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March 5, 2026

SNTG Project No. 24.510.05.01

Springer Creek Bridge Riprap Erosion Repair

Village of Slocan

503 Slocan Street, PO Box 50
Slocan, BC
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Attention: Michelle Gordon – Chief Administrative Officer, Village of Slocan

Re: **Springer Creek Bridge Riprap Erosion Repair – Geotechnical Design Memo**

1.0 Introduction, Background, and Scope

At the request of the Village of Slocan (the Village), SNT Geotechnical Ltd. (SNTG) has prepared a design for the Springer Creek Bridge abutments riprap repair. The Springer Creek Bridge is located on Park Avenue between Slocan Street and Hume Street in Slocan, BC. Figure 1 shows the bridge location on orthoimagery obtained from Google Earth, dated June 30, 2023. Approximate coordinates of the site are 49.7661120 latitude, -117.4667700 longitude (WGS84).

The riprap aprons at the east and west bridge abutments experienced flood-related damage during a high-flow event in the spring of 2020. Scour at the toe of the riprap aprons adjacent to the abutments displaced the lower boulders, which in turn led to undermining of the overlying riprap and adjacent streambank materials.

In response to the damage, the Village has applied for and been approved for funding under the provincial Disaster Financial Assistance (DFA) program. The program offers financial assistance for the restoration of infrastructure that has incurred uninsurable losses caused by a disaster or emergency event. The funding is expressly intended to cover the least-cost option for restoring damaged infrastructure to its pre-event functionality, and as such does not cover betterments, upgrades, enhancements, or additional preventative works.

The enclosed riprap repair design has been developed in accordance with the requirements of the DFA program. The primary objective of the design is to restore the riprap aprons at the east and west abutments to their pre-event conditions. As such, the design is intended solely for restoration purposes and has not been prepared to meet a specific engineering design standard, flood return period, or formal stability criterion. Typical guidance for flood protection in British Columbia, as outlined by the Engineers and

Geoscientists British Columbia (EGBC), suggests that designs intended for permanent flood mitigation should incorporate site-specific hydraulic analyses, return periods, and factor-of-safety considerations. These considerations have not been applied in this DFA funded restoration project.



Figure 1 – Location map of Springer Creek Bridge, Slokan, BC. The approximate location of the creek is delineated by the solid blue line. The dashed blue line indicates a reach where the creek is conveyed underground via a pipe network.

A preliminary assessment of the site was completed by TRUE Consulting in spring 2021. Their report titled "*Springer Creek Streambank and Stream Bed Restoration at Park Avenue*" was submitted to the Village on March 30, 2021. In the spring of 2024, SNTG visited the site to complete a follow-up assessment and was subsequently retained to provide the geotechnical design details and a construction tender drawing package for the proposed riprap repair.

This memo outlines the design specifics of the repair and is intended to be used in conjunction with the attached drawing package "*Springer Creek Bridge Riprap Erosion Repair*" of the same date.

2.0 SNTG Field Review

The SNTG field review schedule was as follows:

- April 9, 2024 – Preliminary site visit, Ryan Williams, P.Geo., Doug Nicol, P.Eng., Dwain Boyer, P.Eng. of SNTG.
- March 25, 2024 – Site review during topographic survey of the study area, Ryan Williams, P.Geo. of SNTG. Topographic survey was completed by SNT Engineering Ltd.
- April 15, 2024 – Site review with Environmental Professional, Ryan Williams, P.Geo. of SNTG, and Lisa Pavelich, RP.Bio. and Beth Wasylshyn, BiT of Masse Environmental Ltd. (Masse).

Observations of existing conditions pertinent to the proposed repair obtained during the site visits are provided herein.

2.1 *East Abutment*

The east abutment is comprised of a cast-in-place reinforced concrete foundation retaining wall measuring 0.8m in height.

An approximately 20m² surface area of large boulder riprap remains within the apron adjacent to the abutment. The existing riprap surface is sloped at approximately 2H:1V (horizontal to vertical) and has been undercut at the toe a vertical distance of up to 1.3m. The riprap is composed of subrounded to rounded clasts composed of mixed orthogneiss and granodiorite composition. The individual clasts range from 0.5-1.0m in diameter. The riprap is hard and durable but is not angular and as a result does not interlock well. Cement appears to have been poured in voids between the riprap in an attempt to create a more robust riprap surface. Given the subrounded to rounded nature of the clasts, it is considered likely that the riprap was sourced locally during initial bridge construction.

