

NONPOINT SOURCE PROGRAM FINAL REPORT

319 Coal Creek Watershed Restoration Project PO 16 FAAA 91181



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This project was conducted in cooperation with the State of Colorado and the United States Environmental Protection Agency, Region 8.

EXECUTIVE SUMMARY

PROJECT TITLE: Coal Creek Watershed Restoration 319 Project

PROJECT START DATE: February, 2011 PROJECT COMPLETION DATE: December 31, 2016

FUNDING: TOTAL BUDGET: \$418,533.00 (including match)

TOTAL SECTION 319: \$236,583.00

MATCH ACCRUED: \$216,250.24

BUDGET REVISIONS:

- Contract time extension from February, 2015 to February 17, 2017.
- Additional funds allocated by the NPS Program in June 2015 in the amount of \$70,000 for Task 2 and Task 13.
- Contract amendment to focus on only Task 1 and Task 2 (PO 16 FAAA 91181) in June 2016.

TOTAL EXPENDITURES \$452,833.24 (including all accrued match)

SUMMARY ACCOMPLISHMENTS

The substantial accomplishments of this project include the following:

- Restored disturbed or nonfunctioning wetlands to improve water quality in Coal Creek.
- Implemented appropriate restoration practices to reduce the metals pollutant loading to Coal Creek.
- Increased organizational capacity
- Increased community involvement and support of watershed related issues.

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EXECUTIVE NARRATIVE

In 2009 the Coal Creek Watershed Coalition (CCWC) completed its Coal Creek Watershed Plan with funds from the Colorado Nonpoint Source Program. That Watershed Restoration Plan would serve as the guiding document for identifying and prioritizing projects within the Coal Creek Watershed that would have a positive impact on overarching water quality.

In 2011, the CCWC secured 319 funding through the Colorado Nonpoint Source Program (NPS) to implement a diverse and targeted set of goals, objectives and projects outlined in the Coal Creek Watershed Restoration Plan to achieve the following:

- reduce metals loading into Coal Creek by completing environmental restoration of the Mount Emmons Iron Fen (MEIF);
- minimize sediment and chloride contributions to the creek by implementing Best Management Practices (BMP's) along Kebler Pass Road;
- complete wetlands and stream bank restoration work.

With funding provided by NPS, and additional funding from the Town of Crested Butte, Division of Mining, Reclamation and Safety, and US Forest Service, the CCWC began implementing projects and programs outlined in the 319 Coal Creek Restoration Project in 2011. The project included thirteen tasks with desirable outcomes and deliverables outlined accordingly.

Over the last six years the CCWC has worked closely with various stakeholders and the Crested Butte community to actively address impairments to water quality in Coal Creek. In October 2016, the CCWC completed its last task and deliverable as outlined in the 319 grant- restoration of the Mount Emmons Iron Fen Ditch.

During this grant period, the CCWC has experienced a tremendous amount of success, as well as set-backs that required diligent adaptive management practices to effectively navigate challenges presented to various aspects and tasks outlined in the grant. Additionally, during this time, the CCWC employed three separate Executive Directors, and these staff changes lead to difficulties and delays in implementing some aspects of the grant. However, the successful completion of the Mount Emmons Iron Fen Restoration project (Task 2) in October 2016, marks completion of all outlined and developed deliverables. Due to the fact that this project was completed at the end of the contract period, no post project monitoring results can be provided in this final report. The CCWC will continue to monitor the site during the coming years.

During the grant period, the CCWC has collected over 1,000 water quality samples from the Coal Creek Watershed to actively monitor and evaluate the effectiveness of the restoration projects outlined and completed in the 319 Coal Creek Restoration Project.

Throughout this grant, the CCWC saw tremendous growth as an organization. The CCWC expanded its geographic reach to include the Upper Slate River Watershed, which sits adjacent to the Coal Creek Watershed, and north of Crested Butte. The Upper Slate River Watershed Plan was completed in October 2014, and the CCWC has already begun working with stakeholders to implement impactful projects in the Upper Slate as prioritized in that watershed plan. Additionally, over the last six years we have actively worked with the community of Crested Butte to engage the general public in watershed and water quality issues, and as such have seen a dramatic increase in public engagement, participation,

and buy-in.

The CCWC is already looking to the future on what tangible and measurable results we can achieve by exploring additional restoration projects not covered in this 319 grant. In 2018, the CCWC is expecting to begin looking at revegetation of the Gossan, a site characterized under this existing grant, but unable to be completed in the given grant period.

The CCWC would like to thank the Colorado Nonpoint Source Program and its staff for all of their dedication, perseverance, assistance, and support over the last six years. Thank you.

INTRODUCTION

In 2003 local organizations initiated a water quality characterization effort in the Coal Creek Watershed. Simultaneously, the EPA completed site characterizations in the Watershed. Initial study results indicated substantial water quality impairments attributed to several features in the Watershed. Public interest in water quality led to the formation of The Coal Creek Watershed Coalition (CCWC) in 2003, to characterize, protect, and restore water quality in the Coal Creek Watershed. CCWC was and remains an important stakeholder in the process to reclaim the Standard Mine, an EPA Superfund site located in the Watershed. The CCWC is also an active leader in water quality, watershed health, and restoration issues in the Crested Butte area. The mission of the Coal Creek Watershed Coalition is “to maintain, restore and enhance the environmental integrity of Crested Butte’s local watersheds to ensure those watersheds and habitats are of the highest possible quality necessary to support wildlife, aquatic life, and human life.”

Coal Creek is the raw drinking water supply for the town of Crested Butte, Colorado. Segments in the Coal Creek Watershed are on the 303(d) List for impairment of the aquatic life standards for cadmium, copper, lead, and zinc, and for impairment of the water supply standard for arsenic and manganese. Water quality impairments are primarily attributed to historic mining activities and naturally occurring geologic features.

As part of the Coal Creek Restoration Project, the Colorado Nonpoint Source Program has worked closely with the CCWC, over the last six years (2011-2017) to identify and prioritize projects in the Coal Creek Watershed to improve overarching watershed health and water quality. This final report is an overview of the work completed by the CCWC to reduce contaminants, improve riparian corridors, and restore degraded wetlands.

