Kerber Creek Restoration Project Final Report

Initiated and Implemented By:

Trout Unlimited/Bureau of Land Management (BLM)

January – December 2011

Authored By:

Jason Willis, Project Engineer, Trout Unlimited

Laura Archuleta, Project Manager, United States Fish and Wildlife Service

Elizabeth Russell, Project Manager, Trout Unlimited

Table of Contents

List of Figures

List of Tables

List of Acronyms

BLM: Bureau of Land Management
BMP: Best Management Practice
BSG: Bonanza Stakeholders Group
CDOW: Colorado Division of Wildlife
CDNR: Colorado Department of Natural Resources
CDPHE: Colorado Department of Public Health and Environment
CDSS: Colorado Division Support Services
CDWR: Colorado Division of Water Resources
CFI: Cover Frequency Index
CSCVA: Crestone and Saguache County Visitor's Agency
CWA: Clean Water Act
CWCB: Colorado Water Conservation Board
EA: Environmental Assessment
EPA: Environmental Protection Agency
FWS: Fish and Wildlife Service
GIS: Geographic Information Systems
GPS: Global Positioning System
HUC: Hydrologic Unit Code
NEPA: National Environmental Policy Act
NPDES: National Pollutant Discharge Elimination System
NPS: Nonpoint Source
NRCS: Natural Resources Conservation Service
PNC: Potential Natural Community
SAPP: Sampling and Analysis Project Plan
ScSEED: Saguache County Sustainable Environment and Economic Development
TMDL: Total Maximum Daily Load
TU: Trout Unlimited
USACE: United States Army Corps of Engineers
USFS: United States Forest Service
USGS: United States Geological Survey
VCUP: Voluntary Clean Up Program
WMP: Watershed Management Plan
WQCD: Water Quality Control Division
WQX: Water Quality Exchange
XRF: X-Ray Fluorescent

1.0 Project Summary

The Kerber Creek Restoration Project is a joint partnership between Trout Unlimited (TU), Bureau of Land Management (BLM), the U.S. Fish and Wildlife Service (USFWS), the U.S. Forest Service (USFS), the Western Hardrock Watershed Team (WHWT), Natural Resources Conservation Service (NRCS), local landowners (Bonanza Stakeholders Group (BSG)), and other partners. Historic mine wastes have washed down through Kerber Creek and are contributing metals and acidic pH to the watershed. This project involved in-situ treatment of mine wastes by demobilizing metals contained in the soil, revegetating those mine wastes, installing fish habitats, rock structures, and stream bank stabilization structures.