A photo of the east abutment and adjacent areas is provided in Figure 2.

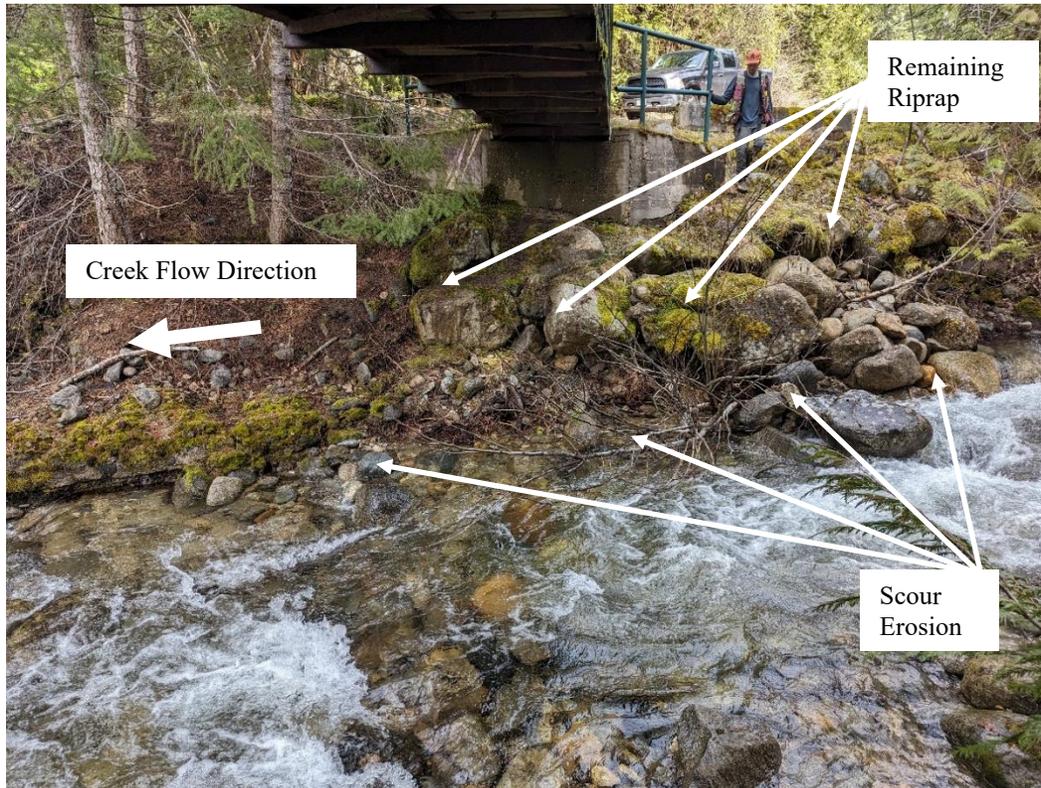


Figure 2 – East Abutment, Springer Creek Bridge.

2.2 *West Abutment*

The west abutment is comprised of a cast-in-place reinforced concrete foundation retaining wall measuring 1.4m in height.

An approximately 12m² surface area of large boulder riprap remains within the apron adjacent to the abutment. The existing riprap surface is sloped at approximately 2H:1V and has been undercut a vertical distance of up to 0.8m. The riprap is composed of subrounded to rounded clasts composed of mixed orthogneiss and granodiorite composition. The individual clasts range from 0.5-1.0m in diameter. The riprap is hard and durable but is not angular and as a result does not interlock well. Cement appears to have been poured in voids between the riprap in an attempt to create a more robust riprap surface. Given the subrounded to rounded nature of the clasts, it is considered likely that the riprap was sourced locally during initial bridge construction.

A photo of the west abutment and adjacent areas is provided in Figure 3.