WATERSHED OVERVIEW

The Coal Creek Watershed is located near Crested Butte in Gunnison County, Colorado (HUC 14020001). Coal Creek is a second order stream within the Coal Creek watershed situated in a moderately steep colluvial valley. The stream segment in the vicinity of the existing drinking water diversion structure is a perennial single thread channel with low to moderate sinuosity and an average channel slope of 2.1%; the grade is fairly steep and continuous. Seasonal variation in stream flow is dominated by snowmelt runoff. The stream is classified as a Rosgen B-4 stream type.

The Coal Creek Watershed is 24.4 square kilometers or approximately 15,600 acres. Much of the watershed is managed by the U.S. Forest Service land (75.5%, 11,851 acres). Private lands account for 20.1% of the watershed (3,158 acres). The remaining fraction (4.4%) is split between the Crested Butte Land Trust, Gunnison County, the Bureau of Land Management, and the Town of Crested Butte.

Gunnison County Road 12 (Kebler Pass Road) parallels Coal Creek; other minor unpaved roads are found throughout the watershed. Motorized vehicle use is high during the summer and fall, especially along Kebler Pass Road (County Road 12). Summer recreation occurs on multiple-use trails and includes hiking, mountain biking, and horseback riding, and others. In the winter, forest roads are used for cross-country skiing, snowshoeing, and snowmobiling.

Currently, the watershed is used primarily for recreation and residential development, including the Town of Irwin and the Town of Crested Butte. Incorporated in 1880 as a mining town, Crested Butte was settled on the banks and within the riparian zone of Coal Creek. Crested Butte has approximately 1,500 residents, 692 households, and 253 families.

Average precipitation ranges from 24 to 48 inches annually; much of which falls as snow. Regional vegetation is predominantly boreal forest. Aspen, fir, and spruce forests dominate the lower elevations, while alpine tundra occurs at elevations above tree line. Microclimates vary with slope, angle, and aspect. Where snow persists longer on north-facing slopes, which results in increased soil moisture content and denser forest vegetation. On the contrary, snow melts earlier from south-facing slopes, resulting in drier soils, which allows increased shrub and grass cover in selected areas. Elevation ranges from approximately 8,860 feet near the confluence with the Slate River to over 12,000 feet along the western boundary of the watershed, in the Ruby Range.

The Coal Creek Watershed was shaped by glacial erosion during the Pleistocene epoch. The high peaks are characterized by laccoliths, dome-shaped igneous intrusions, and sedimentary and volcanic rock formations. The valley bottom is underlain by sand and gravel deposited by glacial ice and melt water. In the middle and late Cenozoic, epizonal plutonic activity created mineralized veins, fractures and faults in the Ruby Range. These mineralized veins produced silver, zinc, lead, copper and gold.

The watershed, also known as the Ruby Mining District, is rich in mineral resources. Hard rock mining began in 1874 and continued until 1974. Vein deposits are contained in north-northeast-trending faults, dikes, and small stocks on the eastern faces of the Ruby Range. These veins are rich in copper, gold, lead, molybdenum, ruby silver, and zinc. The three largest mines were the Standard Mine, the Keystone Mine (managed by the Mount Emmons Mining Company), and the Forest Queen Mine, all of which are located on the southern face of Scarp Ridge or Mt Emmons.

