California Gulch Natural Resource Damages Solicitation Project Proposal Executive Summary

Proposal Name: Upper Arkansas Comprehensive Watershed Restoration Project

Project Description: This project will focus on restoring, rehabilitating, protecting and enhancing areas of the Upper Arkansas basin within Lake County through a comprehensive strategy of watershed-based project implementation that includes:

- Addressing stream function and riparian habitat through in-channel and floodplain restoration on multiple steam reaches within Lake County.
- Addressing historic mine drainage at four sites.
- Addressing aquatic species passage and sediment transport by implementing projects to improve existing culverts and crossings.
- Reducing fuel loading in uplands of critical sub-watersheds through forest mitigation, which also helps to reduce post-fire flooding, and its impacts on downstream values at risk, including but not limited to historic mine sites, public roads and infrastructure, water quality, and water supplies.

All projects have been prioritized by partners through various planning methods, which will be detailed in individual project work plans.

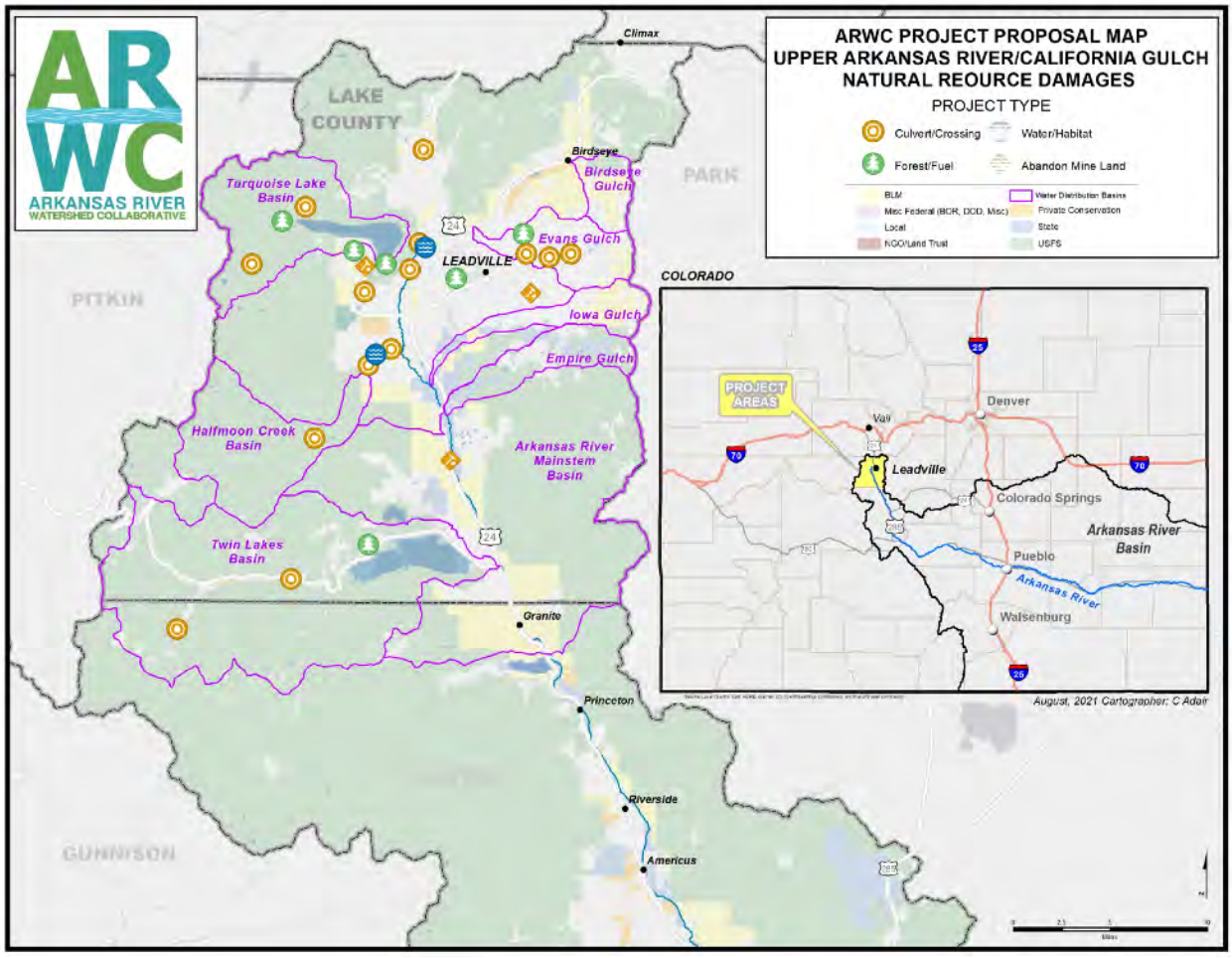
Project Partners: CORE TEAM—ARWC (prime offerer), Lake County, Trout Unlimited
Additional partners: Central Colorado Conservancy, Lake County Open Space Initiative, Colorado Springs Utilities, Aurora Water, Parkville Water District, Leadville, USFS, USGS, BLM, BOR, DRMS, CPW, and private parties.

Point of Contact: Carol Ekarius, Acting Executive Director, ARWC; carol.ekarius@co-co.org; 719-439-2268

Project Timeline: 2022 - 2027
Anticipated Total Project Cost: $10,450,000.00; **Anticipated Project Ask:** $5,225,000.00

Project Area: An interactive version of the map is available at *https://arkcollaborative.maps.arcgis.com/apps/webappviewer/index.html?id=d0fa9cda0749463290cf8a3861fd9d31*

Pink outlined watersheds are significant zones of concern for water supplies;
Yellow circles are crossing projects;
Blue circles are water quality/habitat restoration areas.
Gold boxes are AML projects.
Green trees are fuel mitigation project areas.



Scope of Work

Overview:
The Arkansas River Watershed Collaborative (ARWC), Lake County (the County), and Trout Unlimited (TU) are the lead partners for the Upper Arkansas Comprehensive Watershed Restoration Project (the Project). The Project is designed as a collaborative and holistic approach to implementing a series of partnership projects across the landscape of Lake County. ARWC, the County, and TU are the lead agencies, forming a core team, but many other partners are already engaged officially within our stakeholder team, and will actively participate in specific projects that are of the highest priority to them and their area of interest. These partners include not only federal, state, and local government entities with an interest in the resources, but also private landowners and businesses, such as Newmont and Freeport McMoRan mining companies. This Project will not only protect natural resources across Lake County, but through the mix and placement of projects, will enhance public safety and recreational opportunities, and help to protect past investments of NRD funds from the California Gulch Settlement.

a.) Target Natural Resources:

i.) *Describe how the proposal will restore, replace, acquire, the equivalent of injured natural resources, and how the development, design, implementation, and restored site can be made available for public benefit*.

The program of work, which will include program-wide and project-specific monitoring plans and outreach, is specifically designed to improve aquatic species habitat, terrestrial habitat (including upland forests, wetlands, and riparian), and water quality by addressing four major classifications of projects:

1. **Over-arching:** The Core Team will work on a suite of overarching tasks, including project and stakeholder coordination, outreach, creation of a Sampling and Analysis Plan (SAP) for monitoring, and oversight of monitoring and reporting, as well as management of all components, including final reporting. We anticipate creating an outreach plan and preparing the SAP in the first quarter upon contracting. For outreach, we anticipate public meetings, tours, creation of a story map and website for the Project, and interpretive signage as appropriate (with recognition of NRD funding). The Core Team lead for this work is ARWC.
2. **Addressing stream-corridor function and riparian habitat:** Fish and wildlife depend on well-functioning streams (geomorphically appropriate for the stream type) and healthy riparian habitats. Such stream corridors provide in-channel habitat that is conducive to all life-stages of fish, as well as high quality habitat for benthic organisms, avian species, and other species that depend on the connectivity of riverine and terrestrial habitats. Goals within this subset of projects will focus on stabilizing stream banks and promoting diverse stream morphology and flood-plain connectivity; reducing erosion and downstream sedimentation; enhancing overhead cover for trout; and creating diverse in-stream habitat including pools, riffles, and bars. These projects also provide significantly greater resilience to disturbances such as floods and fires. (Note: Culvert projects—item The Core Team lead for this work is TU.
   Project Specifics: Three water/habitat projects will restore previously untreated reaches of stream along**:**

- ***Halfmoon Creek:*** The Halfmoon Creek segment will seek to improve degraded habitat conditions resulting from the BOR river diversion that marks the upstream extent of this work. Restoration work in this portion of the channel will focus on narrowing, deepening, and defining a low flow channel that fish and benthics can utilize during the altered flow regimes caused by the upstream diversion. This Halfmoon Creek portion of work will build upon numerous culvert replacements proposed in bullet 4 below, which will ultimately reconnect several segments of viable habitat.
- ***East Fork of the Arkansas River:*** Work on this segment will improve over 2,000 feet of critical habitat immediately upstream of the confluence with East Tennessee Creek. This straightened segment of the East Fork of the Arkansas will be reconnected with an abandoned channel to add sinuosity, slow velocities, and improve targeted natural resources. The increased sinuosity will reconnect the adjacent floodplain to help enhance wetland and riparian habitats previously degraded by historic straightening.

3. **Addressing historic mines:** Lake County had robust historic mining operations, with Iowa and California gulches being mined as early as 1860 for gold. By the 1870s, miners were also taking silver and lead from the area, leading to booming mine towns and villages throughout the county, which posted a population over 40,000 by 1880. In 1918, the Climax Molybdenum Mine began operations. Mining continued at a brisk pace through the 1950s, and then has waned, though Climax is operating again. The mines provided many years of economic prosperity to the region, but also yielded significant environmental degradation. Operating mines are managed under permits, but some historic mines have continuing issues. The Core Team lead for this work is TU.

   Project Specifics:

   - ***Sherman—:*** The Sherman Mine (aka.. Day Mines) is located approximately 8 miles northwest of Leadville in upper Iowa Gulch at the foot of Mt Sherman. The Mine operated from 1968 to 1982 producing primarily silver, lead, and zinc. DRMS completed reclamation on the site in 2008 that reestablished the historic natural drainage route through Iowa Gulch and the re-graded waste rock pile. Following the reclamation work, lateral erosion from runoff and storm events has destabilized and widened the channel resulting in the transport of waste rock into the sensitive wetland area below the mine. To mitigate this, DRMS intends to construct grouted riprap channels to stabilize the waste rock and prevent further sedimentation downstream. Approximately 2,000' of drainage channel will be addressed with this project.
   - ***Dinero Tunnel—bioreactor design and monitoring:*** In 2009, a bulkhead was placed in the Dinero tunnel as part of restoration activities in the upper Arkansas River. After installation of the bulkhead, water-quality improved and metal loads decreased at the Dinero tunnel. However, the mine pool created behind the Dinero bulkhead negatively affects water quality in Sugarloaf and Little Sugarloaf Gulches that lie south and north of the ridge containing Dinero and Nelson tunnels. The pool into Sugarloaf Gulch, likely via connection to the Dinero mine pool through Nelson tunnel mine workings and a geologic structure. As of 2017 (most recent monitoring data) aquatic-life water-quality standards were not being met for zinc concentrations in Lake Fork Creek downstream from where all these sources enter the creek. If the hypothesized hydrologic connections between the mine pool, gulches, and Nelson tunnel can be verified, and if viable technology to treat the mine pool is identified, then improvement to water quality in the Dinero mine pool should translate to improved water quality in the two Gulches and the

Nelson tunnel. This proposal seeks to develop a strategy to improve water quality in the Dinero Mine pool and water resources degraded by the mine pool. If successful, this work will lead to an implementable project in the next several years that would clean up resources equivalent to a portion injured by releases of hazardous substances to California Gulch. It is important to note that funding for abandoned mine land (AML) projects is starting to gain traction through efforts like the recent Infrastructure Bill, but these funds are typically limited for use on non-point source projects. Point source projects, or draining mine sites, still present enormous liability risks associated with CERCLA and the Clean Water Act, which prevents groups like ARWC and TU, as well as State agencies, from tackling this work. There is a direct need for targeted liability relief that would allow Good Samaritans to volunteer, and clean-up these draining abandoned mines. Funding, like that from the NRDa, combined with Good Samaritan legislation that would provide liability protections and a well-managed permitting process, are the two keys to really getting a handle on this problem. The question of navigating CWA and CERCLA liability have stalled cleanups for many years, and for over a decade Colorado's delegation have worked on legislation to address this problem. It's long past due to move forward. The AML program and funding in the Infrastructure Bill has added even greater urgency to introducing and passing legislation that establishes a Good Sam program so we can make the most of this funding. For Congress to pass one and not the other is a missed opportunity for clean water. With the lines beginning to blur between water quality and quantity in an ever-growing Western US, we believe that Good Samaritan legislation will happen in the near future to begin utilizing these new funding sources for point source cleanups, like the Dinero Tunnel.

- ***Minnie Cribbed Walls: Five cribbed walls along County Road 2 in California Gulch formerly served as retaining walls for mining waste rock and mill tailings from the early 1880s to 1910s.*** As previously mentioned, the highly-used Mineral Belt trail runs through the footprint of the AY Minnie. By completing the scope of work associated with this project, partners will ultimately protect surrounding water quality by managing contaminated material, while also ensuring safety for public users of the Mineral Belt trail by stabilizing adjacent crib walls. Due to the age of the walls, they have naturally deteriorated, resulting in physical and environmental hazards due to the respective instability and contaminated soils present. Given the historical significance of these cribs walls, a Level II Documentation has already been completed in 2018 with proposed geotechnical drilling and structural investigation scheduled for Fall of 2021. A combination of these studies will help guide partners on the best approach to stabilize the site while also preserving any historical significance of the area. While each wall will pose a unique challenge, an overall aerial estimate for remediation on this project will range from 0.5 to 1 acre.
- ***Fluvial tailings:*** Several barren sections along the 11-mile reach of the Arkansas River have areas of fluvial tailings originally carried downstream from historic mining operations in the Leadville Mining District. These white, crystalline, contaminated deposits are void of vegetation with high levels of metals. Their exposed condition poses a risk for erosion and exposure to ecological and recreational users of the Hayden Meadows area, which has become a winter elk sanctuary and high traffic area for anglers. These fluvial tailings areas are also likely to migrate or leach contaminants to shallow surface/ground waters to the surrounding ecosystem. During initial remedial

and removal actions in OU11, in-situ phytostabilization was wildly successful at remediating these contaminated soils. TU and project partners seek to duplicate these efforts and apply techniques that have been successful at remediating over 100 acres of fluvial tailings at other AML sites across the State. The final outcome will be remediated soils with native vegetation that have the ability to reduce runoff and storm-water contributions to the river, as well as controlling excess sediment yields that can come from un-vegetated alluvial fans and banks. Up to five acres of fluvial tailings and contaminated soils will be reclaimed as part of this project.

