MEMO

TO: British Columbia Ministry of Transportation and Infrastructure

FROM: WSP Canada Group Ltd.

SUBJECT: **Island Rail Corridor– Preliminary Rockfall Assessment Memo**

DATE: **December 5, 2019**

Confidential

SCOPE OF WORK

The Island Rail corridor consists of two Subdivisions; The Victoria Subdivision running between Victoria and Courtenay (225km); and the Port Alberni Subdivision that runs from Parksville to Port Alberni (64km).

A location plan showing the entire corridor and the rockfall hazard areas covered by this report is presented as Figure 1 in the background section of this report.

Background information provided by MoTI included several previous studies (outlined below) several of which had identified two areas of rockfall hazard at mile 15.6, 15.7 and 16.2, 16.3. It was noted that the trains that ran on line were instructed to stop short of these hazard areas as they were a known issue by the track operator. In addition to these known rockfall hazards, WSP carried out a site reconnaissance along the area of track where there was reported rockfall hazard on the Port Alberni spur in the vicinity of Cameron Lake.

The intent of this report is to provide a preliminary high-level review of the rockfall hazards that were identified along with some comment relating to additional rockfall hazards noted during our field work. The report provides discussion and a preliminary level of anticipated effort relating to mitigation of rockfall hazard and comment with respect to potential hazard mitigation. As part of this work a Class D cost assessment (an accuracy of -20% to +30%) has been obtained (for the areas of rockfall that would require a higher level of mitigation – using a full rock mesh approach. This approach may be modified following preliminary/detailed design but was picked to provide a robust fiscal estimate) from a local cost consultant (Advicas), a copy of which is appended.

WSP is not aware of any performance expectations from the operator with respect to known rockfall areas and understands that the present approach is to reduce the train speed and even stop to assess the track condition before continuing.

Further detailed hazard assessment will be required in the future to inform detailed design. This undertaking did not assess soil slopes' drainage channels or other geotechnical hazards.

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BACKGROUND INFORMATION

The following documents were reviewed as part of this assessment:

- Evaluation of the E&N Railway Corridor: Baseline Reference Report. Prepared by Hatch Mott MacDonald for MoTI, 2010
- Evaluation of the E&N Railway Corridor: Foundation Report. Prepared by IBI for MoTI, 2010.
- Track and Geotechnical Conditions, Esquimalt and Nanaimo Railway, Assessment Report, Earthtech report, 2003

The Hatch Mott MacDonald Report identified potential rock fall sites "at Mile 15.6, 15.7, 16.2 and 16.3" and noted that there were "active rock faces with freshly fallen material in the ditches and significant cracking between the blocks". In addition, the report discussed the potential for rockfall detector systems and the relatively high costs of installation and maintenance. It also suggested that more traditional rockfall mitigation measures such as scaling, rock anchors, shotcrete and mesh may be more economical.

The IBI report highlighted areas where "trees fall onto the corridor or loosen rock slopes resulting in debris on the track" and suggested a rock slope hazard risk mitigation plan at known risk sites.

The Earthtech report notes a number of significant rock slopes from Mile 10.0 to 17.0, 20.0 to 26.0 and 36.0 to 37.0. It notes that a Dayliner train hit a rockfall at Mile 16.3 in 1997 and that some changes to train schedules to accommodate stopping in this area as a precaution were apparently made. The report references a number of Golder reports, but these were not available.

Published geological mapping[1] [2]for the previously identified rockfall hazard areas show the bedrock to comprise ribbon chert, cherty argillite, metarhyolite, metabasalt and chlorite schist belonging to the Chert-Argillite-Volcanic Unit (Jurassic to Cretaceous - Leech River Complex on the later map) of Triassic to Cretaceous age.

A number of other previous geotechnical reports were noted in the above publications; but were not available for review.

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[1] Geology – Victoria Map Area, Map 92 B/NW J.E.Muller 1980

[2] Geology – Northern Vancouver Island Project, Geoscience BC, Map 2013-NVI-1-1, 2013

ASSESSMENT WORK

The assessment was limited to a desktop review and a two-day field reconnaissance. The desktop study of the available information provided by MoTI along with in-house records and published geological mapping was undertaken during the summer of 2019.

Following the desktop work two separate field visits were undertaken. The first one day visit was with support from Mr. Al Kutaj of Southern Railway of Vancouver Island (SVI) who provided a hi-rail vehicle and drove our staff from Langford to just north of Shawnigan Station on 16 August 2019.

The second one day visit to review areas of potential rockfall along the Port Alberni Subdivision was undertaken by WSP on 30 August 2019. Access to sections of the track alongside Cameron Lake was limited due to the condition of some of the trestles.

A selection of photographs from our field review is appended.

Rockfall hazard observations from these visits are summarized below.

