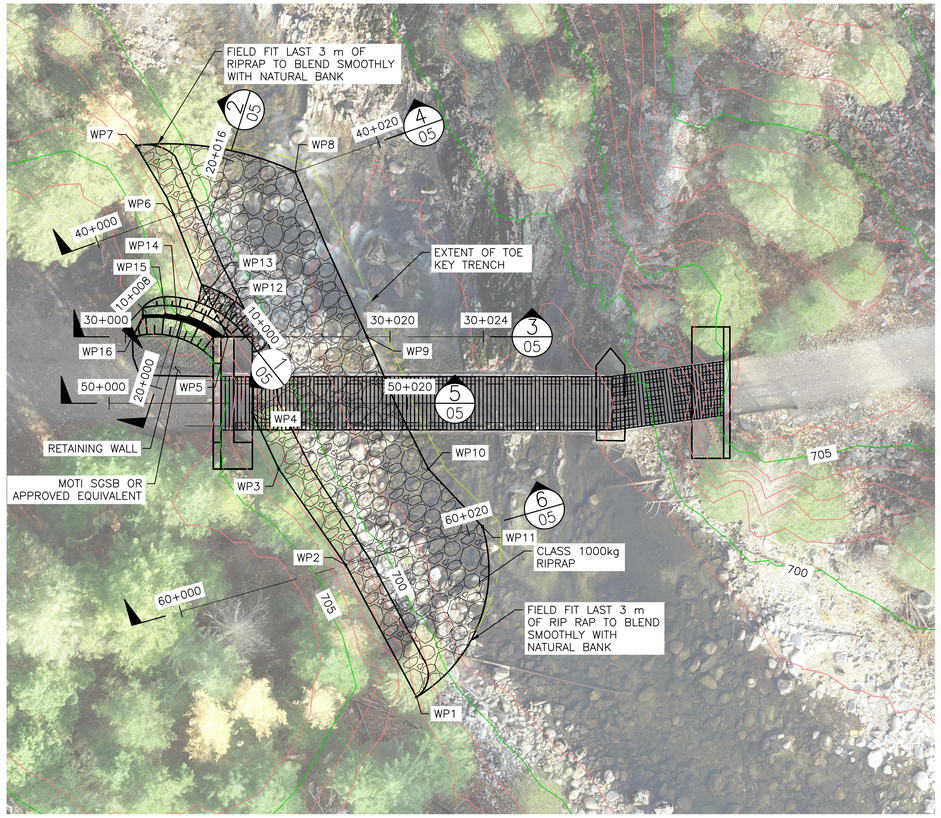
PROJECT
KETTLE VALLEY RAIL TRAIL
BRIDGE ASSESSMENT AND REPAIRS

TITLE
KV-005 BRIDGE
UNDERMINING REPAIR
SECTIONS AND DETAILS

SCALE	PROJECT NO.	DWG. NO.	REV.
AS SHOWN	P10443A01	03	A

KCB-DWG-D-L

CANCEL PRINTS BEARING PREVIOUS REVISION



RIPRAP AND RETAINING WALL – PLAN
1:200

TABLE OF ESTIMATED QUANTITIES		
ITEM	UNIT	QUANTITY
EXCAVATION	CUBIC METRES	180
1000 kg RIPRAP	CUBIC METRES	640
150 MINUS ROCKFILL	CUBIC METRES	12
GRANULAR LEVELING PAD	CUBIC METRES	8
GRS RETAINING WALL	SQUARE METRES	11
SELECT GRANULAR SUB BASE	CUBIC METRES	15
CLASS 1 NON–WOVEN GEOTEXTILE	SQUARE METRES	500

RIPRAP WORKPOINT TABLE		
WORK POINT	NORTHING	EASTING
WP1	5461311.083	351998.568
WP2	5461321.104	351999.121
WP3	5461328.940	351998.644
WP4	5461333.090	351999.095
WP5	5461338.283	352000.352
WP6	5461347.148	352001.513
WP7	5461352.428	352001.767
WP8	5461345.380	352009.956
WP9	5461333.425	352008.312
WP10	5461323.710	352007.214
WP11	5461318.538	352008.287

WALL WORKPOINT TABLE (SEE NOTE 3)			
WORK POINT	NORTHING	EASTING	ELEVATION
WP12	5461338.442	352000.091	703.500
WP13	5461340.805	351998.815	703.500
WP14	5461341.329	351998.207	704.060
WP15	5461341.765	351997.562	704.620
WP16	5461342.464	351996.244	705.180

NOTES:

1. FOR GENERAL NOTES SEE DRAWING 01.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING SURVEY AND CONFIRMING LAYOUT OF THE RIPRAP EXTENTS AND RETAINING WALL LOCATION.
3. STATIONS AND ELEVATIONS PROVIDED FOR GRS WALL ARE APPROXIMATE. FINAL INSTALLED LOCATION AND EXTENTS SUBJECT TO SITE CONDITIONS ENCOUNTERED.

DRAWING REVISIONS						
REVISION	DESCRIPTION OF REVISION	DATE (YYYY–MM–DD)	DRAWN	DESIGNED	CHECKED	APPROVED
A	ISSUED FOR TENDER	2023–03–20	J.P.	J.J.	C.J.	K.G.

ORIGINAL ISSUE	
DRAWN:	J. PANG
DESIGNED:	J. JOHNSON
CHECKED:	C. JOHNSON
APPROVED:	K. GREINACHER

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CLIENT
BRITISH COLUMBIA
Recreation Sites and Trails BC

Klohn Crippen Berger
BC PERMIT TO PRACTICE No. 1000171

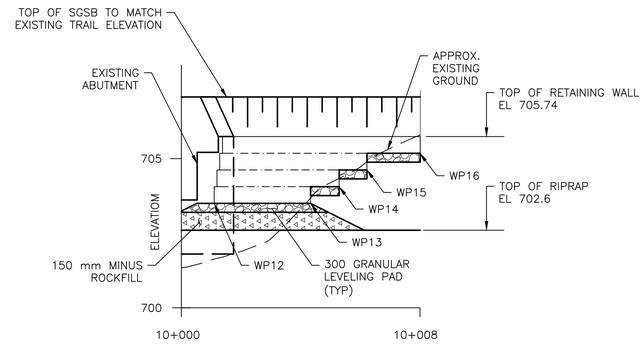
PROJECT
KETTLE VALLEY RAIL TRAIL
BRIDGE ASSESSMENT AND REPAIRS

TITLE
KV–005 BRIDGE
EROSION CONTROL AND SLOPE STABILIZATION PLAN

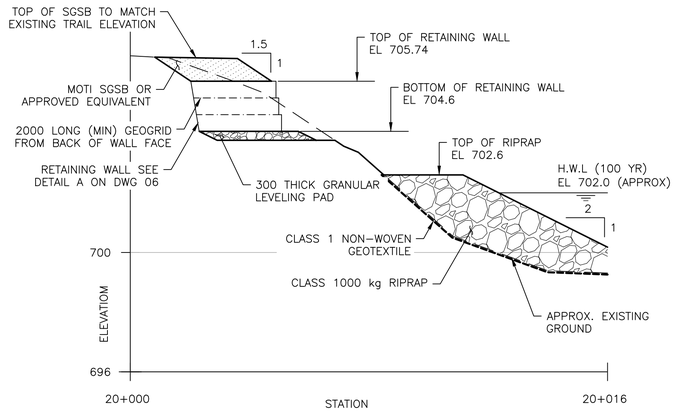
SCALE	PROJECT NO.	DWG. NO.	REV.
AS SHOWN	P10443A01	04	A

