Crested Butte Land Trust

Gunsight Bridge Replacement & Habitat Enhancement Project

Final Report

Prepared for:
Colorado Watershed Restoration Program
Attn: Chris Sturm

January 21, 2019

Crested Butte Land Trust
Grant Amount: $50,000
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Introduction

The Slate River is a vital element of the Crested Butte community. Its presence in the heart of Paradise Divide is one of the most prominent characteristics of the Upper Gunnison Valley. The close proximity of downtown Crested Butte to a river valley with some of the state's highest functioning wetlands, a broad range of recreational opportunities, and unmatched scenic quality is very unique and demands maintaining. Since 1991, the Crested Butte Land Trust (Land Trust) has prioritized the protection of the Slate River Valley. To date, the Land Trust has accomplished the preservation of more than 1,500 acres in the 7-mile Upper Slate River Valley and built more than 14 miles of public trails. In 2003, the Land Trust acquired and conserved the 120-acre Gunsight Bridge property, named for the wooden bridge that sat centrally on the parcel across the Slate River. Over time, the property's key location in the Slate River Valley has made it a hub for a myriad of activities, from fly fishing and cattle grazing, to a spot for families and school groups to enjoy a picnic and a junction for two of the upper valley's most heavily used trail systems. Last October, the Land Trust completed the construction of the new Gunsight Bridge, a full-span suspension bridge designed to interact positively with the Slate River and adjacent riparian habitat.

The project need was born out of a Watershed Assessment of the Slate River (2012), which identified the ¼ mile reach of river up and downstream of Gunsight Bridge as being impaired. Several direct and indirect stressors affecting the reach were identified; the bridge being the most severe. The design and structure of the old bridge were found to contribute to the instability of the reach resulting in instream aggradation, degradation of adjacent wetlands, and bank erosion. To mitigate these impacts, a new bridge was designed to interact positively with the surrounding environment and river hydrology. As planned, the process took two months and included the removal of the old bridge, construction of the new suspension bridge, and the installation of a near-by relief culvert. Completion of construction is considered a huge milestone in this multi-year project.

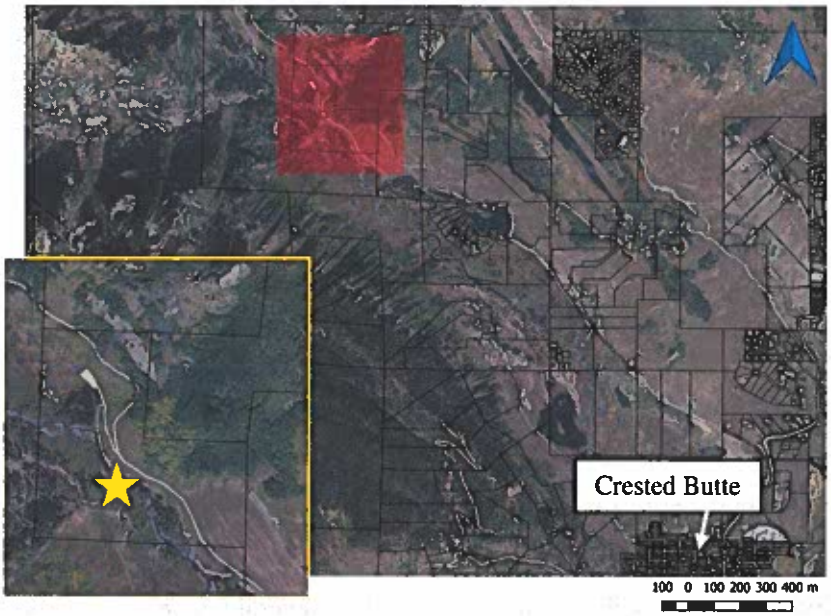
Project Background

Study work for this project began in 2011, when the Land Trust partnered with Coal Creek Watershed Coalition, the Bureau of Land Management, the U.S. Forest Service, and private landowners to complete a watershed plan for the Upper Slate River. The study combined existing information, stakeholder input and several years of monitoring data to create a comprehensive plan for addressing water quality and river channel impairments. Upon completion, the plan identified that the Gunsight reach of the Slate River was, with high certainty, impacted by several manmade stressors and recommended for further evaluation. Following the recommendation, in 2014, the Land Trust competed a Prediction Level Assessment (PLA) on the ¼ mile stretch of the Slate River encompassing Gunsight

