Kerber Creek Restoration-Middle Parcel Project Final Report

Initiated and Implemented By:

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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
EQIP: Environmental Quality Incentives Program
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
WSRA: Water Supply Reserve Account
WMP: Watershed Management Plan
WQCD: Water Quality Control Division
WQX: Water Quality Exchange
XRF: X-Ray Fluorescent

1.0 Project Summary

Site KC16 is divided into three parcels: (1) KC16-E, the easternmost parcel recently completed (2) KC16-M, the middle parcel adjacent to KC16-E and focus of this project and (3) KC16-W, the western parcel separated from KC16-M by other private lands (Figure 1.1). Moving upstream from KC16-E is the middle parcel, or KC16-M.

This project allowed TU and project partners the opportunity to connect to the already restored 5.04 miles of stream in the lower watershed. Since 2009, work has been completed on sites KCHN, KC17, and KC16-E totaling 5.04 miles of restored stream and associated floodplain. In 2014, TU completed construction work associated with the second Colorado Nonpoint Source grant for the watershed. These funds allowed TU and project partners to complete 19.1 acres of mine tailings reclamation and 12,700 feet of stream improvements within the eastern parcel of site KC16.

In 2015, TU originally received $30,000 from WSRA to restore six acres of mine tailings contained within the floodplain of site KC16-M (Figure 1.2). However, due to increased material costs, the budget only allowed for the reclamation of five acres of prioritized mine tailings that coincided with 5,900 feet of in-stream improvements accomplished by the National Resource Conservation Service (NRCS). It was important to perform these two activities together to minimize metals loading due to construction, as well as future erosional events.

The mine tailings were treated and stabilized in conjunction with in-stream work to improve short and long-term bank stability through vegetation establishment. Establishing vegetation is a key component to providing immediate and long-term bank stability between in-stream structures. TU instituted phytostabilization as the treatment method of choice for the associated mine tailings. For KC16-M, a pre-determined mixture of soil amendments was applied to five acres of mine waste deposits and incorporated to a depth of 18-24”. Amendments include: (1) lime, to neutralize soil pH in the short-term, (2) limestone, to provide long-term buffering capacity, and (3) compost, to limit bioavailability in soils by chemically binding metals to the organic molecules. Specific amendment application rates have been determined using data from previous site characterization efforts and from rates used to treat deposits at similar sites in the Kerber Creek watershed. Following amendment application, a native seed mix was distributed using broadcast seeding to promote revegetation of the treated deposits. Straw was then crimped on top to provide protection from erosion. Phytostabilization work will correspond with stream bank reshaping that will take place between in-stream improvements.

The final project total for 2015 work on the middle parcel of KC16 ended up being $30,000 to complete; $3,000 being utilized for Task 1 Project Management and $27,000 for Task 2 Phytostabilization of Mine Tailings.

Goals and objectives listed in the Colorado Nonpoint Source (NPS) grant regarding monitoring were completed in the fall of 2015. NPS funds from the Measureable Results Program (MRP) will continue to be used to monitor progress towards ecological goals as defined in the Project Implementation Plan[1].

Figure 1.1: KC 16 Plan View of Site map showing placement of mine waste areas and property boundaries. WSRA funds went towards restoring the stream and floodplain within the Eastern Parcel.