4. **Addressing forest fuel loading:** One of the most critical issues facing headwater watersheds in Colorado is wildfire. Lake County has recognized the criticality of this issue for their values at risk, and has actively worked on an updated Community Wildfire Protection Planning process (CWPP). The new CWPP has used a science and data-driven roadmap to identify the highest priority of lands for fuel treatment/forest health projects. As seen in the last two decades, and epitomized by the 2020 fire season, wildfires cause significant and long-term issues for fish, wildlife, water quality, and human values at risk (life/safety, homes and businesses, infrastructure, and recreation areas), both during the fire and subsequently for years afterward with altered hydrology and vegetative cover yielding post-fire flooding, ash flows, and debris events. Within Lake County in particular, such post-fire flooding would result in significant harm to critical water supplies—both agricultural and municipal—not only from sediment and ash seen in other fires around Colorado, but also from renewed exceedances from historic mines by undoing decades of good work by DRMS, CDPHE, and other partners. Finally, these projects are based on prescriptions that not only reduce wildfire impacts, but also improve heterogeneity of forests, which increases habitat for a wide variety of species. The Core Team lead for this work is ARWC.
   Project specifics: Partners in this program of work have been working collaboratively to increase the pace and scale of fuel reduction efforts in the region—primarily through planning efforts to date—but this funding will help to significantly ramp up forest restoration/fuel reduction projects on at least 1000 acres (with at least 250 acres on federal lands) that are specifically selected for their proximity to critical water resource values.
5. **Addressing culverts:** Historically, little thought was given to how culverts impact the aquatic ecosystem. Planning that was based exclusively on cost and hydraulic efficiency resulted in structures that were narrower than the natural channel, using head pressure built up on the upstream entry to the culvert to increase velocity and move water through the narrower opening. This typically led to downstream scouring and incision, and ultimately led to culverts being disconnected or perched above the channel on the downstream side. It also led to bank instability upstream and downstream, channel and bank headcutting and collapse, incision well downstream of the culvert, and sediment transport issues in reaches above and below culverts. Aquatic species often fail to pass through such structures due to their being perched too far above the downstream channel or due to increased velocity that exceeds their swimming speed. Finally, these issues frequently lead to excessive debris and sediment buildup within the culverts from the upstream side, resulting in road damage that contributes additional problems for both aquatic and terrestrial species. The crossings identified for our project all suffer from such issues; they preclude aquatic species passage during most if not all of the hydrograph, they cause perpetual maintenance issues for the agencies responsible for their maintenance, and they may present significant safety issues. They also have issues with sedimentation and erosion from adjacent banks due to issues

with their original installation, and are all undersized to handle flows from larger events, particularly — as we have seen time and again in Colorado — if the areas upstream are subject to wildfires. Improving these culverts will also increase safe public access to public lands and water resources for recreation, and assure best opportunity for emergency management to respond to wildfires or other emergencies. The Core Team lead for this work is the County.

***Project specifics*:** Fifteen projects will replace existing culverts with hydrologically and hydraulically appropriate designs that incorporate biological and geomorphic considerations to allow fish at all stages of their lifecycle to pass freely between up and downstream sections. Part of this replacement process will also focus on reducing erosion and sedimentation by performing necessary channel work immediately up- and downstream of the impacted culvert. Most of these projects will utilize bottomless arches, or large box culverts with a baffle-system design to provide fish a flow channel during low-points of the hydrograph within the box, and to provide better sediment transport. The culverts identified for work are on USFS lands, or public roads leading to USFS lands, so these improvements will increase safe public access to public lands and water resources for recreation.

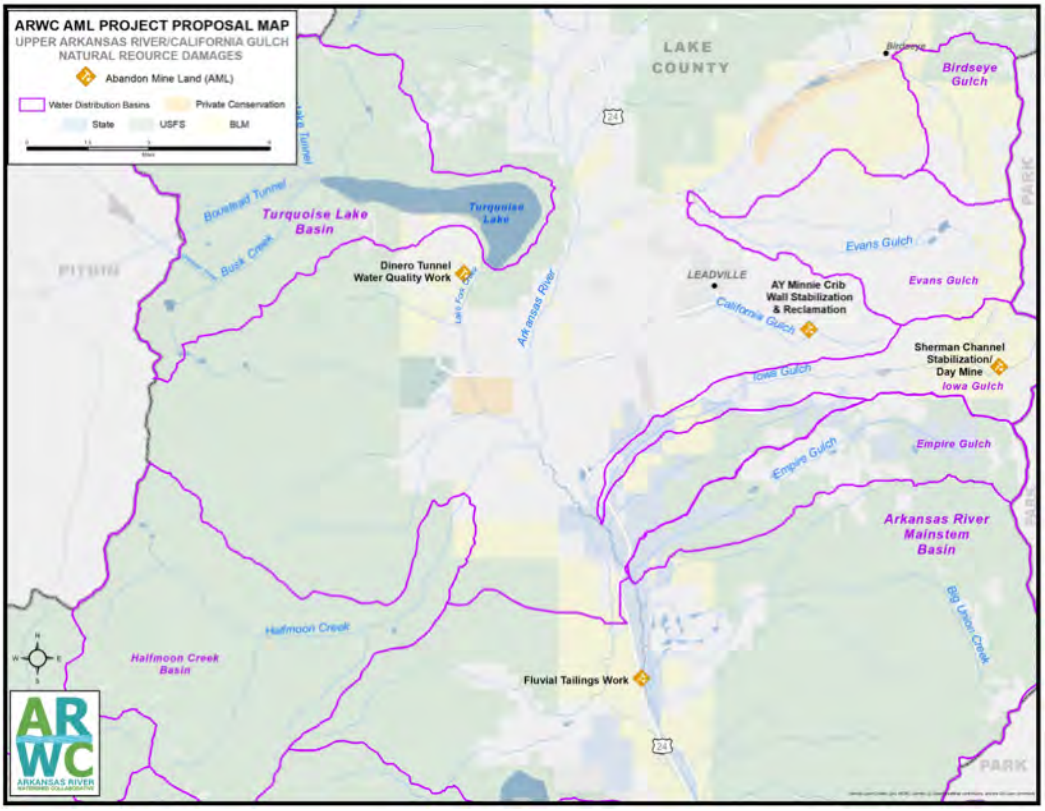
ii.) *Provide detailed description of the area (acreage, linear footage, etc) of natural resources addressed)*

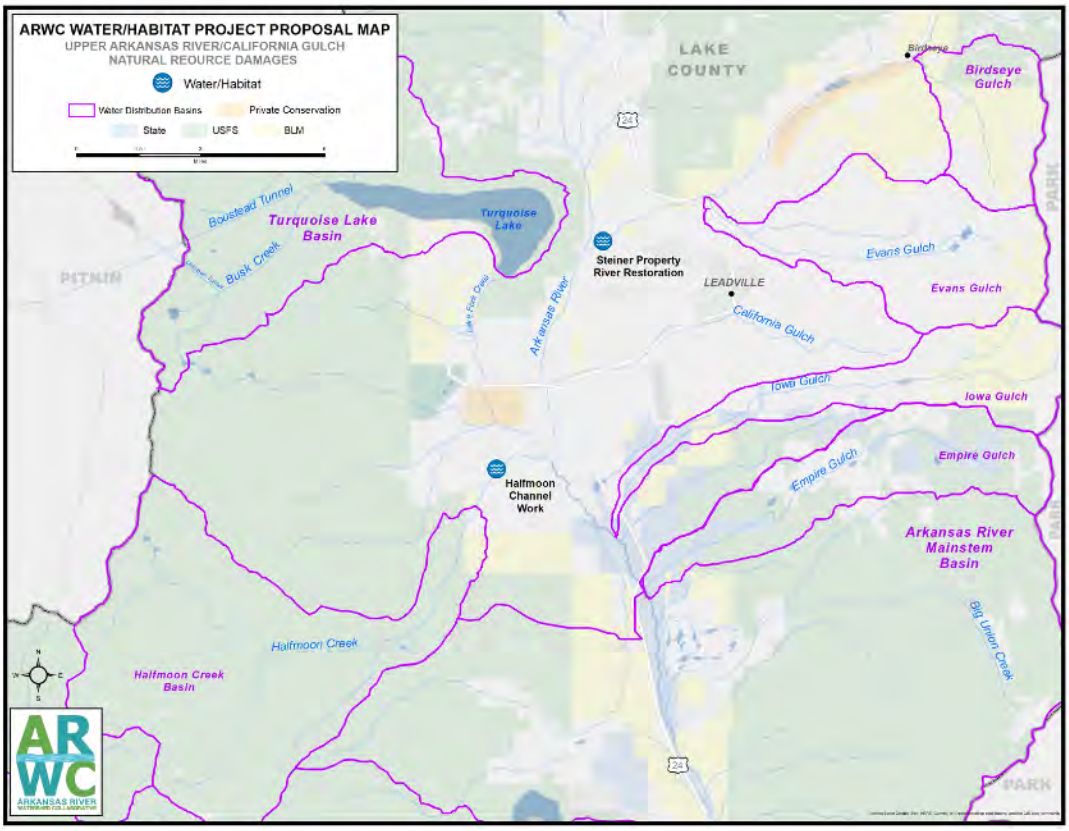
SEE TABLE, next page

Project Category	Number of Projects	Units	Quantity	Notes
Overarching	**1**			**Team Lead: ARWC**
Stakeholder Coordination				Quarterly, or as needed for projects, team meetings, and coordination with various project sub teams, etc
Monitoring				SAP & monitoring projects
Outreach				Story Map website dedicated to project, public meetings/tours, news articles in local press, interp signage as appropriate
Management				Reporting, financial management, coordination with NRDA Trust staff, etc
Addressing stream-corridor function and riparian habitat:	**2**			**Team Lead: Trout Unlimited**
Stream Projects	2	LF	~6,000	
Addressing historic mines	**3**			**Team Lead: Trout Unlimited**
Dinero	1	Project		TU will work with USGS
Minnie	5	Acres	~.75	TU will work with DRMS
Minnie	5	LF	1000	TU will work with DRMS
Sherman	1	LF	2000	TU will work with DRMS
Fluvial Tailings	1	Acres	5	TU will direct concurrent with other stream corridor work
Addressing forest fuel loading:	**6**			**Team Lead: ARWC**
Federal lands	1	Acres	250	ARWC will perform work under a Stewardship Agreement with the San Isabel National Forest
Non-fed lands	5	Acres	750	ARWC will perform work
Addressing culverts	**15**			**TEAM Lead: ARWC**
County Roads	8	Each	8	ARWC will coordinate with Lake County, who will oversee implementation
Forest Roads	7	Each	7	ARWC will coordinate with USFS, and implement under Stewardship Agreement with San Isabel
Associated bank and channel work	15	LF	900	Work around culverts will include reveg of banks, and as needed, in channel vein

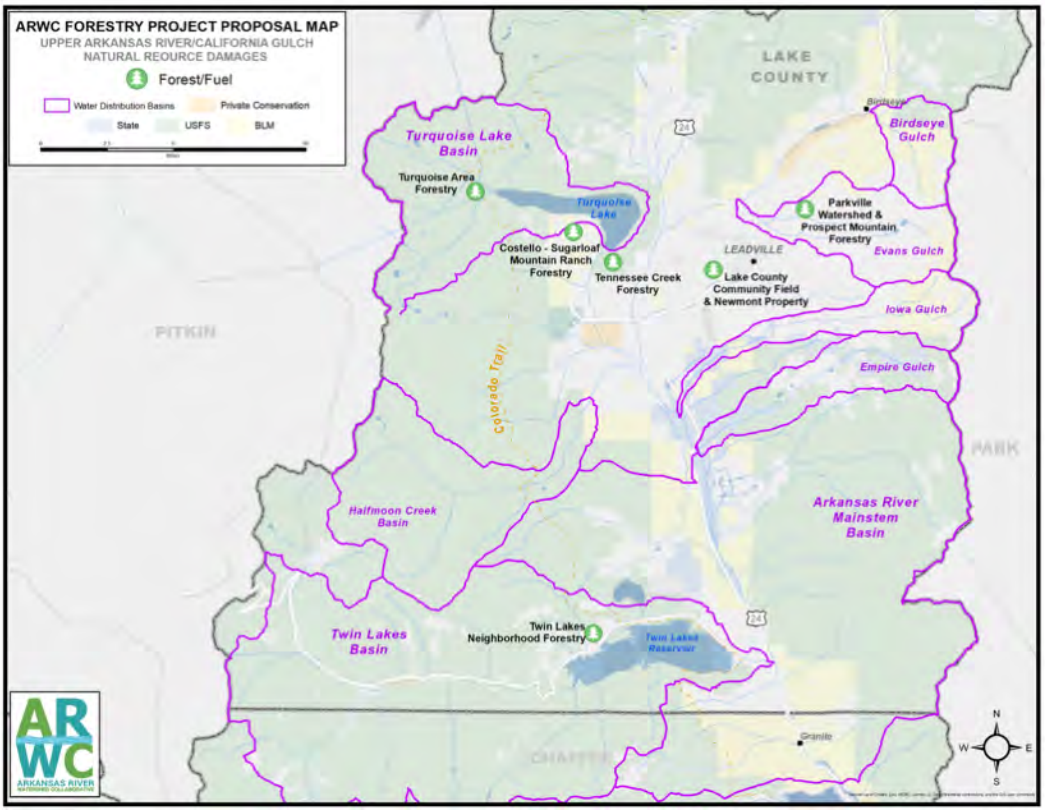
The top map on this page shows the areas of the four projects designed to address historic mine issues. The bottom shows the two area where river restoration/channel/ habitat work will be completed that is not directly associated with a culver.