Langford to Shawnigan Subdivision

Mile/Photo No.	Rockfall Hazard Observation
13.1	Cut rock face typically 3-5m high on west side of track. Irregular blasted face, sub-vertical.
13.35	Cut rock face typically 8-10m high on west side of track. Irregular blasted sub-vertical face. Some fallen rock by side of track.
13.95 (Photo 1)	Cut rock face typically 4-6m high on either side of track. Irregular blasted sub-vertical face.
14.25 (Photo 2)	Cut rock face typically 3-5m high on west side of track. Irregular blasted sub-vertical face.
14.35 (Photo 3)	Cut rock face typically 4-6m high on west side of track. Irregular blasted sub-vertical face.
14.41	Cut rock face typically 7-9m high on west side of track. Irregular blasted sub-vertical face.
14.75	Cut rock face typically 8-10m high on west side of track. Irregular blasted sub-vertical face.
14.85 (north trestle) (Photo 4)	Cut rock face typically 4-6m high on west side of track. Irregular blasted sub-vertical face.
15 (Photo 5)	Cut rock face up to around 20m high on west side of track. Irregular blasted sub-vertical face. Some fallen rock observed at side of track.
15.2 (Photo 6, 7, 8, 9)	Cut rock face up to around 20m high on west side of track. Irregular blasted sub-vertical face. Some existing mesh hanging on south side of exposure.

Mile/Photo No.	Rockfall Hazard Observation
	Large fracture noted on north side of exposure. Lock block wall noted at base along west side of track (probable historical rockfall mitigation) **NOTE** – potential hazard receptor downslope is Highway 1.
15.6 (tunnel south) (Photo 10, 11, 12, 13)	Entrance to tunnel – typically 15-20m high – steeper on west side. Cut rock face blasted, irregular, sub-vertical. Some fallen rock noted at side of track.
Tunnel Roof (Photo 14)	In general, the rock surface was irregular with significant staining and appeared in reasonable condition with localised areas where some scaling would be required. No significant cracks, joints or loose rock were observed.
15.7 (tunnel north) (Photo 15,16,17,18)	Entrance to tunnel – typically 20-30m high with a slight bench noted above the tunnel entrance – steeper on west side. Cut rock face blasted, irregular, sub-vertical. Some fallen rock noted at side of track.
16.2 (Photo 19, 20, 21)	Cut rock face typically 15- 20m high on west side of track. Irregular blasted sub-vertical face. Some fallen rock observed at side of track.
20.9	Approach to Shawnigan crossing – typically 6-8m high on east side of track. Irregular blasted sub-vertical cut face.
21.6 (Photo 22, 23)	North of Shawnigan crossing – typically 8-10m high on east side of track. Irregular blasted sub-vertical cut face. Occasional loose blocks and overhangs noted.

<u>Port Alberni Subdivision</u>

Mile	Rockfall Observation
From east end of Cameron Lake to Summit Lake (see attached photos)	Limited access along tracks due to the condition of the trestles. Significant steep slope up from track on north side of tracks. Occasional local rock fragment observed on track between east end of lake and first trestle. Unable to progress beyond this point due to safety concerns. A number of steep rock cuts exist along the section immediately north of the track. Occasional localised 5-8m (typical) cut rock faces between Cameron Lake and Summit Lake. NOTE – there are a number of vacation cabins that should be considered as downslope receptors

GEOTECHNICAL COMMENTS AND RECOMMENDATIONS

General

The intent of this report is to provide a preliminary assessment of the anticipated level of effort required to mitigate rockfall hazard to the rockfall areas identified along with commentary on potential hazard mitigation options and Class D costing. During the reconnaissance, WSP identified a number of additional areas of rockfall hazard based on discussions with SVI staff that are additional to the two main hazard areas noted in the supporting information.

For this preliminary study, WSP has identified three levels of anticipated effort that would be required to mitigate the hazard. These are classed as low, moderate or high based on our preliminary assessment of potential consequence to the railway as described below:

- **LOW** – typically low height rock cuts, or where there is sufficient ditch width at the side of the track that any likely rockfall would not reach the track.
- **MEDIUM** – rock cuts where there is insufficient ditch width or the rock cut is high enough that there is potential for rockfall to reach the track but the likely size/magnitude of rockfall is relatively small.
- **HIGH** – rock cuts in excess of 8m high where there is potential for large rockfall to reach the track and possibly impact the rail/train/infrastructure.

For low risk we would anticipate that little work other than continued observation and possibly localised scaling would be required by the track operator. For moderate risk we would anticipate that some scaling work may be required following a detailed review. For the couple of high-risk areas identified we have provided a conceptual mitigation strategy that is considered technically suitable for such rockfall hazards involving high strength rock mesh and anchors. We have used this concept as a basis for our Class D cost estimate. Further detailed assessment and analysis would need to be undertaken to inform preliminary/detailed design (as per MoTI Technical Circular T-04/17) in these areas and would yield an update to the cost estimates to reflect the detailed design.

Detailed rockfall classification systems such as the CN Rail Rockfall Hazard Risk Assessment rating system are available and have been used on the CN mainline track in Western Canada. Such a system may be considered for more detailed assessments in the future. These assessments typically require more analysis over longer periods of time to develop the data set on rockfall frequency and the like that can then be used in the rating process.

Typically, such assessments would comprise a detailed assessment of identified risk, including;

1. Frequency, size and probability of rockfall reaching the track.
2. Consequences of train contacting rock, such as derailment, fire, injuries, death. Higher the speeds more severe the consequences.
3. Presence of aggravating factors increases risk such as at entrances to tunnels, bridges, blind curves, steep vertical drop to river or highway below, and presence of public. Mitigating factors could be good sightlines, presence of ditch, reducing speed of operation, presence of rockfall warning devices, and special patrols ahead of trains.

