July 14, 2011

AQUATIC EFFECTS ASSESSMENT

Sweltzer River Bridge Rehabilitation

Submitted to:
Ministry of Transportation and Infrastructure
South Coast Regional Office
7818 6th Street
Burnaby, BC
V3N 4N8

Attention: Virginia Lindstrom

Report Number: 1114220030-002-R-Rev1-1100

Distribution:

1 Copy - Ministry of Transportation and Infrastructure

2 Copies - Golder Associates Ltd.

REPORT

A world of capabilities delivered locally

Golder Associates

Table of Contents

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by the Ministry of Transportation and Infrastructure (MOT) to conduct an Aquatic Effects Assessment (AEA) for the proposed Sweltzer River bridge rehabilitation (the Project). The existing bridge across the Sweltzer River is located near the intersection of the Columbia Valley Highway and Lakeshore Drive, approximately 250 metres downstream from Cultus Lake, BC as shown on Figure 1. The proposed Project involves primarily the rehabilitation and resurfacing of the bridge deck. However, the structural reinforcement of one damaged wooden piling will require construction activities below the High Water Mark (HWM) within the channel of the Sweltzer River. The AEA was conducted to characterize aquatic resources in the Project area; identify the expected scope of construction activities in or near water; identify potential environmental effects; and recommend mitigation measures to minimize the potential for adverse environmental effects from Project-related activities.

2.0 PROPOSED WORKS

The primary component of the Project is re-surfacing of the existing bridge deck, much of which can be undertaken with minimal instream effects through careful implementation of the Fisheries and Oceans Canada (DFO) Operational Statement for Bridge Maintenance (DFO 2007a). However, a single timber pile (Figure 2, Photograph 1) is splitting and requires repair or reinforcement. The MOT is proposing to weld a steel sleeve around the piling as reinforcement, and then fill the space between the piling and the sleeve with grout or concrete (Appendix A; Conceptual Drawings). The steel sleeve would be installed approximately 0.30 m into the channel bed.

Bridge deck resurfacing activities will all occur above the HWM and are expected to include:

- Shallow excavation (~1.0m) and cast-in-place concrete reinforcement of the approach road at either end of the bridge deck;
- Asphalt resurfacing of the existing bridge deck with no modification to the bridge superstructure; and,
- Temporary storage and lay down of construction materials and vehicles.

Based on the conceptual drawings provided by MOT (Appendix A), the total area of temporary disturbances above the HWM is expected to be approximately 200 m^2.

Activities required to repair the single timber pile support require instream work and temporary riparian disturbance and are expected to include:

- Temporary foot access within riparian areas and the channel to conduct reinforcement and repair of the damaged piling;
- Installation of instream environmental control measures;
- Installation of a temporary exclusion structure to isolate the damaged piling from flowing water; and,
- Repairs of the piling including welding and the use of cementitious materials (grout or concrete).

The total area of temporary disturbance below the HWM is predicted to be approximately 50 m^2, with a permanent increase in the size of the piling of less than 1 m^2. Most of the temporary disturbance results from an approximated area of site isolation and dewatering around the damaged pile.

The instream component of the project will likely require the least time to complete, however it is the most sensitive with regard to potential effects to fish and fish habitat and is therefore the primary focus of this assessment. Overall project effects are also considered and discussed in the context of this report. The works are expected to be conducted in September 2011, at a time of low flow. The duration of the works is expected to be approximately two weeks.

3.0 AQUATIC EFFECTS ASSESSMENT

3.1 Methodology

The field reconnaissance generally followed the BC Resource Information Standards Committee (RISC) methods for aquatic habitat assessment (RISC 2008). Pedestrian traverses of upland, riparian and instream areas within the assessment area indicated in Figure 2 were conducted on June 17, 2011. Photos of the site taken during the reconnaissance are included in Appendix B. Fish species presence was assessed from existing government database records. The availability of abundant existing fish information for the Sweltzer River precluded the need for additional sampling as part of this assessment.

3.2 Site Description

The existing bridge across the Sweltzer River is located near the intersection of the Columbia Valley Highway and Lakeshore Drive, in the community of Cultus Lake, BC. The areas south, east and west of the bridge site are currently used for parkland, outdoor recreation and rural residential purposes. The areas north of bridge site are currently occupied by a community hall and a Fisheries and Oceans Canada (DFO) research facility (Cultus Lake Salmon Research Laboratory).

3.3 Fisheries Resources

3.3.1 Watercourses and Waterbodies

There are two watercourses or waterbodies potentially affected by Project works, as listed in Table 1 below. The Sweltzer River is the outlet stream of Cultus Lake (MOE 2011a). The Sweltzer River flows from the north end of Cultus Lake until it joins the Chilliwack River, approximately 2.8 kilometres to the northeast. Fish species documented to occur in these waters are listed in Table 2 below.

Table 1: Watercourse and Waterbody Information (MOE 2011a)

Name/Alias	Watershed Code	Waterbody Identifier	Watercourse Length or Waterbody Surface Area
Sweltzer River	100-065700-09700-13300	00000CHWK	2.77 km
Cultus Lake	100-065700-09700-13300	00117CHWK	627.28 ha

Table 2: Fish Species Occurring Within the Project Area (MOE 2011b)

Name/Alias	Fish Species Present
Sweltzer River	Coho salmon (*Oncorhynchus kisutch*); sockeye salmon/Kokanee *(O. Nerka)*, chinook salmon, (*O. tshawytscha*), pink salmon (*O. gorbuscha*), chum Salmon (*O. keta*), cutthroat trout (*O. clarkii*), Steelhead/Rainbow Trout (*O. mykiss*), mountain whitefish (*Prosopium williamsoni*), Dolly Varden char (*Salvelinus malma*), northern pikeminnow (*Ptychocheilus oregonensis*), redside shiner (*Richardsonius balteatus*), sucker (*Catostomus* sp.), prickly sculpin (*Cottus asper*)
Cultus Lake	Coho salmon (*Oncorhynchus kisutch*); sockeye salmon/Kokanee *(O. Nerka)*, chinook salmon, (*O. tshawytscha*), pink salmon (*O. gorbuscha*), chum salmon (*O. keta*), cutthroat trout (*O. clarkii*), Steelhead/Rainbow Trout (*O. mykiss*), lake whitefish (*Coregonus clupeaformis*), Dolly Varden char (*S. malma*), bull trout (*Salvelinus confluentus*), northern Pikeminnow pikeminnow (*P. oregonensis*), redside shiner (*R. balteatus*), peamouth chub (*Mylcheilus caurinus*), sucker (*Catostomus* sp.), coastrange sculpin (*Cottus aleuticus*),Cultus pygmy sculpin (*Cottus* sp. 2), longnose dace (*Rhinichthys cataractae*), Three-spine stickleback (*Gasterosteus aculeatus*), western brook lamprey (*Lampetra richardsoni*).

3.3.2 Fish Species-at-Risk

Two fish species-at-risk are documented to occur within or near to the Project area, as described below.

Cultus Lake Sockeye Salmon

The Cultus Lake sockeye salmon are a population of anadromous salmon that spawns in Cultus Lake (DFO 2008). This population of fish was declared as "endangered" in 2005 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), but is not currently listed under the Federal Species at Risk Act (SARA). The Sweltzer River is considered a critical migration corridor for the Cultus Lake sockeye salmon (Stone & Stone 2006). Adult sockeye enter Cultus Lake from early August to mid-November, with peak migration in August and September, but do not spawn until November/December (DFO 2008). The timing of this migration means that sockeye salmon will be migrating into Cultus Lake via the Sweltzer River through the Project area when instream works are expected to occur in September 2011.