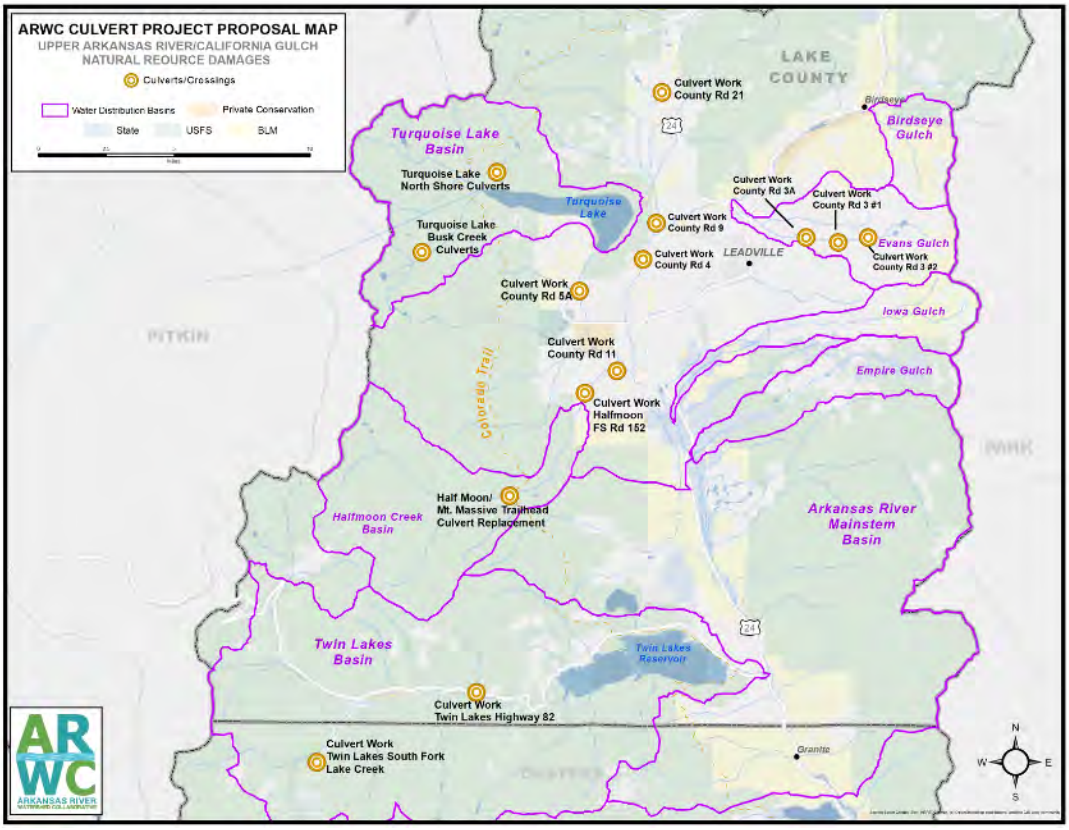
iii.) *Maps*





The top map on this page shows the general vicinities of forest related projects. The bottom shows culverts, which will include some channel and bank stabilization work, as well as replacement of culverts with aquatic species passage culverts.





b.) Objectives:

Provide clear, measurable, realistic, time-phased objectives for work.

1. Develop and follow overarching Sampling and Analysis (SAP) and an Outreach Plans, which will be prepared and submitted in 2022, or within two months of contract, and before any project implementation begins. Each individual project will have an independent work plan submitted to NRDA staff prior to implementation. Depending upon the monitoring identified in the SAP, an additional project-specific SAP and Quality Assurance Plan may be required for individual projects prior to implementation.
2. Coordinate variety of projects in such a way as to maximize environmental and social outcomes, partner objectives, all while reducing cost per project through contracting and procurement efficiencies.
3. Implement high quality watershed projects that improve habitat, water quality, public safety and use, and that increase resilience to floods and fires.

	2022	2023	2024	2025	2026
Overarching					
SAP, Outreach Plan	■				
Project coordination, reporting, admin	■	■	■	■	■
Outreach, stakeholder engagement	■	■	■	■	■
Monitoring	■	■	■	■	■
Addressing stream-corridor function and riparian habitat:					
Planning, NEPA, Permitting	■	■			
Implementation		■	■	■	■
Addressing historic mines					
Planning, NEPA, Permitting	■				
Implementation		■	■		
Addressing forest fuel loading:					
Planning, NEPA, Permitting	■	■			
Implementation	■	■	■	■	
Addressing culverts					
Planning, NEPA, Permitting	■				
Implementation	■	■	■	■	■

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c.) Operational plan:

i.) *Describe in detail how the work will be implemented.*
This project will be implemented as a stakeholder-driven program of work. ARWC, a collaborative formed by the Arkansas Basin Roundtable to serve the basin in leading watershed and forest related work, will serve as the prime contractor, and overall herder of cats, taking responsibility for coordinating the work of various partners to implement a suite of over 26 projects, and will provide point management of the overarching goals, including reporting and oversight of monitoring to assure compliance with a SAP and outreach, and will provide point on the forestry projects. TU will provide point management for the historic mines and habitat work. Lake County will provide point on culverts within the county. ARWC will provide point on culverts. All contracts for external resources will be run by ARWC or TU.

We anticipate that year 1 will primarily be coordinating for NEPA, permits, etc, though general planning for prioritization of projects, community level plans (such as hazard plans, Community Wildfire Protection Plans, and Basin Implementation Plans, etc), and similar general planning is **NOT** part of this project. Some projects are shovel-ready, and will be ready to move in year one upon approval of the work plan. We anticipate most projects will be implemented in years two through four. Year five will primarily be dedicating to finalizing any remaining work, and monitoring and reporting.

Each project (or combination of several projects where they can be coordinated as one) will require a work plan to describe its specific implementation, but a general outline is: Project point (ARWC, TU, or Lake County) will develop the work plan for each project(s) it is taking point for. The stakeholder team and project-specific collaborators for that project will review the plan and approve it, for submittal to NRDA staff prior to implementation.

ii.) *Describe with whom the offerer will collaborate to accomplish the scope of work.*
- ***CORE TEAM: Carol Ekarius, ARWC; Jason Willis, Trout Unlimited; Sarah Mudge, Michael Irwin, and Bryce Ehrlich, Lake County***
- **Federal agencies:** USFS, USGS, BLM, BOR
- **State agencies:** DRMS, CPW; *anticipating grant applications to, and support through* CWCB, CDPHE 319 NPS Health, CSFS
- **Water Providers:** Aurora Water, Colorado Springs Utilities, Parkville Water District, Upper Arkansas Conservancy District, Pueblo Water, Southeastern Colorado Water Conservancy District
- **Local Government:** Lake County, Leadville
- **Nonprofits:** Arkansas River Watershed Collaborative, Trout Unlimited, Central Colorado Conservancy, Lake County Open Space Initiative
- **Others:** Freeport (Climax Mine) and Newmont Mining, private landowners, other local businesses, etc.

iii.) *Describe donors.*
We have a variety of committed partners, representing federal agencies, state agencies, municipal water providers and conservancy districts, and local government entities. We also have private entities, such as Freeport (Climax) or private landowners, committed to specific projects within the suite of projects. ARWC and TU will jointly seek additional funding through

grants and donations, as needed to complete the projects outlined in this application. For example, we plan to make a significant ask through the Arkansas Basin Roundtable to the CWCB Water Supply Reserve grant program. No project will be started until all matching funds for that specific project are fully secured.

iv.) *Provide documentation if applicable:*
Not applicable until individual work plans are submitted.

v.) *Describe to what degree the proposal matches the goals fo the RP/EA.*
The Trustees' objective is to select projects that "restore, rehabilitate, protect, or enhance areas that are related to, proximal to, or have ecological nexus to, the natural resources and related services injured as a result of releases of hazardous substances from historic California Gulch mines."

This project, which takes place in Lake County, is highly consistent with this goal. The combination of projects being proposed all have an ecological design that will restore, rehabilitate, and enhance areas that are in or around the area that sustained the most ecological damage—and that suffered the greatest community impacts. For example, Lake County has the highest poverty level in the central mountain region. As such, these projects will: improve habitat, in areas directly impacted by the mining that took place in Lake County, for both aquatic and terrestrial species; improve enjoyment and potentially increase use by the public; and help compensate the impacted public most directly for the damages at California Gulch through jobs and local spending by contractors and others during implementation. Additionally, these projects will seek to utilize local materials, labor, and Colorado-based contractors to the greatest extent possible to implement the projects.

vi.) *Describe how the proposal will coordinate with complimentary, similar, existing, or other proposed projects in the area, if any.*
By having such broad partners combining forces, we are proposing the ultimate coordinated project, and projects that bring a significant leverage not only in funding, but also in cross-specialized knowledge and commitment to the best overall outcomes. For example, culverts on county roads could easily be replaced without taking into account habitat, but in this proposal, all culvert projects will be aquatic-species passage friendly, and the projects will address instream channel needs and bank vegetation and stabilization as part of the culvert replacement. Likewise, fuel treatment projects have been selected for their importance for protecting water supplies, and prescriptions will be based on best ecological practices for that forest type, as well as BMPs for post-harvest work, such as weed control, or road and trail obliteration.

vii.) *Describe the operation, maintenance and monitoring (OMM) requirements and the entity or entities accepting those responsibilities for a minimum of ten years thereafter…*
Details for each project's OMM will be described in the individual work plans, but all projects will have a single entity that agrees to take on responsibility for the long-term OMM.

viii.) *Describe permits, etc*
Details for each project's permitting requirements will be described in the individual work plans, but all projects will acquire all necessary permits, and the project point (ARWC, TU, or Lake County) will

assure necessary permits are available and all regulations are being complied with prior to and during on-the-ground implementation.

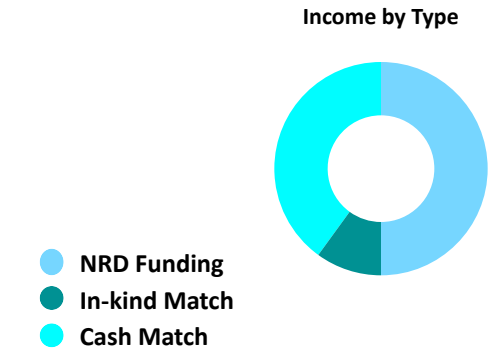
ix.) Project schedule
Details for each project's schedule will be described in the individual work plans. A description of the overall schedule and approach is included in paragraph C(i) above.

x.) *Describe which activities in the operational plan will be tracked, counted, reported, etc.*
Details for each project's activities will be tracked according to criteria developed in the overall SAP, outreach plan, and the individual work plans. We will use smartsheet and an interactive GIS map as part of our tracking. All projects will have photo documentation. All projects will have appropriate units of reportable outcomes (such as linear feet for river work, or acres for fuel mitigation).

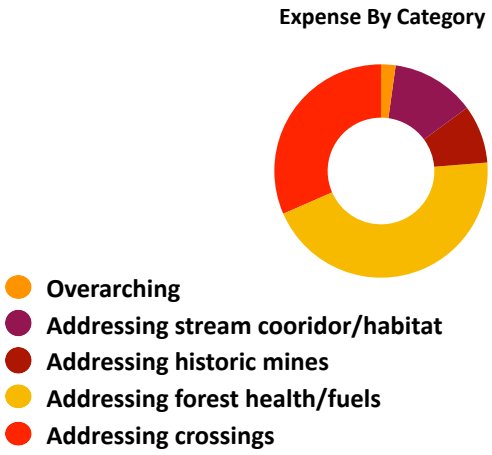
xi.) *Describe documentation and deliverables.*
Details for each project's documentations and deliverables will be included in the individual work plans. Overall documentation will include regular reports with each invoice, and a final overall project report and lessons learned document.

Budget

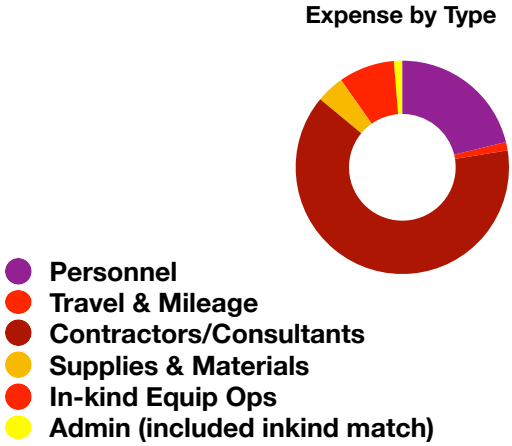
Income Summary	
NRD Funding	$5,225,000
Cash Match	$3,825,000
In-kind Match	$1,400,000
Total income	**$10,450,000**



Expense Summary By Project Category	
Overarching	$260,000
Addressing stream cooridor/habitat	$1,500,000
Addressing historic mines	$1,040,000
Addressing forest health/fuels	$4,125,000
Addressing crossings	$3,525,000
Total expenses	**$10,450,000**



Expense By Expense Type	
Personnel	$2,150,000
Contractors/Consultants	$6,700,000
Supplies & Materials	$400,000
Travel & Mileage	$150,000
In-kind Equip Ops & Engineering	$900,000
Admin (included inkind match)	$150,000
Total expenses	**$10,450,000**



Partner	Anticipated Total Match	Cash Match	In-Kind
ARWC through grants and agreements	$2,100,000.00	$2,000,000.00	$100,000.00
Lake County	$225,000.00	$75,000.00	$150,000.00
Trout Unlimited	$500,000.00	$400,000.00	$100,000.00
Water Utilities	$400,000.00	$350,000.00	$50,000.00
Agency Partners	$1,200,000.00	$600,000.00	$600,000.00
Other Partners	$800,000.00	$400,000.00	$400,000.00
Total	$5,225,000.00	$3,825,000.00	$1,400,000.00

Budget Notes: ARWC's staff have completed large, complex projects of this character in the past, such as leading Hayman Fire, Waldo Fire, Spring Creek Fire recovery, and projects such as the Monarch Steep-slope Fuel Mitigation Project. TU's staff has completed similar habitat and mine reclamation projects. ARWC and TU are committed to fundraising for the necessary cash match, and have an exceptional track record of accomplishing similar fundraising for implementation of large-scale, multi-faceted watershed projects. We anticipate ultimately over-matching, and through additional leverage, producing more outcomes (for example, acres of forest work or culverts) than are minimally committed in the table on page 8, but are providing conservative match and outcomes in this proposal.