Based on the detailed assessment the risk levels would typically be given as;

High Risk - High probability of rockfall reaching track, severe consequences in terms of injury or death, no mitigating factors. Hazards associated with these slopes should be addressed as first priority.

Medium Risk - Probability of rockfall reaching track is moderate because of say presence of ditch, consequences could be severe but good sightlines and slow speed may further mitigate the risk. Hazards associated with these slopes should be addressed as second priority.

Low Risk - Probability of rockfall reaching the track is low, consequences of train contacting rock are moderate with no aggravating factors. Hazards associated with these slopes should be addressed as part of a planned maintenance type program.

For the rock tunnel on the Malahat we have provided some general comments on our visual review, however a detailed assessment of the tunnel structure would be required prior to resuming operations.

Preliminary Rockfall Hazard/Effort Level Rating

Langford to Shawnigan Subdivision

Mile	Preliminary Level of Effort to Mitigate Rockfall Hazard
13.1	LOW
13.35	MEDIUM
13.95	LOW
14.25	LOW
14.35	LOW
14.41	MEDIUM
14.75	MEDIUM
14.85 (north trestle)	LOW
15	HIGH
15.2	HIGH
15.6 (tunnel entrance south)	HIGH
Tunnel roof	MEDIUM
15.7 (tunnel entrance north)	HIGH
16.2	MEDIUM - HIGH
20.9	LOW
21.6	MEDIUM - HIGH

Port Alberni Subdivision

Mile	Preliminary Level of Effort to Mitigate Rockfall Hazard
From east end of Cameron Lake to Summit Lake	Typically, LOW-MEDIUM for the observations made along the track side, however future studies should consider the wider hazard from upslope rockfall hazard along Cameron Lake where there may be risk of rockfall from rock exposures that exist upslope of what is observable from the trackside. These **could be significant** and could pose a threat to the rail infrastructure (and some of the lake side structures), especially during a seismic event. In addition, SVI noted one trestle affected by localised rockfall on the west side of Cameron Lake that was inaccessible during our field review.

Potential Mitigation Measures

The following potential mitigation measures are provided to provide a sense of the anticipated scale of effort required to mitigate the rockfall hazards identified. For the high-risk areas, the actual mitigation measures may be less or more than shown below depending on the outcome of the detailed analysis.

Low Risk Areas

- Observe and maintain as required. Possibly localised scaling and removal of any fallen rock.

Moderate Risk Areas

- Localised scaling and continued review on a regular basis to review rock face condition with the aim of identifying any zones of possible rockfall before they occur. Occasional rock bolt (or other mitigation measure) may be required.

High Risk Areas (Malahat Area)

These areas require a detailed assessment of the rock mass prior to undertaking analysis and a detailed design for mitigation measures. Given the lack of space at the side of the existing track to create a suitable catch ditch we have assumed the need for an anchored rockfall mesh system combined with localised rock bolting. For the purpose of obtaining Class D cost estimates we provided the following conceptual design to a local cost consultant.

- Supply and install 5500m^2 of Geobrugg Tecco 3 mm mesh (or similar), inclusive of all manufacturers recommended steel rope/shackles/connection clips/hardware.
- Supply and install 75 No. Geobrugg (or similar) 3m long 25 mm diameter wire rope anchors to support mesh.
- Supply and install 20 No. 4m long Number 10 Dywidag Anchor bars (double corrosion protection system).
- Supply and install 50 No. Geobrugg (or similar) 2m long wire rope anchors.

Alternative measures ranging from continued observation (not recommended), rockfall barrier fences (limited room) through to rockfall detection fences (no obvious power source and only a warning system not a mitigation measure) could be considered by the operator.

Port Alberni Subdivision

For the Port Alberni Subdivision further assessment would be required to adequately assess the risk from rockfall along the side of Cameron Lake. This would require safer access along the existing trestles as well as access to review the natural slope above the rail cuts. However, for preliminary planning purposes WSP suggests that costs in the order of $250k be allowed for some degree of rockfall mitigation along select sections of this part of the railway corridor based on observations in field and conversations with SVI. This would not include larger scale rockfall hazard as discussed below.

It should be noted that in some areas (specifically along the north side of Cameron Lake on the Port Alberni Subdivision) the rockfall source may exist outside the railway corridor right of way. That is to say, the slope above the track extends many hundreds of metres above the railway, well beyond the visual review from the railway line. A number of large exposed rock bluffs on the slope north of the rail line can be seen from the south side of Cameron Lake. Although identified, these would need to be examined as part of a detailed assessment prior to the line opening. Any future assessment and subsequent mitigation strategies should take into account the adjacent land owners.

FUTURE GEOTECHNICAL WORK

Prior to re-opening the lines, we would anticipate the following geotechnical work with respect to rockfall hazard:

- Undertake a detailed stability assessment on the Moderate-High and High ranked rock faces (including the tunnel).
- Prepare a preliminary/detailed design for rockfall mitigations measures in conjunction with the operator/owner's requirements.
- Undertake a detailed study along the Port Alberni corridor along the Cameron Lake section with respect to rockfall/slope stability on the slopes to the north of the railway corridor (this may require the use of drone flown cameras or helicopters).
- Assist with preparing specifications for rockfall mitigation work.
- Provide construction phase support during mitigation works.