CANCEL PRINTS BEARING PREVIOUS REVISION

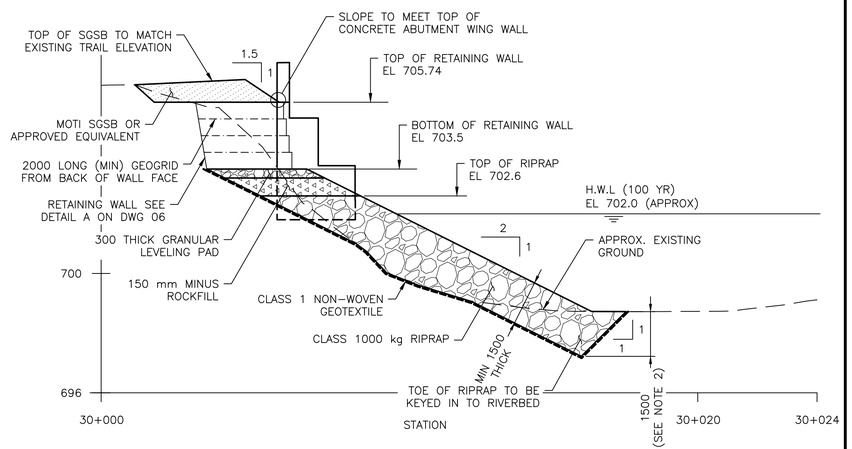
KCB–DWG–0–L



SECTION 1 (04) 1:100

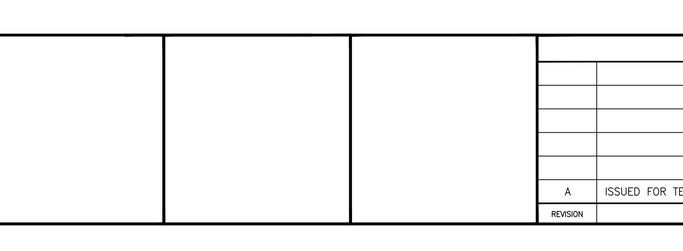


SECTION 2 (04) 1:100

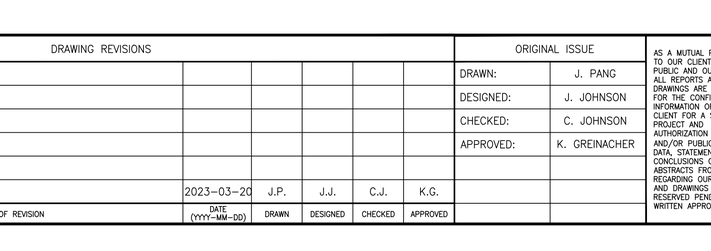


SECTION 3 (04) 1:100

EXPANDED VIEW



SECTION 4 (04) 1:100



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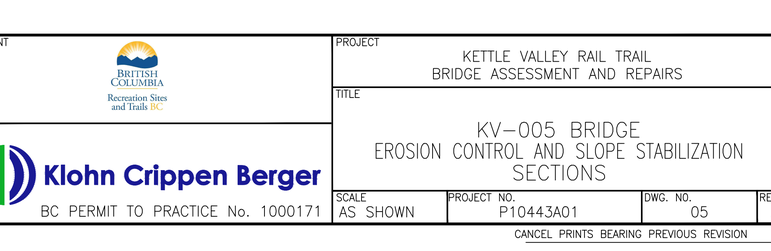


SECTION 6 (04) 1:100

NOTES:

1. FOR GENERAL NOTES SEE DRAWING 01.
2. THE KEY TRENCH IS NOT REQUIRED IN AREAS OF RIVERBED WHERE BEDROCK ENCOUNTERED.
3. RIPRAP MAY BE SHIFTED TOWARDS THE BANK AT TIME OF CONSTRUCTION WITH APPROVAL FROM THE ENGINEER. GENERAL RIPRAP CONFIGURATION, INCLUDING TOP ELEVATION, MINIMUM THICKNESS, AND TOE KEY, SHALL MEET THE REQUIREMENTS SHOWN ON THE DRAWINGS.
4. ALL PERMANENT EXCAVATIONS AND DISTURBED SLOPES SHALL BE GRADED TO NO STEEPER THAN 1.5H:1V.

DRAWING REVISIONS

REVISION	DESCRIPTION OF REVISION	DATE (YYYY-MM-DD)	DRAWN	DESIGNED	CHECKED	APPROVED
A	ISSUED FOR TENDER	2023-03-20	J.P.	J.J.	C.J.	K.G.

ORIGINAL ISSUE

DRAWN:	J. PANG
DESIGNED:	J. JOHNSON
CHECKED:	C. JOHNSON
APPROVED:	K. GREINACHER

AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.

CLIENT: BRITISH COLUMBIA Recreation Sites and Trails BC

Klohn Crippen Berger
BC PERMIT TO PRACTICE No. 1000171

PROJECT: KETTLE VALLEY RAIL TRAIL BRIDGE ASSESSMENT AND REPAIRS

TITLE: KV-005 BRIDGE EROSION CONTROL AND SLOPE STABILIZATION SECTIONS

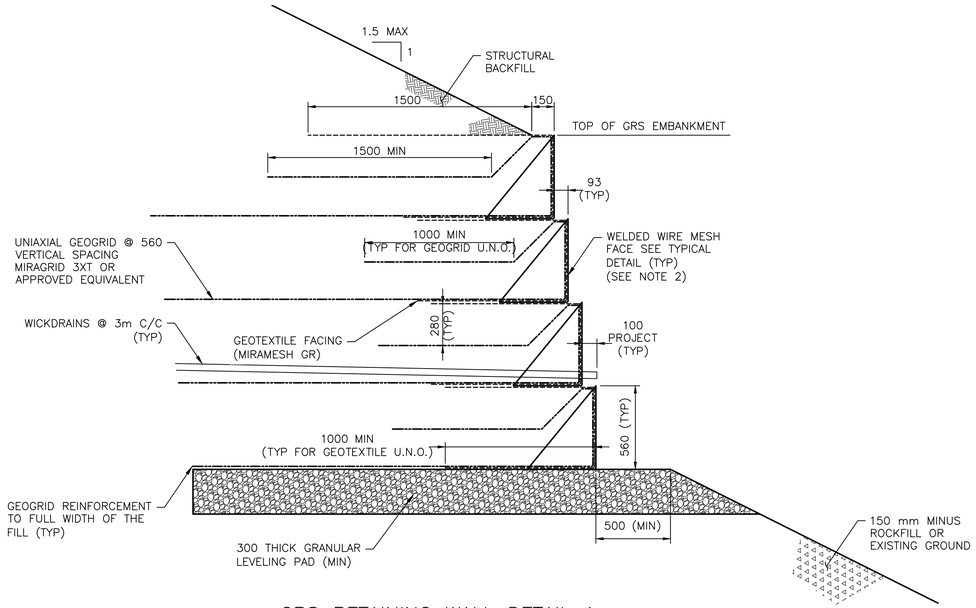
SCALE	PROJECT NO.	DWG. NO.	REV.
AS SHOWN	P10443A01	05	A