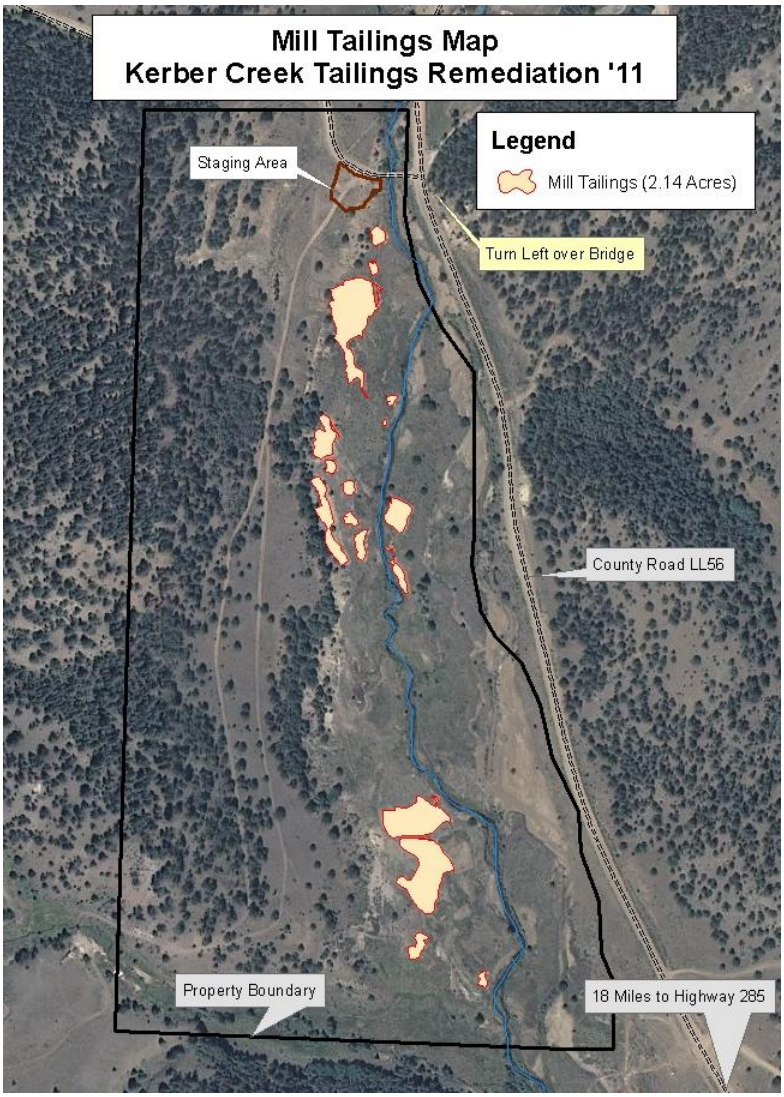
Grant money was used to improve approximately one mile of Kerber Creek and 2.14 acres of mine wastes contained on a private landowner's property (Site KC 20) immediately below the confluence of Brewery Creek and Kerber Creek (Figure 1.1). In-stream restoration was accomplished by installation of 32 bank stabilization rock structures, and adding root wads to erosion-prone stream banks. For additional bank stabilization, a combination of 200 willows, cottonwoods, and sedge mats will be installed on certain stream banks in the early 2012 field season. On problematic bends and incised channel areas, stream banks were engineered and graded to a 3:1 slope.

Mine wastes were remediated by in-situ treatment involving soil amendments such as calcium carbonate ($CaCO_3$), calcium hydroxide ($Ca(OH)_2$), organic compost, seed, mulch, and fertilizer. Over time, cumulative project efforts will help reconnect Kerber Creek to its floodplain and provide further fish and wildlife habitat by increasing channel depth, reducing width, and increasing sinuosity. Previous project work within the Kerber Creek Watershed and monitoring efforts provided necessary background information for a successful design at this site. Both revegetation and bank stabilization methods have proven effective through the success of other projects completed along Kerber Creek between 2008 and 2011.

In addition to the $37,000 awarded through the Colorado Water Conservation Board (CWCB) grant, USFS and BLM contributed $12,000 and $10,000 in matching funds, respectively towards the $34,400 grant award from the Colorado Forest Restoration Pilot Grant. All of the funds were needed for completion of the project, and Trout Unlimited is highly appreciative of the financial support from the aforementioned organizations.

The detailed design was completed in the spring of 2011, and a request for proposal (RFP) was submitted in summer of 2011. Contractor bids were then accepted in August 2011, and a final selection was made in early September 2011. Work was to start in early October 2011, but due to prior engagements, the selected contractor broke ground on October 18, 2011. The first five in-stream structures were installed on 10/24/11, and all in-stream work was completed by the first week in November. By 11/10/11, all mine waste areas on the LL56 side of Kerber Creek were ripped with soil amendments, and progress was made on the southern-most areas. Work was delayed during the second week of November because of snowfall, but a break in the weather allowed for completion of all soil amendments and in-situ work on 11/22/11.