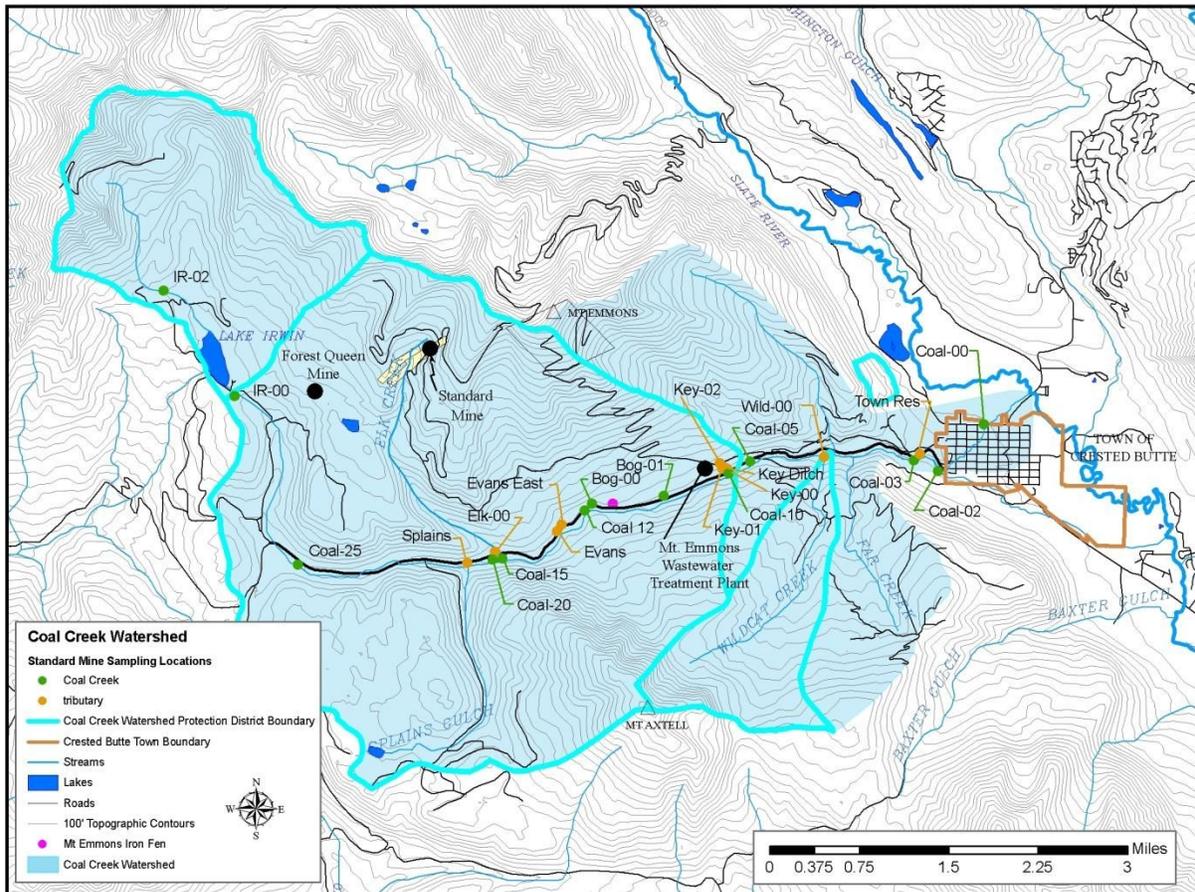


Figure 1: Coal Creek Watershed Map

PROJECT GOALS AND OBJECTIVES

The goals of the restoration project were three-fold; reducing contaminated metals loading into Coal Creek by completing environmental restoration of the MEIF; minimizing sediment and chloride contributions to the creek by implementing Best Management Practices (BMP's) along Kebler Pass Road, and completing wetlands and stream bank restoration work. Each goal was intended to create loading reductions in Coal Creek and to reduce exceedances of table value water quality standards for metals.

Environmental Goal 1

Restore disturbed or nonfunctioning wetlands and mine impacted lands to improve water quality in Coal Creek.

Environmental Goal 2

Identify and implement appropriate restoration practices to reduce the metals pollutant loading to Coal Creek.

Environmental Goal 3

Improve water quality in Coal Creek by reducing sediment loading from roadways and other anthropogenic sources.

Programmatic Goal 1

Identify or implement BMPs to control stormwater runoff and to reduce erosion and resultant sediment loading to Coal Creek.

Programmatic Goal 2

Create healthy riparian corridors throughout the Coal Creek Watershed through education and restoration.

Programmatic Goal 3

Educate landowners and land managers on appropriate practices to maximize the health of riparian corridors on their lands.

Programmatic Goal 4

Educate landowners, residents and visitors on their role in protecting and maintaining healthy riparian corridors.

Programmatic Goal 5

Implement an overall, effective project that addresses nonpoint source pollution.

Programmatic Goal 6

Conduct effective outreach and project administration.

Type of Water Quality Problem including Sources

Metals: The watershed has three major inactive mines contributing to water quality issues, primarily through the introduction of metals to the watershed. The Standard Mine is currently being remediated by the EPA's Superfund program. The Keystone Mine has an active treatment system, constructed in 1981, to address pollutants that originate from a draining adit and drainage from four tailings impoundments. The Forest Queen Mine, located near the Irwin Town site, also contributes metals to Coal Creek; although at a smaller magnitude than the Standard and Keystone Mines. The Mt. Emmons Iron fen and adjacent gossan also contribute metals to Coal Creek.

Roadways: Roadway-related contaminants reach Coal Creek through a series of roadside ditches and culverts installed to control stormwater. A wetland survey by David Cooper (1993) mentioned dust as a problem in the Coal Creek Watershed. Since that time, the stretch of Kebler Pass Road between Crested Butte and the Wildcat Bridge has been paved and Gunnison County Road and Bridge crews have used magnesium chloride for dust abatement on the remaining gravel portions of the road. Current stormwater control measures include only limited sediment and velocity reducing devices (i.e. rip rap), downstream of culvert outfalls. A lack of additional velocity reduction and sediment capture strategies has resulted in significant incising of the roadside ditches and downgradient of conveyance structures (e.g. culvert to rip rap structure to riparian area), which increases sedimentation in Coal Creek and adjacent riparian areas. Throughout the watershed, approximately 10 miles of gravel and paved

surfaces are within 100 feet of Coal Creek. The road cut slopes have created additional slope stability issues, causing erosion and sedimentation and in some areas.

Dust Suppressants: Gunnison County applies magnesium chloride as a dust suppressant during road maintenance activities. Recent studies by the CCWC indicate chloride concentrations in Coal Creek are elevated above baseline conditions (<5 mg/L) during rainfall events (up to approximately 30 mg/L). Chloride concentrations remain lower than the EPA water supply standard of 250 mg/L. An aquatic life standard for chloride does not exist.

Physical/Habitat: The highest priority sites, which are described in the 2009 riparian assessment (included in Appendix) report, include:

- The Forest Queen Mine, which is in need of reclamation and stream/riparian restoration.
- The Kebler Lumber Mill/The Ender Lumber Company (TELCO) Mill Site Wetland, which needs sawdust removal, trash removal, and revegetation, plus a restored water flow.
- Coal Creek between Splains Gulch and Irwin Forks, which needs the implementation of roadway best management practices and stream/riparian restoration. Kebler Pass Road is located in the riparian wetland for most of this section.
- The riparian corridor through the Town of Crested Butte, which needs restoration and engineering of the stream/riparian zone to produce a “greenbelt” and to increase human safety.
- Coal Creek on the Crested Butte Land Trust Property near the confluence with the Slate River, which needs improved cattle management or fencing to keep cattle away from the riparian zone. Additionally, the eroded and widened stream needs channel and riparian restoration.
- The lower portion of the watershed, which needs noxious weed removal and management.
- Coke ash piles at the Jokerville Mine, which are eroding and need removal coupled with site revegetation.

319 GRANT TASK REPORTING

Detailed task reporting can be referenced in the CCWC’s submitted monthly and/or quarterly 319 reimbursement request narratives and semi-annual reports.

-Task 1: Mt. Emmons Iron Fen Assessment

Report: In 2011 and 2012, the CCWC partnered with the US Forest Service (USFS) Gunnison Field Office to assess a degraded wetland that sits adjacent to Kebler Pass Road. The Mount Emmons Iron Fen is a unique geologic feature that is estimated to be 10,000 years old and a natural source of metals to Coal Creek Segment 12. The 2009 Coal Creek Watershed Plan identified this site as a natural source of metals.

The wetlands down gradient of the fen are degraded. In 1986, Gunnison County dug an unpermitted diversion ditch through the center of the wetland to de-water the adjacent hillslope that continually sluffed material onto Kebler Pass Road, which required frequent and costly maintenance of the road and cut-slope. The ditch, referred to as the “86 Ditch”, negatively impacts the downgradient portions of the wetland. Since 1986, the 86 Ditch has deteriorated and breached in a number of places. Breached areas in the ditch allowed voluntary recruitment of native vegetation and over time restored wetland hydrology in selected areas. The USFS, in partnership with the CCWC, created a restoration design to

allow natural sheet flow from the Mt. Emmons Iron Fen to further reclaim the portion of the wetland down gradient of the 86 Ditch. If successful, the restoration project would prevent excessive stormwater run-off and minimize road maintenance activities, while sequestering metals in wetland vegetation, organic matter, and soils thereby improving water quality in Coal Creek.