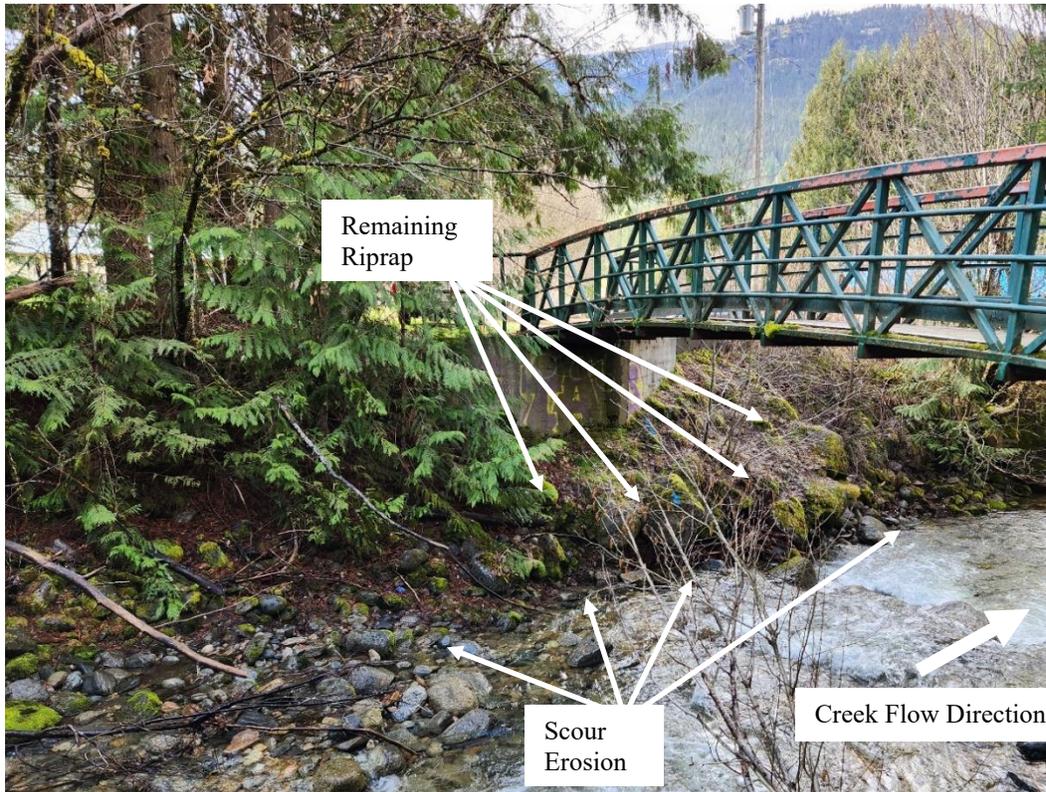


Figure 3 – West Abutment, Springer Creek Bridge.

2.3 *Topographic Site Survey*

A topographic site survey was completed on March 25, 2024, by SNT Engineering Ltd. Survey information was subsequently marked up by SNTG to show pertinent site features (e.g. East/West Abutments, remaining riprap). Results are provided in Figure 4, with the approximate extents of the remaining riprap at the east and west abutments outlined in purple.