Cultus Pygmy Sculpin

The Cultus Pygmy Sculpin (DFO 2007; MOE 2011c) is a small fish known only to occur within the pelagic waters of Cultus Lake. This fish is red-listed in BC and currently listed as Threatened by COSEWIC. This species of fish is listed under SARA, and is subject to protections and prohibitions under the BC *Wildlife Act*, *Fish Protection Act* and the Federal *Fisheries Act*. Current knowledge of the Pygmy Sculpin life history indicates it is pelagic for most of its life history, foraging in the deeper waters of Cultus Lake, and spawns from late May to early September, presumably in rocks and gravel in deeper portions of the shoreline. At present, spawning activity in streams has not been observed (DFO 2007). This would indicate that habitat for this species is unlikely to be adversely affected by the proposed Project works, but there is still some uncertainty regarding specific habitat requirements for this species.

3.4 Aquatic Habitat

Within the assessment area, the Sweltzer River is sinuous, with riffle-pool morphology and an average gradient of 1%. The average bankfull width of the channel is 29.3 m and the average wetted width was 28.0 m at the time of the assessment. The channel is relatively uniform in depth with an average bankfull depth of 1.3 m and average water depth of 0.66 m at the time of the assessment. The Sweltzer River is perennially wetted, and the dominant bed material is gravel and sand. Directly under the bridge, the channel is 34 m in width, with a wetted width of 31 m, bankfull depth of 1.4 m and water depth of 0.6 m at the time of the assessment. The dominant substrate at this location is sand. Instream cover within the Project area was assessed as moderate, consisting primarily of instream vegetation (cattail and bulrushes) upstream (west) of the bridge; undercut banks and overhanging vegetation along the south bank of the assessment area; and pool areas downstream of the bridge. Very few pieces of functional large woody debris were observed.

3.4.1 Fish Habitat

Overall fish habitat quality within the general Project area and specifically at the bridge location was assessed as moderate to good, but in general lacks more complex habitat features and instream cover. Rearing and overwintering habitat potential was assessed as good, based on the presence of perennial flows, sufficient water depth, and proximity to accessible riverine habitat downstream and lacustrine habitat (Cultus Lake) upstream. Migration habitat potential was assessed as good to excellent based on the observed water depth, perennial flow, shallow gradient and unobstructed passage to and from Cultus Lake. The Sweltzer River is considered a critical migration corridor for the Cultus Lake sockeye salmon (Stone & Stone 2006). Spawning habitat potential was assessed as moderate to good, based on observed water depth, flow, gradient, and the presence of suitably sized gravels. Spawning areas have been identified upstream of the Project site at the outlet of Cultus Lake (Stone & Stone 2006). However, observations made during the field reconnaissance indicate that spawning habitat within the Project area is best downstream of the bridge, and that spawning habitat potential is low to moderate directly beneath the bridge as the substrate is mainly sand.

3.4.2 Instream Vegetation

Instream vegetation within the assessment area is limited primarily to a large area of bulrush (*Schoenoplectus* spp.) and cattails (*Typhus latifolia*) located west (upstream) of the bridge site as indicated on Figure 2. Within the remainder of the channel, instream vegetation is very sparse and limited to the channel margins. The invasive Yellow-Flag Iris (*Iris pseudacorus)* was also observed in the Project area. At the bridge, no instream vegetation was observed.

3.4.3 Riparian Vegetation

Riparian vegetation in the general Project area is generally described as mature, mixed second-growth forest, consisting mainly of deciduous species on the north bank and coniferous species on the south bank. The riparian areas adjacent to the Sweltzer River have been substantially modified by past recreational use and rural residential development. Tree species observed were Red cedar (*Thuja plicata*), Amabilis Fir (*Abies amabilis*), Douglas Fir (*Pseudotsuga menziesii*), Red Alder (*Alnus rubra*), Bigleaf maple (*Acer macrophyllum*), and

unidentified horticultural varieties. The understorey consists primarily of Salmonberry (*Rubus spectabilis*), Thimbleberry (*Rubus parviflorus*) and invasive Himalayan Blackberry (*Rubus discolor*). Riparian groundcover was predominantly unidentified grasses and forbs. At the bridge crossing, the riparian areas of least sensitivity (predominantly introduced grasses and forbs) were directly adjacent to the bridge approaches, including the southwest corner of the bridge nearest to the location of the damaged piling.

4.0 ENVIRONMENTAL EFFECTS ASSESSMENT

4.1 Aquatic Habitat Effects

Golder anticipates that limited disturbance of instream habitat will be required during Project works and this could result in potential adverse effects to aquatic habitat and fish species in the Project area. These potential effects are:

- Habitat alteration, disturbance or disruption;
- Elevated suspended sediment levels or water quality changes; and,
- Introduction of deleterious substances.

4.1.1 Aquatic Habitat Alteration, Disturbance or Disruption

Based on available project information, as described in Section 2.0, the expected area of temporary disturbance within the Sweltzer River channel is approximately 50 m^2. This is based on the estimated area required to access, isolate and repair the damaged piling. Temporary disturbances would be caused by foot access within the channel and by the placement of instream sediment controls, fish exclusion barriers and site isolation/dewatering equipment around the damaged piling. After construction, all temporary structures would be removed. The extent of permanent alteration of instream habitat is estimated at less than 1 m^2, consisting solely of the slight increase in diameter of the repaired piling.

4.1.2 Elevated Suspended Sediment Levels and Water Quality Changes

Instream construction activities and surface erosion from disturbed banks have the potential to increase suspended sediment levels within the Sweltzer River. The effects of introduced suspended sediment on fish include altered behaviour and/or physiology. Increased egg mortality, decreased hatching success, and loss of suitable spawning substrate are potential results of elevated suspended sediment levels. Behavioural responses experienced by fish exposed to elevated suspended sediment levels include disruption of territorial behaviour, out-migration, and depressed feeding rate. The severity of the effects of an increase in suspended sediment levels is a function of both sediment concentrations and duration of the sediment episode.

4.1.3 Introduction of Deleterious Substances

Spills of some substances such as fuel, oil, grease from accidental leaks, or spills from equipment working in or around watercourse crossings, could reach surface waters directly or by surface runoff. Spills can affect fish health as spilled chemicals may be acutely or chronically toxic to fish, affecting normal survival, growth, development, or reproduction.

In addition, grout or concrete being used to repair and reinforce the damaged piling could be exposed to surface water or bank runoff. Concrete, cement, mortars, grouts and other Portland cement or lime-containing construction materials are highly basic or alkaline (pH of uncured concrete is approximately 13; recommended pH range for aquatic life is 6.5 to 9.0) and are highly toxic to fish. These materials can also be sources of increased suspended sediment levels, with potentially harmful and toxic effects as described in Section 4.1.2 above.

4.2 Riparian Habitat Effects

4.2.1 Vegetation

The proposed project works are not expected to require or result in large scale disturbance of riparian areas. The total area of upland disturbance is estimate at approximately 200 m^2, and primarily limited to the approach road right-of-way, or other areas developed for parking or otherwise previously disturbed. Disturbance to riparian vegetation to provide foot access the channel is expected to be less than 10 m^2 and limited to those areas immediately adjacent to the bridge abutments. The riparian vegetation at these locations is primarily introduced grasses and forbs of low ecological value.