In addition to the rockfall mitigation work, WSP recognizes that there would be other areas of geotechnical assessment and design that may be required along the rail corridor. These may include, but are not limited to:

- Site characterisation for structures/seismic upgrades to structures and areas where the ground may be vulnerable to seismic liquefaction (as per Appendix E: Seismic Considerations Memo).
- Review of potential impact from underground mining hazards from both the Nanaimo and Cumberland coalfields.

CLOSING AND TERMS

This report was prepared in accordance with our service contract with MoTI for this project. Should you require further information please contact the undersigned.

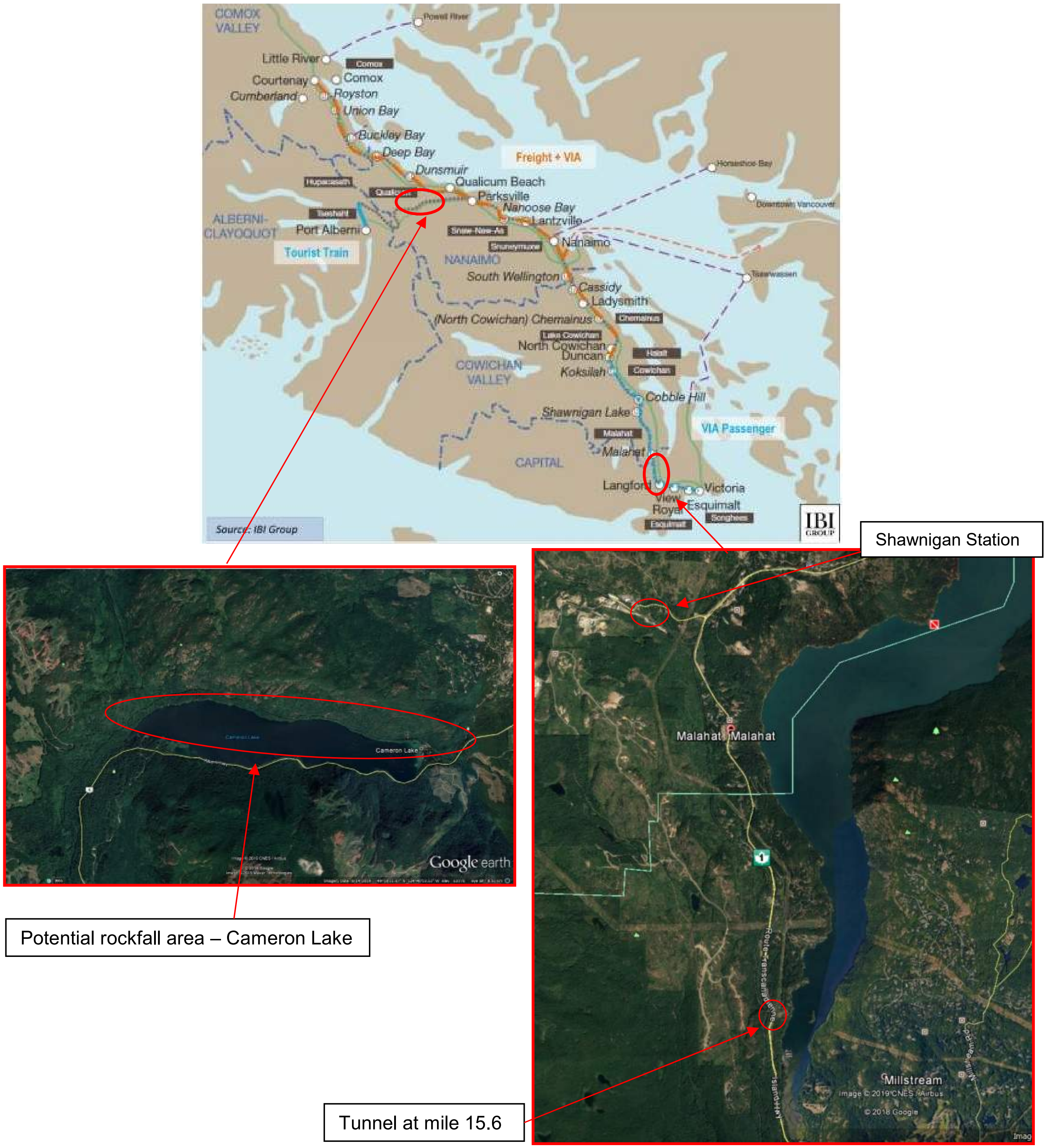
Yours sincerely,

WSP Canada Inc.

Per: Russell Scott, M.Sc., P.Eng.
Senior Geotechnical Engineer

Reviewed by: Carl Miller, M.Sc., P.Eng.
Senior Geotechnical Engineer

Attachments: Location Plan/Rockfall Areas
Photographs
Advicas Class D Cost Assessment
Standard Limitations



wsp	PROJECT: E&N Railway Condition Assessment				
	TITLE: Site Location Plan				
	CLIENT: BC Ministry of Transportation				
DRAWING NO.: 1	DATE: October 2019	FILE NO.: 19M-00626-00	SCALE: NTS	DRAWN BY: BNV	REV NO.:

PHOTO TABLE

Photo	Description
	Photo 1: Mile 13.95 looking South.
	Photo 2: Mile 14.25 looking South.