During the summer of 2011, the USFS and CCWC installed six shallow piezometers to assess groundwater levels at the site. CCWC developed a request for proposals (RFP) to select a contractor to implement the reclamation design. A site tour was held on August 23rd, 2012. Three contractors, along with staff from the Town of Crested Butte, Gunnison County, and the USFS attended the site tour. After speaking with the contractors, it became evident that the available funds to complete the project, approximately \$50,000 at that time, were not adequate. Due to budget concerns, the Fen Ditch Restoration Project was temporarily put on hold. The NPS Program approved re-allocating those funds for the Gossan.

In 2013, the CCWC began assessment and design to revegetate the Gossan, located northeast of the Mount Emmons Iron Fen. The Gossan is a naturally occurring feature composed of limonite and other iron oxides. In 1978, a fire on the AMAX Mining Company property burned portions of the gossan; vegetation cover remains very sparse. The western portion of the gossan drains to the Mount Emmons Iron Fen, and the remainder drains to Coal Creek via small intermittent drainages. The gossan contributes metal loading to Coal Creek Segment 11 (Coal Creek Watershed Plan, 2009). The CCWC hired Andy Herb, owner of AlpineEco, to develop vegetation test plots at the Gossan – six blocks with four plots in each (24 total) were installed and monitored in 2013, 2014, and 2015. That data was supplied to the Nonpoint Source Program on a yearly basis (2013-2016 Gossan Memos included in the Appendix).

-Task 2: Mt. Emmons Iron Fen Restoration

Report: In 2014 the CCWC secured an additional \$17,000 in funding from the USFS Regional Advisory Committee (RAC) Fund to supplement the existing \$53,000 provided by NPS for restoration at the Mount Emmons Iron Fen Ditch. With funding in place the CCWC released an RFP to select a contractor to implement the NRCS engineered restoration design at the Fen Ditch. The contract was awarded to Lacy Construction, LLC of Crested Butte in August 2014. Construction began in October 2014, challenges with the NRCS design, delays in materials, and weather quickly created challenges. After many changes to the original NRCS engineering design and delays associated with snow in early fall, the project was completed on November 21st, 2014.

After heavy April snowfalls and one of the wettest springs in Colorado history (precipitation was 230% and 170% of average in May and June, respectively) the diversion structure began to fail. Runoff eroded massive portions of the 55-degree hillslope and saturated soils and fill sluffed onto Kebler Pass Road. Two separate emergency repairs, by Al's Backhoe of Crested Butte, were necessary to keep Kebler Pass Road open.

On May 5th, 2015, the USFS decided to re-open the 86 Ditch as an "emergency action" to divert water away from the hillslope and diversion structure in an effort to protect Kebler Pass Road. On May 6th USFS personnel accessed the project area and re-opened the 86 Ditch with a mini-excavator. The action violated the Section 404(d) of the Clean Water Act, the USFS Resource Management Plan, and a State of Colorado Special Interest Site management agreement. As a result of the violation, the US Army Corps

of Engineers became involved with the project.

In July 2015, CCWC led stakeholders on a tour of the Fen Ditch area. The objective was to find an agreeable solution to rehabilitate the wetland, stabilize the hillslope, and ultimately improve water quality at the site. After the hillslope stabilized, in August 2015, the CCWC hired All County Survey to survey the site. The August 2015 survey data was incorporated into a new engineering design developed by the USFS (the design was submitted to NPS Program as part of the review process). The USFS design was finalized in February, 2016 and shared with all stakeholders. The USFS design included three phases. September 2016 was selected as the start date of phase one.

The CCWC hired McCollum's excavating to construct the USFS design. The USFS allocated \$40,000 to complete the project, while NPS funds in the amount of \$54,313 were re-allocated from the Gossan Revegetation task. Currently, revegetation at the gossan is not possible because the USFS will not allow the project to proceed until after the Mount Emmons Fen Ditch Project is complete.

Phase one of the Mount Emmons Iron Fen Ditch Restoration Project began on September 6th, 2016 and work was completed on September 30th, 2016. Phase two began on October 3rd and was completed on October 14th, 2016. Phase three will be completed by the USFS in June 2017; the CCWC is a stakeholder, but not an active partner in phase three. During phase three the USFS will repair the portions of the wetland damaged when the 86 Ditch was re-opened.

The CCWC will continue to monitor the site and collect water quality samples from Coal Creek immediately above and below the project area, as well in the adjacent tributaries; for at least the next three years.

-Task 3: Inactive Mine Characterization

Report: The CCWC hired summer field staff in 2013 to collect water quality and sediment samples at four abandoned mine sites located in the Coal Creek Watershed. These locations were identified by the Colorado Division of Reclamation, Mining and Safety as potential sources of water quality impairment. Division of Reclamation, Mining and Safety provided additional funds to supplement NPS funds allocated for this task. The Inactive Mine Characterization Report was completed in January, 2015 and shared with NPS. Metal concentrations in water and sediment samples were relatively low and do not suggest additional action is required.

The Inactive Mine Characterization Final Report is included in the Appendix.

-Task 4: Best Management Practices (BMP'S) – Check Dams

Report: During the summer of 2010, CCWC summer field staff installed and maintained over 30 GeoTextile check dams in prioritized locations along Kebler Pass Road in an effort to reduce sediment deposition in Coal Creek; maintenance continued during the summer of 2011. After completing the WEPP: Road survey in late 2011, the CCWC and Michael Blazewitz of the Measurable Results Program (MRP) determined that the sediment mobilization and deposition from Kebler Pass Road was much lower than originally anticipated, and in 2012 the remaining funds for this task were reallocated to other tasks.

The results of the 2011 WEPP: Road are presented in the Coal Creek 2011 Measurable Results Program

Report which is included in the Appendix.