Figure 1.1: KC 20 Plan View of Site map showing placement of mine waste areas, property boundary, and the section of Kerber Creek that was restored

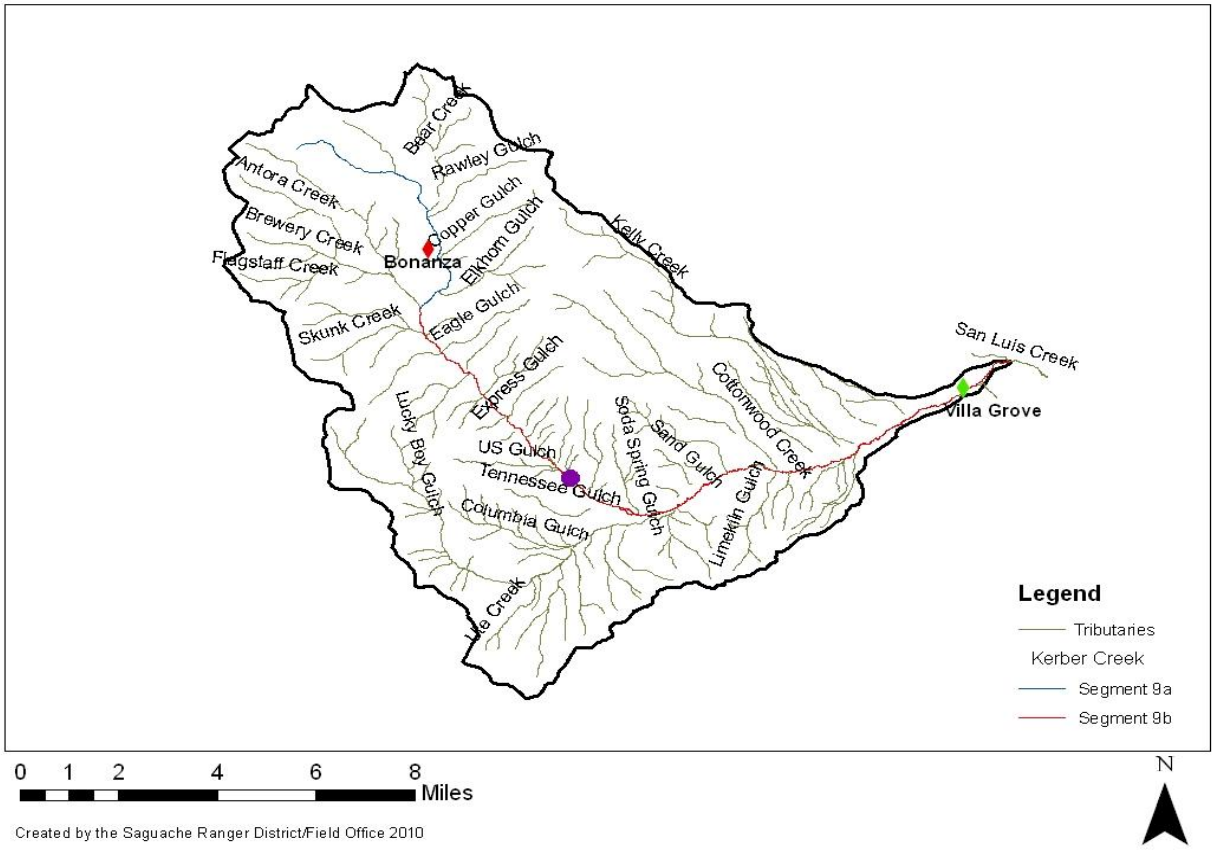


2.0 Background

The Kerber Creek watershed is divided into two segments, both of which have designated beneficial uses by the Colorado Water Quality Control Commission. Segment 9a, a 6-mile stretch of the mainstem of Kerber Creek from its source to immediately above the confluence of Brewery Creek, is designated as Recreation E, Water Supply, and Agricultural uses whereas Segment 9b, a 19-mile stretch of the mainstem of Kerber Creek from its confluence with Brewery Creek to its confluence with San Luis Creek, is designated as Aquatic Life Cold 1, Recreation E, Water Supply, and Agricultural uses (CDPHE, 2008) (Figure 2.1). The project site

is in Segment 9b and is on the main stem of Kerber Creek below the confluence of Brewery Creek.

Figure 2.1: Kerber Creek Watershed, WQCC Stream Segments, and Tributaries. (Purple circle represents a USGS gauge station which measures stream flow.)