Key Staff:

ARWC

- Carol Ekarius, Emeritus Director, 40 years of experience managing large-scale, multi-faceted construction projects, forestry projects and programs, river restoration and habitat projects and programs, and grants and agreements.
- Jonathan Palakian, Executive Director, 15 years of experience managing watershed-scale programs and projects, and grants and agreements.
- Carrie Adair, Operations Director, 12 years of experience managing data and GIS information, watershed programs and projects, and grants and agreements.
- Andy Lerch, Forester, years of experience designing and implementing forestry projects.

Trout Unlimited

- Jason Willis, PE, 14 years experience, specializing in mine reclamation and river restoration

Lake County

- Sarah Mudge, County Commissioner, 5 years experience as a commissioner in Lake County and prior to that, managing nonprofits.
- Bryce Ehrlich,
- Michael Irwin - Director Lake County Public Works - 25+ years Construction and construction management. 17 years with Lake County completing various projects, including Road and Bridge, Landfill, Facilities and Airport construction.

Full resumes for all key staff available upon request. Carol Ekarius resume attached in Appendices

Public Communications

Public Communication Strategy: Describe the process that will be used to demonstrate inclusiveness, communication, and opportunities for public input over the course of the project.

As discussed, one of the first steps the core team will undertake will be to develop an outreach plan. That said, we do intend to utilize a story map and website that we will establish for the Project. We intend to do public meetings during the initial kick-off period, in conjunction with Lake County Commissioner meetings, and through at least one separate weekend meeting, to inform the public. We will present through other meetings in the area, such as the Arkansas Basin Roundtable, as appropriate. We will utilize the local newspaper, the Leadville Herald, and the local web blog, Leadville Today, to publish press releases and articles about projects as they are being implemented. Some projects may be suitable for interpretive signage, and if they are, we will include that element in the project's work plan.

Relationship to Ranking Criteria

Screening Criteria	Analysis
Compliance with SPP	We have complied with requirements of the SPP
Compliance with laws	Partners are aware of all legal requirements, and will comply with all laws, rules, regulations, and permitting requirements for each specific project within the overall Project. Note that NEPA has been completed on some specific project areas by other partners, or is underway.
Public health and safety	This Project will improve public health and safety by the selection and design of work being undertaken. For example, improving culverts increases public safety through safe transport as well as emergency response; forestry work reduces the intensity of wildfire, thus reducing all aspects of fire and post-fire impacts; restoration and mine projects improve water quality, which protects public health and safety.
Eligibility	As all projects are in Lake County they have a clear nexus to the historic releases. Forestry work, although a bit unique to an NRD proposal, will protect investments already made with past-NRD, CERCLA, and other investments by reducing the impacts of post-fire flooding to earlier reclamation and restoration sites.
Ranking Criteria	**Analysis**
Public Support	Although early CERCLA work in California Gulch met with some public push back, the community has grown to appreciate the work, and with the NRD projects, there has been greater support as these projects have improved water quality and recreational opportunities. Through the recent CWPP update (see more below) the County performed a citizen survey (488 responses) that shows 90% of respondents support forest mitigation to protect values at risk. The survey also showed that 53% recreate outdoors, but 89% agree that outdoor recreation is critical to the local economy, and support projects that improve the quality of recreation opportunities. (Copy of report available upon request.)
Likelihood of Success	The Core Team and project-specific partners bring decades of experience in implementing such broad programs of work and specific projects as outlined in the overall Project. With a suite of different projects built in, we have a scalable approach that can accommodate the funding availability to get the best projects implemented, and that can result in savings through strategic bundling of procurement to accomplish the projects that are outlined here.
Technical Feasibility	Specific projects outlined here are based on generally acceptable approaches to reclamation and restoration, and the partners bring extensive knowledge of BMPS and these implementation techniques to the table.

Ranking Criteria	Analysis
Multiple Natural Resource Benefits	Through the large-scale watershed-based approach we are proposing, we advance a holistic view of the projects with the eye toward maximizing natural resource benefits. For example, by not only incorporating fish passage, but also looking at channel and bank stability when improving culverts, we are concurrently addressing aquatic species and sedimentation issues. Forest projects increase heterogeneity, thus providing habitat for a wider array of species, as well as reducing the impacts of post-fire flooding on water quality.
Time to Provide Benefits	Benefits of some projects, such as culvert improvements, show benefits almost immediately, whereas projects such as forest-health work may take several years after completion to show increases of species diversity, and it may be years before we have a wildfire in the area that would negatively impair water quality if the work is not completed. River restoration projects tend to show the benefits to species and water quality within just a few years, whereas mine-related projects can take many years to show improvement in water quality downstream of the work. We anticipate that the combination of projects, however, will begin to show marked improvements within just a few years at the most.
Duration of Benefits	The watershed-based approach we are using shows benefits for decades if not longer. CERCLA and NRD have already documented such long-term benefits, and the Project will build on that success.
Non-NRD match	We are committed to meeting the minimum 50% match, though as discussed above, we do believe that NRD funding will provide a base upon which we can leverage more resources to increase the outcomes specified in this request. We project only 10% of the project total budget to be represented by inkind match, and 40% to be cash match.
Protection of Implemented Projects	Most of the project work is taking place on public lands, and thus protected for the future.
Alignment with Regional Planning	This project aligns with plans developed by various partners. The new county-wide CWPP and all-hazard plans, for example, are key to prioritizing forest project acres. The culverts were identified through a multi-party planning process that was funded by Colorado Springs Utilities and Aurora Water last year, and that used a post-fire hydrology assessment to help in prioritizing the culverts in most need of attention.
Public Access	As the majority of projects are on public lands (federal or local) they are accessible to the public.

Appendices

Offeror's Organization:
The Arkansas River Watershed Collaborative (ARWC) is a 501(c)3 nonprofit watershed group formed by the Arkansas Basin Roundtable membership, which includes representatives of each county in the Arkansas Basin, municipal water providers, water conservancy districts, agricultural, environmental and recreation interests, and ad-hoc federal and state agency representatives. Our staff have connections not only to ARWC, but also to the Coalition for the Upper South Platte and the Purgatoire Watershed Partnership, and over the last several decades have become recognized leaders in the state in implementing such broad-scale collaborative projects. We have worked extensively with federal and state agency partners (particularly CDPHE through the 319 Nonpoint Source Program and CWCB) on grant-driven projects, including overseeing ~$40 million of investments in both the Hayman and Waldo fire recovery efforts. In partnership with the San Isabel National Forest, we are currently implementing a ~$2 million dollar steep-ground demonstration project on Monarch Pass, which is treating forest acres on slopes up to 60%. We have annual audits, and in some years, we have been audited pursuant to the Federal Single Audit Act when we pass the threshold of $750,000 in federal awards in a single year. We routinely procure over $1 million per year in outside contract services, and in peak years have procured over $11 million in a year.

References among state agency staff with familiarity to our leadership and project work:
Tammy Allen, CDPHE, tamara.allen@state.co.us, 720.236.3154
Chris Sturm, CWCB, chris.sturm@state.co.us, 720.219.4384

Past Performance: See Projects List, Next Page—We have just included funding over $250k. Many lines of our database combine to larger projects. Access to the entire list of funders and projects is available as a smartsheet online document, which can be shared upon request. No projects we have completed have had cost overruns, nor encountered significant technical difficulties.

Funder	Year Approv	Grant Name	Program Type	Amount of Award
USFS	2021	Action Implementation Mitigation	Collab Dev	$4,461,000.00
El Paso County	2013	Waldo	Emerg Mgmnt	$2,100,000.00
NFF with Coke, Aurora, Gates, Vail	2012	Trail Creek	River Resto	$1,680,000.00
City Colo Spgs	2013	Waldo	Emerg Mgnt	$1,629,946.00
CSFS	2009	ARRA	Forestry	$1,565,000.00
USFS	2019	South Ark Stewardship Agreement (Monarch Pass)	Forestry	$1,200,000.00
DNR	2013	Wildfire Mitigation	Forestry	$1,000,000.00
USFS	2012	Waldo	Emerg Mgnt	$759,000.00
CDPHE	2010	Trail Creek	Post Fire	$694,800.00
CWCB	2015	Horse Creek	River Resto	$650,000.00
CDPHE	2014	WALDO	Emerg Mgnt	$500,000.00
Crown	2017	F2F: Building Capacity to Protect Western Watersheds	Collab Dev	$500,000.00
Crown	2020	Crown	Collab Dev	$500,000.00
HCWCD	2020	Spring Fire	Fire Recovery	$500,000.00
Crown	2015	Forest work	Capacity	$500,000.00
DW (CSFS)	2014	USPP DW Non-Fed Lands Forest Treatment Partnership	Forestry	$500,000.00
USFS	2018	CMAT	Emerg Mgmnt	$480,000.00
CDPHE	2016	Horse Creek	River Resto	$433,307.00
CWCB	2019	Monarch	Forestry demo pr	$403,739.00
USFS	2011	Trail Creek		$387,000.00
Colorado Springs Utilities	2016	WALDO	Post Fire	$376,500.00
Custer County - CDPHE	2017	Wetmore	Post Fire	$345,074.00
CWCB	2021	Ark Basin Fire & Flood	Mixed programs	$345,074.00
PC LWTF	2009	Park County LWTF	River Resto	$312,000.00
CDPHE	2021	Post-fire BMP Implementation Spring Creek Fire (Idlewild)	Forestry	$300,000.00
DNR	2014	Wildfire Mitigation	Forestry	$293,333.33
CWCB	2017	Ark Watershed Collab Develop	Collab	$291,500.00
CSFS	2009	WPHFI	Forestry	$276,000.00
Crown	2015	Collaborative Development	Forestry	$275,000.00
CWCB	2018	Ark Basin Watershed Health Initiat	Mixed programs	$253,000.00
CSFS	2017	2017 NE Teller Cnty Adjacent Lands Project-Stevens/CAFA	Forestry	$250,000.00

Carol Ekarius
Curriculum Vitae

Experience:

2014 to Current. Chief Executive Officer, Coalitions & Collaboratives, Inc. Formed as a new organization by the leadership of the Coalition for the Upper South Platte, this organization helps other nonprofits work on collaborative conservation. COCO is working with a number of place-based affiliates, including providing sub-awards to aid in their efforts; developing innovative programs with the U.S. Forest Service to expand on-the-ground work in communities around the West to reduce wildfire impacts, including operating the AIM grant program, which has funded numerous collaboratives in Colorado, and such as managing the Community Mitigation Assistance Teams; providing support to post-fire communities who are coping with flooding and other challenges following wildfires across the West, including hosting the After The Flames conferences, resource pages, and webinars; and piloting a public/private partnership around forest-carbon market approaches. Carol's strategic and visionary leadership are acknowledged by many in the watershed and forestry universe, with awards such as the 2012 USFS Chief's Award and a 2015 Excellence in Environmental Stewardship Award from the Colorado Department of Public Health and Environment, and appointments such as Environmental Representative to the legislatively established Colorado Forest Health Advisory Council.

2019 to Current. Interim Executive Director, Arkansas River Watershed Collaborative. Carol helped the Arkansas Basin Roundtable to establish a basin-wide watershed collaborative, and has helped develop that organization, which has been focusing on forest health efforts in the headwaters of the Arkansas basin, and on post-fire recovery from fires that have happened in the basin over the last several years.

1999 to 2019. Executive Director, Coalition for the Upper South Platte. Carol helped get this nationally recognized watershed group off the ground, working to oversee all functions and staff, including financial management, project implementation, outreach to the public, grant administration, and other functions required to run a nonprofit organization. CUSP members include major water providers, such as Denver Water, Aurora Water, and Colorado Springs Utilities, as well as county governments, conservation and conservancy districts, and other NGOs. She has represented the organization on various committees and task forces, such as the Front Range Fuel Treatment Partnership Roundtable, the South Platte Protection Plan Committee, and the National Commission on Science and Sustainable Forestry. The group works on projects ranging from fire rehabilitation after many wildfires (including the 2002 Hayman fire and 2012 Waldo Canyon fire), to environmental education, forest health, river restoration, and weed control projects across public and private boundaries.

1989 to Current: Self-employed Write and Nonprofit Consultant. For over 20 years, Carol worked as a self-employed writer, and as a technical consultant to other nonprofits and the governmental sector. Her freelance writing credentials include 12 books in print, as well as articles in a variety of magazines. Her consulting has included contract report writing, grant writing, meeting facilitation, and project management support on a wide array of projects and programs.

1989-1998: Self-employed Farmer. Carol and her husband owned and operated an organic, grass-based farm in Central Minnesota during this period. She also ran the consulting business from the farm, providing technical support to public and nonprofit entities.

1981-1989: District Manager, Frisco Sanitation District, Frisco, CO. As manager of the District, Carol oversaw day-to-day operations and major construction projects of a sanitation district providing wastewater treatment services to a community of 8,000, and represented the Board in an official capacity. The District's annual operating budget was $500,000 per year, and she managed a $4,000,000 construction project during her tenure. The plant won EPA's National Operation and Maintenance Award under her leadership. In this position, she was a key player in helping to create the first pollution trading regulation in the nation. Under the "Lake Dillon Regulation," Summit County, a national ski country treasure, could continue to grow but also maintain Dillon Reservoir as a high quality water body for municipal and recreational purposes by utilizing a cap and trade approach to phosphorous pollution.

Other Public and Nonprofit Experience:

1985-1989: Town Board Member, Silverplume (CO)
1984-1989: Board Member, People for Silverplume
1989-1991: Chairman, Sustainable Farming Association of Minnesota
1991-1997: Executive Director, Sustainable Farming Association of MN
1992-1995 Kellogg Foundation Leadership Fellow
1995-1997: Board Member, Minnesota Institute for Sustainable Agriculture (Univ. of MN)
1995-1997: Member, National Sustainable Agriculture Working Group
1998-2004: Board Member, Hartsel Community Library Board
2000-2003: Board Member, Colorado Watershed Assembly
2000-2003: Treasurer, Colorado Watershed Assembly
2001-2002: Executive Committee Member, Colorado Water Trust
2002-Current: Executive Committee Member, Front Range Fuel Treatment Partnership Roundtable
2013: Member, Governor's Wildfire Insurance Task Force
2017-Current: Governor's appointee, Colorado Forest Health Advisory Council
2018-Current: Ex-officio member of the national Wildfire Leadership Council (Washington-level leadership from USFS, DOI, and other organizations)

Education:

1989: BS, Civil Engineering, University of Colorado at Denver
1975: Certificate in Medical Laboratory Technology, Monmouth Medical Center Professional Development Program, Long Branch, NJ
1974: AS, Biology, Ocean County College, NJ

COLORADO
Department of Public Health & Environment

October 29, 2021

Ms. Carol Ekarius
Acting Executive Director
Arkansas River Watershed Coalition

RE: Upper Arkansas Comprehensive Watershed Restoration Project Proposal for California Gulch Natural Resource Damages Funding

Dear Ms. Ekarius:

The California Gulch Natural Resource Damages Trustee Council (TC), a State and Federal partnership, reviewed the *Upper Arkansas Comprehensive Watershed Restoration Project* proposal for Natural Resource Damages funding. As you know, this funding is available to implement natural resource restoration in the Upper Arkansas River Watershed.