-Task 5: BMP's - Erosion Control and Revegetation

Report: The CCWC maintained erosion control mats for two years. The mats, installed from 2009 to 2011 survived the snowpack well and revegetation is evident in most areas where the mats were installed. The CCWC and Measureable Results Program (MRP) modeled sediment transport and delivery on Kebler Pass Road in 2011. The model identified two road segments that delivered most of the sediment to Coal Creek. BMPs for those two segments were identified and we continued to communicate with MRP about alternatives. This data and assessment became available following the initial chip-sealing in 2010 of Kebler Pass Road (MM22 - MM24); upon learning the results of the MRP Road WEPP study, CCWC approached Gunnison County about chip-sealing the remaining segment of Kebler (which would address the two identified segments), but Gunnison County had no interest in chip-sealing the remaining segment of Kebler. Addressing sedimentation became less of a priority and those funds were reallocated to Task 2 to help address the primary impairment to Coal Creek, metals.

Long-term maintenance needs continue to be a challenge to successfully implementing BMPs. Gunnison County's limited staff and large region of responsibility makes them understandably reluctant to commit to additional regular maintenance (i.e. sediment removal, seeding).

The results of the 2011 WEPP: Road are presented in the Coal Creek 2011 Measurable Results Program Report which is included in the Appendix.

-Task 6: BMP's – Chip Seal

Report: Chip-seal was applied to selected segments of Kebler Pass Road in 2010 in a partnership with Gunnison County. Vegetation in the roadside ditches was measured in 2012 and 2014 to evaluate changes in vegetation type and cover following the chip-sealing project. The Road WEPP model indicated that chip-sealing may increase run-off volume from the road surface, resulting in increased flow and erosion in the roadside ditches.

The 2011 WEPP: Road model results are presented in the Coal Creek 2011 Measurable Results Program Report (see Appendix). The Roadside Vegetation Report is included in the Appendix.

-Task 7: Red Lady Basin Assessment

Report: This task was not completed due to insufficient funds and an unclear action plan for engineering designs, and alternatives analyses. Funds for this task were reallocated to Task 2.

-Task 8: Confluence Parcel Restoration

Report: Fencing through the study reach, installed in 2010, had a dramatic effect allowing vegetation at the site to recover voluntarily. Beavers have returned to the site, dams and other structures alter hydrology and sediment transport, which has increased bank stability.

Alpine Ecological Resources and EcoMetrics completed a detailed study of Coal Creek within the Crested Butte Land Trust's Confluence Parcel. The 2012 study's findings contradict the findings of the 2009 riparian assessment completed by Dr. Kevin Alexander and Wendy Brown. The 2012 study indicated

that grazing impacts may not have been as severe as indicated in the 2009 report. The 2012 study indicates there are some sediment transport issues and recommended moving the stream channel to the west, away from Gothic Road, to allow the stream to meander without compromising the road. In 2011, Gunnison County armored the southern edge of the channel, near the road, with rip-rap to reduce erosion. The study also mentioned bedload transport issues on the Slate River, which is detailed in the 2012 Geomorphic Assessment for the Upper Slate River Watershed Plan.

The findings from both studies were shared with staff from Gunnison County's Public Works Department which is currently in the process of engineering a new bridge to replace the bridge on Gothic Road that spans the Slate River. Additional work at this site was deemed unnecessary at this time and funds were reallocated.

-Task 9: Riparian Workshop

Report: In the Town of Crested Butte the riparian corridor along Coal Creek, which is approximately 2,900 feet of stream bank, has been heavily altered by stream channel modifications and armoring. The CCWC held a workshop to encourage homeowners to plant native vegetation and promote responsible stewardship of private property through an educational workshop. The workshop was hosted on June 27th, 2012 and had 29 attendees. Feedback from the workshop was positive and the Upper Gunnison River Water Conservancy District's Education Committee repeated the workshop in Gunnison with funding included in their 2013 budget.

-Task 10: Develop Sampling and Analysis Project Plan

Report: Multiple versions of the SAPP were developed by the CCWC and Technical Coordinator, Ashley Bembenek, throughout the time-frame of this grant. The 2016 version of the Coal Creek Watershed SAPP is included in the Appendix. This is a more recent SAPP to the originally approved SAPP done in conjunction with the WQCD Measurable Results Program. Water quality data collected as part of the SAPP were uploaded to the Colorado Data Sharing Network (CDSN) and exported to the EPA's Water Quality Exchange (WQX, formerly STORET).

-Task 11: Restoration Assessment and Evaluation

Report: As projects and programs outlined in the Tasks above were completed, regular assessment and evaluation on effectiveness were developed both informally and formally. All applicable reports are included in the Appendix with more specific details for each individual Task.

Throughout this grant, the CCWC collected water quality data and other forms of data that allowed the organization and stakeholders to assess the effectiveness of projects and programs outlined in the Coal Creek Restoration Project Grant.

-Task 12: Outreach and Awareness

Report:

Outreach Goals:

1. Facilitate cooperative assessments and the exchange of information in order to identify and address water quality concerns in a proactive manner by providing high quality, objective data.

2. Increase public awareness of watershed issues by communicating water quality and watershed related information in relevant and understandable ways.
3. Expand the public's participation in protecting Crested Butte's watersheds.
4. Develop the internal capacity of the organization's staff, board, and other volunteers to accomplish the mission of the organization.

Outreach Activities:

Since initiating the Coal Creek Watershed Restoration grant in 2011, CCWC has hosted several education and outreach events. The Outreach and Education committee and Coal Creek Technical Committee/stakeholders were formed in May 2011. Since that time, the committees have met quarterly and the stakeholder group has met on a monthly basis. These meetings have allowed for a public dialog during the planning process.

The CCWC partnered with HCCA and the local radio station, KBUT, to create a radio series called "Wading in the Water". The series, which airs four times weekly, provides a local perspective on water quality and watershed issues. A variety of local experts have participated on topics ranging from drought to public lands access, and geomorphology. To date, 44 episodes have been produced. Episodes are archived on www.KBUT.org. In addition to the original air time, which reaches listeners across the entire Gunnison Valley, episodes have been played up to forty times on the website.