4.2.2 Wildlife

Based on the provided Project information, and similar to the potential effects predicted for riparian vegetation, the disturbance, alteration or removal of habitat and resources for terrestrial wildlife is not expected to result from Project activities. The disturbance of preferred habitat for terrestrial species-at-risk is also considered low. Therefore, potential effects to terrestrial wildlife species are anticipated to be limited mainly to:

- Temporary disturbance or accidental harm/mortality during construction;
- Accidental introduction of contaminants into the environment during the construction phase; and,
- Localized, short-term impacts to air quality and noise generation, as a result of operation of heavy machinery during construction.

5.0 PROJECT MITIGATION STRATEGIES

Potential effects of the proposed works on terrestrial and aquatic ecosystems can be avoided, mitigated, or managed through implementation of the best management practices (BMPs) and general habitat protection measures. Given the high ecological value and sensitivity of the instream portion of Project area, the general mitigation strategy for the Project should include minimizing the footprint and duration of all instream and upland

work areas as much as possible. Preference should also be given to work methods that allow repairs and maintenance to occur from the bridge deck or above the HWM. If it is possible to satisfactorily repair the damaged piling without requiring access or disturbance of the channel, that work method should be preferentially used. Additional recommended mitigation strategies are provided in the following sections.

5.1 Environmental Management Plan

For the proposed Project, it is recommended that an Environmental Management Plan (EMP) be prepared by a qualified environmental professional on behalf of the construction contractor to provide prescriptive guidance for environmental protection measures during project works. The EMP shall be consistent with the requirements of Section 165 (Protection of the Environment) of the MOT's Standard Specifications for Highway Construction[1] and with the BC MOE's recommended BMPs for instream works. Specifically, this includes the mitigation strategies contained in the Fisheries and Oceans Canada (DFO) Operational Statement for Bridge Maintenance (DFO 2007a) and in "General BMPs and Standard Project Considerations" and "Bridge Superstructure Maintenance and Repair" as detailed in the MOE's Instream Works guidebook[2] (MOE 2011d). The EMP will provide measures to avoid, minimize or mitigate adverse environmental effects from the planned works and to achieve compliance with the terms and conditions of environmental permits, authorization and approvals issued for the Project.

In addition, the EMP would outline the necessary content and requirement for the submission, by the successful Contractor, of detailed, site-specific EMP Component Plans (*i.e.*, Erosion and Sediment Control Plan, Construction Materials and Waste Management Plan, Spill Prevention and Emergency Response Plan). The Component Plans would provide site-specific mitigation measures to achieve compliance with the EMP and applicable legislation and regulations, and environmental permitting for the Project.

5.2 Environmental Monitoring

Golder recommends that an appropriately qualified professional Environmental Monitor (EM) be retained during Project works to inspect, provide recommendations, and report on the implementation of the EMP and recommended mitigation measures. The role of the Environmental Monitor will be to monitor, evaluate, and report on the performance of construction activities, and effectiveness of environmental control strategies and mitigation measures in achieving compliance with environmental regulatory permits, approvals and authorizations, and legislation. Environmental monitoring by qualified personnel can also reduce the likelihood of activities, whether accidental or intentional, which contravene environmental legislation and regulations.

Responsibilities of the Environmental Monitor typically include the following:

- Confirming that the environmental management measures, controls, and specifications are properly implemented as per the terms and conditions of any regulatory permits and approvals for the works;

[1] "2009 Standard Specifications for Highway Construction, http://www.th.gov.bc.ca/publications/const_maint/contract_serv/standardspecs.htm

[2] Available online at http://www.env.gov.bc.ca/wld/instreamworks/introduction.htm

- Liaising with regulatory agencies, and other key stakeholders;
- Providing technical assistance on environmental matters to construction personnel and regulatory agencies;
- Inspecting activities during construction to evaluate and report on compliance with terms and conditions of approvals and permits;
- Providing recommendations for modifying and/or improving environmental mitigation measures, as necessary;
- Documenting construction activities with field notes and photographs;
- Suspending construction activities that are causing, or potentially causing, risk of environmental damage; and,
- Preparing factual environmental monitoring summary reports throughout the duration of construction which summarize activities and actions taken to minimize potential effects during each of the construction activities.

5.3 Reduced Risk Instream Work Windows

Works in and about watercourses are usually undertaken at times of the year during lower flow periods when spawning is not taking place, the potential for eggs or alevins to be present is low, and overwintering juveniles are not present. Based on the fish species known to occur or migrate through the Project area, the period of lowest risk for instream works is July 31 to August 15 (MOE 2006). However, construction of this project is intended to occur between September 6 and October 31, which is outside the above reduced risk window. It should be noted that this is a general recommendation for streams within the Lower Mainland area and that the specific least risk work window for the Sweltzer River will need to be determined and mutually agreed to in consultation with MOE, DFO and MOT prior to commencing construction once a more definitive description of the nature, extent and duration of the instream works portion of the project is available from MOT's Contractor and a more detailed mitigation strategy to minimize potential effects can be provided.

5.4 Species-at-Risk

As identified in Section 3.3.2, there are two aquatic species-at-risk known to occur within or near the Project area. The "Guidelines for Reduced Risk Instream Work Windows" for the Lower Mainland Region (MOE 2006) state that where works in and around a stream can potentially impact any COSEWIC or Provincially "Red" or "Blue" listed species-at-risk, appropriately qualified professional biologists should be retained to assist in project planning, design and monitoring, to minimize risk and facilitate compliance with species-at-risk legislation. In particular, the BC MOE's Lower Mainland Region Species at Risk biologists should be contacted for project specific guidance on the timing of works on streams that support Species at Risk (MOE 2006).

5.5 Work Site Isolation

Prior to undertaking instream works, the following environmental mitigation measures are recommended to maintain unrestricted flows and downstream water quality, and to avoid direct disturbance to aquatic organisms present within the watercourse.

- Wherever possible, conduct bridge repair activities from the bridge deck and above the HWM of the channel to minimize the disturbance of habitat and aquatic wildlife;
- Undertake works during a low flow period, and limit the time spent within the channel to the extent possible;
- Install instream sediment control works and fish exclusion nets around work and access areas within the channel prior to the start of construction;
- Depending on the work method used to repair the piling, install a temporary instream structure (sandbag coffer dam or similar) to facilitate full isolation and dewatering of the channel area around the piling;
- Complete a salvage of fish that may be present within isolated work areas before the start of construction. An appropriately qualified professional must complete the salvage. It is the responsibility of the salvage crew to obtain the Scientific Fish Collection Permit required by applicable provincial and Federal legislation before conducting the salvage activities.
- Employ appropriate handling and release techniques to minimize the potential for damage or injury to fish or other organisms rescued during salvages;
- Following the salvage, dewater the isolated portions of the stream channel requiring instream works using a suitably sized pump;
- As a precaution, screen the intake of any pumps used for withdrawing the water from the work areas in accordance with DFO's *Fish Screening Directive* (DFO1995) with 2.54 mm mesh size and a minimum unobstructed screen area of 0.93 m^2 (10 square feet) for each 0.0283 m^3/sec (1 cfs) of water entering the intake; and,
- Do not allow water pumped from the work areas to directly re-enter watercourses or waterbodies if it contains suspended sediments or other potentially deleterious substances.