KCB-DWG-D-L

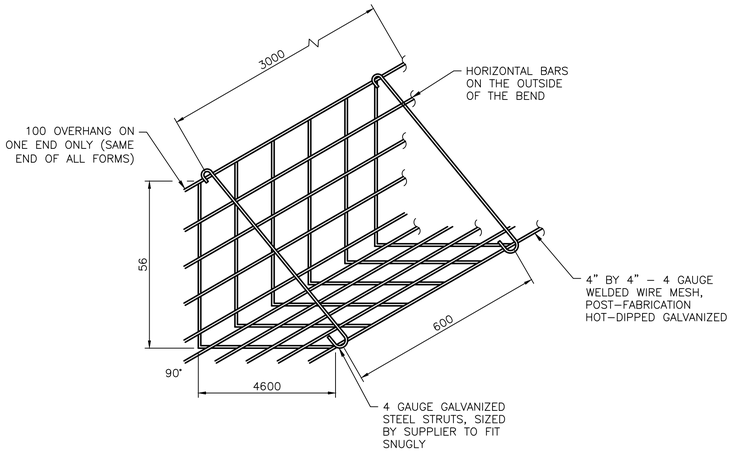
CANCEL PRINTS BEARING PREVIOUS REVISION

NOTES:

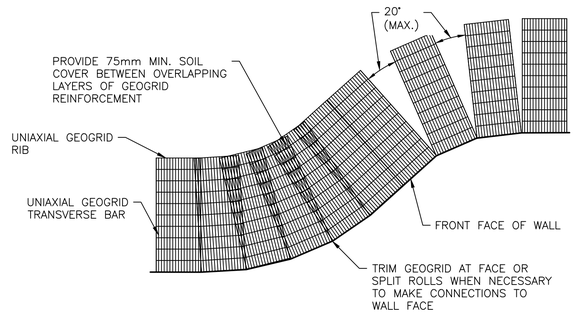
1. FOR GENERAL NOTES SEE DRAWING 01.
2. GRS RETAINING WALL FACING COULD BE DESIGNED BY A PROPRIETARY SUPPLIER TO BE A STONE FACE OR VEGETATED FACE OPTION.



GRS RETAINING WALL DETAIL A
1:20



TYPICAL WELDED WIRE MESH FACE DETAIL
N.T.S.



GEOGRID PLACEMENT ON CURVES DETAIL – PLAN VIEW
N.T.S.

DRAWING REVISIONS						
A	ISSUED FOR TENDER	2023–03–20	J.P.	M.C.	C.J.	A.P.
REVISION	DESCRIPTION OF REVISION	DATE (YYYY–MM–DD)	DRAWN	DESIGNED	CHECKED	APPROVED

ORIGINAL ISSUE	
DRAWN:	J. PANG
DESIGNED:	M. CORMIER
CHECKED:	C. JOHNSON
APPROVED:	A. PORT

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CLIENT
BRITISH COLUMBIA
Recreation Sites and Trails BC

Klohn Crippen Berger
BC PERMIT TO PRACTICE No. 1000171

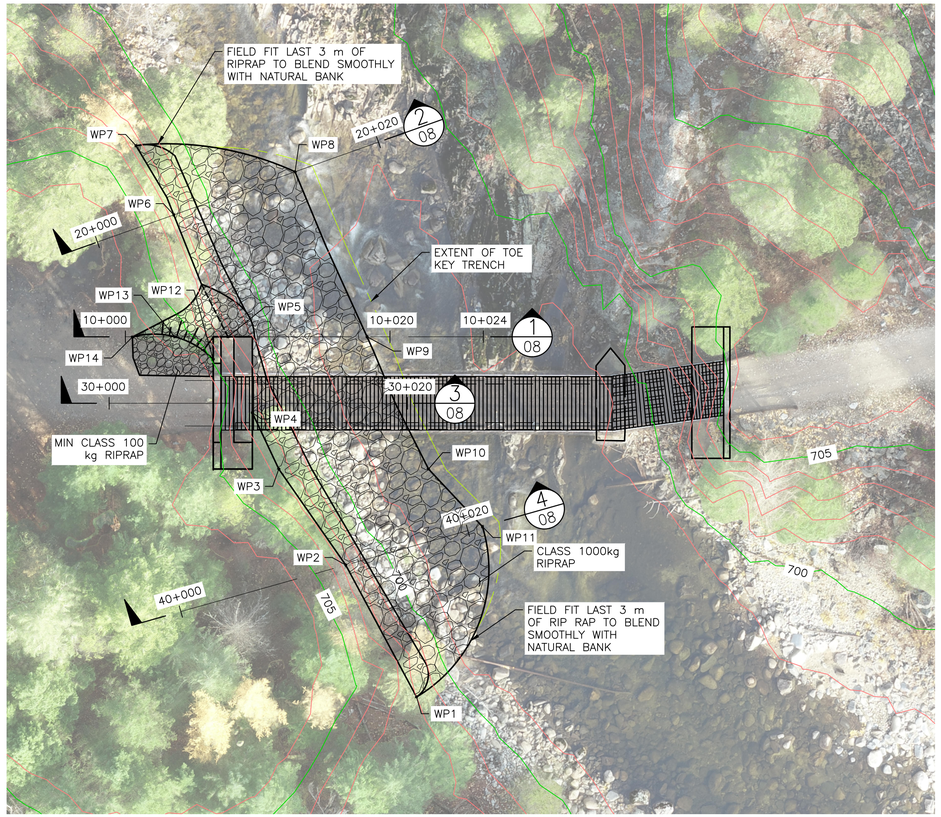
PROJECT
KETTLE VALLEY RAIL TRAIL
BRIDGE ASSESSMENT AND REPAIRS

TITLE
KV–005 BRIDGE
RETAINING WALL DETAILS

SCALE	PROJECT NO.	DWG. NO.	REV.
AS SHOWN	P10443A01	06	A

CANCEL PRINTS BEARING PREVIOUS REVISION

KCB–DWG–D–L



RIPRAP AND PLACED ROCK FILL SLOPE – PLAN

1:200

RIPRAP WORKPOINT TABLE		
WORK POINT	NORTHING	EASTING
WP1	5461311.083	351998.568
WP2	5461321.104	351999.121
WP3	5461328.940	351998.644
WP4	5461333.090	351999.095
WP5	5461338.283	352000.352
WP6	5461347.148	352001.513
WP7	5461352.428	352001.767
WP8	5461345.380	352009.956
WP9	5461333.425	352008.312
WP10	5461323.710	352007.214
WP11	5461318.538	352008.287

TOP OF SLOPE WORKPOINT TABLE		
WORK POINT	NORTHING	EASTING
WP12	5461337.499	351998.712
WP13	5461340.142	351997.306
WP14	5461341.606	351994.877

TABLE OF ESTIMATED QUANTITIES		
ITEM	UNIT	QUANTITY
EXCAVATION	CUBIC METRES	150
1000 kg RIPRAP	CUBIC METRES	640
PLACED ROCK FILL (MIN. 100 kg RIPRAP)	CUBIC METRES	50
CLASS 1 NON-WOVEN GEOTEXTILE	SQUARE METRES	500

NOTES:

1. FOR GENERAL NOTES SEE DRAWING 01.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING SURVEY AND CONFIRMING LAYOUT OF THE RIPRAP EXTENTS AND FILL SLOPE LOCATION.