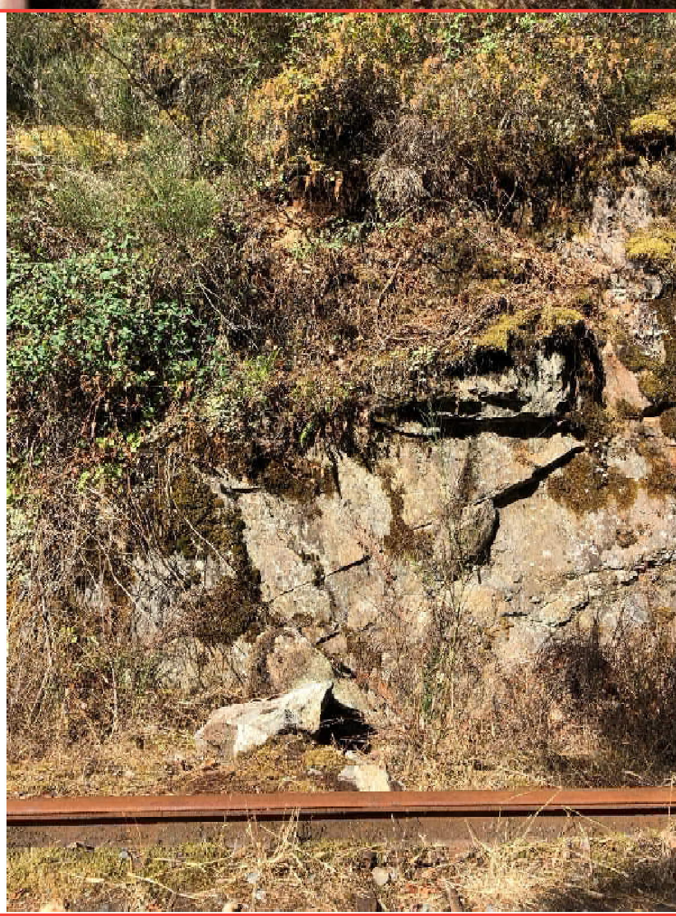
	Photo 3: Mile 14.35 rock in ditch.
	Photo 4: Mile 14.85 fallen rock.

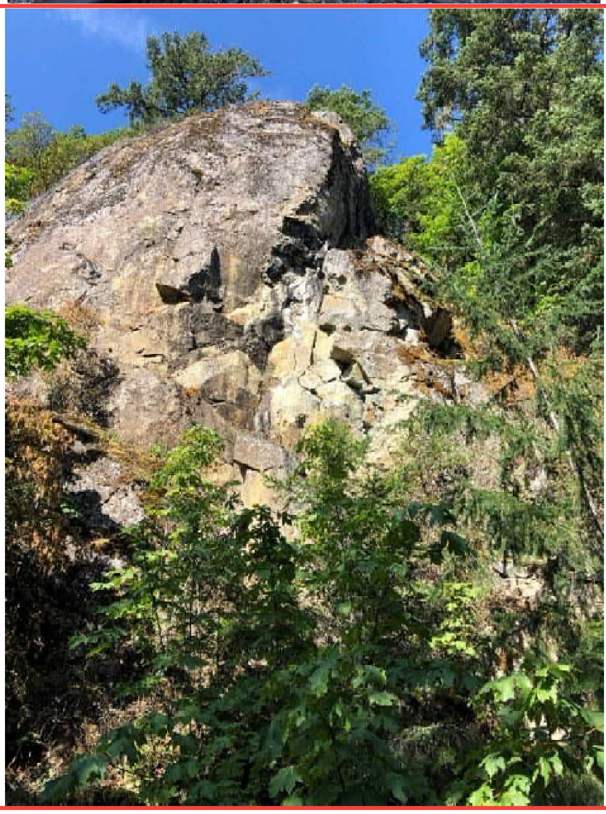
	Photo 5: Mile 15.
	Photo 5: Mile 15.2 (approx. 20 m high).

	Photo 7: Lock blocks at mile 15.2.
	Photo 8: Close up of rock fracture at mile 15.2.

		Photo 9: Existing mesh on South side of rock face at mile 15.2.
		Photo 10: Tunnel entrance South (looking North).

	Photo 11: Rock above tunnel entrance South.
	Photo 12: Fallen rock adjacent to Tunnel entrance South.

	Photo 13: Fallen rock at tunnel entrance South.
	Photo 14: Tunnel roof.

	Photo 15: Above tunnel entrance North.
	Photo 16: Tunnel entrance North (looking South).