5.6 Erosion and Sediment Control

Instream construction activities and surface erosion from upland construction activities have the potential to increase suspended sediment levels within the Sweltzer River. To avoid adverse effects to fish and fish habitat, the following measures are recommended:

- Install erosion and sediment control measures around instream work areas prior to commencing works;
- Undertake upland vegetation clearing, if required, immediately prior to excavation and earthworks to minimize the length of time that soils are exposed;
- Delineate project area boundaries with high visibility snow fencing, or other suitable means, such that riparian vegetation in adjoining areas will not be disturbed;

- Implement and maintain preventative measures in anticipation of the potential generation and release of sediment-laden water during construction (*e.g.* silt fences, check dams, interception ditches) as necessary in accordance with permits and approvals, BMPs and anticipated field conditions;
- On erosion-prone slopes, cover exposed soils with geo-textiles, tarpaulins or straw to prevent erosion;
- Restrict vehicles and equipment to designated work areas and designated access routes;
- Store and contain excavation soil, construction waste or other substances deleterious to aquatic life in a manner which prevents their entry into watercourses or waterbodies, and dispose of such materials in a suitable off-site location;
- Fill material placed within the average HWM of the stream, if necessary, should be free of silt, overburden, debris or other substances deleterious to aquatic life;
- Suspend works during intense rainfall events or when surface erosion occurs which may negatively affect water quality conditions;
- Stabilize exposed or disturbed areas of soil to minimize erosion potential and re-seed or replant as soon as possible; and,
- Conduct instream works in isolation of flowing waters as described above in Section 5.5.

5.7 Spill Prevention and Emergency Response

The proposed construction works will require heavy machinery to complete the bridge repair and maintenance activities. The following environmental mitigation measures are recommended to minimize potential effects to aquatic habitat within and downstream of the site during construction.

5.7.1 Equipment Fuelling & Maintenance

- Maintain equipment be used by construction crews in good working order, without leaks or excess grease on lubrication points;
- Remove construction equipment from fisheries sensitive zones at the end of each workday;
- Conduct fuelling of vehicles and equipment and equipment maintenance more than 20 m from any watercourse or waterbody;
- Equip service vehicles used for fuelling with automatic shut-off valves;
- Equip each piece of heavy equipment with spill kits with absorbent pads and containment booms;
- Equip heavy equipment operating near or above the aquatic environment with biodegradable, hydraulic oil; and,

- Contain used oil, filters, grease cartridge lubrication containers and other products or wastes from equipment maintenance in a secure, covered receptacle and dispose of off-site at a facility permitted to handle such wastes.

5.7.2 Fuel Handling and Spills

- Avoid bulk storage of fuel on-site;
- Store and handle flammable substances in compliance with the *Transportation of Dangerous Goods* and *Worksafe BC* regulations;
- Report all spills or suspected spills of petroleum products or other potentially harmful materials to DFO and MOT (a responsibility of the Environmental Monitor);
- Keep spill kits with absorbent materials ready at hand on-site at all times; and,
- Contain and clean up identified spills immediately. Contaminated absorbent materials, soils and vegetation should be properly contained and removed for appropriate off-site disposal at a facility permitted to handle such wastes.

5.8 Cementitious Materials Control

All repair work involving the use of concrete, cement, mortars, grout and other Portland cement or lime-containing construction materials should be conducted so that sediments, debris, concrete, and concrete fines are not deposited, either directly or indirectly, into the aquatic environment. The following precautions and mitigation measures are recommended to limit the potential for generation and release of suspended sediments and the potential for elevated pH levels:

- Prevent water contacting uncured or partly cured concrete, grout or Portland cement or lime-containing construction materials from entering, directly or indirectly, the aquatic environment unless it has been tested and found to have a pH of between 6.5 and 9.0 pH units and a turbidity of less than 25 NTU;
- Have an appropriate pH remediation system, such as a CO_2 tank and diffuser, available during concrete works and have the system ready for immediate deployment should a concrete release occur;
- Isolate instream or near-stream concrete from flowing water for a minimum of 72 hours;
- Do not schedule cast-in-place concrete work when there is a high probability of inclement weather within 72 hours of the pour;
- Collect, contain and remove from site for treatment and disposal all concrete wash water;
- Do not dispose of excess concrete on-site; and,

- Measure and record in-situ pH regularly during concrete works. The required frequency of this monitoring should be developed in consultation with the regulatory agencies, and may require continuous monitoring during sensitive periods. If pH values below 6.5 or above 9.0 are observed, implement emergency mitigation procedures immediately.

5.9 Waste Management

Cleanup and housekeeping of the site should be a constant requirement during the construction period. The contractor should, at all times, keep the work site free from accumulations of waste materials generated by employees or by the work. On completion of construction, the Contractor should remove all temporary structures, rubbish, and waste materials resulting from the operation and dispose of such materials appropriately off-site.

5.10 Vegetation and Wildlife

Potential adverse effects to terrestrial wildlife and habitat are not anticipated. However, the following are recommended measures to prevent, minimize, or manage potential effects of the proposed works on vegetation and terrestrial wildlife:

- Minimize clearing and grubbing activities to those areas required to complete construction activities;
- Retain trees, wherever possible;
- Avoid clearing and grubbing during the bird nesting period (typically from April 1st to July 31st). Should it be necessary to undertake clearing activities during this period, it is recommended that a breeding bird and nest survey be conducted by a qualified biologist to ensure active nest sites will not be disturbed by project activities;
- Whenever possible, schedule construction activities to avoid daily sensitive times for wildlife, such as dawn or dusk;
- Implement best construction practices to minimize noise generation during the construction phase;
- Dispose of cleared native and non-native vegetation species at an appropriate location to prevent expansion of invasive, non-native species into adjacent areas. This includes the potential removal and disposal of invasive aquatic vegetation;
- Re-vegetate any disturbed areas as soon as possible after construction by planting and seeding with native trees, shrubs or grasses and cover such areas with straw to prevent erosion and to help seeds germinate; and,
- Follow the DFO guidance on Riparian Revegetation (DFO 2010) for seeding and replanting of riparian vegetation. If there is insufficient time remaining in the growing season, stabilize the site and cover exposed areas to prevent erosion and vegetated the following spring.

6.0 CONCLUSIONS

The proposed works are intended to extend the operational life of the bridge over the Sweltzer River and avoid more invasive or disruptive repair and reconstruction works in the near future. Based on Golder's understanding of the project and that the preferred construction method will consider minimizing risk to the environment, we anticipate that potential adverse effects resulting from the proposed works can be successfully managed with careful implementation of effective mitigation measures provided in a comprehensive EMP.

7.0 LIMITATIONS AND USE OF REPORT

This report was prepared for the exclusive use of the Ministry of Transportation and Infrastructure (MOT), its assignees and representatives, and is intended to serve as an Aquatic Effects Assessment for repairs and resurfacing of the bridge across the Sweltzer River located near the intersection of the Columbia Valley Highway and Lakeshore Drive, Lake in the community of Cultus Lake, BC.

This report is limited to an assessment of potential effects of the Project on aquatic and riparian habitats and is not intended to meet the requirements of an environmental assessment under the *Canadian Environmental Assessment Act* (CEAA). This report is not intended to identify or evaluate potential effects outside of the proposed Project area.