DRAWING REVISIONS						
A	ISSUED FOR TENDER	2023-03-20	J.P.	J.J.	C.J.	K.G.
REVISION	DESCRIPTION OF REVISION	DATE (YYYY-MM-DD)	DRAWN	DESIGNED	CHECKED	APPROVED

ORIGINAL ISSUE	
DRAWN:	J. PANG
DESIGNED:	J. JOHNSON
CHECKED:	C. JOHNSON
APPROVED:	K. GREINACHER

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CLIENT

BRITISH COLUMBIA
Recreation Sites and Trails BC

Klohn Crippen Berger

BC PERMIT TO PRACTICE No. 1000171

PROJECT

KETTLE VALLEY RAIL TRAIL
BRIDGE ASSESSMENT AND REPAIRS

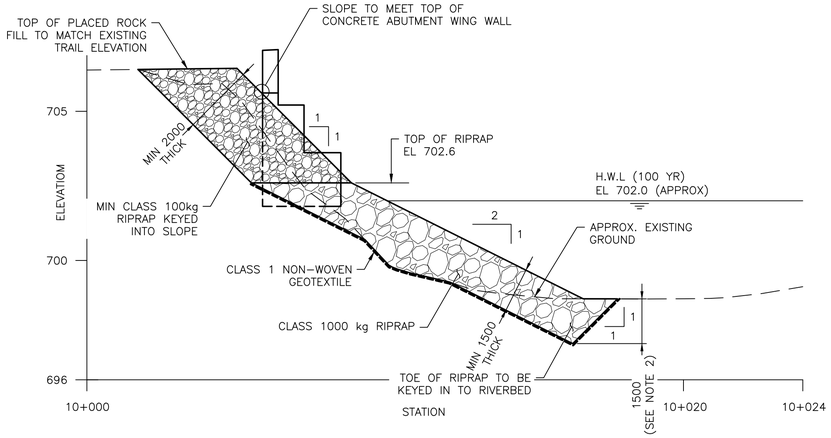
TITLE

KV-005 BRIDGE
EROSION CONTROL AND SLOPE STABILIZATION
PLAN (ALTERNATIVE SLOPE STABILIZATION)

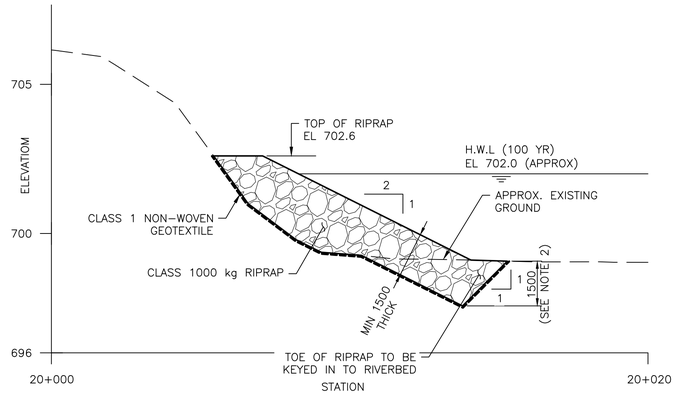
SCALE	PROJECT NO.	DWG. NO.	REV.
AS SHOWN	P10443A01	07	A

CANCEL PRINTS BEARING PREVIOUS REVISION

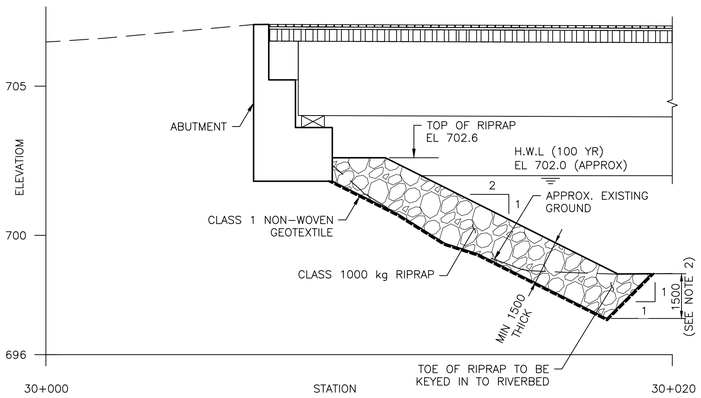
KCB-DWG-D-L



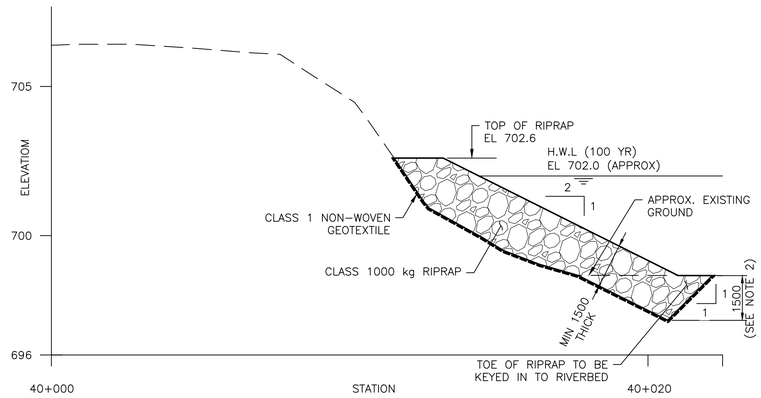
SECTION 1 (07) 1:100



SECTION 2 (07) 1:100



SECTION 3 (07) 1:100



SECTION 4 (07) 1:100

NOTES:

1. FOR GENERAL NOTES SEE DRAWING 01.
2. THE KEY TRENCH IS NOT REQUIRED IN AREAS OF RIVERBED WHERE BEDROCK ENCOUNTERED.
3. RIPRAP MAY BE SHIFTED TOWARDS THE BANK AT TIME OF CONSTRUCTION WITH APPROVAL FROM THE ENGINEER. GENERAL RIPRAP CONFIGURATION, INCLUDING TOP ELEVATION, MINIMUM THICKNESS, AND TOE KEY, SHALL MEET THE REQUIREMENTS SHOWN ON THE DRAWINGS.
4. ALL PERMANENT EXCAVATIONS AND DISTURBED SLOPES SHALL BE GRADED TO NO STEEPER THAN 1.5H:1V.

DRAWING REVISIONS							ORIGINAL ISSUE	
							DRAWN:	J. PANG
							DESIGNED:	J. JOHNSON
							CHECKED:	C. JOHNSON
							APPROVED:	K. GREINACHER
A	ISSUED FOR TENDER	2023-03-20	J.P.	J.J.	C.J.	K.G.		
REVISION	DESCRIPTION OF REVISION	DATE (YYYY-MM-DD)	DRAWN	DESIGNED	CHECKED	APPROVED		

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CLIENT: BRITISH COLUMBIA Recreation Sites and Trails BC

Klohn Crippen Berger
BC PERMIT TO PRACTICE No. 1000171

PROJECT: KETTLE VALLEY RAIL TRAIL BRIDGE ASSESSMENT AND REPAIRS

TITLE: KV-005 BRIDGE EROSION CONTROL AND SLOPE STABILIZATION SECTIONS (ALTERNATIVE SLOPE STABILIZATION)

SCALE	PROJECT NO.	DWG. NO.	REV.
AS SHOWN	P10443A01	08	A

KCB-DWG-D-L

CANCEL PRINTS BEARING PREVIOUS REVISION

PHOTO 1: OVERVIEW OF BRIDGE LOOKING DOWNSTREAM. REFERENCES TO "RIGHT" AND "LEFT" SIDES OF THE BRIDGE ARE AS SEEN LOOKING DOWNSTREAM