Bridge. The PLA determined the bridge's alignment and structure to have adverse impacts on the river and its adjacent wetlands. In particular, the bridge's narrow span, the five sets of instream piers, and the old elevated railroad grade were identified as restricting the area's natural hydrologic regime. It was understood that by removing some of these stressors, the project would have positive and far-reaching effects on the habitat quality up and downstream of the bridge. With the project needs understood, the Land Trust transitioned into the project's planning phase in the summer of 2017. The Land Trust worked with Canyon Bridge LLC, a small company that specializes in the design, fabrication, and construction of environmentally sensitive and remote pedestrian suspension bridges to plan for the new Gunsight Bridge. The planning phase work included a wetland delineation, micropile tests, river cross-sections, planning for the culvert installation, and an agrological inventory. The tests were critical for informing the bridge and culvert installation designs. Study results indicated that a relief culvert and a 100' suspension bridge can be implemented on-site to interact positively with the river, its floodplain and surrounding habitat while also better withstanding the dynamic nature of the Slate River.

Site Summary

Gunsight Bridge is located on a 120-acre property owned in fee by the Land Trust. The property is encumbered with a conservation easement held by the Town of Crested Butte. The property is approximately four miles northwest of downtown Crested Butte and accessed via County Road 734 (Slate River Road). The property is adjacent to private and public land as well as additional conserved land owned by the Land Trust.



Map 1: Gunsight Bridge property and bridge (star) location.

Long-term Project Goals and Objectives

The six years of study work and thorough project planning prepared the Land Trust and its project team for a successful construction phase. The ultimate project goal was to replace a heavily used pedestrian bridge with a full-span suspension bridge designed to interact positively with the surrounding environment and river hydrology. However, the long-term project objectives were broken into three main categories: erosion mitigation and channel stabilization, riparian habitat improvement and re-vegetation, and the need to provide continued safe river crossing for year round recreationists.

Methods

The Gunsight Bridge construction took place over a two-month timeframe, from September through October, 2018. CWCB funding was critical to the success of the project. In particular, CWCB funds were used for the removal of the old Gunsight Bridge (1), the labor/equipment/lodging/transport project costs (12), the relief culvert installation (9), re-vegetation work (10), and the geomorphology monitoring planned for 2019 as part of the project's five-year monitoring plan (11). The project team arrived Thursday, September 6th to stage equipment and machinery on site. On Friday, September 7th, the Land Trust held a final community site visit to share information with interested visitors and community members about the project need and timeline. The project timeline consisted of the following actions:

1. **Initial Deconstruction of Existing Bridge:** The old bridge was deconstructed in phases throughout the build to allow Chris Haaland, owner of Canyon Bridge LLC, to use the old bridge structure as scaffolding for placement of the new bridge (see photo 1). This process began with the removal of the old bridge railings and later, the decking.
2. **Abutment Location Preparation:** Following the removal of the old bridge wingwalls, the new abutment sites were graded and prepared for the layout and installation of the micropiles (see photo 2).
3. **Micropile Layout and Installation:** The micropile locations were sited on Tuesday, September 11th and installed over the course of the following six days (see photo 3). Gunsight Pass Road was temporarily closed during this time, however, pedestrian and bicycle traffic through the area was still accessible via the temporary bridge (see photo 4).
4. **Concrete Installation:** Following the completion of the micropile installation, the project team built the concrete forms for the anchor blocks, abutments and wingwalls (see photo 5).
5. **Steel Installation and Welding:** The first steel bridge component installed were the two 14' tall support towers. One tower was attached to each abutment. Following the tower

installation, the bridge frame (made up of four segments) was placed (see photo 6). The frame components rested atop the bridge scaffolding as they were welded in place over the course of one week.