We understand the AWRC proposal to be comprehensive over several environmental media and the total NRD funding request is $5,225,000.00

After review of the proposal, the Council requests further information from AWRC to help in its evaluation of the proposal. Below is a list of the information and feedback needed in order to help the TC to complete its evaluation. Consistent with the structure of your proposal, we have sequenced the request for information through environmental media/type of project.

Please call (303) 692-3321 or email me at susan.newton@state.co.us if you have questions.

Sincerely,

Susan Newton

Susan Kay Newton
Federal Facilities Project Manager/Natural Resource Damages Coordinator
Remediation Program
Hazardous Materials and Waste Management Division

cc: David Kreutzer, AGO
Laura Archuleta, DOI
Traci Robb, USBR
Ed Perkins, CPW
John Smeins, BLM
Melody Mascarenaz, CDPHE

Trustee Council for California Gulch Natural Resource Damages
Comments to ARWC's Proposal Upper Arkansas Comprehensive Watershed Restoration Project

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General Comments to Proposal

- All projects need specific budgets per our discussions. We understand that project budgets may be estimates based on similar work, but we need the detailed budget information (per SPP) to be able to evaluate the proposal.
    - Engineering costs are generally not paid by NRD funds, but as described in the Solicitation for Project Proposals (SPP), these costs may be counted toward matching funds. Please detail what funds (match or NRDs) would cover those costs.
- Please be sure maps match up with projects (names/types of project) and their descriptions in the text of the document.
- Every proposed project should include a specific description regarding how the project will address restoration of the injured resource described in the Solicitation for Project Proposals (SPP).

Over-arching (p.3, #1)

a. Initial paragraphs appear to refer to project overhead costs which might not be fundable through NRD dollars, as per the SPP (B. Funding, p. 10). Overhead/administration costs are problematic, as the stated use of the NRD funds is that they must be used as direct project costs rather than on administrative costs.
b. The 'Over-arching' section needs a specific budget. Following are some budget-related questions that the Trustee Council has regarding the 'Over-arching' part of the project:
    i. Are Administration/Overhead costs part of this budget? What funds cover those?
    ii. What proportion of NRD dollars will be used for outreach?

Stream Corridor/Riparian Projects

General Comment

a. The Proposal states there are three stream reaches, but only two are listed (Halfmoon and East Fork) – is there a third? Please clarify and be sure project names are the same on map(s) as in the narrative.
b. The Trustee Council suggests ARWC seek input from Alex Townsend, CPW aquatic biologist, regarding the fishery benefits for all in-stream projects

Specific Comments

Half-Moon Project

c. If there is not a fish passage at the BOR diversion structure on Halfmoon Creek, is there still a benefit to the fishery from the in-stream project? What would that be?
d. The Trustee Council reviewed some information we had from 2019 regarding discussions about a Halfmoon Creek fish passage at the BOR diversion. This would be an extremely complicated project that would need a fish passage feasibility study to be completed as an initial phase. At one point, CPW considered being the lead for drafting a feasibility study as they have done several in the recent past; however, it was not a priority project for them, so it was tabled. At that time, BOR was not opposed to the feasibility study and would require a feasibility study to be done consider moving forward. Currently, Halfmoon Creek is meeting the goals of the instream flow program with the 7 cfs based on a 2019 assessment by CPW.
e. Please provide information on current geomorphic conditions of Halfmoon Creek compared with what would be considered to not be degraded. How does that relate to the issues such as pool-riffle ratio, depth, wetted perimeter, etc., that CPW looks at for the instream flow program?
f. Please clarify last sentence of Halfmoon Creek instream paragraph on p. 4 – it is confusing. It is not clear how the culvert projects upstream benefit (or connect) to this specific project without fish passage at the BOR diversion. Without fish passage, there is a section of stream that goes dry at certain times of the year downstream of the BOR diversion.

East Fork of the Arkansas

a. We did not tour this project specifically, and proposal does not go on to provide any more information. Please provide information on current geomorphic conditions of this section of East Fork of the Arkansas River compared with what would be considered to not be degraded.
b. We would like to see input from a CPW fisheries biologist.
c. Please provide information regarding how this project will benefit the fisheries.

Historic Mines

Specific Comments

Sherman Mine:

a. The Trustee Council understands there is a 100% design for the Sherman Mine. Can this be provided?

Dinero Tunnel

a. Please provide a detailed budget and explain why the 'strategy' or investigative phase is needed? What is the monitoring showing? Is water quality from Dinero impacting aquatic life in Lake Fork? Is there a monitoring report that can be shared?
b. What is the project deliverable and who might implement any recommendations that could stem from the investigation work?
c. Please better explain the two phases of the project in terms of strategy for treating mine pool water that might be developed and how implementation might follow.
d. The project's ultimate goal appears to be largely dependent upon Good Samaritan legislation that will not happen anytime soon. Please describe why implementation of this initial phase is worthwhile at this time instead of when legislation is more certain. For example, would this project provide information that could be used elsewhere?

Minnie Crib Walls

a. This project must be removed from the proposal because it is in an Operable Unit of the Superfund Site with a designated Potentially Responsible Party.

Fluvial Tailings

a. This is a straightforward project but we will need a detailed budget.

Addressing Forest Fuel Loading

General Comments

a. The Trustee Council does accept the general idea that reducing fuel loading and slowing fire is a good way to protect the watershed, but it is unclear if the proposed project areas do indeed feed into the Upper Arkansas watershed in areas where we have funded past projects. It appears many of the projects do not protect the investments we have already made as is stated in the proposal.
b. Longevity of the investment over time is an issue. Tree regrowth will occur shortly after cutting and it takes commitment to protect the investment and keep benefits over time. Does this project have any O&M (Operations and Maintenance) components or how would that be addressed in 10-20 years?
c. The project areas must have an ecological nexus to the injured resource and 3-44 of the 6 project areas do not seem to have that nexus but rather, protect water

resource (i.e., water supply streams). Please describe the nexus to the injured resource.

Specific Comments

Newmont property – Please provide a map of property ownership in relationship to the proposed sites. Is part this site on the Superfund Site in OU 4? Should Newmont be doing their own forestry work to mitigate this hazard? While the Trustee Council agrees that fire mitigation is very important, they are concerned that this project is geared toward protecting human infrastructure/values, not natural values, and the specific purpose of this funding is to benefit the natural environment in the absence of human values and benefit.

Tennessee Creek, Sugar Loaf Mountain, and Parkville Watershed/Prospect Mountain - Please describe more clearly how the projects benefit the injured resource as described in the SPP (Upper Arkansas Watershed) and/or protect the other NRD-funded investments toward other projects. Also please describe the nexus between the project and the NRD criteria based on location, surface area, watershed hydrology, likely impacted riparian zones and habitat/species that are therefore at risk.

Culverts

General Comment

a. With the understanding that costs may vary between projects, please provide general information regarding anticipated cost per culvert.

Specific Comments

b. For the Half Moon (one culvert) near Half Moon Road (CR 11) and FS Rd 152, please clarify this location and why there is a need for a fish passage culvert at this location, especially if one is not in place at this time. Looking at aerial imagery there does not appear to be any designated system roads that cross Halfmoon Creek downstream of the BOR diversion.
c. On the map, the CR 11 Culvert project is shown on Halfmoon Creek, but our site visit was looking at the culvert over Lake Fork – which location is being proposed?
d. Twin Lakes Highway 82 Lake Creek Culvert Projects – this location appears to be at Black Cloud Creek on Hwy 82 – please clarify location and need for the project. Is culvert needed for fish passage and for what fishery?
e. Twin Lakes South Fork Lake Creek (TW-SCC120 and TW-SCC130) - please clarify location and need for the project. Is culvert needed for fish passage and for what fishery?

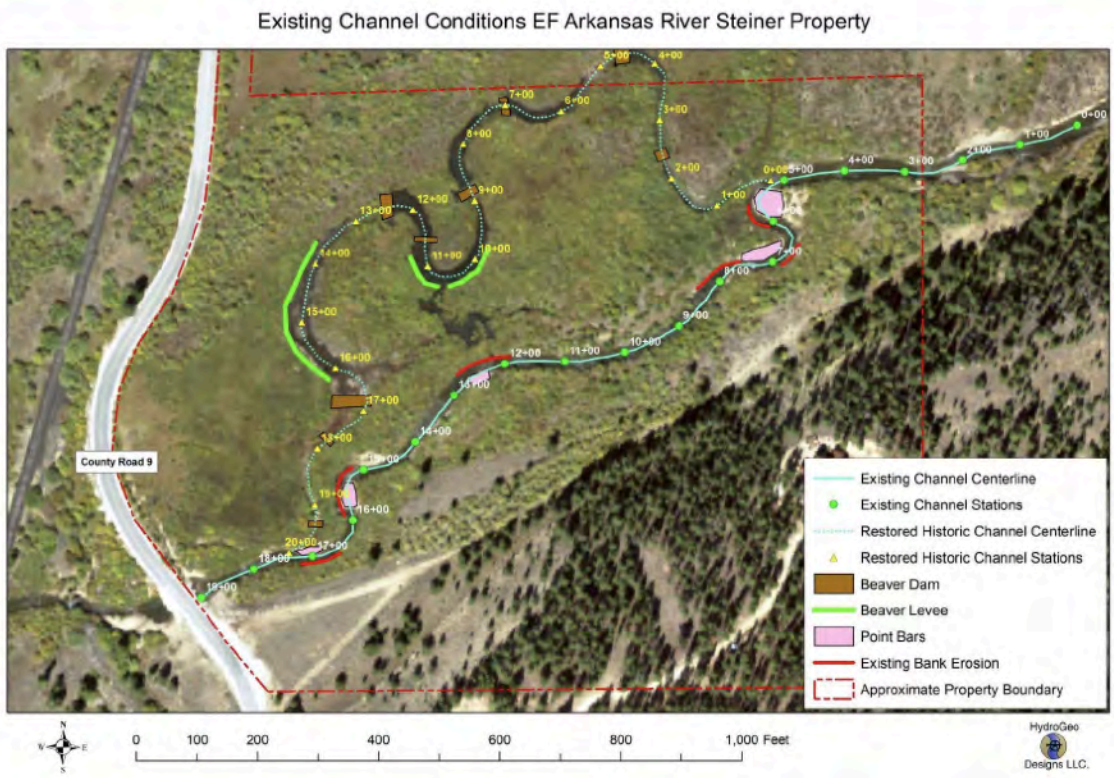
California Gulch Natural Resource Damages Solicitation Project Proposal
Executive Summary
ADDENDUM

Proposal Name: Upper Arkansas Comprehensive Watershed Restoration Project

Response to Trustee's Letter:

1. **Over-arching:** Overarching covers SAP and overall monitoring, and community engagement and outreach. Admin is included in specific project areas based on the Federal de minimus of 10% is strictly counted as match.
2. **Addressing habitat and mines (combined after removal of several projects):**
   - ***Steiner:*** The project has a contributing drainage area of 52.2 mi2, draining to the west and south from the continental divide and surrounding high mountain ridges. The channel elevations at the site range from 9764 to 9746 ft NAVD 88 and the site has a high ridge to the south with that site approximately 70 feet above the valley floor. The valley floor climbs gradually in the northward direction toward the adjacent property to the north owned by the Climax mine. The current site conditions consist of a bifurcated two channel reach that has hydraulic connectivity to both channel reaches (Figure 2). The southern channel is approximately 1600 LF and carries the vast majority of the current channel flow. This channel is fairly steep 1.26% gradient riffle/run channel with limited meander sinuosity. The channel consists of a cobble bed channel with nearly continuous riffle run sequence and limited deep pool habitat. Eroding banks are present on several of the outer bend areas despite dense willow and sod vegetation. Point bar development is present in five locations. Fisheries habitat is currently limited by swift riffle flows throughout the reach and limited deep pool/undercut bank habitat. The northern reach on the site is the historic stream channel, this stream channel does have limited hydraulic connectivity currently to the south branch, however the flow into the channel is limited particularly at lower flow rates. This channel reach currently has a series of nine (9) beaver dams spread throughout the reach (Figure 2). These beaver dams average 2-3 feet in height and backwater up throughout the reach. Significant siltation has occurred in the reach in the time that the majority of the stream flow has gone through the southern reach. The shallow still water has limited fisheries habitat This channel has significantly better fisheries potential than the southern reach if flows are re-introduced to the reach. The channel length is approximately 2000 LF and the historic meander pattern will provide the potential for an excellent riffle/run/pool/glide sequence that will provide deep pool habitat that can be augmented with toe wood treatments that can provide stable bank conditions with undercut fish habitat in the toe wood locations. Pool excavations can be utilized to create deeper pools in the meander

bends. Additionally, the newly restored glide areas will provide excellent spawning habitat for brown trout.