PHOTO 2: OVERVIEW OF BRIDGE LOOKING UPSTREAM

PHOTO 3: EROSION AT THE "RIGHT" BANK AND UNDERMINING AT THE ABUTMENT ON THE UPSTREAM SIDE OF BRIDGE

PHOTO 4: UNDERMINING AT THE "RIGHT" ABUTMENT

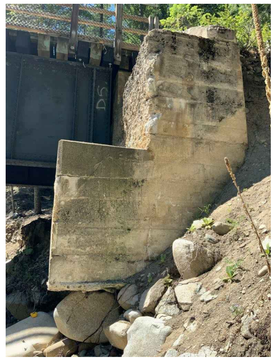

PHOTO 5: UNDERMINING AT THE "RIGHT" ABUTMENT

PHOTO 6: EROSION AT THE "RIGHT" BANK UPSTREAM OF BRIDGE

PHOTO 7: EROSION AT THE "RIGHT" BANK DOWNSTREAM OF BRIDGE

PHOTO 8: UNDERMINING AT THE DOWNSTREAM CORNER OF PIER

DRAWING REVISIONS

REVISION	DESCRIPTION OF REVISION	DATE (YYYY-MM-DD)	DRAWN	DESIGNED	CHECKED	APPROVED
A	ISSUED FOR TENDER	2023-03-20	J.P.	M.C.	K.M.	K.G.

ORIGINAL ISSUE

DRAWN:	J. PANG
DESIGNED:	M. COVENEY
CHECKED:	K. MITCHELL
APPROVED:	K. GREINACHER

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CLIENT

BRITISH COLUMBIA
Recreation Sites and Trails BC

Klohn Crippen Berger
BC PERMIT TO PRACTICE No. 1000171

PROJECT
KETTLE VALLEY RAIL TRAIL
BRIDGE ASSESSMENT AND REPAIRS

TITLE
KV-005 BRIDGE PHOTOS

SCALE	PROJECT NO.	DWG. NO.	REV.
AS SHOWN	P10443A01	09	A

CANCEL PRINTS BEARING PREVIOUS REVISION

KCB-DWG-D-L

Appendix C

Environmental Regulatory Approvals

[Environmental Regulatory Permits will be forwarded in a revised copy of the CEMP upon their receipt.]

Appendix D

Environmental Monitoring Site Forms

Environmental Monitoring Daily Report Form

DAILY ENVIRONMENTAL INSPECTION REPORT	
Project:	
DWB Project #:	
Client:	
Client Contact:	
Inspection Date:	
Environmental Monitor(s) on Site:	

SITE SUMMARY
Present Weather Based on the Past 24hr Period:
Permits and Plans: ☐ Was the toolbox meeting attended and were environmental topics discussed? (List below) ☐ Environmental pre-work completed (If applicable, outline details below: who, what, where, when) ☐ Construction Environnemental Management Plan (EMP) on site ☐ Environmental Site-specific Plan or Work Procedure onsite (If Applicable) Comments:
Spill Response
☐ Spill response materials on-site/in vehicles and equipment ☐ Refuel location outside Environmentally Sensitive Area (30m from stream) ☐ Refuelling tanks/equipment inspected for proper containment and design ☐ Equipment inspected for leaks or excessive grease (Identify equipment # or make/model below) Comments:

Wildlife and Archaeology	
☐ Were any wildlife observations reported? (Document below)	
☐ Did any chance archaeological finds occur since last visit? (Report/Cease all works as required)	
Comments:	

CURRENT CONSTRUCTION ACTIVITIES	
Identify Location, Equipment, Task, and Supervisor contacted while onsite:	Photo #

SEDIMENT AND EROSION CONTROL MEASURES	
Are existing measures functioning as designed and effectively controlling the site?	*Photo #*
(Location, SEC Issue, Repair or Modification Required)	
Are new SEC measures required? (Provide rationale, location, issue, supplies required)	*Photo #*
Environmental Monitor Signoff:	
Time and Hours Onsite:	

TURBIDITY MONITORING DATA SHEET				
STATION NUMBER	**STATION LOCATION (UTM)**	**DATE (DD/MM/YY) & TIME (24:00)**	**READING (NTU)**	**COMMENTS**
TURBIDITY UNIT CALIBRATION INFORMATION **(CALIBRATE UNIT AT START AND END OF EVERY DAY)**				
DATE CALIBRATED	**TIME CALIBRATED**	**COMMENTS**		

Environmental Sign Off Record

ENVIRONMENTAL SIGN OFF RECORD	
DWB Project Number:	
Client or Contractor(s):	
Client or Contractor Supervisor(s):	

Construction Environmental Management Plan (CEMP) Contract Sign-Off

The following sections of the CEMP have been discussed during the onsite prework.

Note: These sections require the contractor's employees to sign-off stating that they are fully aware and understand all of the information and materials that have been discussed and presented during the CEMP onsite prework. This sign-off demonstrates that all of the contractor's employees are aware and understand their environmental requirements and responsibilities as per the CEMP. If any changes occur during the works prescribed and require changes to the CEMP, the contractor and all of its employees will be notified of the corrective measures that have been implemented.

1. **Spill Response Plan**
2. **Erosion and Sediment Control Plan**
3. **Contractor employees have been made aware and are conscious of ALL ENVIRONMENTAL PERMITTING PERTINENT TO THIS CONTRACT.**