6. **Cable Fitting:** First, the 1 ¼" main cables were hung, from the anchor blocks to the support towers and across the bridge frame. Later, the 9/16" suspender cables of varying lengths were hung vertically from the main cables to the bridge frame (see photos 7 and 8).
7. **Hand Railing and Wood Decking Installation:** Following the cable fittings, the hand railings were placed and welded to the bridge frame. Next, the wood decking (3x12 treated timber) was installed (see photo 9).
8. **Wingwall Railing Installation:** The last bridge component to be installed were the hand railings on the wingwalls. These railings were not included in the original bridge design, but their need was realized once the concrete was poured and a distance over 30" was realized from the ground to the top of the wingwalls (see photo 10).
9. **Culvert Installation:** The relief culvert installation was the last component of the project to be completed. An excavator was used to place the 24" wide culvert beneath the railroad grade, directly south of the bridge. A tandem load of 6-12" angular cobble was used to create the rock spill pad at the culvert's eastern end (see photo 11). Additional loads of road base and 3" minus rock were used to fill and re-surface the railroad grade around the culvert.
10. **Re-vegetation *(2019)*:** With guidance from AlpineEco staff, Land Trust stewardship staff will work with community volunteers to complete the re-vegetation work. This is scheduled to take place in early-mid June, depending on run-off, and will consist of planting small willows, sod plugs and native grasses adjacent to the bridge abutments.
11. **Year 1 Geomorphology Monitoring *(2019)*:** A five-year monitoring plan was designed to measure the immediate and long-term success of the project objectives. Beginning in 2019, monitoring activities will be implemented in late summer/early fall and include channel and floodplain/vegetation monitoring.
12. **Labor, Equipment and Lodging, Transport:** This budget item included the cost of contracting a heavy machinery crew for the bridge removal and construction, as well as their associated lodging and transportation costs for the two-month project period.

Results

The Gunsight Bridge Replacement and Habitat Enhancement project brings immediate and long-term results.

Immediate Results: An immediate project result is a new and improved Gunsight Bridge. With the loss of the upstream wingwall in 2017, the old bridge became increasingly hazardous for users and required regular upkeep by Land Trust staff. The new bridge is estimated to have a 75-year life-span and serves as the only safe, year-round crossing of the Upper Slate River. It is utilized by over 100,000 users annually, from hikers and bikers to guided groups led by the Adaptive Sports Center, and alpine and Nordic skiers.

Long-term Results: Long-term project results include ecological benefits to be gained by the river morphology and adjacent riparian habitat. The former bridge impaired the flow of water and sediment in the Slate River, creating an area of deposition upstream of the bridge. The new bridge was designed to improve water and sediment transport through a wider span with no supporting piers in the river. Additionally, the former bridge and trail system altered the natural flow of water causing the riparian area east of the trail downstream of the bridge to dry out. Over time, the project aims to improve the riparian hydrology and vegetation by improving flow through the bridge and allowing some water to pass through the trail via the culvert. This is expected to re-establish 0.6 acres of riparian habitat and improve 0.9 acres of riparian habitat. The methods used to account for these improvements have been developed as part of our five year monitoring plan.

Conclusion and Discussion

All components of the proposed project were completed although two unsubstantial changes were made. The key elements of the construction were efficiently completed in the anticipated two-month project timeline, including the old bridge removal, new bridge construction and culvert installation. The two changes to the project implementation include the number of culverts installed (one instead of three), and the timing of the re-vegetation work. Three primary objectives were developed prior to the project start-date, and each objective was met.

Project Objectives:

Objective 1: Erosion mitigation and channel stabilization

The old Gunsight Bridge was built of wood and supported by five sets of four piers each (see photo 12). The piers, aligned perpendicularly with the bridge span and exposed to direct flow, acted as a strainer for woody debris that frequently finds its way down the Slate River during high flows. Debris was regularly caught by the piers as it moved down river, acting like a dam and impounding water upstream. Additionally, the bridge's 80' span across the river was too narrow,

and constrained the river channel to an unnaturally narrow width, limiting the ability of the river to utilize its floodplain and directly exposing the bridge abutments to the erosive power of the river.

The new bridge was designed and built to accommodate the dynamic nature of the Slate River; its span across the river was lengthened by 20 feet, allowing the river channel to flow underneath the bridge naturally and unobstructed. The suspension of the new bridge eliminated the need for the instream piers, which lessened flood risk and damage caused by sediment deposition and erosion from the impounded segment of river.