Kerber Creek was officially listed by the State of Colorado as an impaired waterway in 1996 when its two segments were included on the Colorado 303(d) List of Impaired Waterways for non-attainment of metals standards. In 2006, CDPHE again listed segments 9a and 9b as impaired on the 303(d) List. Segment 9a was listed for its failure to support the water supply use classification and for failing to support the cadmium (total recoverable), silver (total recoverable), lead (total recoverable), and pH standards. In addition, Segment 9b was listed as impaired for non-attainment of the aquatic life use standards for dissolved cadmium, dissolved copper, and dissolved zinc. CDPHE completed a water-quality assessment project which led to the development of a TMDL for Kerber Creek (CDPHE, 2008). Analysis of water quality during development of the TMDL indicated that Kerber Creek is impacted by continuous discharge of high metal content drainage from legacy mining features (non-permitted point sources), erosion of high metal content mining wastes into Kerber Creek, and storm water runoff. Implementation of cleanup activities is necessary to reduce impacts from legacy mining activities.

However, as of 2008 no loading reduction of lead, silver, or pH was required to meet the water quality standards for Segment 9a due to previous reclamation work in the watershed. Therefore, only cadmium is not attaining the Water Supply Use based water quality standard for

Segment 9a. To achieve this goal, an average load reduction of 49% is necessary to reach the TMDL of 0.078 lbs/day for cadmium. For Segment 9b, an 18% load reduction of copper is necessary to reach TMDL standards. Both cadmium and zinc were removed from the 2008 303(d) list in Segment 9b. Even though only cadmium (Segment 9a) and copper (Segment 9b) remain on the 2008 303(d) list, lead, silver, pH, and zinc continue to seasonally exceed water quality standards in segment 9b. These constituents will continue to be monitored through 2015. Work done as part of this project will assist in the attainment of water quality goals.

3.0 Project Approach and Implementation

The approach to this project refers to the completion and obtainment of several objectives pertaining to overall stream health. Restoration efforts should help attain the following objectives:

1. Improve water quality by reducing metals contamination from mine waste areas
2. Increase sinuosity
3. Reduce channel width
4. Improve depth
5. Increase macro-invertebrate density
6. Increase fishery density
7. Increase upland vegetation cover
8. Stabilize stream banks
9. Reduce metal mobility in soil

In order to effectively implement the goals and objectives of this project, a list of tasks were developed. Each task funded by CWCB had a detailed description, method and procedure, and a deliverable. Of the seven tasks delegated for this project, three were funded by CWCB, which included Project Management, Revegetation, and Bank Stabilization. To ensure proper implementation TU employees followed each method and procedure for the corresponding task.

4.0 Tasks

The tasks pertaining to CWCB funds were first delegated in the scope of work (SOW), and used to successfully implement techniques before and during construction. TU, along with their construction partner, Tezak Construction, worked together to make sure the assigned tasks were completed.

4.1 Project Management

This task included the administration of grant funds and the completion of contracts for implementation of project work. By acting as the fiscal agent for the project, TU received, held, and distributed grant money. TU, in conjunction with BLM, USFWS, and NRCS, also created a SOW and RFP that provided details about site improvements. Throughout the construction phase, a TU representative was present on-site for 2 days out of each work week. While on-site,

TU oversaw the contractor's progress with respect to the work plan and other environmental objectives. The contractor interaction proved to be very productive throughout the project. Issues arose regarding type of fertilizer, delay in compost delivery, and design implementation questions, which were quickly mitigated by the relationship between the TU representative and the contractor. Photo documentation is included in Section 5.0, and photos were taken before ground-breaking, during construction, and after completion of restoration to show improvements throughout the project. Status reports pertaining to allocation of funds and progress to project goals were conducted throughout the project.