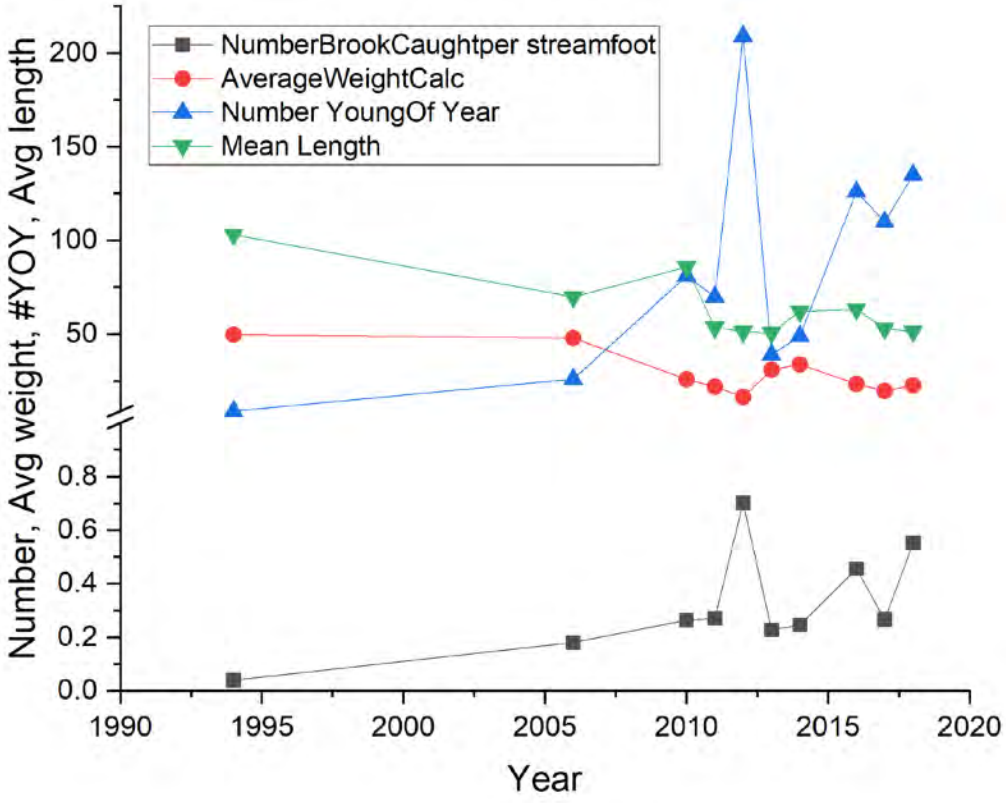
- ***Sherman—:*** DRMS completed reclamation on the site in 2008 that reestablished the historic natural drainage route through Iowa Gulch and the re-graded waste rock pile. Following the reclamation work, lateral erosion from runoff and storm events has destabilized and widened the channel resulting in the transport of waste rock into the sensitive wetland area below the mine. To mitigate this, DRMS intends to construct grouted riprap channels to stabilize the waste rock and prevent further sedimentation downstream. Approximately 2,000' of drainage channel will be addressed with this project. *See additional information attached at end of this document.*
- ***Dinero Tunnel—bioreactor design and monitoring:***
  Question a from Trustees:The investigative phase is needed because we simply do not have enough information about the Dinero mine pool geometry and chemistry to implement a treatment strategy at the present time. We need (1) to delineate the geometry of the mine pool formed behind the Dinero bulkhead, (2) to better understand the composition of water in the mine pool, and (3) to perform bench scale tests to decide which type of passive treatment amendment is most suited to improving the water-quality of the Dinero mine pool.

(1) A rough picture of the geometry of the Dinero mine pool can be inferred from the locations of all springs and seeps whose water quality has been negatively affected by discharge from the mine pool. We have that information, and we do understand that rough geometry. But, in the fractured-rock geology of the area, we cannot simply connect the dots between the springs to understand the mine pool geometry. The subsurface between the springs does not have continuous permeability. We need to better understand the geometry of the mine pool to identify potential locations for applying passive treatment to the mine pool. What location(s) for treatment has(have) the greatest potential to impact the greatest number of springs that are fed by the mine pool? We cannot answer that question without a better picture of mine pool geometry.
(2) The water that flows out of the Dinero tunnel right now is mostly water that flows out of a fracture in front of the bulkhead, not mine pool water that leaks from behind the bulkhead. In addition, the composition of the small amount of leakage that does flow from behind the bulkhead is likely affected by interacting with the concrete of the bulkhead and does not represent in-situ water quality of the mine pool. The selection of treatment materials in the mine pool will depend on the chemistry and stratification of the mine pool. Thus, we need samples of mine pool water from drill holes. These drill holes would also be possible locations to inject treatment material.
(3) We cannot implement a treatment based on our current (2021) limited knowledge of mine pool chemistry. Bench scale tests of different potential treatment materials with the mine pool water are the industry standard for this type of remedy.

Water-quality monitoring of the Dinero area conducted by USGS from 2006 to 2017 shows limited improvement due to the Dinero bulkhead in Lake Fork Creek, downstream from the Dinero area. The most recent monitoring report (Walton-Day and others, 2021, *attached*, see particularly Figure 5 and table 1) shows statistically significant decreases in manganese concentrations in Lake Fork Creek (site LF-580) since installation of the bulkhead. There is a slight, but not statistically significant decrease in zinc concentrations. Manganese loads (load is a measure of the total amount of metal flowing past the site) decrease but not at a rate that is statistically significant. Zinc loads increase and are not statistically significant. High water years show poorer water quality than low water years (see June 2011 manganese and zinc at LF-580 on fig. 5). This effect may be due to discharge of more degraded groundwater from the Dinero area to the Lake Fork Creek upstream from site LF-580. Manganese water quality standards are generally met at the Lake Fork Creek site, but zinc water-quality standards are not. The increase in zinc load is concerning and may explain why zinc water-quality standards are not being met. Other sites (Nelson tunnel, Sugarloaf Gulch, Little Sugarloaf Gulch) show water-quality degradation after installation of the Dinero bulkhead.

Brook trout data (1994-2018) obtained from Colorado Parks and Wildlife for a site on Lake Fork Creek approximately 300 m downstream from the Dinero area show some evidence of increasing recruitment at the site (more fish per linear feet of stream, and more young of year). But, average weight and length have gone down over the same period, perhaps indicating the effects of more, but smaller fish. One brown trout was captured in 1994 and 2018. One lake trout was captured in 2006 and 2011. The site is not stocked and brook trout dominate. Andrew Treble at Colorado Parks and Wildlife

concurred that there may be more recruitment at the site, but overall no significant changes. All told, there is some evidence of limited water quality and biotic improvement in Lake Fork Creek. But, several sites upstream near the Dinero tunnel have experienced marked declines in water quality due to the effects of the mine pool behind the Dinero bulkhead that partially negate, and could eventually potentially overwhelm the limited improvements that have occurred after bulkhead installation. More remediation is needed to obtain significant, lasting water-quality and biotic improvement in Lake Fork Creek downstream from the Dinero area.



Question b: We see the deliverable as geotechnical and structural drilling data that would provide partners on the feasibility of in-situ treatment behind the bulkhead. These drilling operations would allow for delineation of the mine pool and where it is located related to the bulkhead and any collapses that might be present. Through this drilling investigation, water quality would also be generated to evaluate metal concentrations at various locations behind the bulkhead. A concurrent pilot study would allow partners to evaluate which treatment might best apply given the conditions underground.

Question c: During the investigative phase of the project we would be looking ahead, as much as possible within the demands of the investigation, to implementation. Implementation would ultimately depend on the remedy chosen. Our first choice for

partners to implement would be the partners in the study. We would be investigating whether or not this type of in situ treatment of groundwater (the mine pool) would be subject to liability protection under existing statutes, or whether Good Sam legislation would be required. Are there other ways we could design the remedy that would work within existing protections? This aspect of the project requires more investigation and discussion. Question d: Absolutely this project could provide data and an approach that could be used elsewhere at other AML sites. The steps listed as part of this project would be necessary precursors to full-scale implementation. If these studies and data gathering were to warrant implementation at this site, it would be a good candidate for Good Sam given legislation would eventually be passed. While the legislative aspect is an uncertainty, progressing AML treatment like proposed in this study needs to be furthered to improve the suite of water quality technologies available to industry and other entities. More and more, investigations of bulkhead remedies are showing limited long-term improvement to water quality. However, bulkheads are protective against blow outs and to downstream infrastructure. Advancing our capability to improve the water-quality effects of bulkhead remedies would have a large benefit to other sites where bulkheads have been used, particularly the Bonita Peak Superfund site, but also other sites in Colorado and elsewhere.

- ***Fluvial tailings:*** There are five large fluvial tailings deposits located along the 11-mile reach of the Arkansas River floodplain where previous habitat and Superfund activities took place. These remaining fluvial tailings were not completed as part of these actions and still remain leaving a barren landscape prone to localized and downstream environmental degradation (Figure 1).

Figure 1: Current conditions in the five fluvial tailings areas in the Arkansas River floodplain. These areas can continue to degrade surrounding environmental quality and habitat.

These fluvial deposits have already been mapped and quantified per past CPW efforts that Trout Unlimited (TU) will now take over and manage subsequent cleanup actions. Fluvial tailings areas associated with this scope of work are scattered at various locations along the accessible Arkansas River floodplain, or adjacent to recently developed walking and angling trails that have been implemented during past actions (Figure 2).

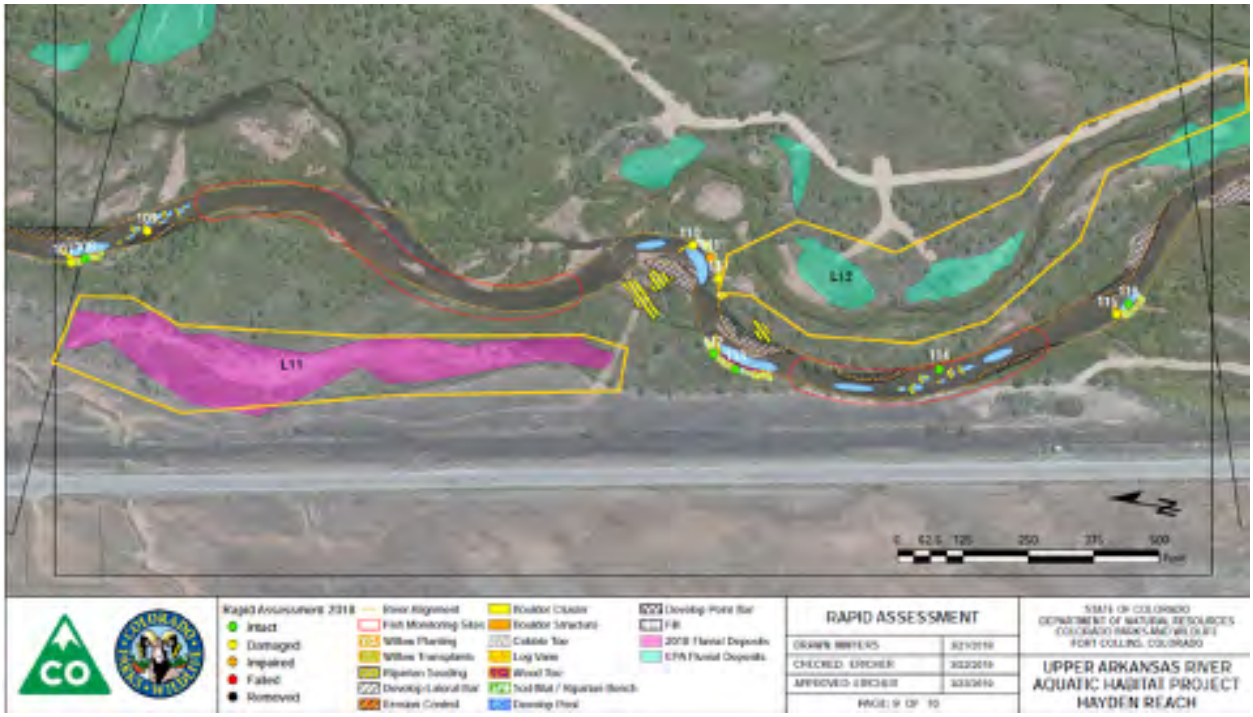


Figure 2: L11 Pink fluvial tailings area highlighted by past CPW UAR study. During this work each of the five fluvial tailings were mapped and quantified. In this figure, L11 is approximately 83,820 square feet.

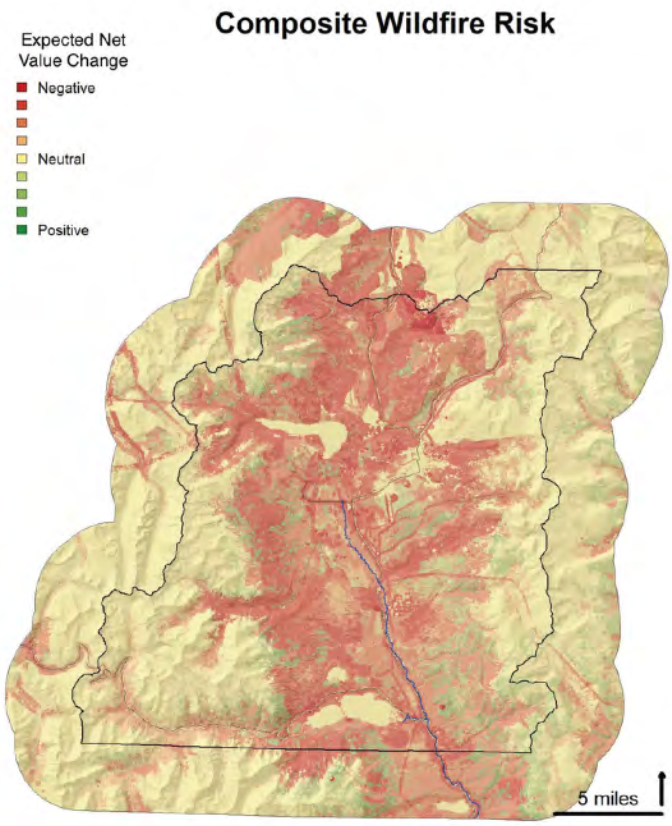
As indicated in Figure 2, Fluvial Deposits are labeled with an L and highlighted in pink. Between the five areas L7 through L11, approximately 6.88 acres (7 acres) make up the SOW where NRD funds are being requested. Trout Unlimited has a long history of remediating fluvial tailings and mine waste across the State over the past decade. Using best management practices and working with Federal and State agencies have allowed TU to become an industry expert when taking on these types of projects.

Work is planned to begin in the planning stages for this project in 2022 with the soil sampling in the spring followed by installation of test plots on all five deposits to figure out the best recipe for reclamation and revegetation. The original OU11 prescription will be considered and validated in the field compared to other best practices for revegetation over recent years. Test plot success will ultimately drive the amendment quantities for full-scale reclamation that will

ideally take place in Fall of 2023 pending all access agreements and liability documents are in place between TU, agencies and landowners. Work to procure these documents will likely begin during 2022 and continue into the beginning of 2023.

The fluvial tailings have also been a priority of the Lake County Open Space Initiative (LCOSI), which TU has been a member of for years. Many of the members of LCOSI have voiced support of this project and it was recently identified in the strategic short-term plan to help or assist in completion of fluvial tailings reclamation. TU looks forward to working to finish out these remaining areas of contamination.