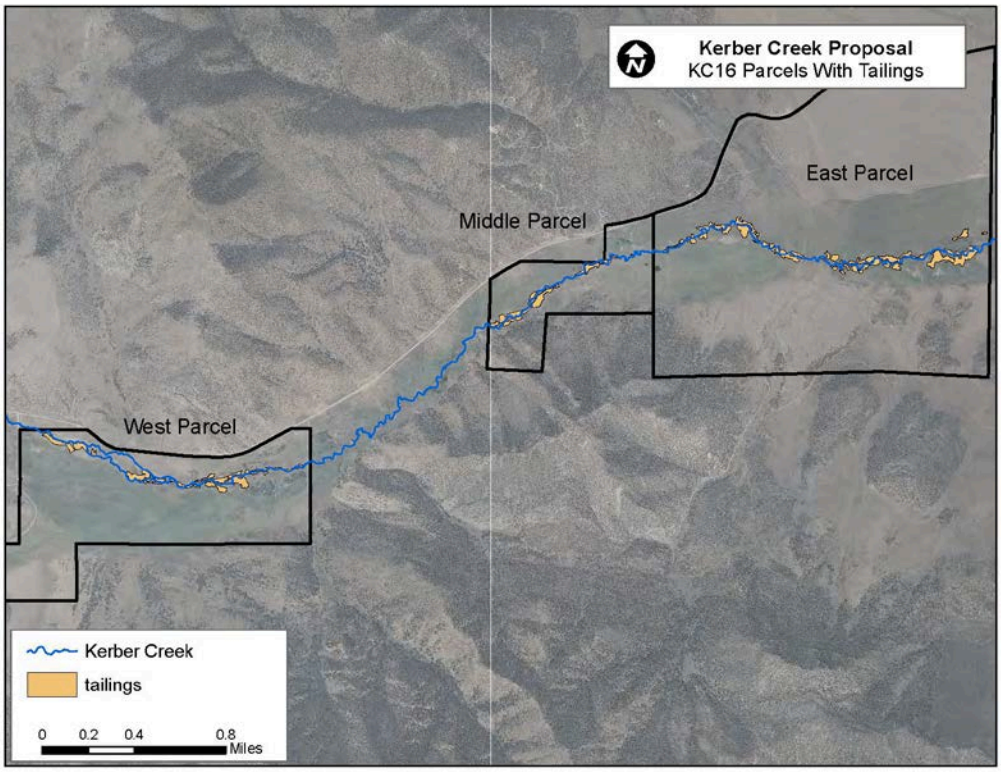
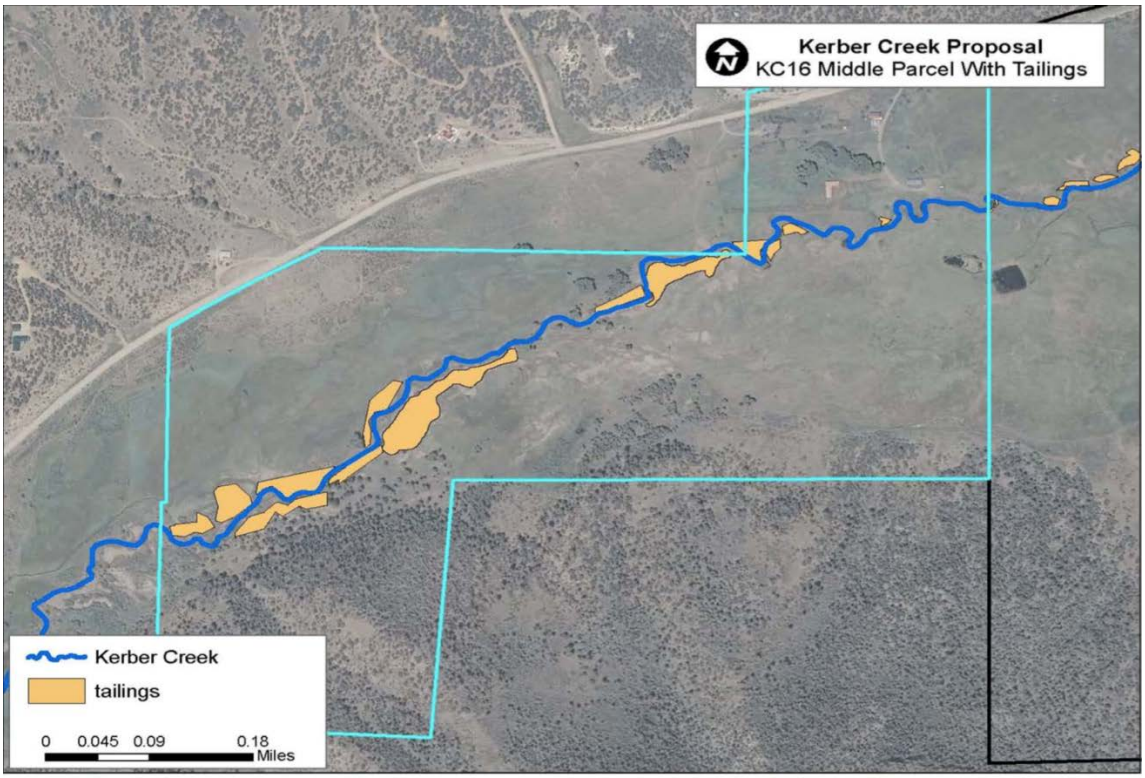