Objective 2: Riparian habitat improvement and re-vegetation

Over time, the elevated trail (old railroad grade) leading to the bridge had prevented the river from flooding onto the surrounding floodplain (see Map 2). Instead, the flow was routed through the bridge opening (see photo 13). During high water the area upstream and to the west of the trail served as backwater habitat. However, the area downstream and east of the trail had dried out due to the lack of connectivity to floodwater.

The Land Trust's plan to install two relief culverts beneath the elevated trail changed after the completion of a Class III Cultural Resource Inventory and Archaeological Recordation of the project site. A portion of the railroad grade (the Anthracite Spur of the Denver & Rio Grande Railroad) was identified as eligible to the National Register of Historic Places due to the fact that it has remained relatively undisturbed since its abandonment in 1946. Therefore, the Land Trust's plan to install a second culvert beneath the grade was not supported. However, one 24" wide relief culvert was installed beneath the "non-supporting" segment of railroad grade, closer to the bridge. Project ecologist Mark Beardsley, of EcoMetrics, supported this change in scope. Next spring, re-vegetation will occur around the graded and re-built bridge abutment areas to stabilize the river bank and to promote the growth of native plant species. Materials used will include locally sourced willow stakes and bundles, native seeds and sod plugs.

Objective 3: Provide continued safe river crossing for year round recreationists

Gunsight Bridge serves as a critical link for trail connectivity in the Slate River Valley and for the entire Crested Butte region. It has long been the only permanent crossing across the Slate River and is centrally located between two heavily used Lower Loop and Lupine trail networks. According to a 2015 visitation study, approximately 100,000 users rely on the ridge annually for recreation opportunities. The new bridge will remain open year-round to non-motorized

recreationalists and was designed to allow for the continued use of hand-cycles. Hand railings were installed on the abutment and wingwalls to create a safe space for the school groups and families that the area is known to attract (see photo 10).

Monitoring:

Together with the project ecologists, the Land Trust has developed a comprehensive five-year monitoring plan. The work, to be performed by EcoMetrics, will include monitoring the river morphology and riparian effects of the new bridge and culvert on the Slate River. Each year, for five years, the Land Trust will work with ecologist Mark Beardsley to perform four monitoring tasks; cross-section surveys, vegetation surveys, aerial photos and photo-points. The monitoring data will be used to document changes and to identify any maintenance or adaptive management needs. The data collected will build off pre-project site monitoring completed in 2013, 2014, 2017 and 2018. Combined, the existing data and proposed monitoring methods will be used to measure the Land Trust's success in reaching its targeted improvements.

CWCB funds will be used to perform the first year of monitoring (2019). The Land Trust anticipates securing funds for future monitoring from local funders including the Upper Gunnison River Water Conservancy District, as well as from private Land Trust supporters.

Lessons Learned:

Two unexpected turns in the project planning and construction phases required the re-convening of the project team and ultimately, lessons learned. As mentioned earlier, the Class III Cultural Resource Inventory and Archaeological Recordation required the culvert installation plan to be revisited and adjusted. Originally, we had planned to install three 18" wide culverts beneath the railroad grade. Their size and placement locations were based off of the wetland delineation completed as part of the project's planning phase. However, this planning effort was done in advance of having the final Cultural Resource Inventory and Archaeological Recordation complete. Following this discovery, the project team worked to develop a new plan capable of achieving the same improvements to the riparian habitat. Having an informed project team, highly familiar with the project background made this change attainable. While it was determined that a single, 24" wide culvert would work, this change in scope required further communication with project partners and funders. It also served as a good reminder to have all assessment work completed well in advance to the project start-date.

Second, we had not anticipated the need for hand railings on the wingwalls. This finding was realized in early October and required increasing the project budget by $10,000. This came at a time when the Land Trust had already heavily campaigned for project funds locally and risked donor fatigue by reaching back out to the community for additional funds. Thankfully, the Land Trust board of directors and loyal Land Trust supporters stepped up to the challenge. However, this was not without added stress and pressure for Land Trust staff. As a result, a contingency value will be built into future stewardship project budgets.

Future Work:

Remaining project components include the re-vegetation work and annual monitoring for 2019 through 2023. This spring, the Land Trust will host a volunteer work day for community members to help with the re-vegetation work. With guidance from AlpineEco and Land Trust staff, volunteers will assist with planting approximately 200 small willows, sod plugs and native grasses adjacent to the bridge abutments. Site monitoring will be performed by EcoMetrics, with help from Land Trust stewardship staff, each spring.