The inferences concerning the conditions of the Site are based on information obtained from a limited review of available literature, and a field reconnaissance conducted by Golder staff on June 17, 2011. In developing this environmental overview report, Golder has relied in good faith on information provided by government and MOT. We accept no responsibility for any deficiency or inaccuracy contained in this report as a result of our reliance on the aforementioned information.

The findings and conclusions documented in this Report have been prepared for the specific application to this Project and have been developed in a manner consistent with the level of care normally exercised by environmental professionals currently practicing under similar conditions in the jurisdiction. Golder makes no other warranty, expressed or implied.

Any use which a third party makes of this Report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Golder accepts no responsibility for damages, if any suffered, by any third party as a result of decisions made or actions based on this Report.

8.0 CLOSURE

We trust that the information contained in this report meets your present requirements. Please contact us if you have any questions or concerns regarding the above.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

Michael Achuff, AScT., B.I.T.
Environmental Scientist

Reviewed by:

ORIGINAL SIGNED

Shawn Redden, B.Sc., R.P.Bio
Senior Biologist

ORIGINAL SIGNED

Patrick Brisbin, P.Eng., P.Ag.
Associate, Water Resources Engineer and Agrologist

MA/SR/PEB/tk

\\bur1-s-filesrv2\final\2011\1422\11-1422-0030\1114220030-002-r-rev1-1100 aea cultus 0714_11.docx

9.0 REFERENCES

Fisheries and Oceans Canada (DFO). 1995. Freshwater Intake End-of-Pipe Fish Screen Guideline. Available at: http://www.dfo-mpo.gc.ca/Library/223669.pdf

DFO. 2007a. Bridge Maintenance – Pacific Region Operational Statement. Available at: http://www.pac.dfo-mpo.gc.ca/habitat/os-eo/pdfs/bridge_maintenance_e.pdf

DFO. 2007b. Recovery Strategy for Cultus Pygmy Sculpin (Cottus sp.) in Canada. Species at Risk Act Recovery Strategy Series. Available at: http://dsp-psd.pwgsc.gc.ca/collection_2007/ec/En3-4-43-2007E.pdf

DFO. 2008. Aquatic Species at Risk – Sockeye Salmon (Cultus Lake). Available at: http://www.dfo-mpo.gc.ca/species-especes/species-especes/cultus_sockeyesalmon-saumonsockeye-eng.htm

DFO. 2010. Riparian Areas and Revegetation. Available at: http://www.pac.dfo-mpo.gc.ca/habitat/reveg/index-eng.htm

BC Ministry of Environment (MOE). 2006. "Guidelines for Reduced Risk Instream Work Windows, Ministry of Environment, Lower Mainland Region (March 2006)". Available at: http://www.env.gov.bc.ca/wsd/regions/sry/wateract/work_windows_sry.pdf.

MOE. 2011a. Habitat Wizard. Available at: http://webmaps.gov.bc.ca/imf5/imf.jsp?site=moe_habwiz.

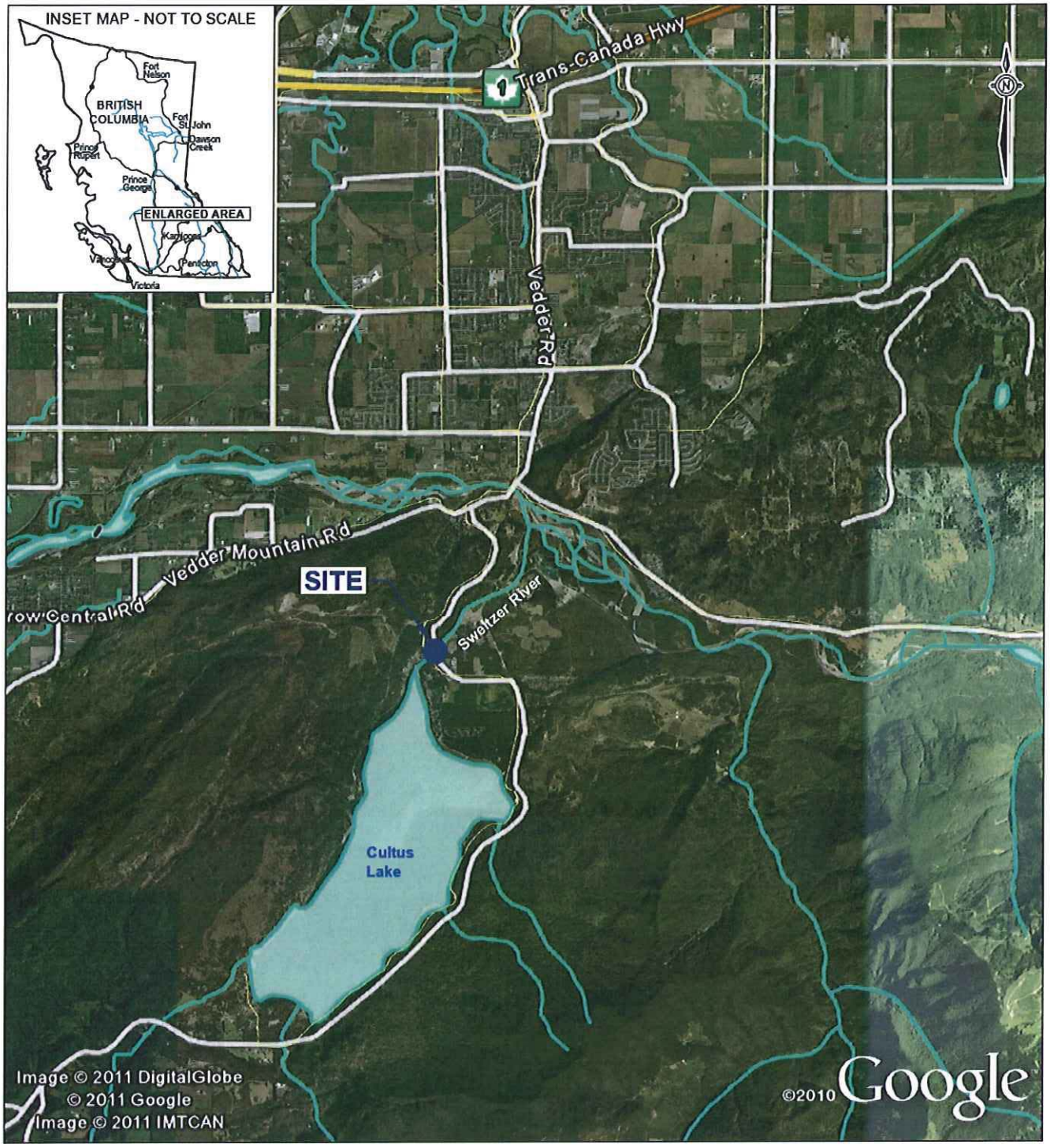
MOE. 2011b. Fisheries Information Summary System (FISS). Available at: http://a100.gov.bc.ca/pub/fidq/main.do;jsessionid=8e248a8d30d9efb986607604472d8c42d9f3ff1d8b25.e3uMah8KbhmLe34QbN4MchyOaxb0n6jAmljGr5XDqQLvpAe

MOE. 2011c. Conservation Data Centre's BC Species and Ecosystem Explorer. Available at: http://a100.gov.bc.ca/pub/eswp/.