Contractor Supervisor(s): _____

Date: _____

Contractor's Environmental Monitor: _____

Date: _____

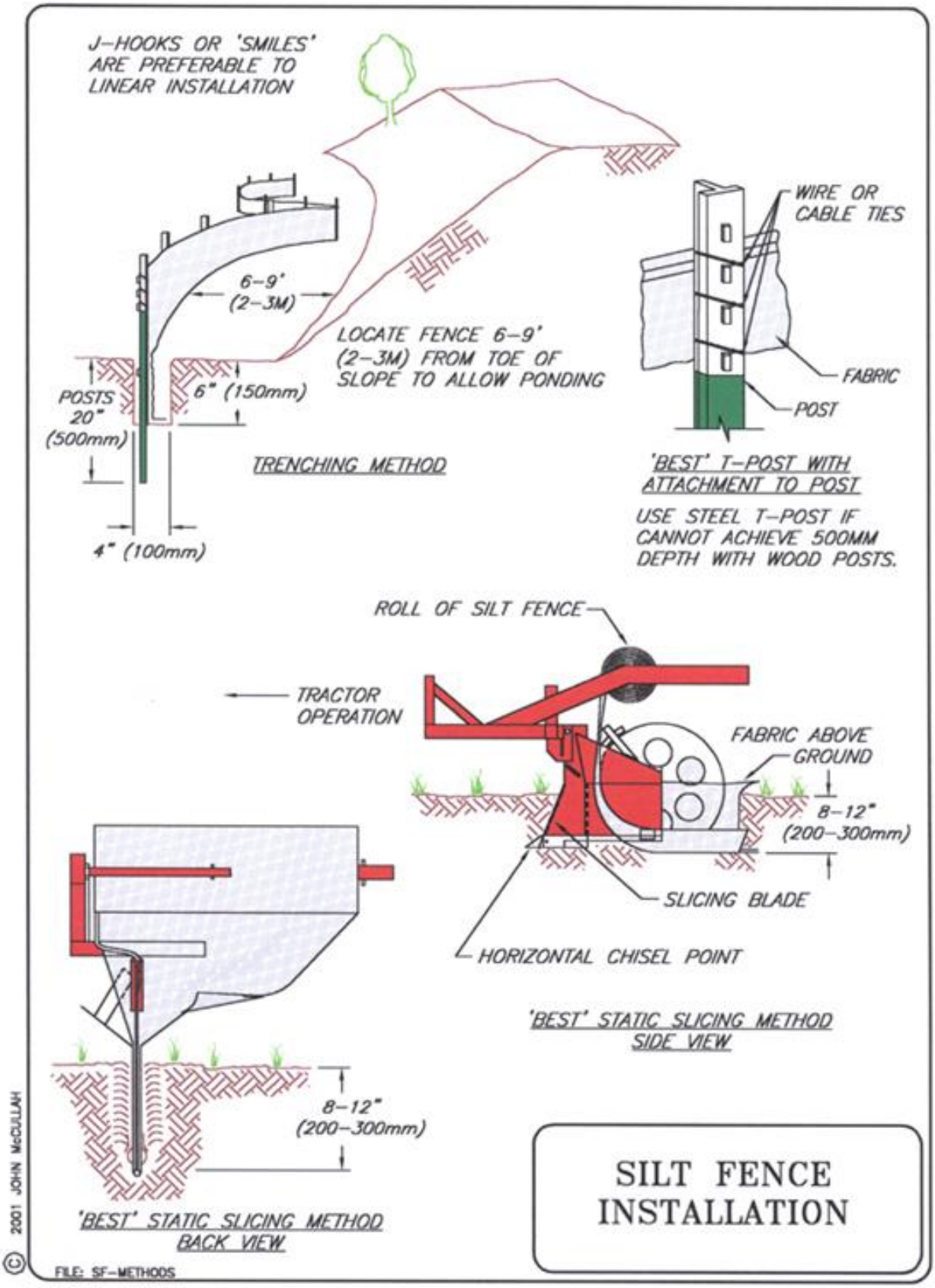
THIS DOCUMENT SHOULD BE POSTED ONSITE AND MADE AVAILABLE AT ALL TIMES TO ALL PARTIES OF CONCERN AS PER THE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

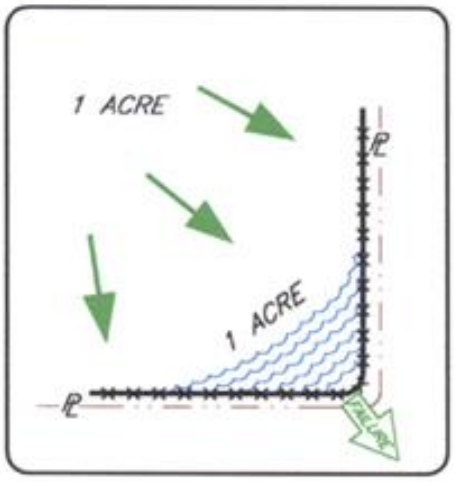
CONTRACTOR EMPLOYEES ACKNOWLEDGEMENT OF THE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN WITH EMPHASIS ON THE SPILL RESPONSE PLAN & EROSION AND SEDIMENT CONTROL PLAN.				
Printed Name	Signature	Date	Updated Revision(s) Date and Section	Acknowledgement signature of updates

****The CEMP is a dynamic document and can be altered and updated during any time of the contract.**

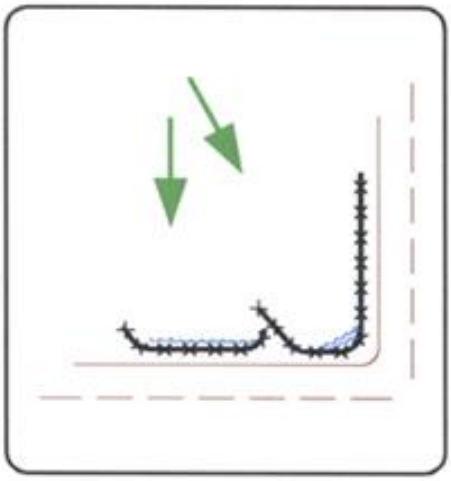
Appendix E

Typical ESC Best Management Practices

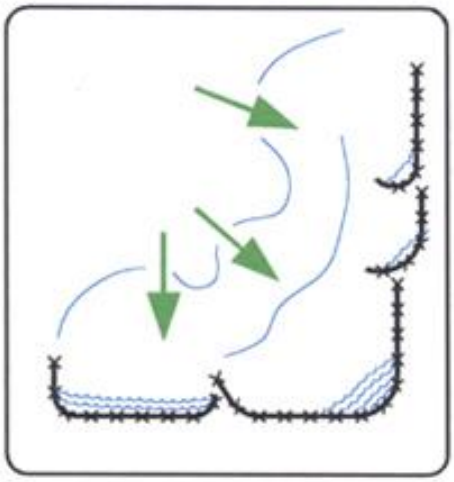

J-HOOKS OR 'SMILES' ARE PREFERABLE TO LINEAR INSTALLATION
6-9' (2-3M)
LOCATE FENCE 6-9' (2-3M) FROM TOE OF SLOPE TO ALLOW PONDING
POSTS 20" (500mm)
6" (150mm)
4" (100mm)
TRENCHING METHOD
WIRE OR CABLE TIES
FABRIC
POST
'BEST' T-POST WITH ATTACHMENT TO POST
USE STEEL T-POST IF CANNOT ACHIEVE 500MM DEPTH WITH WOOD POSTS.
ROLL OF SILT FENCE
TRACTOR OPERATION
FABRIC ABOVE GROUND
8-12" (200-300mm)
SLICING BLADE
HORIZONTAL CHISEL POINT
'BEST' STATIC SLICING METHOD SIDE VIEW
8-12" (200-300mm)
'BEST' STATIC SLICING METHOD BACK VIEW
SILT FENCE INSTALLATION
© 2001 JOHN McCULLAH
FILE: SF-METHODS

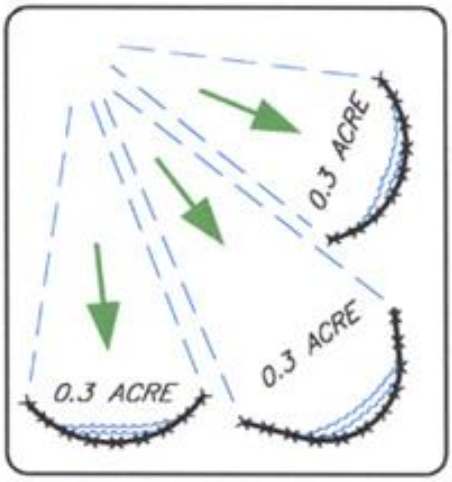


Incorrect – Do Not layout "perimeter control" silt fences along property lines. All sediment laden runoff will concentrate and overwhelm the system.



Correct – Install J-hooks





Discreet segments of silt fence, installed with J-hooks or 'smiles' will be much more effective.