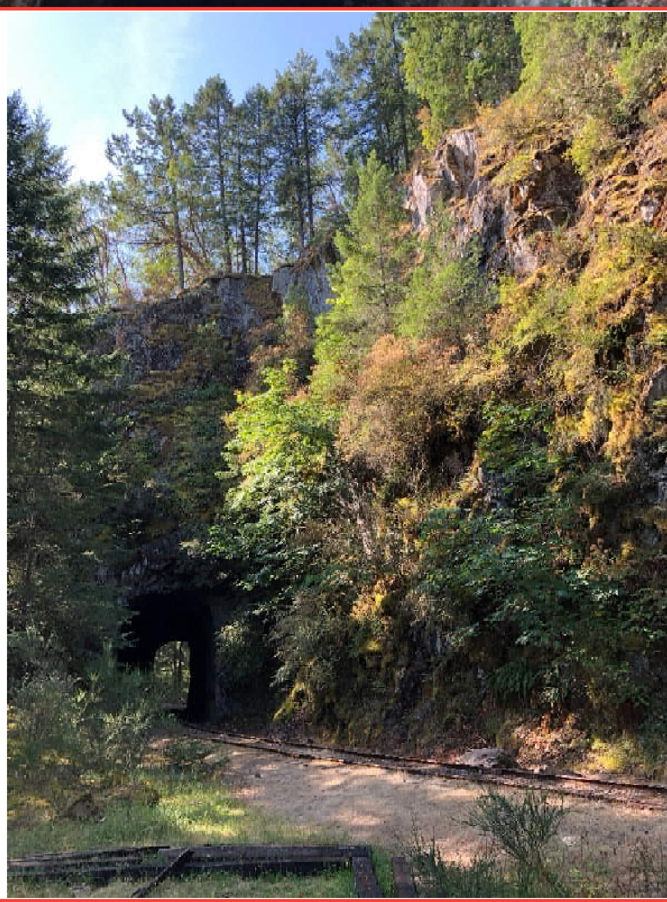
	Photo 17: Rock structure above tunnel entrance North (note recent wedge failure).
	Photo 18: General view South of tunnel entrance North (approx. 30 m high).

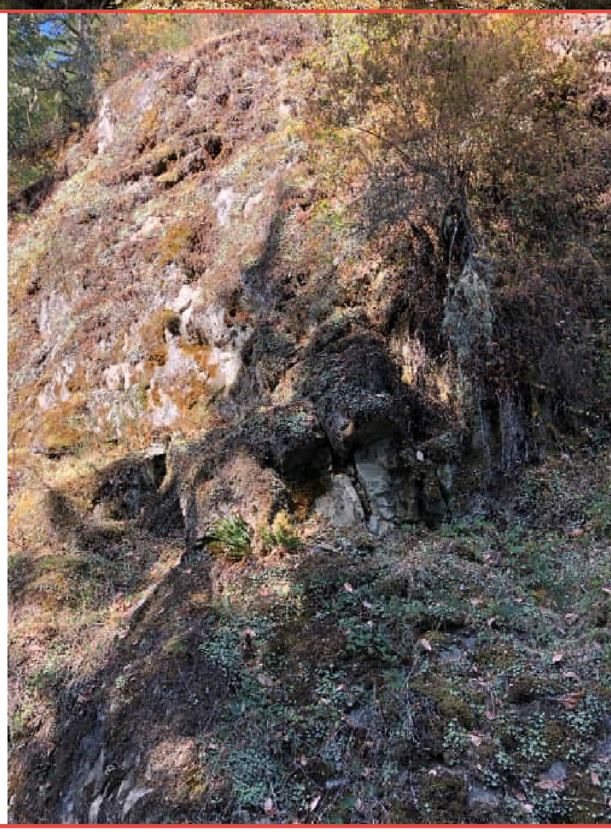
		Photo 19: Rock face at mile 16.2 approx. 20 m high.
		Photo 20: Loose rock at mile 16.2.

	Photo 21: Mile 16.2 fallen rock.
	Photo 22: Mile 21.6 fractural rock and tree growth.

Photo 23:
Close up of rock face at mile 21.6 (note recent wedge failure).

PHOTO TABLE

Photo	Description
	Photo 1: Irregular rock cut close to Summit Lake.
	Photo 2: General view North across Cameron Lake.