Actual Expense Budget

	Crested Butte Land Trust	Town of Crested Butte	Tip for the Trust	Bureau of Land Management	Colorado Parks & Wildlife Non-Motorized State Trails	Upper Gunnison River Water Conservancy District	1% for Open Space	Pig Difference	Colorado Water Conservation Board	TOTAL
Cash										
Project Administration	$ 6,004		$ 6,000					$ 2,996		$ 15,000
Existing bridge demolition & removal		$ 5,000				$ 5,000			$ 5,000	$ 15,000
Excavation for anchor blocks, tower foundation & abutments	$ 14,000			$ 1,000	$ 10,000					$ 25,000
Micropile installation	$ 15,000				$ 50,000		$ 5,000			$ 70,000
Concrete installation	$ 30,000				$ 20,000		$ 5,000			$ 55,000
Bridge cable and fittings					$ 15,000					$ 15,000
Structual Steel	$ 10,000				$ 25,000					$ 35,000
Welding and fabrication		$ 10,000			$ 55,000					$ 65,000
Wood decking					$ 5,000					$ 5,000
Labor, equipment, lodging, transport	$ 1,747				$ 5,000	$ 17,000			$ 29,253	$ 53,000
Railings	$ 10,000									$ 10,000
Construction Management					$ 15,000					$ 15,000
Relief Culvert Installation									$ 7,747	$ 7,747
Re-vegetation Materials									$ 2,000	$ 2,000
Maintenance Endowment	$ 17,500									$ 17,500
SGM Survey Work	$ 6,921									$ 6,921
2018 Monitoring	$ 3,600									$ 3,600
2019 Monitoring (Year 1)									$ 6,000	$ 6,000
CASH SUB-TOTAL	$ 114,772	$ 15,000	$ 6,000	$ 1,000	$ 200,000	$ 22,000	$ 10,000	$ 2,996	$ 50,000	**$ 421,768**
In-Kind	**Description**	**No. of Units/hour**	**Cost per unit/hour**							
Colorado Division of Mining Reclamation & Safety	Road Improvements									$12,000
BLM	Project Planning	40	$150							$6,000
Town of Crested Butte	Project Planning	15	$44.71							$671.00
IN-KIND SUBTOTAL										**$ 18,671**
TOTAL										**$ 440,439**

CWCB % of cash total: 12%
CWCB % of total: 11%

Photo 1: Scaffolding built on top of old bridge with deck and railings removed.

Photo 2: Project team siting location for micro piles after grading the new abutment area.

Photo 3: Micro pile installation at southern (downstream) abutment.

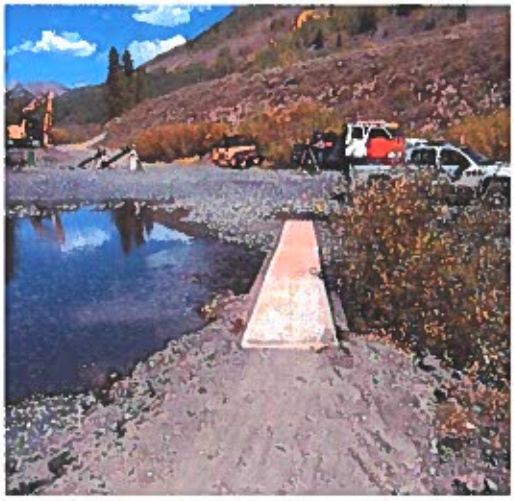


Photo 4: Temporary bridge built for trail users for duration of project.

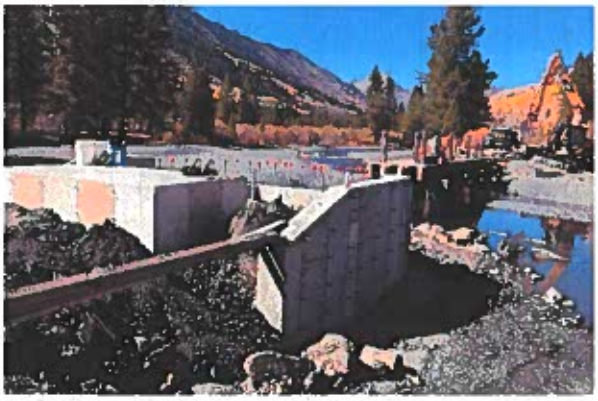


Photo 5: Concrete anchor block, abutment and wingwall at southern (downstream) bridge end.