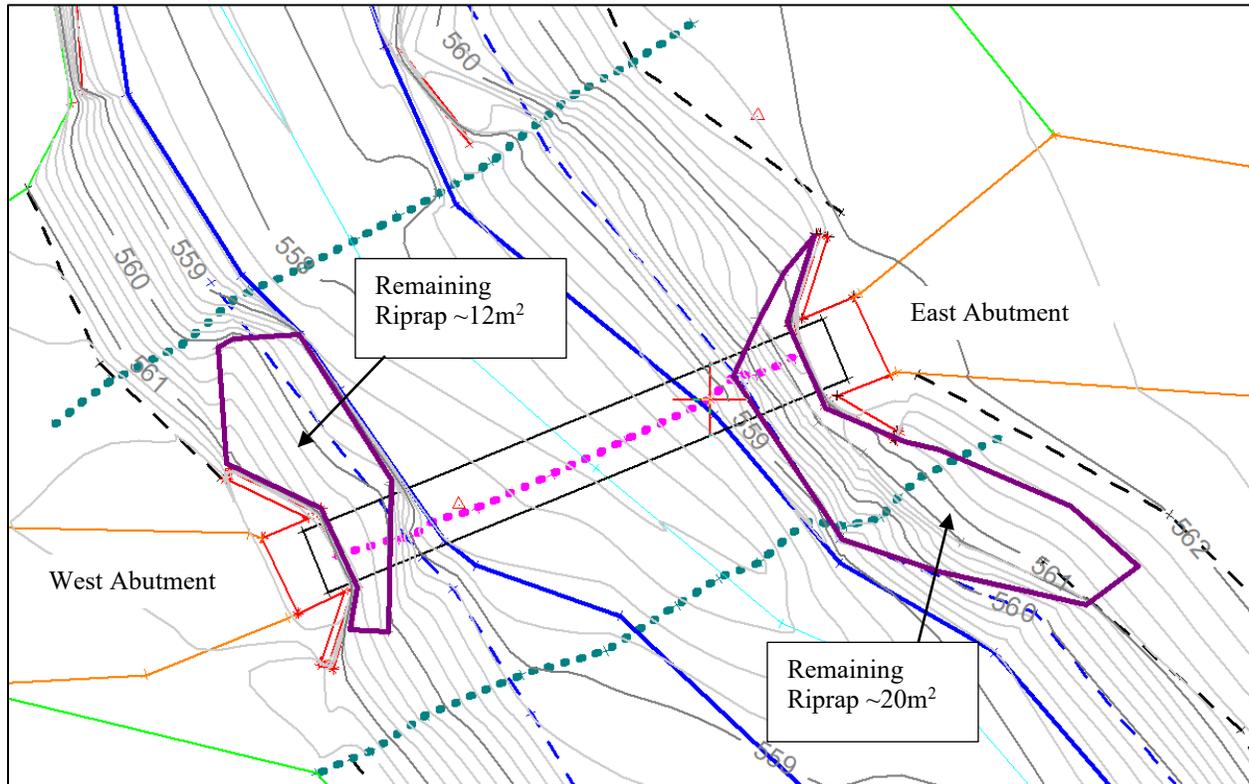


Figure 4 – Topographic survey (markup) of the site. Approximate extents of remaining riprap outlined in purple.

3.0 Design and Construction Details

Details of the proposed riprap repair design can be found in the attached drawing package. The objective of the design is to restore the riprap aprons at the east and west abutments to their pre-event condition, and consequently the design has not been prepared to meet a specific engineering design standard.

3.1 Site Preparation

We anticipate the following activities will be required prior to or during construction. This is not a complete list. Specifics on construction sequencing will be left to the contractor, provided prior approval is granted by the Village representative.

- Remove minor trees/shrubs to facilitate access
- Remove bridge and store on-site (if required for riprap repair)
- Locate and delineate 150mm water supply pipe (exact location unknown)
- Install approved stream diversion method (one side at a time – as per Masse plan)
- Remove existing riprap apron (east and west abutments)
- Subexcavate creek bed and regrade bank per depths and grades specified in drawings
- Replace the bridge and general site clean-up

3.2 *Environmental*

Masse Environmental (Masse) of Nelson, BC has prepared and submitted to the Village the report titled "*Springer Creek Pedestrian Bridge Scour Protection Work Construction Environmental Management Plan (CEMP)*", dated June 3, 2025. All stipulations contained within the report must be adhered to during construction.

All in-stream work shall be compliant with the BC Provincial Section 11 application (Changes In and About a Stream) as well as the Department of Fisheries and Oceans (DFO) Fish Permit application.

Primary environmental considerations during construction include, but are not limited to, the following:

- Conduct all machine operations from the top of the bank
- To prevent the spread of Whirling Disease, all equipment shall be free of mud and dirt and appropriately disinfected according to the Provincial requirements and recommendations prior to and after use (before mobilization to and from site)
- The footprint of the new riprap shall not exceed the previously existing riprap apron footprint
- All riprap materials shall be sourced from a quarry with documented verification of supplying non-acid-generating (NAG) rock. If such verification is unavailable, ARD-ML testing shall be conducted per MOTT Technical Circular T-04/13. The contractor is fully responsible for supplying and using NAG materials
- Restore all disturbed areas to their preconstruction condition and seed with a native seed blend for riparian areas
- Initiate and complete all in-stream works within the fish window (Kootenay Region) – July 16 to August 31
- Any vegetation clearing occurring within bird breeding season (~April 15 to August 15) shall be preceded by a nest survey conducted by a qualified biologist and approved by an RPBio
- Adhere to all environmental guidelines, stipulations, and management plans including, but not limited to: fuel and fluids; erosion and sediment; water and air quality; waste management; and wildlife management
- A worksite isolation (creek diversion) plan shall be submitted to and approved by the Village representative prior to any in-stream works. This may include use of gravel-filled coffer bags
- All works shall proceed in accordance with the field review stipulations outlined in the referenced CEMP document. Where surveys/site observation are required, no work shall be conducted without express approval of the RPBio or their representative