3. ***Addressing forest fuel loading:***
We have reduced the acres from 750 to 250 on non-fed lands, and will focus those acres on county-owned lands that drain directly to areas in California Gulch and that drain to the 11-Mile reach where NRD funds have been used for restoration. The FS will also implement acres in the area that drains to the 11-Mile section, rather than above Turquoise, due to Trustee concerns with nexus. We believe these changes make a direct connection to nexus, and the county will maintain the treatment areas on their lands. The areas identified are also all high-priority based on composite risk areas within the new CWPP.



4. **Addressing culverts:**
We have narrowed the culvert list to the county's highest priority culverts in the area that drains to the 11 Mile reach, and eliminated FS culverts above Turquoise and Twin Lakes. Jason Willis has reached out to Alex Townsend of CPW, and he will be working with us on reviewing culvert design issues relating to passage and stream habitat improvement as the remaining culvert projects move forward.

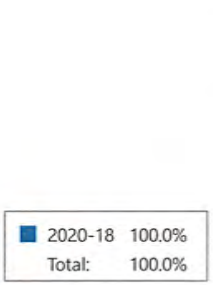
Lake County Road and Bridge

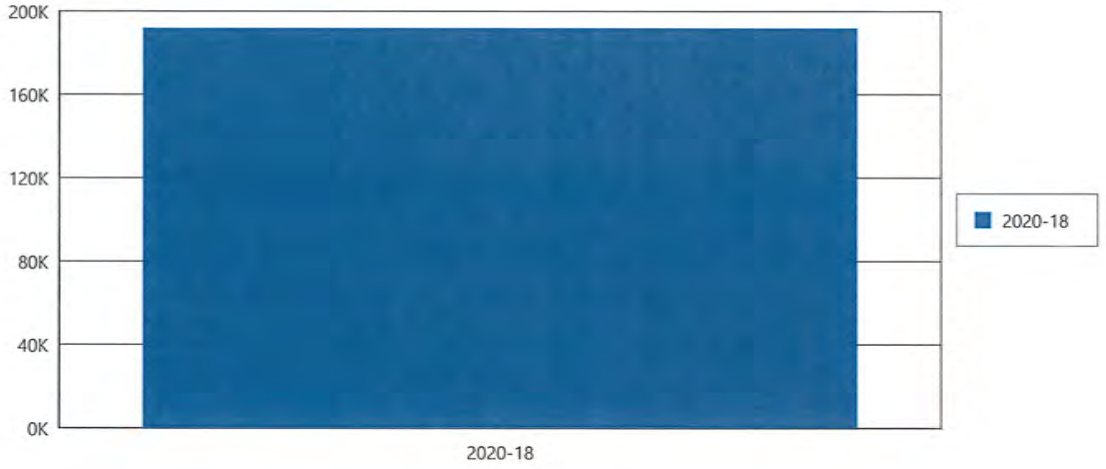
Reporting Dates All Dates

Project Cost Comparison Summary

Sorted by Project Number

Project Number / Name		Labor Cost	Equipment Cost	Material Cost	Contractor Cost	Overhead Cost	Total Cost	Unit Costs	Completion Status/Active
2020-18	Arkansas River Bridge Replace	$45,385.13	$53,227.50	$11,616.49	$81,741.71	$0.00	$191,970.83	$0	N 100% Y
Grand Total		**$45,385.13**		**$11,616.49**		**$0.00**			
Projects:	1		**$53,227.50**		**$81,741.71**		**$191,970.83**		





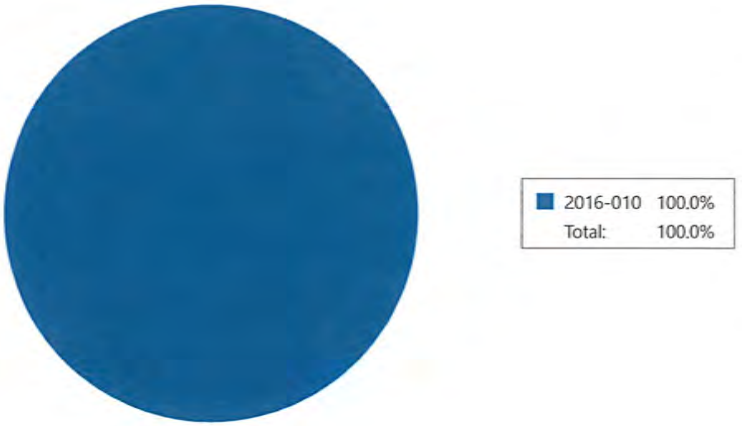
Lake County Road and Bridge

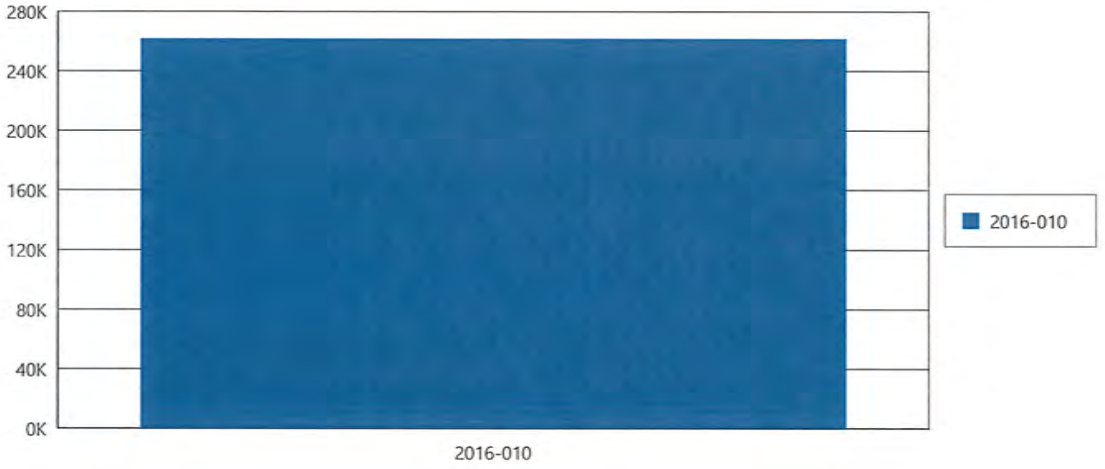
Reporting Dates All Dates

Project Cost Comparison Summary

Sorted by Project Number

Project Number / Name		Labor Cost	Equipment Cost	Material Cost	Contractor Cost	Overhead Cost	Total Cost	Unit Costs	Completion Status/Active
2016-010	County May Queen Culvert	$42,892.40	$33,687.89	$29,583.37	$155,803.80	$0.00	$261,967.46	$0	Y 100% N
Grand Total		**$42,892.40**		**$29,583.37**		**$0.00**			
Projects:	1		**$33,687.89**		**$155,803.80**		**$261,967.46**		





Lake County Road and Bridge

Reporting Dates All Dates

Comprehensive Detail by Project/Task

2020-18 / Arkansas River Bridge Replace			Labor Hrs	Labor Cost	Equipment	Eqp Hr/Mi	Eqp Cost	Material	Mat Used	Mat Cost	Contractor Cost	Overhead Cost	Total Cost
100 / Consulting Services													
KHA	01/31/20	105,621									$11,050.00		$11,050.00
KHA	06/22/20	105,622									$10,262.23		$10,262.23
TS	09/02/20	106,332									$5,437.50		$5,437.50
Consulting Services Sub Total			**0.00**	**$0.00**			**$0.00**			**$0.00**	**$26,749.73**	**$0.00**	**$26,749.73**
10000 / Testing													
KAI	09/24/20	106,329									$1,510.00		$1,510.00
KAI	10/28/20	106,328									$962.50		$962.50
Testing Sub Total			**0.00**	**$0.00**			**$0.00**			**$0.00**	**$2,472.50**	**$0.00**	**$2,472.50**
101 / Supplier													
RMSC	08/31/20	106,330									$1,766.93		$1,766.93
RMSC	08/31/20	106,331									$3,277.86		$3,277.86
WAGNER	09/16/20	105,799									$2,141.20		$2,141.20
WAGNER	09/30/20	105,798									$400.00		$400.00
WAGNER	10/07/20	105,797									$11,350.00		$11,350.00
WAGNER	10/23/20	105,800									$6,800.25		$6,800.25
WAGNER	11/05/20	105,801									$13,084.00		$13,084.00
COB	12/11/20	107,947									$13,699.24		$13,699.24
Supplier Sub Total			**0.00**	**$0.00**			**$0.00**			**$0.00**	**$52,519.48**	**$0.00**	**$52,519.48**
210 / Operator/Truck Driver													
003/Romero	08/17/20	102,954	10.00	$289.10	0244	2.00	$170.00						$459.10
006/Hockett	08/18/20	102,941	10.00	$270.60	0242	10.00	$850.00						$1,120.60
147/Kerrigan	08/18/20	102,942	10.00	$246.00	0177	2.00	$120.00						$366.00
147/Kerrigan	08/18/20	102,942			0307	8.00	$848.00						$848.00
098/White	08/18/20	103,238	10.00	$270.60	0242	10.00	$850.00						$1,120.60
147/Kerrigan	08/19/20	103,232	10.00	$246.00	0324	4.00	$408.00						$654.00
147/Kerrigan	08/19/20	103,232			0177	2.00	$120.00						$120.00
003/Romero	08/19/20	103,235	10.00	$289.10	0800	4.00	$360.00						$649.10
006/Hockett	08/19/20	103,237	10.00	$270.60	0305	10.00	$1,060.00						$1,330.60
003/Romero	08/20/20	103,225	11.00	$318.01	0800	4.00	$360.00						$678.01
003/Romero	08/21/20	103,224	6.00	$260.19	0800	6.00	$540.00						$800.19

Comprehensive Detail by Project/Task

2020-18 / Arkansas River Bridge Replace			Labor Hrs	Labor Cost	Equipment	Eqp Hr/Mi	Eqp Cost	Material	Mat Used	Mat Cost	Contractor Cost	Overhead Cost	Total Cost
003/Romero	08/24/20	103,219	10.50	$303.56	0800	4.00	$360.00						$663.56
086/Marcella	08/25/20	103,106	10.00	$270.60	0244	9.00	$765.00	Road Base 6	14.00	$122.61			$1,158.21
003/Romero	08/25/20	103,211	11.00	$318.01	0800	8.00	$720.00						$1,038.01
025/Stultz	08/25/20	103,212	2.00	$71.30	0305	2.00	$212.00						$283.30
025/Stultz	08/25/20	103,213	4.00	$119.60	0226	4.00	$360.00						$479.60
086/Marcella	08/26/20	103,114	10.50	$289.63	0800	9.00	$810.00						$1,099.63
025/Stultz	08/26/20	103,205	3.00	$89.70	0226	3.00	$270.00	Road Base 6	50.00	$437.89			$797.59
147/Kerrigan	08/26/20	103,209	10.00	$246.00	0244	10.00	$850.00	Road Base 6	28.00	$245.22			$1,341.22
006/Hockett	08/28/20	103,193	9.50	$385.61	0307	9.50	$1,007.00						$1,392.61
086/Marcella	08/31/20	103,459	10.00	$270.60	0305	5.00	$530.00						$800.60
006/Hockett	08/31/20	103,562	10.00	$270.60	0800	10.00	$900.00						$1,170.60
006/Hockett	08/31/20	103,563	0.50	$20.30	0800	0.50	$45.00						$65.30
147/Kerrigan	08/31/20	103,577	10.00	$246.00	0305	6.00	$636.00						$882.00
003/Romero	08/31/20	103,584	10.50	$309.43	0800	5.00	$450.00						$759.43
006/Hockett	09/01/20	103,564	10.00	$270.60	0800	10.00	$900.00						$1,170.60
003/Romero	09/01/20	103,585	10.00	$289.10	0800	5.00	$450.00						$739.10
147/Kerrigan	09/02/20	103,579	10.00	$246.00	0244	5.00	$425.00						$671.00
025/Stultz	09/02/20	103,596	5.00	$149.50	0307	5.00	$530.00						$679.50
003/Romero	09/04/20	103,588	9.50	$411.97	0800	9.50	$855.00						$1,266.97
025/Stultz	09/04/20	103,600	5.50	$246.68	0305	5.50	$583.00						$829.68
006/Hockett	09/17/20	104,064	10.00	$270.60	0800	10.00	$900.00						$1,170.60
003/Romero	09/21/20	104,054	10.00	$289.10	0800	2.00	$180.00						$469.10
003/Romero	09/28/20	104,656	10.00	$289.10	0800	4.00	$360.00						$649.10
147/Kerrigan	09/29/20	104,645	10.00	$246.00	0200	4.00	$340.00	3/4 wash rock	14.00	$252.00			$838.00
003/Romero	09/29/20	104,651	10.00	$289.10	0800	4.00	$360.00						$649.10
003/Romero	10/01/20	104,637	10.00	$289.10	0800	6.00	$540.00						$829.10
003/Romero	10/05/20	104,628	10.00	$289.10	0800	4.00	$360.00						$649.10
147/Kerrigan	10/06/20	104,685	10.00	$246.00	0244	2.00	$170.00						$416.00
147/Kerrigan	10/06/20	104,685			0320	5.00	$375.00						$375.00
003/Romero	10/06/20	104,686	10.00	$289.10	0800	4.00	$360.00						$649.10
147/Kerrigan	10/07/20	104,691	10.00	$246.00	0244	9.00	$765.00	Road Base 4	84.00	$735.84			$1,746.84
003/Romero	10/07/20	104,695	10.00	$289.10	0800	4.00	$360.00						$649.10
147/Kerrigan	10/08/20	104,697	10.00	$246.00	0244	5.00	$425.00	1221	34.97	$769.34			$1,440.34
086/Marcella	10/08/20	104,726	4.00	$108.24	0244	4.00	$340.00	Road Base 4	42.00	$367.92			$816.16
003/Romero	10/08/20	104,757	10.00	$289.10	0800	7.00	$630.00						$919.10
003/Romero	10/09/20	104,752	9.00	$390.29	0800	7.00	$630.00						$1,020.29
025/Stultz	10/09/20	104,753	9.00	$269.10	0226	9.00	$810.00	Road Base 6	60.00	$525.47			$1,604.57
003/Romero	10/13/20	105,169	10.00	$289.10	0302	3.00	$267.00						$556.10