Figure 1.2: KC 16 M Plan View of Site map showing placement of mine waste areas and property boundaries. WSRA funds went towards restoring the stream and floodplain within the Middle Parcel in 2015.

[1] Kerber Creek Restoration Project. 2013. Project Implementation Plan. BLM Saguache Field Office.



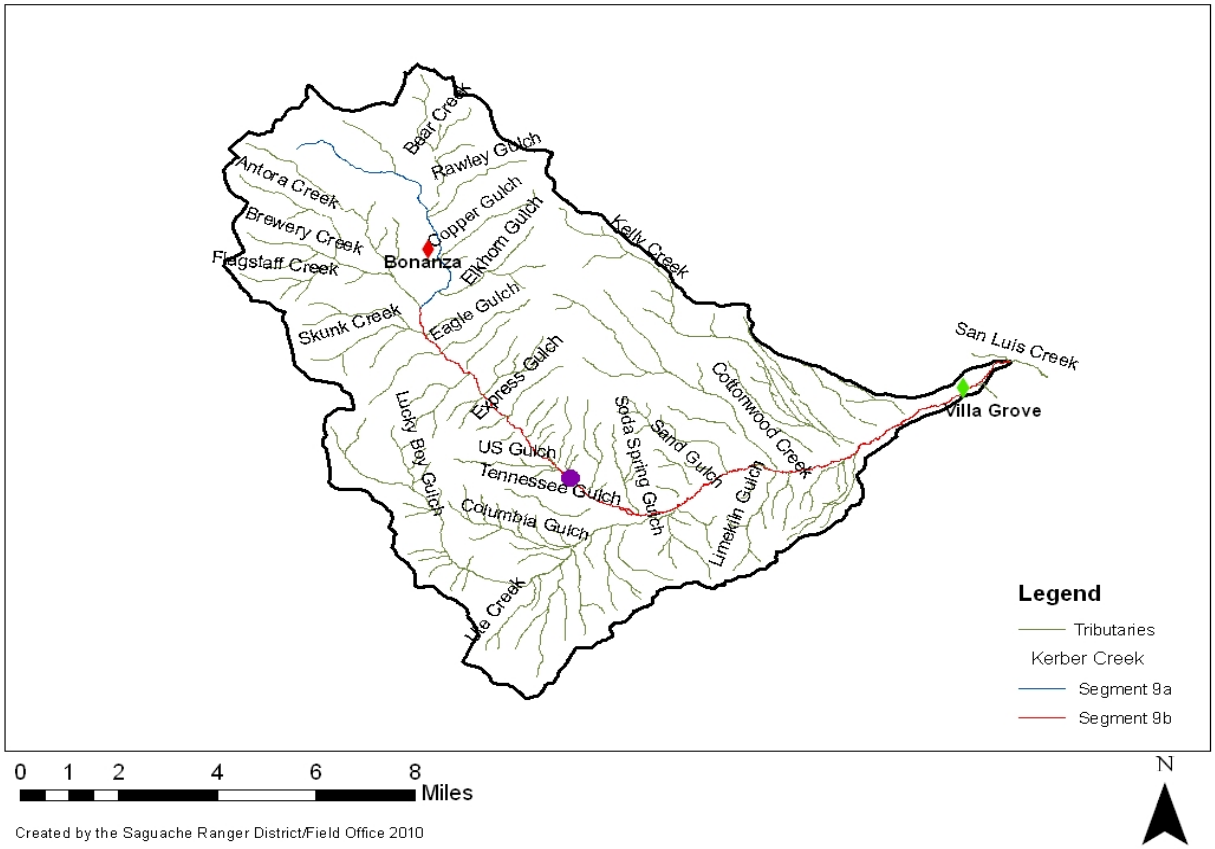
2.0 Background

The Kerber Creek Restoration Project (KCRP) is a collaborative effort dedicated to restoring the Kerber Creek watershed (Figure 2.1). Several tributaries and the main stem of Kerber Creek have been heavily impacted by legacy mining activities stemming from the Bonanza Mining District. Dozens of silver, lead, copper, and zinc mines operated in the District from the 1880s to the 1970s, with major production occurring mainly during the 1920s and 1930s. Mine wastes and tailings, originally sequestered behind dams in the upper watershed, were transported downstream and deposited in the Kerber Creek floodplain during high flow events that caused the dams to fail. These mine waste deposits led to phytotoxic soil conditions that decimated the riparian vegetation, which subsequently destabilized the stream banks and significantly altered channel morphology. In addition to these impacts, groundwater and runoff flowing through and over the mine waste deposits as well as flow from draining adits at former mine sites impaired water quality throughout the watershed. In the 1990s, the American Smelting and Refining Company (ASARCO, Inc.) partnered with local landowners, the US Forest Service (USFS), and the Bureau of Land Management (BLM) to initiate voluntary cleanup efforts in the watershed. These efforts significantly improved water quality and aquatic habitat by plugging the Rawley 12 draining adit and relocating over 100,000 cubic yards of tailings to a repository lower in the watershed. However, additional work on lower watershed mine waste deposits was not possible after 2002, when ASARCO, Inc. declared bankruptcy.

In 2005, BLM began an investigation of the environmental condition of the lower watershed, completing a full environmental assessment in 2006. This investigation was the beginning of KCRP, which today functions as a non-legal entity grounded in partnerships among a variety of organizations, including, but not limited to, USFS, BLM, the US Fish and Wildlife Service (USFWS), the Natural Resources Conservation Service (NRCS),