The following education and outreach activities occurred as the grant was implemented:

1. Improve the local community's awareness and knowledge of water quality and watershed issues as it relates to the Coal Creek Restoration grant, ambient water quality standards, and the Mount Emmons Iron Fen Ditch.
2. Monthly Dine Out for Coal Creek Events.
3. Tabling – Informational booth and community engagement at various local events including the Crested Butte Farmers Market, CBAC Avalanche Awareness Night, HCCA Backcountry Film Festival, Crested Butte Arts Festival, Gunnison Whitewater Festival, and Western State Colorado University events.
4. As implementation projects are completed provide coverage in local media outlets- The Crested Butte News, Gunnison Country Times, and KBUT.
5. Continue existing K-12 education programs.
6. Maintenance of the Coal Creek Watershed Coalition website – www.coalcreek.org
7. Annual Presentations to the Upper Gunnison River Water Conservancy District, Town of Crested Butte Town Council, Gunnison County Board of County Commissioners, and the Gunnison County Planning Commission.

-Task 13: Grant Administration

Report: The CCWC Board of Directors and Executive Director provided semi-annual reports, reimbursement requests, and final grant reports in a timely fashion. Additionally, the CCWC and CCWC Technical Coordinator, Ashley Bembenek, had regular contact with our 319 Grant administrator, Ms. Bonie Pate.

EVALUATION OF GOAL ACHIEVEMENT AND RELATIONSHIP TO THE STATE NPS MANAGEMENT PLAN

The Coal Creek Restoration Project completed the items in Programmatic Goals 1-6. A watershed restoration plan was completed and priority projects and programs within that plan were implemented during the grant period. The CCWC successfully identified and/or implemented BMPs to control stormwater runoff, reduce erosion and resultant sediment loading to Coal Creek. The CCWC helped restore and create healthy riparian corridors throughout the Coal Creek Watershed and effectively educated landowners and land managers on appropriate practices to maximize the health of riparian corridors on their lands. The CCWC successfully implemented a program to address nonpoint source pollution, complete public outreach, and project administration.

The Coal Creek Watershed Restoration Project has supported the objectives identified in the *Colorado NPS Management Plan (2005)* on a local, watershed level.

MONITORING RESULTS

In-depth monitoring results specific to each task are outlined below. Currently, it is not possible to quantify water quality improvements in Coal Creek for Task 2 – Mt Emmons Iron Fen Restoration.

The Mount Emmons Iron Fen Restoration Project was completed in October 2016; near the end of the contract period, and post project monitoring could not be completed prior to the end of the grant period. Since the project was completed in October 2016, the CCWC has collected water quality samples at the site during two separate sampling events. However, the limited data set is not sufficient to evaluate changes in water quality in Coal Creek Segment 11. The CCWC will continue to monitor in the coming years to assess site conditions and water quality improvements associated with the restoration work completed in 2016. The data and analysis will be shared with the Nonpoint Source Program as it becomes available.

In 2016 the EPA continued reclamation work at the Standard Mine Superfund Site, which is a primary source of metals loading in Elk Creek and Coal Creek. In the coming years, water quality in Coal Creek should improve as a result of the EPA's work at the Standard Mine and restoration at the Mount Emmons Iron Fen Ditch (Task 2). The CCWC, in partnership with EPA, will continue monitoring water quality in the coming years to measure actual water quality changes in Coal Creek as a result of the projects.

-Task 1: Mt. Emmons Iron Fen Assessment

A portion of the Coal Creek Watershed NPS grant was used to collect samples from the Mount Emmons Iron Fen and Gossan. A fen is a groundwater fed wetland. A gossan is a heavily weathered section of ore or mineral vein that is exposed at the ground surface. The composition of a gossan is similar to the ore that it is derived from. Typically gossans are rich in pyrite, quartz, and base metals; however the degree to which each is present is controlled by the amount of physical and chemical weathering that has occurred. Iron oxides are common and account for the red, brown, and yellow staining present at most gossans. In past studies, the fen and gossan were identified as large pollutant sources to Coal Creek. However, limited data was available to identify pollutant sources from the relatively large area. Sample collection occurred in July, August, and October of 2011 and 45 surface water samples were collected from 32 locations. The samples were analyzed for dissolved and total metals. Flow was measured on nine occasions during the sample events. Due to the limited number of flow measurements, only 20 percent, this discussion will focus on metal concentrations, rather than metal

loading.

The 2011 characterization effort confirmed that the Mt. Emmons Iron Fen and the adjacent gossan are substantial natural metal loading sources in the Coal Creek Watershed. The 2011 data was used to refine the spatial and temporal loading patterns.

Cadmium, copper, lead, and zinc concentrations measured at the gossan were three to ten times higher than the concentrations measured in the fen area. Iron concentrations in the Mt. Emmons Iron Fen were consistently higher than in the gossan; iron solubility is controlled by geochemical conditions in the fen. Cooper et al. (pending publication) found that metal concentrations in surface water and groundwater typically declined from east to west in the vicinity of the Mt. Emmons Iron Fen. Cooper attributed this trend to increased groundwater flows from glacial moraines, which are more prominent on the western portion of the fen. During Cooper's studies, groundwater from the glacial moraines was neutral in pH and lacked substantial metal concentrations; which sharply contrasts the acidic metal rich waters that originate from the primary fen spring(s) which are located in altered sulfur bearing bedrock.

Dispersed flows from seeps, springs, and intermittent tributaries near the Mt. Emmons Iron Fen and gossan are significant sources of metals loading to Coal Creek during and immediately following snowmelt. During drier periods, dispersed flow sources play a less substantial role in metals loading to Coal Creek. However, preliminary findings from the piezometer study indicate that intense summer precipitation may generate surface flows (i.e. groundwater levels reach ground surface thereby activating spring and seep flow) more frequently than previously anticipated. However, water quality sample collection did not occur during or immediately following intense summer precipitation events; and the water quality during storm-related flow events remains unknown.

The Coal Creek 2011 Measurable Results Program Report (see appendices C, D, and E) provides additional details.