SILT FENCE PLACEMENT FOR PERIMETER CONTROL

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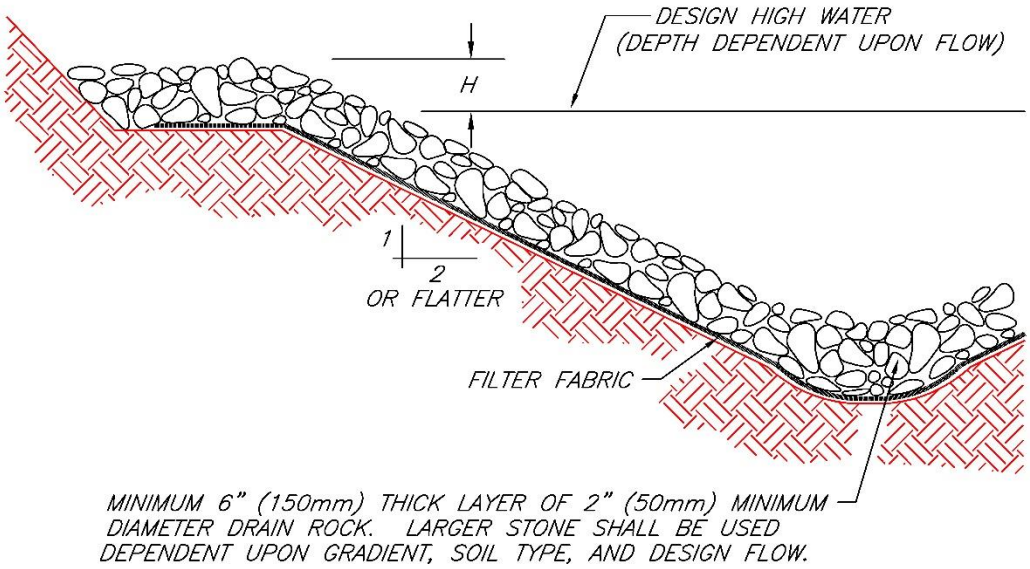
FILE: SF-PERIMETER CONTROL

DESIGN HEIGHT (H), WIDTH AND STONE SIZE SHALL BE DETERMINED BY THE ENGINEER



TYPICAL SECTION

ROCK LINED CHANNEL

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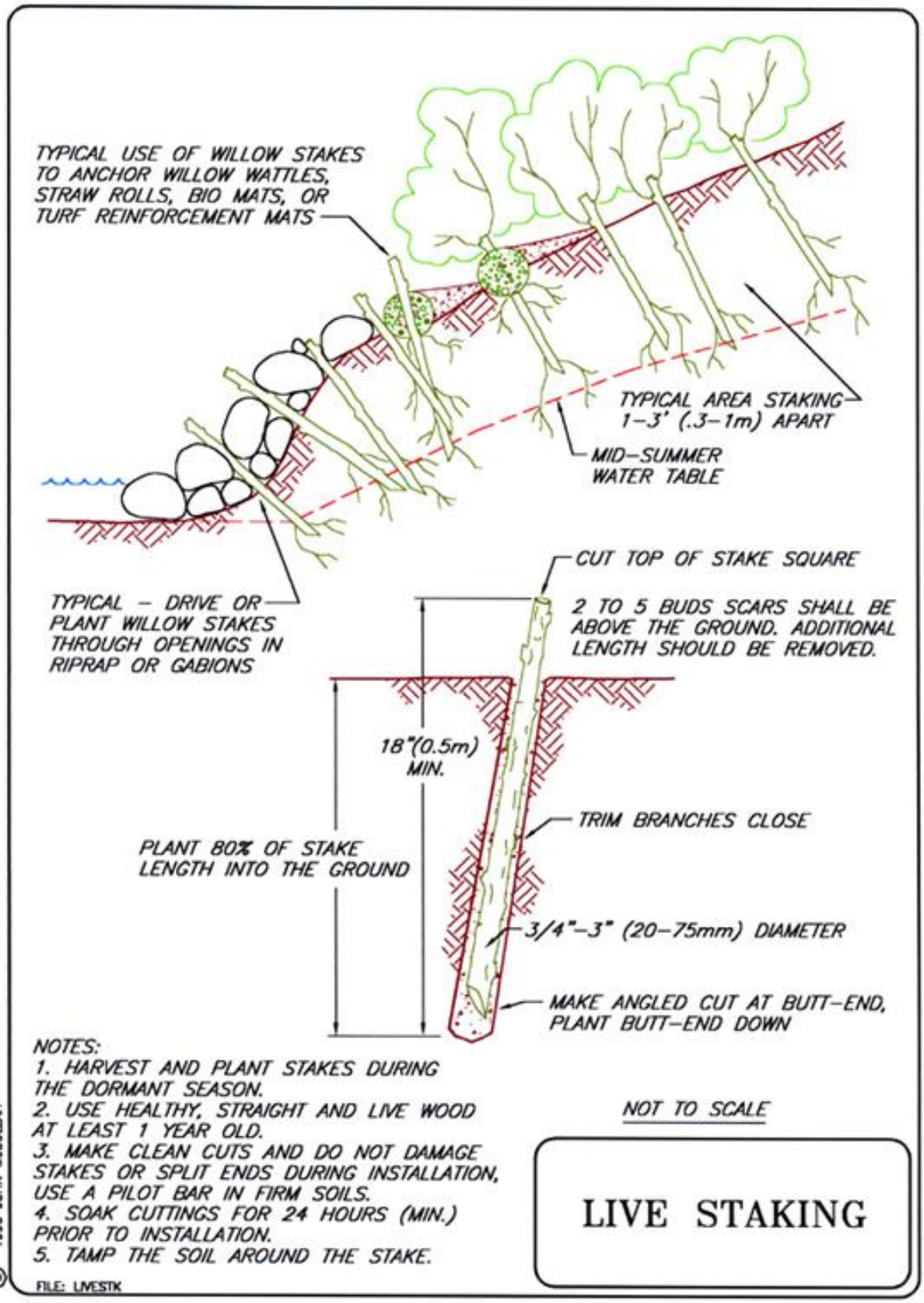
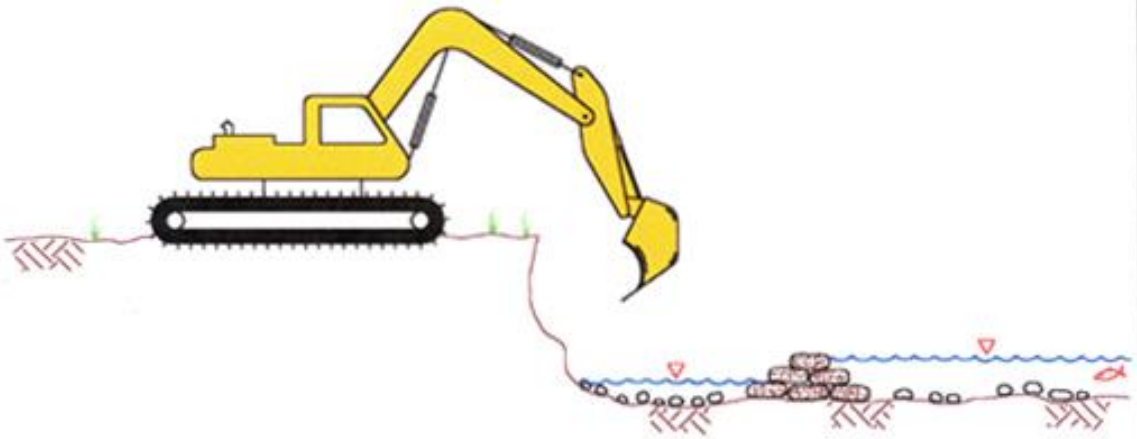
FILE: RCKCHNEL