TU, Saguache County Sustainable Environment and Economic Development (ScSEED), the Colorado Department of Public Health and Environment (CDPHE), and the Bonanza Stakeholders Group (BSG), a coalition of more than 20 private landowners in the Kerber Creek watershed. Since 2007, the project has successfully treated over 85 acres of mine wastes, restored over 17,900 feet of stream bank, and installed over 369 in-stream rock structures in the lower watershed. These accomplishments have been made possible by the over $2 million in grant funding awarded to the project to date and scores of project volunteers, who have collectively contributed over 13,000 hours.

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



3.0 Project Approach

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 listed in the original 319 NPS Proposal

1. Improve water quality by reducing metals contamination from mine waste areas
2. Reduce channel width
3. Improve depth

4. Increase macro-invertebrate density
5. Increase fishery density
6. Increase upland vegetation cover
7. Stabilize stream banks
8. 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 4 tasks delegated for this project, two were funded by WSRA, which included Project Management, Phytostablization of Mine Tailings. The other two tasks, in-stream Restoration, and Monitoring, were funded through other groups. 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, Mike Tezak Construction, worked together to make sure the assigned tasks were completed. A description of the specific tasks completed during this project using WSRA funds are listed in the subsequent sections

4.1 Project Management

This task included the administration of grant funds, completion of contracts for implementation of project work, invoicing, and report writing. TU ensured proper completion of project tasks by adhering to a project schedule (Table 4.1). Mike Tezak Construction out of Cotopaxi, CO successfully won the bid process, which was initiated by NRCS for completion of the associated in-stream work. The Trout Unlimited phytostabilization work was added as an additional scope item for the 2015 construction season. Throughout the construction phases, a TU representative was present on-site for at least 1 day per each work week to ensure proper construction methods. 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. Photo documentation is included in Section 5.0, and photos were taken before ground-breaking and after completion of restoration to show improvements.