MOE . 2011d. Instream Works Guidebook. http://www.env.gov.bc.ca/wld/instreamworks/introduction.htm

Resource Information Standards Committee (RISC). 2008. Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Site Card Field Guide. April 2008. Version 2.0.

Stone, David Leigh and Stone, Jennifer McKim. 2006. "Caring for Cultus Lake." Available online at http://www.cultuslake.bc.ca/attachments/40/Caring_for_Cultus_Lake.pdf



1.5 0 1.5
SCALE (APPROX.) KILOMETRES

PROJECT MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SWELTZER RIVER BRIDGE REHABILITATION
AQUATICS EFFECTS ASSESSMENT
CULTUS LAKE, B.C.

TITLE

KEY PLAN

REFERENCE

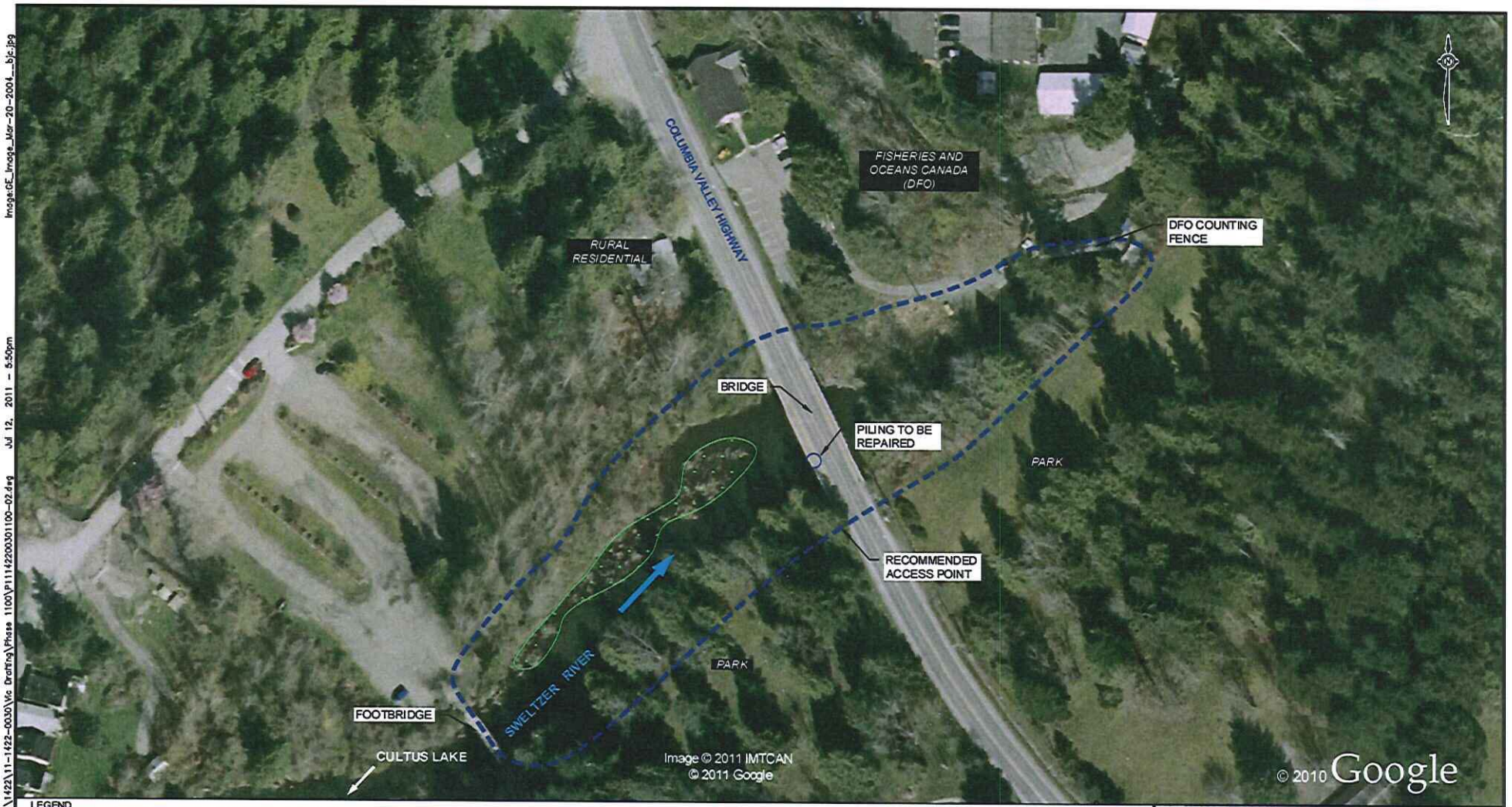
IMAGE OBTAINED FROM GOOGLE EARTH, USED UNDER LICENSE. GOOGLE EARTH IMAGE IS NOT TO SCALE.
ADDITIONAL BASE DATA OBTAINED FROM GeoBC WEB MAPPING SERVICES.

Golder Associates
Victoria, BC

PROJECT	11-1422-0030		FILE No.	K1114220030 1100-01
DESIGN	MA	29 JUN 11	SCALE	AS SHOWN REV. 0
CADD	JEF	12 JUL 11		
CHECK	MA	12 JUL 11		
REVIEW	SR	12 JUL 11		

FIGURE: 1

\\vic1-s-filesrv1\Data\Active\2011\1422\11-1422-0030\Vic Drafting\Phase 1100\K1114220030 1100-01.dwg Jul 12, 2011 - 5:52pm



LEGEND

- ASSESSMENT STUDY AREA
- CATTAIL, BULRUSHES
- DIRECTION OF FLOW

REFERENCE

IMAGE OBTAINED FROM GOOGLE EARTH, USED UNDER LICENSE. IMAGERY DATE: MARCH 20, 2004. GOOGLE EARTH IMAGE IS NOT TO SCALE.

20 0 20
SCALE (APPROX.) METRES

PROJECT: MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SWELTZER RIVER BRIDGE REHABILITATION
AQUATICS EFFECTS ASSESSMENT
CULTUS LAKE, B.C.

TITLE: SITE PLAN

Golder Associates Victoria, BC

PROJECT	11-1422-0030	FILE No.	P1114220301100-02		
DESIGN	MA	29 JUN 11	SCALE	AS SHOWN	REV. 0
CADD	AW	30 JUN 11			
CHECK	MA	12 JUL 11			
REVIEW	SR	12 JUL 11			