-Task 2: Mt. Emmons Iron Fen Restoration

Final construction phases I and II were completed in late 2016. Additional restoration work and seeding in the areas near the emergency 86 Ditch will occur in June 2017. Because the project is still underway, and only two monitoring events have occurred following completion of phase II construction, it is not possible to determine whether load reductions have occurred as a result of the Mt. Emmons Iron Fen Restoration Project. However, the paragraphs that follow provide estimated loading reductions attributed to the Me. Emmons Iron Fen Restoration.

The Coal Creek 2011 Measurable Results Program Report provides results from the initial characterization efforts (see appendices C, D, and E). Water quality data collected through CCWC's long-term monitoring program (which includes locations downgradient of the fen and gossan) are available on the Colorado Data Sharing Network (CDSN) and WQX portals.

Dissolved cadmium concentrations down-gradient of the fen range from 5.8 to 9.7 ug/L; which generates an estimated annual load of up to 1.3 pounds per year. Dissolved copper concentrations

range from 2.8 to 6.8 ug/L; which generates an estimated annual load of up to 1.3 pounds per year. Dissolved zinc concentrations range from 2,130 to 2,960 ug/L; which generates an estimated annual load of up to 541 pounds per year.

Following revegetation in June 2017, we anticipate that the BMP structures and restored vegetation will retain more water in or adjacent to the fen which will decrease surface water runoff and increase water retention within the wetland. Decreased run-off will help reduce metal loading to Coal Creek by decreasing the volume of surface water that reaches the creek. Increased water retention will facilitate metal sorption to soil organic matter and soil particulates (especially clay) and precipitation within the wetland which decreases metal concentrations in the water. Together these factors are estimated to reduce metal loading to Coal Creek by 25 percent. **Given the loads measured between 2010 and 2015, cadmium and copper loads may decrease by approximately 0.3 pounds per year, and zinc loads may decrease by approximately 135 pounds per year.**

-Task 3: Inactive Mine Characterization

Metal concentrations in water and sediment samples were relatively low and do not suggest additional action is required.

-Task 4: Best Management Practices (BMP'S) – Check Dams

In 2011 CCWC staff installed erosion control BMPs in areas that were prioritized based on preliminary survey results and field observations of erosion. Thirty check dams were installed in the roadside ditch, adjacent to Kebler Pass Road, to capture sediment and reduce water velocity. Three drain inlet filters were installed in stormwater inlets in the Town of Crested Butte. During the summer study period, 1,539 pounds of sediment were collected from the check dams and inlet filters. Based on this number, the check dams reduced sedimentation in Coal Creek by mitigating **4,617 pounds of sediment over three years. A composite sediment sample was analyzed for nitrogen and phosphorus content. The results indicate that phosphorus and nitrogen loads were reduced by approximately 3.74 and 0.29 lbs, respectively, during the three-month study. More detailed monitoring results are provided in Coal Creek 2011 Measurable Results Program Report.**

-Task 5: BMP's - Erosion Control and Revegetation

Results from the 2009 road inventory were used to identify the most erosive fillslopes along Kebler Pass Road. In 2010, CCWC staff seeded and installed erosion control fabric on approximately 7,500 square feet of fillslopes. In 2011, CCWC assisted the Measurable Results Program staff to quantify erosion on cut and fillslopes. The data was processed using the WEPP: Disturbed model, which did not indicate that any of the surveyed slopes were significant contributors to erosion. More detailed monitoring results are provided in Coal Creek 2011 Measurable Results Program Report.

-Task 6: BMP's – Chip Seal

In 2011, WEPP: Road model results indicated that chip-sealing would increase sediment loads in the Coal Creek Watershed. The model suggested that increased vegetation in the roadside ditches would provide the best opportunity to decrease sediment loads in the roadside ditches, and therefore Coal Creek.

However, extensive vegetation in roadside ditches presents safety and maintenance issues. Because of these concerns the roadside ditches were not seeded.

The CCWC conducted two seasons of post-project vegetation monitoring for both chip-sealed and untreated sections of the road. The survey results indicate that vegetation cover immediately adjacent to chip-sealed sections of the road was improved relative to untreated segments of Kebler Pass Road, where magnesium chloride is applied. However, the vegetation corridor adjacent to Coal Creek adequately captures sediment and mitigates deposition to Coal Creek regardless of the road surface treatment. A complete discussion of the results is included in the Coal Creek 2011 Measurable Results Program Report (see appendix).

-Task 7: Red Lady Basin Assessment

This task was not implemented. Thus, monitoring did not occur.

-Task 8: Confluence Parcel Restoration

From the 2012 Coal Creek Confluence Reach Assessment Report (Alpine Eco, complete report included in Appendix):

The Confluence Reach of Coal Creek is in generally good condition overall, but it has specific segments with clearly identified stability concerns related to the proximity of Gothic Road and to the formation of a delta where Coal Creek enters an area of the Slate River that forms a backwater behind an artificial constriction related to the Gothic Road Bridge. Outside of these impacted segments, the riparian vegetation appears to be good and improving, and both channel morphology and stability are rated good. Thus, these unimpacted segments may serve as a reference for the potential stable, functional condition.

Documented impairment on the two impacted segments offers a good restoration opportunity, and recommended restoration activities involve realignment of the channel at these two locations. This would also involve sizing and shaping the realigned channel based on natural channel design using parameters measured in this study, constructing riparian floodplain buffer areas between the stream and the road, revegetating these new floodplain areas, and temporarily stabilizing the new channel segments with bioengineering techniques so that they are stable during the time while new vegetation becomes established.

The CCWC met with private landowners and the Crested Butte Land Trust to discuss the report findings. We determined that the most appropriate measure for the site was to allow for natural recruitment and stabilization in the riparian area.

-Task 9: Riparian Workshop

All activities associated with this task were summarized in a previous section of the report.

-Task 10: Develop Sampling and Analysis Project Plan

All activities associated with this task were summarized in a previous section of the report.

-Task 11: Restoration Assessment and Evaluation

The data collected as part of this task is summarized in tasks 1-6, and 8.

-Task 12: Outreach and Awareness

All activities associated with this task were summarized in a previous section of the report.

-Task 13: Grant Administration

All activities associated with this task were summarized in a previous section of the report.

NEXT STEPS AND BEST MANAGEMENT PRACTICES IDENTIFIED

The CCWC will continue to collect high quality water quality data and develop projects that improve water quality in Coal Creek. In particular, CCWC looks forward to evaluating water quality changes in Coal Creek as a result of restoration at the Mt. Emmons Iron Fen Ditch.