Table 4.1: Completed Project Schedule

Table 4.1: Complete Project Schedule			
Tasks	**Task Description**	**Start Date**	**Finish Date**
1	Project management	6/10/15	7/13/16
2	Photostabilization of Mine Tailings	6/10/15	12/31/15
3	In-stream restoration	7/1/2015	12/31/15
4	Monitoring	Ongoing	9/30/15

4.2 Phytostabilization of Mine Tailings

Mike Tezak Construction was hired to preform construction activities along Kerber Creek on KC16-M. The original task description in the grant application specified a treatment goal of six acres of mine tailings. This estimate ended up being unattainable due to increased material costs even with the donation of the BLM limestone. However, after a combination of budget manipulation and amendment rate scaling TU was able to treat 5 acres of mine tailings/wastes this past fall. This comes in at 83% (5/6) of our original goal, which we feel was an accomplishment given the fact that the price of organic compost increased from $35/ton delivered in 2014 to $62.1/ton delivered in 2015.

To ensure that the most effective treatment was implemented, TU staff selected five acres to be treated closest to the stream corridor. The acre that was not treated was furthest from the stream corridor and will act as a test plot area in 2016. TU sees this as an opportunity to refine rate prescriptions and cut costs for future similar projects. Several types of leftover amendments (lime, limestone, biosol, and humate) were stockpiled adjacent to eleven 10ft x 10ft test plots on the untreated area. This area will act as a revegetation study that TU staff will complete in 2016 to refine amendment rates and evaluate effectiveness of different combinations. A composite soil sample of all eleven grids was collected this past summer and analyzed at Colorado Mountain College (CMC) to provide baseline data and a basis for rate calculations.

Phytostabilization was the method of choice to treat the mine tailings. It 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. The result provides a good growing medium for riparian vegetation that has long term stability while reducing bioavailability for entry into the food chain through aquatic life. Amounts of limestone, lime, and compost were calculated based upon initial soil chemistry data for KC16-M (Figure 4.2). For neutralization purposes, 101 tons of Lime ($Ca(OH)_2$) and 220 tons of limestone ($CaCO_3$) were used. The Limestone was donated by the Bureau of Land Management saving the project $16,548. The purpose of these components is to 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, or toxic forms, thus preventing migration to surface or ground

water. These amendments were ripped into the soil at depths between 18". Next 353 tons of organic compost were mixed to a depth ranging from 8-12". In addition to the 106 pounds of Kerber Creek Seed mix that was distributed, 11 tons weed-free mulch/straw was crimped in on top of 787 pounds of mono-ammonium phosphate (MAP) fertilizer.

Figure 4.2: Soil Amendment amounts per tailings pile used by contractor at site KC 16-M for in-situ restoration

Work Data Sheet for Kerber Creek - Middle Parcel (Site KC16 Remediation 2015)

General Site Information				Actual Required Site Amendments (Tons)			Site Revegetation		
Work Site	Tailing Map Site Designation	Est. Tailing Depth (i	Area Acres	CaCO3 18" > Dept	Ca(OH)2 18" > Dept	Compost	Seed @ 20#/ac	Mulch @ 2 ton/ac	TSP @ 150#/ac.
KC 16	middle1	0-36	0.0306	1.34	0.62	1.82	0.65	0.06	4.85
KC 16	middle2	0-36	0.2063	9.04	4.20	12.27	4.36	0.44	32.69
KC 16	middle3	0-36	0.2361	10.34	4.81	14.04	4.99	0.50	37.40
KC 16	middle4	0-36	0.3873	16.97	7.89	23.03	8.18	0.82	61.36
KC 16	middle5	0-36	0.6352	27.82	12.93	37.77	13.42	1.34	100.64
KC 16	middle6	0-36	0.5389	23.60	10.97	32.05	11.38	1.14	85.37
KC 16	middle7	0-36	0.2939	12.87	5.98	17.48	6.21	0.62	46.56
KC 16	middless1	0-36	0.1000	4.38	2.04	5.95	2.11	0.21	15.84
KC 16	middless2	0-36	0.0852	3.73	1.73	5.06	1.80	0.18	13.49
KC 16	middless3	0-36	0.8042	35.22	16.37	47.82	16.98	1.70	127.40
KC 16	middless4	0-36	0.7550	33.07	15.37	44.90	15.95	1.60	119.61
KC 16	middless5	0-36	0.2767	12.12	5.63	16.45	5.84	0.58	43.84
KC 16	middless6	0-36	0.5884	25.77	11.98	34.99	12.43	1.24	93.22
		Total:	4.9377	220.00	101.00	294.00	106.00	11.00	787.00