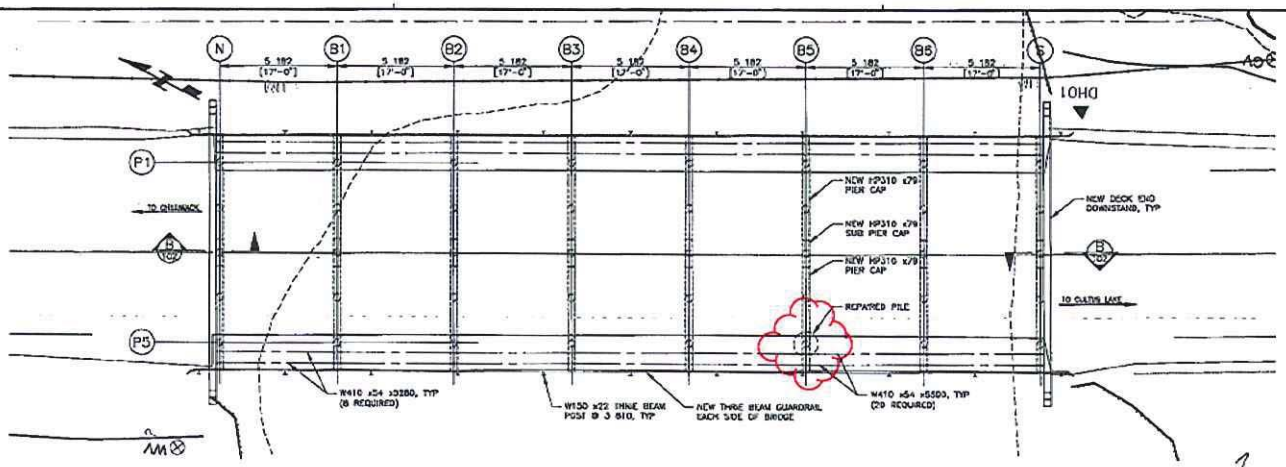
FIGURE: 2

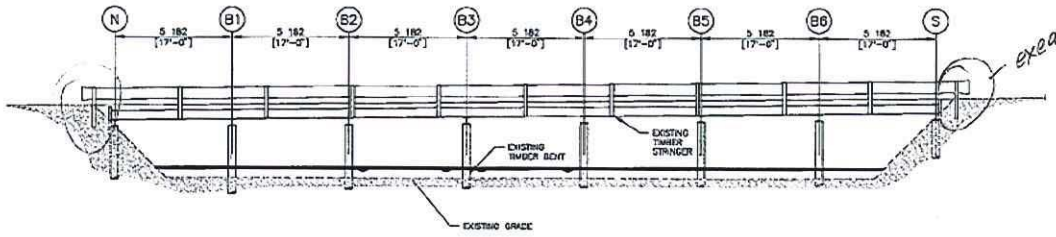
\\vic1-s-filesrv1\data\Active\2011\1422\11-1422-0030\06 Drafting\Phase 1100\P1114220301100-02.dwg Jul 12, 2011 - 5:50pm Image:GE_Image_Mar-20-2004__b|c.jpg

APPENDIX A

Conceptual Drawings

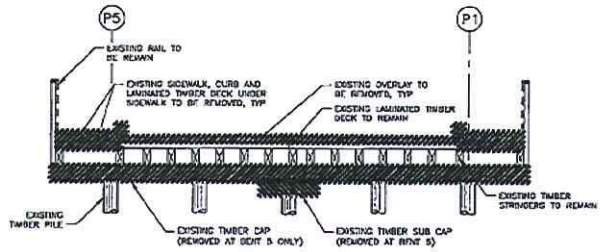
May 26, 2011



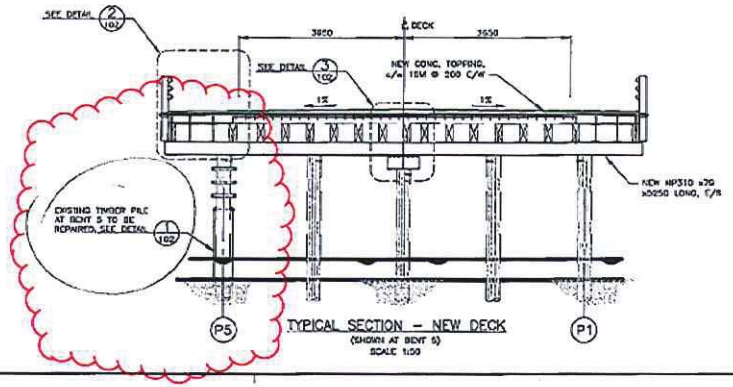


ELEVATION
SCALE 1:100

exaggeration?



TYPICAL SECTION – EXISTING DECK
SCALE 1:50



TYPICAL SECTION – NEW DECK
(SHOWN AT BENT 5)
SCALE 1:50

PRELIMINARY NOT FOR CONSTRUCTION

Consultant Logo: Associated Engineering

Rev	Date	Description	Init

REVISIONS

BRITISH COLUMBIA | Ministry of Transportation & Infrastructure
SOUTH COAST REGION

COLUMBIA VALLEY DISTRICT
COLUMBIA VALLEY HIGHWAY

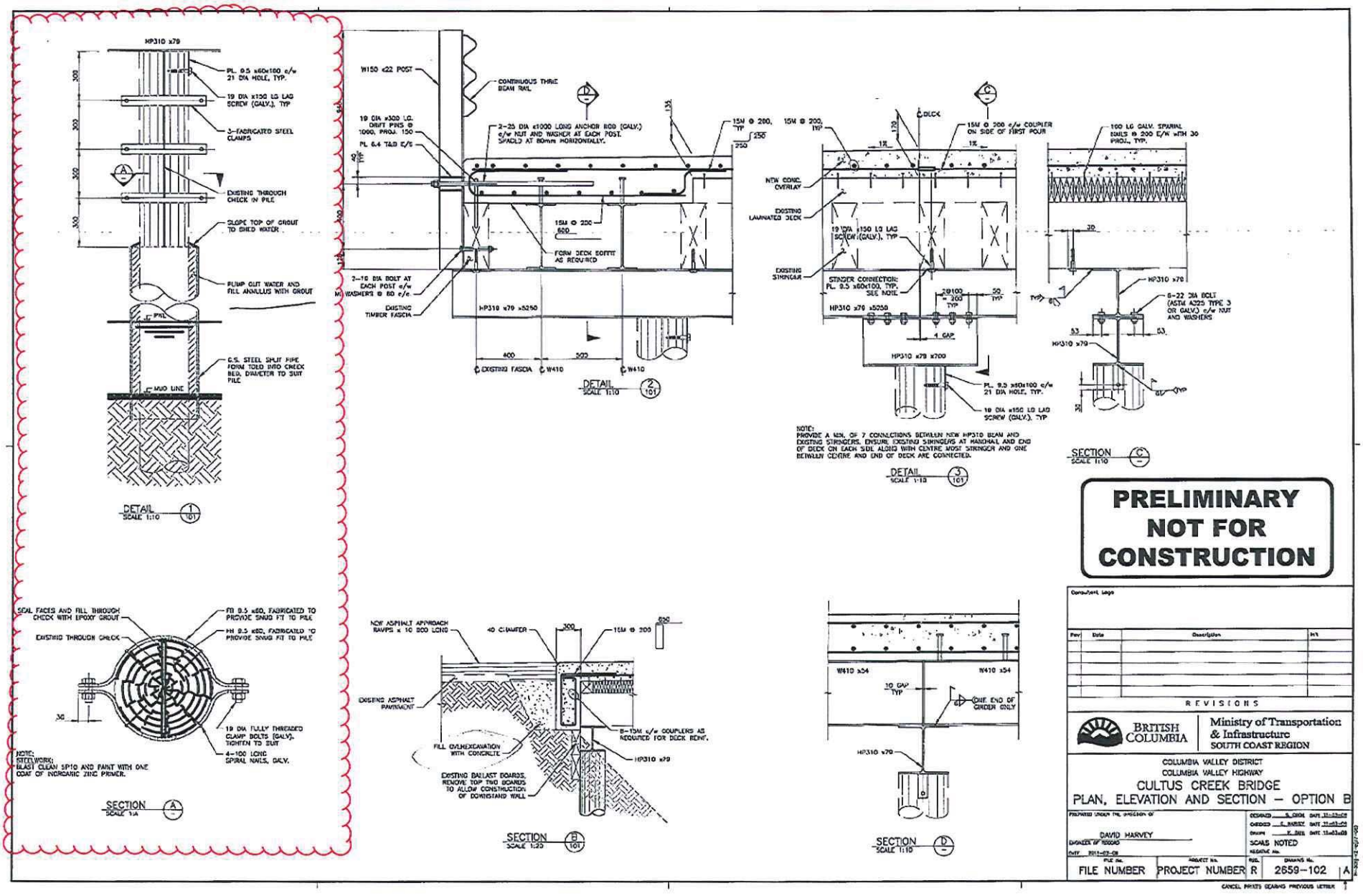
CULTUS CREEK BRIDGE
PLAN, ELEVATION AND SECTION – OPTION B