Looking ahead, the CCWC plans to submit proposals for funding to revegetate the Gossan in 2018. Funding options are currently being investigated. Initially, the CCWC plans to submit a proposal to the Colorado Watershed Restoration Grant Program in 2017.

QUALITY ASSURANCE REPORTING

The CCWC, with assistance from Ashley Bembenek, CCWC Technical Coordinator, developed a Sampling and Analysis Project Plan (SAPP) and a Quality Assurance Project Plan (QAPP). Those documents were amended, as needed, during the five year grant period, and are in the Appendix.

COORDINATION EFFORTS

Coordination of this plan was extensive, but limited to Gunnison County. The CCWC coordinated all CCWC Technical Committee meetings, contractors, VISTA personnel, Summer Program Members, initiatives, and deliverables. We were instrumental in identifying and bringing a diverse group of stakeholders to the table. Through systems thinking and adaptive management, the CCWC was able to coordinate public and stakeholder buy-in, participation, and support of the projects and programs outlined in the 319 Coal Creek Restoration Project.

The following partners and stakeholders are directly involved in the activities of the organization: U.S. Forest Service, U.S. Bureau of Land Management, U.S. Environmental Protection Agency, Colorado Division of Reclamation, Mining and Safety, Colorado Parks and Wildlife, several divisions and units within the Colorado Department of Public Health and Environment, Gunnison County, Town of Crested Butte, Crested Butte Land Trust, Upper Gunnison River Water Conservancy District, High Country Conservation Advocates, Rocky Mountain Biological Laboratory, Western State Colorado University, Colorado Trout Unlimited, Gunnison Angling Society, Office for Resource Efficiency, Crested Butte Community Library, Crested Butte Mountain Biking Association, Elk Mountain Hikers Club, Alpine Meadows Homeowners Association, Crested Butte Nordic Club, Allen Family Ranches, Colorado Water Trust, Mountain Roots, and the Crested Butte Arts Festival. Additionally, the CCWC's partners and stakeholders include numerous local business owners, and year-round and seasonal residents and landowners.

COORDINATION FROM OTHER STATE ENTITIES

The coordination on this restoration project(s) from State agencies primarily includes CDPHE and the Colorado Division of Reclamation, Mining, and Safety (DRMS). DRMS has a representative on the Technical Committee who provided extensive input, financial resource and in-kind donations, review of documents, and assistance with project implementation.

OTHER STATE ENVIRONMENTAL PROGRAM COORDINATION

In identifying and compiling water quality data during this restoration project to guide implementation, the CCWC have retrieved Colorado Department of Public Health and Environment (CDPHE) data and resources, Colorado Department of Wildlife (CPW) fish data, and Division of Reclamation, Mining, and Safety (DMRS) resources.

USDA PROGRAMS (E.G. ENVIRONMENTAL QUALITY INCENTIVES PROGRAM (EQIP), HYDROLOGIC UNIT FUNDING, BUFFER INITIATIVE, CONSERVATION RESERVE PROGRAM)

USDA programs were not used in this grant.

ACCOMPLISHMENTS OF AGENCY COORDINATION MEETINGS

Due to the nature of the extensive review and implementation process of our 319 grant, we believe that the accomplishments outlined in this final report offer an extensive and appropriate list of projects within the Coal Creek Watershed that can be referenced by the CCWC and other stakeholders and partners in future projects or programs initiated in the Coal Creek Watershed.

RESOURCES/COORDINATION FROM FEDERAL LAND MANAGEMENT AGENCIES

Coordination occurred through consultation with individual resource managers at the US Forest Service (USFS) Gunnison Field Office; most specifically for the Mt. Emmons Iron Fen and Gossan Restoration tasks and deliverables.

OTHER SOURCES OF FUNDS

The CCWC received additional financial support for projects and or tasks in the Coal Creek Restoration Project implementation process from DRMS, USFS, Town of Crested Butte, and private donations.

SUMMARY OF PUBLIC PARTICIPATION

Overall, the public's interest and involvement with the CCWC has grown since its inception in 2003. The general public were invited to all CCWC Board meetings and Technical Committee meetings. The public rarely participated in those meetings; however the CCWC engaged the public on projects and programs that were on-going during the five year grant. CCWC staff attended Town of Crested Butte Town Council meetings to update council members and town staff on projects in the Coal Creek Watershed, provided public service announcements to the Crested Butte News and KBUT Community Radio, updated the

CCWC website (www.coalcreek.org), and posted relevant information to all CCWC social media outlets.

In addition to these outreach and engagement efforts to increase public participation, the CCWC regularly solicited volunteers from the community to assist in water quality monitoring and sampling events, Road WEPP surveying, and BMP's installation and maintenance throughout the Coal Creek Watershed.

ASPECTS OF THE PROJECT THAT DID NOT WORK WELL

Overall, this restoration project was completed in due to tremendous effort from CCWC staff, board and technical committee members. One of the main issues that caused difficulties for CCWC staff and NPS personnel was the fact that the grant period was extended multiple times; due to unforeseen circumstances. In particular, many aspects of the original tasks and deliverables had to be amended or changed completely. Often, those changes were out of the control of the CCWC. These changes extended the time required to complete many of the projects and programs outlined in our 319 grant. The CCWC appreciates the dynamic and understanding role that NPS staff, grant administrators, and personnel played during those times and throughout the life of the grant.

Additionally, the CCWC employed three different Executive Directors during this grant period, which accounted for some confusion, delays, and impacts to the project.

FUTURE ACTIVITY RECOMMENDATIONS

The 319 Coal Creek Restoration Project laid the framework for additional implementation projects in the Coal Creek Watershed. This grant has provided the CCWC with a more specific and strategic plan for future restoration projects. Including the Gossan revegetation project, which the CCWC is hoping to secure funding for in 2017 or 2018, with plans for implementation in late 2018. Metals loading from the Gossan is significant and restoration work to reduce water runoff by increasing vegetation cover could yield substantial load reductions in Coal Creek.

Appendix Documents: In Google Drive "CC 319 Final Report"