To cut off 1 acre of phyto work only treat 0.75 acres directly along stream channel of largest pile on South Side of the stream. (I reduced this from 1.755 acres to 0.755 to cut out an acre of costs)

** Tailing Map Site Designation refers to Mine waste map for middle parcel of KC16 property

4.3 In-Stream Restoration (Not funded through WRSA)

A site survey and design of engineered structures was completed by NRCS personnel. Mike Tezak Construction implemented restoration activities according to the Environmental Quality Incentives Program (EQIP) contract with NRCS. These activities included the installation of root wads, willow clump transplants, and 69 engineered rock structures. In-stream restoration was implemented in-conjunction with Task 2 (Phytostabilization of mine tailings) to prevent future negative erosional impacts.

Overall, a total of 5,900 feet of stream was restored using both vegetative transplants and engineered rock structures. An estimated 1,000 cubic yards of bank was reshaped during stream restoration procedures.

4.4 Monitoring (Not funded through WRSA)

Project personnel monitored a variety of geomorphological, biological, and water quality variables at previously established sites throughout the watershed. Data collected will be used to evaluate the effects of the project and to document project success.

During the 2015 field season TU staff along with BLM personnel completed high flow water quality monitoring, cross section measurements, and daubenmire vegetation transects.

As specified in the KCRP Sampling and Analysis Project Plan (SAPP)[2], available upon request: water quality, stream sinuosity, macroinvertebrate population, fishery density, and vegetation cover will be monitored at five sites; channel width and channel depth will be monitored at four sites; and repeat photographs will be taken at five sites that correspond with vegetation monitoring sites. All monitoring and data analysis methods will follow standard, approved practices that have been utilized for past restoration projects in the watershed, thus allowing for direct comparison between data collected before and after restoration.

The completed monitoring from 2015 can be found in the Kerber Creek final 319 II Report for the Colorado Department of Public Health and Environment (CDPHE). This report was recently completed and submitted to CDPHE for review on June 30th, 2016. Sections were completed evaluating success of each of the environmental objectives listed in Section 3.0 above. This report is available upon request.

5.0 Photo Points

The photo set shown below represents a brief snippet of the work that was over the course of 2015 at KC16-M to improve mine waste areas with no vegetation (Figure 5.1).

Figure 5.1: KC16-M looking at mine waste areas with little vegetation (left) and after restoration involving phytostablizatinon. (right)

[2] Kerber Creek Restoration Project. 2013. Sampling and Analysis Project Plan. BLM Saguache Field Office.

6.0 Conclusion

The Kerber Creek Restoration project at site KC16-M has resulted in a major improvement in the stream and land quality of this section of the watershed. About 5,900 feet of stream within the middle parcel of KC16 has been fully restored. This includes 69 rock structures installed and five acres of mine wastes treated using in-situ soil amendments specific to the site soil chemistry. Although the goal of six acres was not achieved due to budgets, restoring the 5 prioritized acres will have a significant impact on the area. Work associated with KC16-M connects downstream sections of KC16-E, which was restored in 2012 through 2015 by past WSRA and CDPHE funds. This result provides long reaches of stream that are now suitable habitats with stable banks and improved soil quality. Improving the overall stream health of this section will only help Kerber Creek get closer to attaining State water quality standards for Segment 9b. Task 2, the phytostabilzation of five acres of mine waste rock, was paid for using 90% of WSRA funds; while the other 10% was used for Task 1, project management. TU is grateful for the funding and the opportunity to work with CWCB on projects like Kerber Creek. We look forward to continuing our great relationship on similar projects in the future.