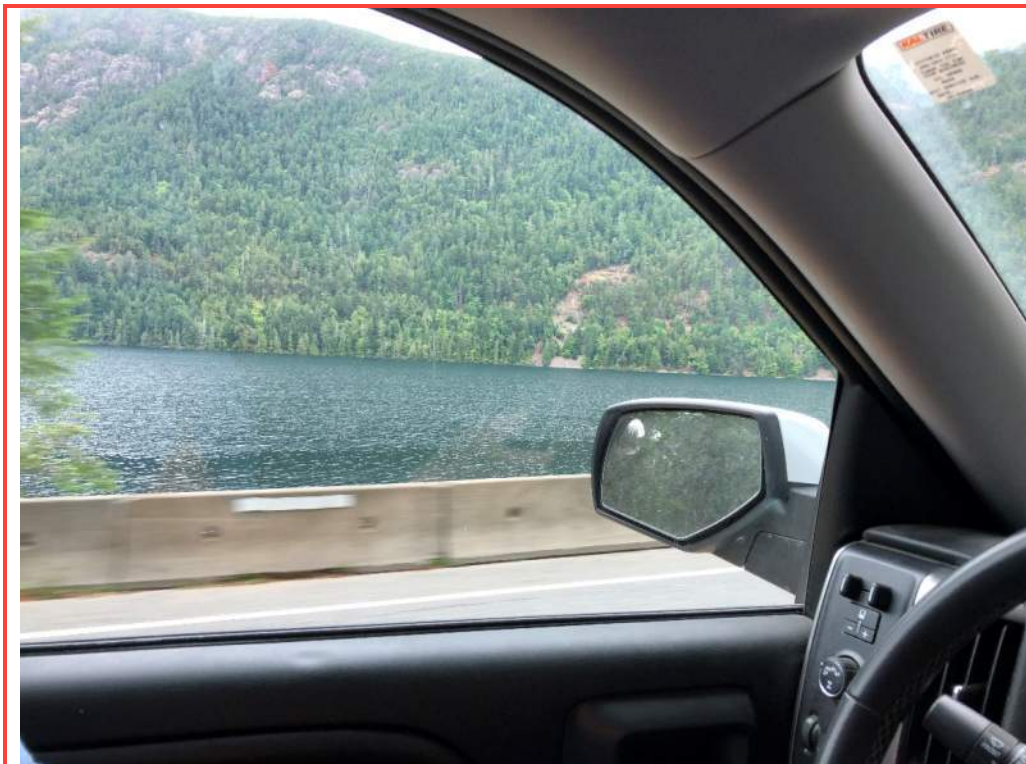


Photo 3: Historic slide area Approx. co-ord. 49.296810 – 124.611607.

Photo 4: Gabion baskets at toe of slope approx. co-ord. 49.293110 – 124.589763.

	Photo 5: Fallen boulder beside track.
	Photo 6: Fallen boulder beside track.

	Photo 7: Fallen rock on track.
	Photo 8: Rock cut above track.

	Photo 9: Fallen rock on track.
	Photo 10: Rock exposure adjacent to track.

	Photo 11: Rock exposure adjacent to track.
	Photo 12: Loose rock above track.

Photo 13:
Rock cut adjacent to east end of trestle (first trestle west of the east end of Cameron Lake).

***Note – other than Photo 1 (Summit Lake) these photos are between East end of Cameron Lake and the first trestle to the West.**

Professional Quantity Surveyors
Sustainability Consultants

CLASS D ESTIMATE

ISLAND RAILWAY CORRIDOR – ROCKFALL MITIGATION

SOUTHERN VANCOUVER ISLAND

November 14, 2019

Prepared by
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TABLE OF CONTENTS

SECTION **PAGE**

APPENDICES

per: Advicas Group Consultants Inc.

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INTRODUCTION

This report sets out the Class D estimate of capital construction cost for the proposed Island Railway Corridor – Rockfall Mitigation in Southern Vancouver Island.

Project Description

The project comprises the installation of steel mesh, steel rope and rock anchors to stabilize the rock face on four areas of the E&N Railway corridor, south of the Shawnigan Station.

ESTIMATE COSTS

The estimate costs have been developed in current (November, 2019) dollars. The estimated capital construction cost is **$1,400,000**

Estimate backup sheets are included in Appendix A.

Escalation

The estimate is priced at current market price levels.

It is common knowledge that Vancouver Island was not immune to the major market downturn and saw a major correction in market price levels during the latter part of 2008 and early 2009. A further downward correction occurred in Spring 2010 driven by pressure on pricing levels from mainland contractors pursuing work on the Island.

Since the downturn of 2008/2009 Victoria has seen a slow recovery, culminating in 2015, to a return to the Island historical escalation norm of 3 to 4% per annum. Since early 2016 the Victoria market has undergone a further major change. Construction activity has accelerated with numerous major projects under construction, bringing with it an inherent labour shortage, and an upward pressure on market price levels.

Industry is reporting increases upwards of 10%, confirmed through tender pricing levels and ongoing discussions with industry. We recommend the Client make provision for market price level increase, based on the following increases through to 2020:

- Nov to Dec 2019 – 2%
- 2020 – 10%

BASIS OF THE ESTIMATE

We have assumed that the work will be tendered competitively in one contract.

In all cases the estimates are based upon our assessment of fair value for the work to be carried out. We define fair value as the amount a prudent contractor, taking into account all aspects of the project, would quote for the work. We expect our estimate to be in the middle of the bid range to ensure that funding for the work remains adequate for the duration of the project.

It should be noted that Advicas Group Consultants Inc. does not have control over the cost of labour, materials, or equipment, over the Contractor's methods of determining bid prices, or over competitive market conditions. We define competitive conditions in the project as attracting a minimum of three general contractors' bids with a minimum of two sub-trade tenders, and suppliers' tenders, within each of the sub-trade categories. Accordingly, Advicas Group Consultants Inc. cannot and does not warrant or represent that bids will not vary from the estimate.

The current construction market is extremely active, bringing with it a volatility in tender price levels. We have seen tenders exceeding budget where there has been a single general contractor bid, or suspected single sub-trade, or supplier bid. Whilst we endeavor to gauge the developing market conditions, it is not always possible to predict industry interest in this project, and the potential for a poor, uncompetitive, response.