4.2 Revegetation Efforts

Tezak Construction was hired to revegetate banks along Kerber Creek on KC 20, increasing root mass, improving riparian habitat, and stabilizing stream banks. Root wads were installed where appropriate in-conjunction with rock structures and NRCS designs. In addition to root wads and sedge mats installation, a volunteer group (organized by WHWT) is scheduled to plant a combination of approximately 200 willows, cottonwoods, or other native woody species in the riparian corridor. These plantings were delayed until early in the 2012 field season due to weather issues after completion of construction in November 2011. The TU employee has been working with the US Fish and Wildlife Service's Partners for Fish and Wildlife Program (FWS) out of Monte Vista, CO to get a variety of native woody species to be planted at the site. It has been estimated that 250 seedlings will be provided and incorporated by FWS in the early 2012 field season as well. Having a diverse group of vegetation will allow for better habitat for native birds and macroinvertebrates. Additionally, TU, FWS, and NRCS have been working together to design a grazing management plan at KC20 to protect the completed restoration work. Fencing will be funded by FWS and installed onsite early in the 2012 field season to prohibit trespassing livestock. This fence will help support the Open Range and Fence Law, which means that when a property is protected by a lawful fence, civil recourse is available to the landowner for damage caused by the trespassing livestock. The fencing of this area will be essential to protect the investment and restoration efforts by participating agencies

Phytostabilization is an *in-situ* (in-place) treatment of mine wastes consisting of the introduction of lime, limestone and organic compost as amendments to affected soil, usually followed by a site's revegetation. Lime ($Ca(OH)_2$) and limestone ($CaCO_3$) bind to metals, demobilizing them and raising the pH of the soil. This process reduces the mobility of metals by altering them into less soluble, mobile, or toxic forms, prevents migration to surface or ground water, prevents airborne spread through dust, and reduces bioavailability for entry into the food chain through aquatic life or vegetation (Neuman et al., 2005). Various amounts of limestone, lime, and compost were ripped into the soil at depths between 18-24 inches (Table 4.1).

KC 20 was seeded with a mix formulated for Kerber Creek. Species selected for revegetation were chosen because they were present in the area, were readily available, and were known to be relatively metals-tolerant. The site was revegetated by broadcast seeding, 250 bales of straw were used as mulch, and mono-ammonium phosphate (MAP) as fertilizer (Table 4.1).

Table 4.1: Soil Amendment amounts used by contractor at site KC 20 for in-situ restoration

Site	Acres	$CaCO_3$	$Ca(OH)_2$	Compost	Barley Straw	Mono Ammonium Phosphate
		18" depth	16" depth	wet/tons	Bales	lb MAP/ac
KC20	2.14	91.84	94.85	82	250	154.2

4.3 Bank Stabilization

TU and NRCS representatives performed a site walkthrough in the fall of 2011 to determine placement, type, and number of rock structures/bank stabilization needed at KC20. NRCS then provided designs and drawings of bank stabilization and rock structure placement to protect against excessive erosion, and provide a more natural and stable stream channel. The final NRCS design consisted of 275 cubic yards (cu. yds) of rock and 125 cu. yds of bank excavation and backfilling. The 275 cu. yds of cobbles and boulders were from a local limestone quarry and transported to the site. It proved to be beneficial that the in-stream rock was from a limestone quarry, which helped contribute to raising the pH of the acidic surface water to more neutral levels. Tezak Construction appropriately followed NRCS designs, and installed 32 limestone-based rock structures in the 1-mile section of Kerber Creek below the bank-full water mark. A breakdown of structures is listed below.

32 Rock structures

- 12 Cross vanes
- 3 Rock barbs
- 6 Toe rocks
- 6 Low head dams
- 5 J-hooks

In addition to the 125 cu. yds of bank excavation recommended by NRCS, an additional 426 cu. yds was performed by Tezak Construction to ensure proper streambank reshaping to a 3:1 slope. Construction implementation progressed from downstream to upstream, due to accessibility issues and material staging options. Imported limestone rock was staged at several locations along the creek, while bank reshaping and rock placements were performed with a large track excavator (Figure 4.1). Most of the rock placement and in-stream work performed by the excavator was from the bank and not within the active channel due to the size of Kerber Creek.

Figure 4.1: Excavator and truck containing limestone in-stream rock along Kerber Creek at KC 20

Prior to restoration, a high width/depth ratio was recorded, and long riffle sections were predominant in this section of Kerber Creek. Without sufficient depth and small numbers of pool habitats, over-wintering of a trout population was unsustainable. However, installation of these structures will help shield fragile banks from excessive erosion, repositioning the speed and sinuosity, and improve fish, and macroinvertebrate habitat. The restoration also helps to reshape the degraded stream channel by establishing a predominant thalweg and an alternating pool and riffle system that is typical of natural stream systems. Immediate impacts were observed after installation of rock structures and bank stabilization such as, providing instream cover, and decreased width/depth ratio.

