

January 7th, 2019

Mr. Gary Davis
President
Billings Bench Water Association
1111 Main Street, # 114
Billings, Montana 59105

Revised Proposal for Rockfall Mitigation at the Irrigation Canal Tunnel Portal in North Billings, Montana

Mr. Davis:

GeoStabilization International® (GSI®) is pleased to offer this revised proposal to perform rockfall mitigation services for the unstable rock formation above the irrigation canal tunnel portal in North Billings, Montana. We performed a drone survey to obtain more precise information on the unstable rock formation and ability to remove the mass in lieu of in place anchoring.

Discussions with the BBWA and City of Billings indicate that removal of the unstable rocks is preferred even if damage to the canal and inlet occurs during the process. The results of our drone survey and analyses indicate that the unstable rocks may be removed **without** blasting. GSI concurs that removal of the rock is the best option considering BBWA will budget for repair of the canal, if required.

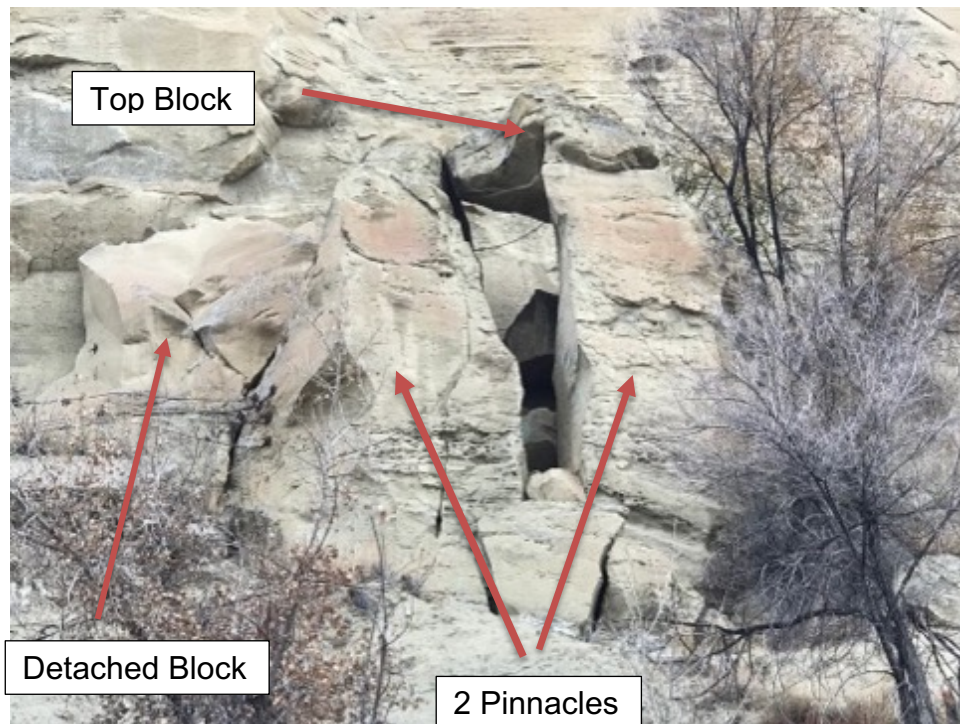
Project Description

Two pinnacles have rotated out from the massive sandstone bluff and support a smaller block at the top and associated detached blocks behind and to the west of the pinnacles. The block rotation is confirmed by tension observed on cable lashing and a bent plate on the rock bolts that were previously installed. These unstable blocks are directly above the canal tunnel portal and would likely impact the structure if they fail.

Site access is possible from both above and below the formation; the top access off of the Chief Black Otter Trail and the bottom access from the BBWA Canal access road and parking area at the tunnel portal. The blocks will be dislodged using a combination of hand tooling and high pressure air bags.

We understand that water flows in the canal from April 15th until October. The work scope may be completed before the April 15th commencement of water flow. The total project duration is anticipated to take 2 weeks.

Photo looking up at two pinnacles and associated detached blocks.



Drone photo from above.



Drone photo looking east.



Photo looking west showing tensioned cable and bent plate.





Schedule and Estimate

The rockfall mitigation, as described, is expected to approximately 1 working week for a fee of \$97,500. The proposed scope of work assumes working 10 hours per day, 6 days per week as daylight permits.

Exclusions and Clarifications

- Assumes BBWA will secure access to the top and bottom of the bench with appropriate stake holders.
- Assumes BBWA will secure any necessary permits. GSI will provide stamped drawings for this effort, if required.
- Excludes repair of existing improvements including but not limited to the canal portal and liner.
- Excludes removal of scaled debris.

This proposal is contingent that the site conditions do not significantly change prior to our mobilization. GeoStabilization International is confident that we can successfully complete the rockfall mitigation in a safe, efficient manner, and will mitigate future rockfall hazard to the canal tunnel portal.

We would be happy to further elaborate on our work scope at an in person meeting with the BBWA board and membership, if requested.

Sincerely,
GeoStabilization International

Bryan Wavra, P.E.
Senior Engineer, NW Region
Bend, Oregon
bryan@gsi.us
503-999-4187

Acceptance: _____