Contingency Reserves

Contingency is an allowance specifically identified within our elemental cost analysis to meet unforeseen circumstances and represents an assessment of the financial risk relating to this project. As detailed design information becomes available, this risk will diminish, and the contingency allowances will accordingly reduce.

Design contingency is introduced into the estimated cost at the earliest estimate stage and is a measurement of the amount and detail of the design information available. As the design develops and systems and material selections are fixed, the amount of the contingency allowance is reduced and is absorbed into the measured elements. On completion of contract documents, at tender stage, the allowance is normally reduced to zero.

Our determination of this risk level and the amount of the contingency allowance is the result of many years of cost planning, on over 4,000 construction projects, and of monitoring the increasing design information that occurs during the design phase. The design contingency is not a discretionary cost element.

A design contingency allowance has been included, calculated at 15% of the construction costs, to provide for unforeseen items arising during the design phase.

No allowance has been made for construction contingency. This typically provides for unforeseen items arising during the construction period – such as field conditions, coordination discrepancies – which will result in change orders and extra costs to the contract, other than changes in scope.

No allowance has been made for project contingency. This is a contingency, held by the Client, to be used at his discretion to fund specific Client driven changes to the project scope, conditions, etc.

Taxes

GST is excluded from the estimate.

PST at 7% is included in the estimate.

Exclusions

The following items are excluded from the capital construction cost:

- Storage costs
- Rock excavation
- Soft landscaping
- Site fencing
- Site furniture
- Site signage
- Separate prices
- Client Administration costs
- Clerk of Works
- Client Project Manager
- Land acquisition costs
- Offsite costs
- Material testing
- Premium costs associated with environmental contaminants
- Survey fees
- Financing costs
- Legal fees
- Client Insurances costs
- Development cost charges
- Development permit fees
- Phasing of the work
- Out of hours working
- Consultants' fees and expenses
- Construction contingency
- Project contingency
- Escalation
- GST

Documentation

The estimate is based on the following:

- WSP Canada
  - Site map: Aerial Tunnel Location

    Received Oct 21, 2109

- Emails and telephone discussions with the design team during the preparation of the estimate

APPENDIX A

ESTIMATE BACKUP SHEETS

	QUANTITY	UNIT	RATE	COST
SUMMARY				**$1,400,000**
Rockfall Mitigation				$900,000
Site Overheads		23%		$207,000
Office Overheads & Profit		10%		$110,700
Design Contingency		15%		$182,290
GST				Excluded
Escalation				Excluded
Rockfall Mitigation	5,500	m²	$163.64	$900,000
Mobilise/de-mobilise equipment, labour and material	1	sum	$10,000.00	$10,000
Geobrugg Tecco 3mm mesh (or equivalent)	5,500	m²	$130.00	$715,000
Geobrugg Tecco wire rope anchors (or equivalent)	125	no.	$1,000.00	$125,000
#10 DYWIDAG anchor bars	20	no.	$2,500.00	$50,000

Standard Limitations

WSP Canada Inc. ("WSP") prepared this report solely for the use of the intended recipient, BC Ministry of Transportation and Infrastructure, in accordance with the professional services agreement between the parties. In the event a contract has not been executed, the parties agree that the WSP General Terms for Consultant shall govern their business relationship which was provided to you prior to the preparation of this report.

The report is intended to be used in its entirety. No excerpts may be taken to be representative of the findings in the assessment.

The conclusions presented in this report are based on work performed by trained, professional and technical staff, in accordance with their reasonable interpretation of current and accepted engineering and scientific practices at the time the work was performed.

The content and opinions contained in the present report are based on the observations and/or information available to WSP at the time of preparation, using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by WSP and other engineering/scientific practitioners working under similar conditions, and subject to the same time, financial and physical constraints applicable to this project.

WSP disclaims any obligation to update this report if, after the date of this report, any conditions appear to differ significantly from those presented in this report; however, WSP reserves the right to amend or supplement this report based on additional information, documentation or evidence.

WSP makes no other representations whatsoever concerning the legal significance of its findings.

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WSP has provided services to the intended recipient in accordance with the professional services agreement between the parties and in a manner consistent with that degree of care, skill and diligence normally provided by members of the same profession performing the same or comparable services in respect of projects of a similar nature in similar circumstances. It is understood and agreed by WSP and the recipient of this report that WSP provides no warranty, express or implied, of any kind. Without limiting the generality of the foregoing, it is agreed and understood by WSP and the recipient of this report that WSP makes no representation or warranty whatsoever as to the sufficiency of its scope of work for the purpose sought by the recipient of this report.

In preparing this report, WSP has relied in good faith on information provided by others, as noted in the report. WSP has reasonably assumed that the information provided is correct and WSP is not responsible for the accuracy or completeness of such information.

Benchmark and elevations used in this report are primarily to establish relative elevation differences between the specific testing and/or sampling locations and should not be used for other purposes, such as grading, excavating, construction, planning, development, etc.

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Standard Limitations

Design recommendations given in this report are applicable only to the project and areas as described in the text and then only if constructed in accordance with the details stated in this report. The comments made in this report on potential construction issues and possible methods are intended only for the guidance of the designer. The number of testing and/or sampling locations may not be sufficient to determine all the factors that may affect construction methods and costs. We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.]

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