TYPICAL USE OF WILLOW STAKES TO ANCHOR WILLOW WATTLES, STRAW ROLLS, BIO MATS, OR TURF REINFORCEMENT MATS
TYPICAL AREA STAKING 1-3' (.3-1m) APART
MID-SUMMER WATER TABLE
TYPICAL - DRIVE OR PLANT WILLOW STAKES THROUGH OPENINGS IN RIPRAP OR GABIONS
CUT TOP OF STAKE SQUARE
2 TO 5 BUDS SCARS SHALL BE ABOVE THE GROUND. ADDITIONAL LENGTH SHOULD BE REMOVED.
18"(0.5m) MIN.
PLANT 80% OF STAKE LENGTH INTO THE GROUND
TRIM BRANCHES CLOSE
3/4"-3" (20-75mm) DIAMETER
MAKE ANGLED CUT AT BUTT-END, PLANT BUTT-END DOWN
NOTES:
1. HARVEST AND PLANT STAKES DURING THE DORMANT SEASON.
2. USE HEALTHY, STRAIGHT AND LIVE WOOD AT LEAST 1 YEAR OLD.
3. MAKE CLEAN CUTS AND DO NOT DAMAGE STAKES OR SPLIT ENDS DURING INSTALLATION, USE A PILOT BAR IN FIRM SOILS.
4. SOAK CUTTINGS FOR 24 HOURS (MIN.) PRIOR TO INSTALLATION.
5. TAMP THE SOIL AROUND THE STAKE.
NOT TO SCALE
LIVE STAKING
© 1996 JOHN McCULLAH
FILE: LIVESTK

BENEFITS/LIMITATIONS

- Difficult to dewater
- Inexpensive
- Labor intensive to install and remove
- Sand may be deposited in stream if bags break, better to use clean gravel



SAND BAG/GRAVEL BAG TECHNIQUE

INSTREAM EROSION AND SEDIMENT CONTROL ISOLATION TECHNIQUES

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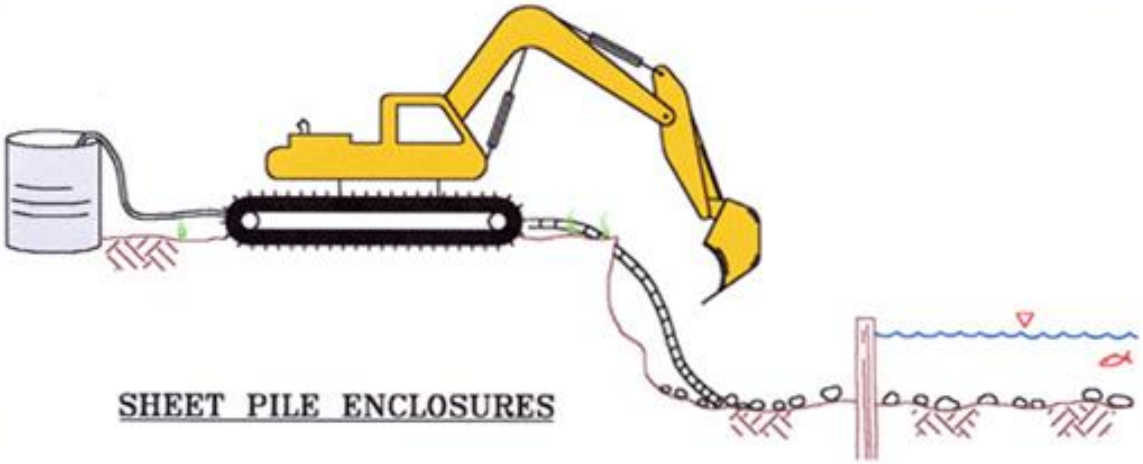
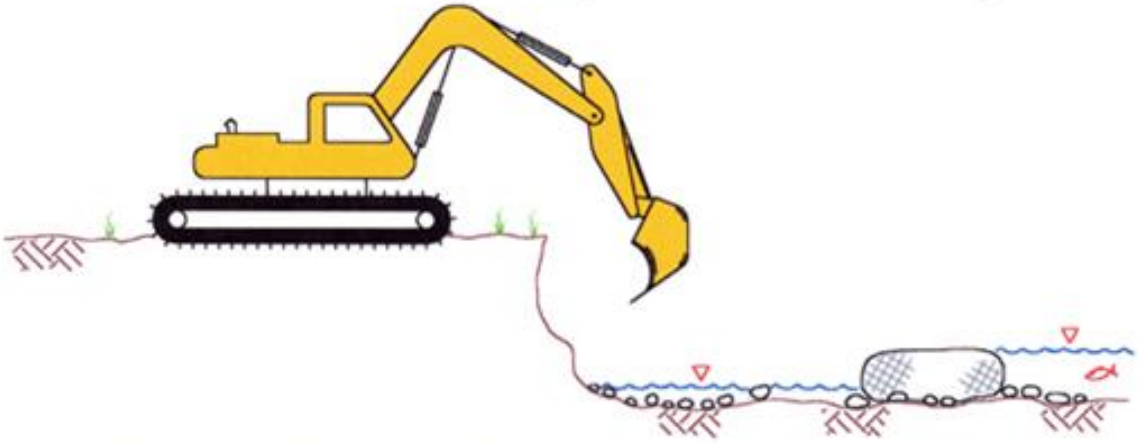
FILE: INSTREAM TECHNIQUES3

BENEFITS/LIMITATIONS
- Allows full dewatering
- Relatively expensive
- Useful in large rivers, lakes, high velocity
- Not really appropriate for small streams
- Requires staging and heavy equipment access areas



SHEET PILE ENCLOSURES

BENEFITS/LIMITATIONS
- Allows partial dewatering
- Moderately expensive
- Ease of installation and removal unknown
- Can be designed for small streams to large rivers



WATER–FILLED GEOTEXTILE (AQUA DAM)

INSTREAM EROSION AND SEDIMENT CONTROL ISOLATION TECHNIQUES

© 2001 JOHN McCULLAH

FILE: INSTREAM TECHNIQUES2

Appendix F

Spill Report Form

Spill Report Form

KEY CONTACTS:	
EMERGENCY MANAGEMENT BC (REPORTABLE EMERGENCY):	1-800-663-3456 (24 HOUR HOTLINE)
CANUTEC/TRANSPORT CANADA	TEL. (613) 996-6666
ENVIRONMENT CANADA	TEL. (604) 666-0370

REPORTABLE QUANTITIES	
Flammable Gas – i.e. propane	10 kg or 10 minutes
Non-flammable Gas – i.e. CO2	10 kg or 10 minutes
Flammable Liquids	100 litres
Corrosive liquid acids and caustics – i.e. battery acid	5 kg or 5 litres
Environmental hazardous substances – i.e. PCBs	1 kg or 1 litre
Oil and Waste	100 litres
Other substances – i.e. power wash water)	200 kg or 200 litres
Antifreeze	5 litres
Pesticides / Herbicides	1 kg or 1 litre

INCIDENT DETAILS	
Date of Spill:	**Material Spilled:**
Reporter's Name:	**UN # and Class:**
Department:	**Quantity Spilled:**
Phone Number:	**Location of Spill:**
Address:	
Description of Spill:	
Cause of Spill:	
Remediation Actions Taken:	
Agencies Attending Scene (eg. Fire Dept. etc.):	
Employees/Contractors Attending Scene:	
Additional Information:	