5.0 Photo Points

The photos shown below represent the work that was done on-site to improve the degraded conditions that were present such as, incised stream channel, cutbanks, and mine waste areas with no vegetation. All in-situ phytoremediation photos show the mine waste areas before, and after all soil amendments, seed, fertilizer, and straw were incorporated. The stream restoration photos display the high vertical wall banks in the before photos, while the after photos show bank stabilization by rock structures.

The northernmost and largest mine waste area was 0.56323 acres (Figure 5.1) and was immediately below the specified staging area. This area was one of the last to be completed since the contractor performed in-situ treatment from downstream to upstream.

Figure 5.1: KC 20 looking south from staging area at first large mine waste area before restoration (left) and after (right)

The largest mine waste areas in the southern portion of the property totalled 0.8223 acres (Figure 5.2). These two areas were divided by a small vegetated area, and were in a heavy cattle grazing and traffic section.

Figure 5.2: KC 20 lower mine waste area facing twin mountains before restoration (left) and after (right)

The largest mine waste area was a priority due to its size, and visual deficiences that could be viewed from the LL56, Brewery Creek roads, and landowners access road (Figures 5.3 and 5.4).

Figure 5.3: KC 20 first mine waste area facing west toward aspen tree before restoration (left) and after (right)

Figure 5.4: KC 20 on Brewery Creek Bridge looking southwest before restoration (left) and after (right)

A skinny section of mine waste connected two larger areas and was used as an access road by the contractor during construction (Figure 5.5). Since this area was toward the north of the site, it was one of the last to be restored. Significant improvement is can be observed, with no trace of the access road.

Figure 5.5: KC 20 2nd mine waste area (long and narrow) facing north before restoration (left) and after (right)

There were several areas along Kerber Creek that had steep banks, large width-depth ratios, and poor trout habitats. Banks were pulled back to a 3:1 slope and J-hooks were installed on appropriate meander bends (Figures 5.6 and 5.7) to reposition the thalweg and stream energy toward the center of the channel and away from the banks.

Figure 5.6: KC 20 Kerber Creek cutbank before restoration (left) and after J-hook installation and reshaping (right)

Figure 5.7: KC 20 Kerber Creek meander bend before restoration (left) and after installation of J-hook (right)

6.0 Conclusion

The Kerber Creek Restoration project at site KC 20 has resulted in a major improvement in the northernmost section of Segment 9b. A one mile section of stream below the confluence of Brewery Creek and Kerber Creek had 32 rock structures installed, and 2.14 acres of mine wastes treated using in-situ soil amendments specific to the site soil chemistry. KC 20 work connects several miles of Kerber Creek that have already been rehabilitated downstream on other private properties. This result provides long reaches of stream that are now suitable habitats. In addition to the benefits towards trout habitats, the width-depth ratio and streambank stabilization have visually improved since construction concluded. Improving the overall stream health of this section will only help Kerber Creek achieve water quality standards for Segment 9b.

The revegetation of native riparian species will take place during the upcoming 2012 field season in conjunction with FWS, and volunteer groups. Trout Unlimited will also work with FWS to provide and install fencing ensuring grazing management on all restored areas in the floodplain and riparian corridor.

References

[CDPHE, 2008] Colorado Department of Public Health and Environment. 2008. Total Maximum Daily Load Assessment (TMDL). Kerber Creek, Saguache County, Colorado, Colorado Water Quality Control Division.

[Neuman et al. 2005] Neuman, D.R., Vandeberg, G.S., Blicker, P.B., Goering, J.D., Jennings, S.R., Ford, K. 2005. Phytostabilization of Acid Metalliferous Mine Tailings at the Keating Site in Montana. ASMR, Lexington, KY. http://www.cfc.umt.edu. Accessed 8/15/2009.