PREPARED UNDER THE DIRECTION OF
DAVID HARVEY
ENGINEER OF RECORD
DATE 2011-05-06

DESIGNED S. COOK DATE 11-05-06
CHECKED D. HARVEY DATE 11-05-06
DRAWN K. BUS DATE 11-05-06
SCALE AS NOTED
NEGATIVE No.

FILE No.	PROJECT No.	REG.	DRAWING No.	
XXXX	XXXXX	X	2659–101	A

CANCEL PRINTS BEARING PREVIOUS LETTER


HP310 x79
PL. 9.5 x60x100 c/w 21 DIA HOLE, TYP.
19 DIA x150 LG LAG SCREW (GALV.), TYP.
3-FABRICATED STEEL CLAMPS
EXISTING THROUGH CHECK IN PILE
SLOPE TOP OF GROUT TO SHED WATER
PUMP OUT WATER AND FILL ANNULUS WITH GROUT
PWL
MUD LINE
C.S. STEEL SPLIT PIPE FORM TOLD INTO CHECK REQ. DIAMETER TO SUIT PILE
DETAIL SCALE 1:10 1/101
W150 x22 POST
CONTINUOUS THRIE BEAM RAIL
19 DIA x300 LG. DRIFT PINS @ 1090, PROJ. 150
PL 6.4 T&B E/S
2-25 DIA x1000 LONG ANCHOR ROD (GALV.) c/w NUT AND WASHER AT EACH POST. SPACED AT 80mm HORIZONTALLY.
15M @ 200, TYP
15M @ 200
FORM DECK SOFFIT AS REQUIRED
2-19 DIA BOLT AT EACH POST c/w M WASHERS @ 80 c/c
EXISTING TIMBER FASCIA
HP310 x79 x5250
400
500
EXISTING FASCIA
W410
DETAIL SCALE 1:10 2/101
DECK
15M @ 200 c/w COUPLER ON SIDE OF FIRST POUR
NEW CONC. OVERLAY
EXISTING LAMINATED DECK
19 DIA x150 LG LAG SCREW (GALV.), TYP
EXISTING STRINGER
STRDER CONNECTION: PL. 9.5 x60x100, TYP. SEE NOTE
HP310 x79 x5050
29100 x 200 TYP
50 TYP
4 GAP
HP310 x79 x200
PL. 9.5 x60x100 c/w 21 DIA HOLE, TYP.
19 DIA x150 LG LAG SCREW (GALV.), TYP
NOTE:
PROVIDE A MIN. OF 7 CONNECTIONS BETWEEN NEW HP310 BEAM AND EXISTING STRINGERS. ENSURE EXISTING STRINGERS AT ABUTMENT AND END OF DECK ON EACH SIDE ALONG WITH CENTRE MOST STRINGER AND ONE BETWEEN CENTRE AND END OF DECK ARE CONNECTED.
DETAIL SCALE 1:10 3/101
100 LG GALV. SPIRAL NAILS @ 200 E/W WITH 30 PROJ., TYP.
HP310 x79
6-22 DIA BOLT (ASTM A325 TYPE 3 OR GALV.) c/w NUT AND WASHERS
SECTION SCALE 1:10 C/-
SEAL FACES AND FILL THROUGH CHECK WITH EPOXY GROUT
EXISTING THROUGH CHECK
FB 9.5 x60, FABRICATED TO PROVIDE SNUG FIT TO PILE
PB 9.5 x60, FABRICATED TO PROVIDE SNUG FIT TO PILE
36
19 DIA FULLY THREADED CLAMP BOLTS (GALV), TIGHTEN TO SUIT
4-100 LONG SPIRAL NAILS, GALV.
NOTE:
STEELWORK:
BLAST CLEAN SP10 AND PAINT WITH ONE COAT OF INORGANIC ZINC PRIMER.
SECTION SCALE 1:5 A/-
NEW ASPHALT APPROACH RAMPS x 10 000 LONG
40 CHAMFER
300
15M @ 200
600
EXISTING ASPHALT PAVEMENT
FILL OVEREXCAVATION WITH CONCRETE
8-15M c/w COUPLERS AS REQUIRED FOR DECK REINF.
HP310 x79
EXISTING BALLAST BOARDS, REMOVE TOP TWO BOARDS TO ALLOW CONSTRUCTION OF DOWNSTAND WALL
SECTION SCALE 1:25 B/101
W410 x54
W410 x54
30 GAP TYP
ONE END OF GIRDER ONLY
HP310 x79
SECTION SCALE 1:10 D/-
PRELIMINARY NOT FOR CONSTRUCTION
Consultant Logo
Rev | Date | Description | Init
REVISIONS
BRITISH COLUMBIA
Ministry of Transportation & Infrastructure
SOUTH COAST REGION
COLUMBIA VALLEY DISTRICT
COLUMBIA VALLEY HIGHWAY
CULTUS CREEK BRIDGE
PLAN, ELEVATION AND SECTION – OPTION B
PREPARED UNDER THE SUPERVISION OF
DAVID HARVEY
ENGINEER OF RECORD
DATE 2011-03-08
DESIGNED S. CHOW DATE 11-03-08
CHECKED C. BARRY DATE 11-03-08
DRAWN K. SEE DATE 11-03-08
SCALE NOTED
REGION No.
FILE No.
PROJECT No.
REG. DRAWING No.
FILE NUMBER
PROJECT NUMBER
R 2659-102 A
CANCEL PRINTS BEARING PREVIOUS LETTER

APPENDIX B

Site Photographs

Photograph 1: View of the downstream portion of the Project area showing riparian conditions. DFO counting fence is visible in the background.

Photograph 2: View of upstream portion of the Project area showing riparian and instream vegetation conditions. The cattail/bulrush area is the largest section of instream vegetation.

Photograph 3: View of piling repair location looking downstream. Recommended instream access would be from the right hand (southern) side of the photograph.

Photograph 4: View of piling repair location. Substrate at this location is predominantly sand; water depth was 0.6m.

Photograph 5: View of channel and riparian conditions at the southwest corner of the bridge. This area is the recommended instream access point.

Photograph 6: View of channel and riparian conditions at the southeast corner of the bridge.

At Golder Associates we strive to be the most respected global group of companies specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

Africa	+ 27 11 254 4800
Asia	+ 852 2562 3658
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

Golder Associates Ltd.
#300 – 2190 West Railway Street
Abbotsford, British Columbia, V2S 2E2
Canada
T: +1 (604) 850 8786

Golder Associates