3.3 *Geotechnical*

Geotechnical aspects of the design are provided in the attached drawing package. Key considerations are outlined below:

3.3.1 *Preparation and Material Management*

- Remove existing riprap apron material from the affected areas at the east and west abutments. Subject to approval by the Field Engineer, existing riprap may be repurposed in the upper tiers of the repair

- Source and deliver new riprap material to the site. Imported riprap shall meet a minimum standard of MoTT Class 500kg riprap and must consist of well graded, hard, durable, sound, angular, non-acid generating blocky rock and must be approved by the Field Engineer prior to placement
- Gradation requirements for MoTT Class 500kg riprap are outlined in the table below:

Percent Finer by Weight (D%)	Diameter (mm)
D ₁₀₀	1220 (maximum diameter)
D ₈₅	1030
D ₅₀	715
D ₁₅	330

3.3.2 Excavation and Embankment Preparation

- Excavate surface materials to prepare the area for the new apron. Slope the embankments in front of the abutments at 100% (1H:1V)
- Do not excavate or disturb the existing 150mm diameter water supply pipe
- Do not undermine existing concrete abutments during excavation. Adhere strictly to any excavation setbacks from the abutments as guided by the Field Engineer
- Do not disturb any private property
- Subexcavate creek bed at the toe of the proposed riprap apron to approximately 0.7m depth. This is necessary to facilitate proper embedment of the base tier of riprap for scour protection
- All excavated soils containing organics, deemed unsuitable by the Field Engineer, or not required for the construction works shall be hauled off-site to an approved waste facility

3.3.3 Riprap Placement and Construction

- The riprap apron must be constructed in a bottom-up manner, starting with the lowest tier at the excavated toe
- The largest clasts must be used in the base tier and be embedded below the creek bed by approximately 2/3 of their diameter for scour protection
- Clast diameter of subsequent, higher tiers shall generally decrease toward the top of the apron. Use smaller clasts to fill interstitial spaces such that the final structure is dense and stable
- The new construction shall not exceed the toe of the previously existing riprap apron (i.e. encroachment into the creek shall not exceed the footprint of the previous apron)
- Final slopes of the riprap aprons adjacent to the east and west abutments are estimated at 100% and 90%, respectively (measured from the base of the abutments)
- Guidance during all phases of excavation and riprap placement will be provided by the Field Engineer and must be adhered to. This may include excavation setbacks from the abutments and staging requirements for excavation/riprap placement that shall be assessed based on ground conditions observed at the time of construction

3.3.4 *Required Field Reviews*

- The Field Engineer shall be present during all works involving:
 - > Riprap removal
 - > Excavation
 - > Embankment preparation
 - > Riprap placement
- No work related to the above phases shall proceed in the absence of the Field Engineer without their prior express approval. Commencement of each phase shall not proceed until prior phases have been approved in writing by the Field Engineer

3.3.5 *Estimated Material Quantities*

- The following table outlines estimated material quantities for the construction. Values given are approximate and for planning purposes only. The Contractor shall be wholly responsible for verifying the necessary material quantities

Material	Estimated Quantity
Excavation (existing riprap + soil embankment)	50m ³
Riprap (total required within the new aprons)	75m ³
Wastage (soil, organics)	30m ³

3.4 *Site Restoration*

The work site and affected areas must be cleaned-up and restored to their pre-construction conditions, as best as reasonably practicable. This includes but is not limited to the following activities:

- Replace and secure the pedestrian bridge to its pre-construction condition
- Remove and properly dispose of all excess, surplus, or unsuitable materials from the site
- Re-grade disturbed areas to match the surrounding terrain and drainage patterns
- Re-seed all disturbed soil surfaces with a seed mix approved by the Village representative
- Remove and properly dispose of all construction debris, temporary works, and equipment from the site
- Ensure the site is left free of hazards and visually unacceptable materials

4.0 Closure – Report Use and Limitations

This memo was prepared for the exclusive use of the Village of Slocan. The material in it reflects SNT Geotechnical Ltd.'s best judgment and professional opinion in light of the information available to it at the time of preparation. Any use that a third party makes of this report or any reliance on or decision to be made based on it is the responsibility of such third parties. SNT Geotechnical Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or action based, or lack thereof, on this report. No other warranty is made, either expressed or implied.

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Attached:

- Drawing Package: Springer Creek Bridge Riprap Erosion (Rev.1, March 5, 2026)