Photo 6: Support tower and bridge frame installation.

Photo 7: Main cable installation across bridge.

Photo 8: Suspension cable installation from main cable to bridge deck.

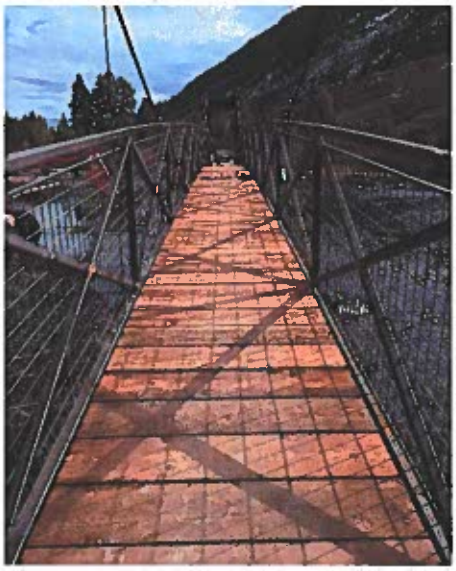


Photo 9: Wood deck installation.

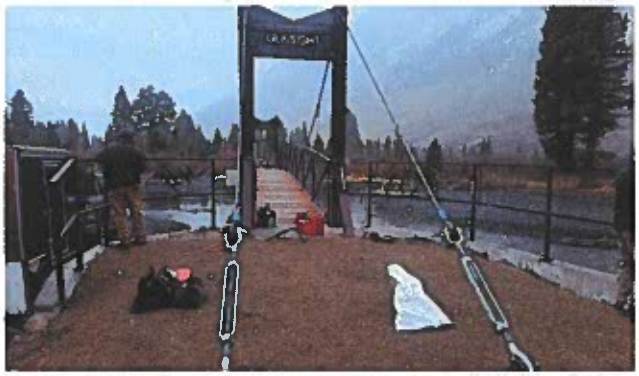


Photo 10: Hand railing installation on wingwalls.

Photo 11: Rock spill pad beneath the culvert's eastern end.

Photo 12: Former Gunsight Bridge with eroded wingwall and deteriorating support piers.

Photo 13: Former Gunsight Bridge at high-water. Backwater habitat pictured in top right of photo.

Map 2: Alignment of the new, 100' bridge, the relief culvert and improved/re-established wetlands. Water flow direction shown with blue arrows.

Budget Items & Attached Invoices

Existing bridge demolition and removal: In total, the cost to remove the old Gunsight Bridge was $15,000. Attached is a Canyon Bridge LLC invoice (#18007) which includes the bridge demolition and removal cost.

> **Canyon Bridge LLC:** $88,250.00 ($5,000.00 from CWCB towards bridge removal cost).

Labor, equipment, lodging and transportation: In total, the project's labor, equipment, lodging and transportation cost was $53,000. Attached is a Canyon Bridge LLC invoice (#18010) which includes a portion of the labor/equipment/lodging/transportation costs.

> **Canyon Bridge LLC:** $70,600.00 ($29,253.00 from CWCB towards the labor, equipment, lodging and transportation cost).

Relief culvert installation: Due to the change in scope to install one culvert instead of three, the overall relief culvert installation cost was lower than anticipated. All culvert associated costs totaled $7,747.00. The following invoices/material make up the total:

> **Gunnison Muffler & Pipe:** $1,411.10 (culvert, plus transport).
>
> **Gunnison Materials LLC:** $1,615.90 (fill material for railroad grade and spill pad, plus transport).
>
> **Mountain Highwall Concrete Contractors, Inc.:** $2,800.00 (heavy machinery equipment used for railroad grade excavation, rock placement, backfill and compaction of railroad grade).
>
> **EcoMetrics:** $1,920.00 (Mark Beardsley's hours for culvert installation).
>
> **Total:** $7,747.00

Total reimbursement requested at this point: $42,000.00