Comprehensive Detail by Project/Task

			Labor Hrs	Labor Cost	Equipment	Eqp Hr/Mi	Eqp Cost	Material	Mat Used	Mat Cost	Contractor Cost	Overhead Cost	Total Cost
2020-18 / Arkansas River Bridge Replace													
003/Romero	10/13/20	105,169			0800	4.00	$360.00						$360.00
086/Marcella	10/14/20	105,024	2.00	$54.12	0244	2.00	$170.00	Road Base 6	14.00	$122.61			$346.73
006/Hockett	10/14/20	105,159	4.00	$108.24	0226	4.00	$360.00	Road Base 6	20.00	$175.16			$643.40
003/Romero	10/14/20	105,161	10.00	$289.10	0458	2.00	$128.00						$417.10
003/Romero	10/14/20	105,161			0800	3.00	$270.00						$270.00
006/Hockett	10/15/20	105,150	6.00	$162.36	0205	6.00	$540.00	Road Base 6	66.00	$578.01			$1,280.37
003/Romero	10/15/20	105,154	10.00	$289.10	0244	8.00	$680.00	Road Base 6	28.00	$245.22			$1,214.32
003/Romero	10/15/20	105,154			0458	1.00	$64.00						$64.00
086/Marcella	10/19/20	105,061	10.00	$270.60	0243	10.00	$900.00	Road Base 6	36.00	$315.28			$1,485.88
003/Romero	10/19/20	105,144	10.00	$289.10	0244	6.00	$510.00	CAS	56.00	$481.60			$1,280.70
003/Romero	10/19/20	105,144			0800	1.00	$90.00	Road Base 6	28.00	$245.22			$335.22
003/Romero	10/19/20	105,144			0302	2.00	$178.00						$178.00
086/Marcella	10/20/20	105,108	10.00	$270.60	0243	9.00	$810.00						$1,080.60
003/Romero	10/20/20	105,137	10.00	$289.10	0800	4.00	$360.00						$649.10
003/Romero	10/20/20	105,137			0458	2.00	$128.00						$128.00
003/Romero	10/20/20	105,137			0453	3.00	$285.00						$285.00
006/Hockett	10/21/20	105,131	10.00	$270.60	0242	10.00	$850.00	PTR	34.00	$238.00			$1,358.60
006/Hockett	10/21/20	105,131						CAS	17.00	$146.20			$146.20
003/Romero	10/21/20	105,134	10.00	$289.10	0226	8.00	$720.00						$1,009.10
003/Romero	10/21/20	105,134			0220	8.00	$680.00						$680.00
147/Kerrigan	10/27/20	105,544	10.00	$246.00	0305	4.00	$424.00						$670.00
147/Kerrigan	10/27/20	105,544			0242	2.00	$170.00						$170.00
003/Romero	10/27/20	105,682	10.00	$289.10	0800	7.00	$630.00						$919.10
006/Hockett	11/03/20	105,662	11.50	$311.19	0324	11.50	$1,173.00						$1,484.19
086/Marcella	11/03/20	105,794	11.00	$308.66	0243	10.00	$900.00						$1,208.66
Operator/Truck Driver Sub Total			**545.00**	**$15,646.06**			**$36,896.00**			**$6,003.58**	**$0.00**	**$0.00**	**$58,545.65**
215 / Road Grading													
098/White	10/14/20	105,157	10.00	$270.60	0403	10.00	$1,300.00						$1,570.60
098/White	10/15/20	105,152	10.00	$270.60	0403	10.00	$1,300.00						$1,570.60
098/White	10/19/20	105,147	10.00	$270.60	0403	10.00	$1,300.00						$1,570.60
098/White	10/20/20	105,140	10.00	$270.60	0403	10.00	$1,300.00						$1,570.60
098/White	10/21/20	105,132	10.00	$270.60	0403	10.00	$1,300.00						$1,570.60
Road Grading Sub Total			**50.00**	**$1,353.00**			**$6,500.00**			**$0.00**	**$0.00**	**$0.00**	**$7,853.00**
220 / Misc. Labor													

Comprehensive Detail by Project/Task

2020-18 / Arkansas River Bridge Replace			Labor Hrs	Labor Cost	Equipment	Eqp Hr/Mi	Eqp Cost	Material	Mat Used	Mat Cost	Contractor Cost	Overhead Cost	Total Cost
086/Marcella	08/17/20	102,923	10.00	$270.60									$270.60
147/Kerrigan	08/17/20	102,945	10.00	$246.00	0177	2.00	$120.00						$366.00
098/White	08/17/20	103,244	10.00	$270.60									$270.60
086/Marcella	08/18/20	102,928	10.00	$270.60									$270.60
086/Marcella	08/19/20	103,051	10.00	$270.60									$270.60
146/Copeland	08/19/20	103,233	10.00	$221.40									$221.40
098/White	08/19/20	103,236	10.00	$270.60									$270.60
146/Copeland	08/20/20	103,226	11.00	$252.54									$252.54
147/Kerrigan	08/20/20	103,228	10.00	$246.00	0177	2.00	$120.00						$366.00
006/Hockett	08/20/20	103,229	1.00	$27.06									$27.06
006/Hockett	08/20/20	103,230	10.00	$270.60									$270.60
025/Stultz	08/24/20	103,215	10.50	$319.70									$319.70
147/Kerrigan	08/24/20	103,220	10.00	$246.00	0177	5.00	$300.00						$546.00
146/Copeland	08/24/20	103,221	10.00	$221.40	0200	4.00	$340.00	3/4 wash rock	28.00	$504.00			$1,065.40
098/White	08/24/20	103,223	10.00	$270.60									$270.60
006/Hockett	08/25/20	103,210	10.00	$270.60									$270.60
025/Stultz	08/25/20	103,214	5.00	$149.50									$149.50
098/White	08/25/20	103,216	11.00	$308.66									$308.66
147/Kerrigan	08/25/20	103,217	10.00	$246.00	0120	2.00	$152.00						$398.00
146/Copeland	08/25/20	103,218	10.00	$221.40	0200	2.00	$170.00	3/4 wash rock	14.00	$252.00			$643.40
098/White	08/26/20	103,201	10.00	$270.60									$270.60
003/Romero	08/26/20	103,202	5.00	$144.55									$144.55
025/Stultz	08/26/20	103,206	5.00	$149.50	0226	1.00	$90.00	3/4 wash rock	25.00	$450.00			$689.50
146/Copeland	08/26/20	103,208	10.00	$221.40	0200	3.00	$255.00	Road Base 6	28.00	$245.22			$721.62
098/White	08/27/20	103,194	11.50	$327.69									$327.69
025/Stultz	08/27/20	103,196	1.00	$41.40	0177	2.00	$120.00						$161.40
003/Romero	08/27/20	103,197	11.00	$318.01									$318.01
006/Hockett	08/27/20	103,200	10.00	$270.60									$270.60
025/Stultz	08/28/20	103,190	9.00	$403.65	0177	2.00	$120.00						$523.65
003/Romero	08/28/20	103,191	9.50	$412.02									$412.02
098/White	08/28/20	103,192	9.50	$385.61									$385.61
006/Hockett	08/29/20	103,188	2.00	$81.18									$81.18
006/Hockett	08/29/20	103,189	2.00	$81.18	0189	2.00	$152.00						$233.18
025/Stultz	08/29/20	103,601	4.00	$179.40									$179.40
006/Hockett	08/30/20	103,187	2.00	$81.18									$81.18
025/Stultz	08/30/20	103,593	4.00	$179.40									$179.40
025/Stultz	08/31/20	103,594	10.50	$319.70									$319.70
086/Marcella	09/02/20	103,506	10.00	$270.60									$270.60

Comprehensive Detail by Project/Task

2020-18 / Arkansas River Bridge Replace			Labor Hrs	Labor Cost	Equipment	Eqp Hr/Mi	Eqp Cost	Material	Mat Used	Mat Cost	Contractor Cost	Overhead Cost	Total Cost
006/Hockett	09/02/20	103,565	10.00	$270.60									$270.60
003/Romero	09/02/20	103,586	10.00	$289.10									$289.10
025/Stultz	09/02/20	103,597	5.00	$149.50									$149.50
006/Hockett	09/03/20	103,566	10.00	$270.60									$270.60
003/Romero	09/03/20	103,587	10.00	$289.10									$289.10
025/Stultz	09/03/20	103,598	10.00	$299.00									$299.00
006/Hockett	09/05/20	103,567	2.00	$81.18									$81.18
006/Hockett	09/05/20	103,568	2.00	$81.18									$81.18
003/Romero	09/05/20	103,589	2.00	$86.73									$86.73
006/Hockett	09/06/20	103,569	2.00	$81.18									$81.18
003/Romero	09/06/20	103,590	2.00	$86.73									$86.73
006/Hockett	09/07/20	103,570	2.00	$81.18									$81.18
006/Hockett	09/07/20	103,571	2.00	$81.18									$81.18
006/Hockett	09/08/20	103,574	4.00	$108.24									$108.24
147/Kerrigan	09/08/20	103,581	8.00	$196.80	0177	5.00	$300.00						$496.80
003/Romero	09/08/20	103,592	10.00	$289.10									$289.10
098/White	09/10/20	103,893	10.00	$270.60									$270.60
003/Romero	09/10/20	103,922	5.00	$144.55									$144.55
086/Marcella	09/10/20	103,929	10.00	$270.60									$270.60
006/Hockett	09/10/20	103,930	10.00	$270.60									$270.60
006/Hockett	09/12/20	103,939	2.00	$81.18									$81.18
006/Hockett	09/12/20	103,940	2.00	$81.18									$81.18
003/Romero	09/12/20	103,941	4.00	$173.46									$173.46
006/Hockett	09/13/20	103,937	2.00	$81.18									$81.18
006/Hockett	09/13/20	103,938	2.00	$81.18									$81.18
025/Stultz	09/14/20	104,081	8.00	$239.20									$239.20
146/Copeland	09/14/20	104,082	10.00	$221.40									$221.40
147/Kerrigan	09/14/20	104,083	10.00	$246.00	0302	10.00	$890.00						$1,136.00
006/Hockett	09/14/20	104,085	10.00	$270.60									$270.60
025/Stultz	09/15/20	104,077	10.00	$299.00									$299.00
006/Hockett	09/15/20	104,078	10.00	$270.60									$270.60
146/Copeland	09/15/20	104,079	10.00	$221.40									$221.40
147/Kerrigan	09/16/20	104,069	10.00	$246.00									$246.00
025/Stultz	09/16/20	104,071	10.00	$299.00									$299.00
146/Copeland	09/16/20	104,072	10.00	$221.40									$221.40
006/Hockett	09/16/20	104,073	10.00	$270.60	0800	10.00	$900.00						$1,170.60
147/Kerrigan	09/16/20	104,074	10.00	$246.00	0324	5.00	$510.00						$756.00
025/Stultz	09/17/20	104,063	10.00	$299.00									$299.00

Comprehensive Detail by Project/Task

2020-18 / Arkansas River Bridge Replace			Labor Hrs	Labor Cost	Equipment	Eqp Hr/Mi	Eqp Cost	Material	Mat Used	Mat Cost	Contractor Cost	Overhead Cost	Total Cost
146/Copeland	09/17/20	104,066	6.50	$143.91									$143.91
147/Kerrigan	09/17/20	104,067	10.00	$246.00									$246.00
025/Stultz	09/18/20	104,060	4.00	$179.40									$179.40
006/Hockett	09/19/20	104,057	2.00	$81.18									$81.18
006/Hockett	09/19/20	104,058	2.00	$81.18									$81.18
025/Stultz	09/19/20	104,059	2.00	$89.70									$89.70
025/Stultz	09/20/20	104,055	2.00	$89.70									$89.70
006/Hockett	09/20/20	104,056	2.00	$81.18									$81.18
147/Kerrigan	09/21/20	104,053	10.00	$246.00	0189	2.00	$152.00						$398.00
025/Stultz	09/21/20	104,409	5.00	$149.50	0177	5.00	$300.00						$449.50
146/Copeland	09/21/20	104,413	5.00	$110.70									$110.70
098/White	09/21/20	104,414	10.00	$270.60									$270.60
086/Marcella	09/22/20	104,317	10.00	$270.60									$270.60
098/White	09/22/20	104,403	10.00	$270.60									$270.60
003/Romero	09/22/20	104,408	10.00	$289.10									$289.10
098/White	09/23/20	104,397	10.00	$270.60									$270.60
147/Kerrigan	09/23/20	104,398	10.00	$246.00									$246.00
003/Romero	09/23/20	104,399	10.00	$289.10									$289.10
086/Marcella	09/23/20	104,489	10.00	$270.60									$270.60
147/Kerrigan	09/28/20	104,653	10.00	$246.00									$246.00
098/White	09/28/20	104,655	10.00	$270.60									$270.60
006/Hockett	09/28/20	104,657	10.00	$270.60									$270.60
086/Marcella	09/29/20	104,521	10.00	$270.60	0242	4.00	$340.00	1221	30.14	$663.08			$1,273.68
006/Hockett	09/29/20	104,646	10.00	$270.60									$270.60
098/White	09/29/20	104,650	10.00	$270.60									$270.60
086/Marcella	09/30/20	104,533	10.00	$270.60									$270.60
147/Kerrigan	09/30/20	104,639	10.00	$246.00									$246.00
006/Hockett	09/30/20	104,643	10.00	$270.60									$270.60
086/Marcella	10/01/20	104,546	7.00	$189.42									$189.42
147/Kerrigan	10/01/20	104,638	10.00	$246.00									$246.00
147/Kerrigan	10/02/20	104,629	5.50	$190.30	0120	2.00	$152.00						$342.30
146/Copeland	10/05/20	104,623	10.00	$221.40									$221.40
006/Hockett	10/05/20	104,624	10.00	$270.60									$270.60
098/White	10/05/20	104,625	10.00	$270.60									$270.60
146/Copeland	10/06/20	104,622	10.00	$221.40	0242	10.00	$850.00	3/4 wash rock	15.66	$281.88			$1,353.28
006/Hockett	10/06/20	104,687	10.00	$270.60									$270.60
098/White	10/06/20	104,762	10.00	$270.60									$270.60
006/Hockett	10/07/20	104,690	10.00	$270.60									$270.60

Comprehensive Detail by Project/Task

2020-18 / Arkansas River Bridge Replace			Labor Hrs	Labor Cost	Equipment	Eqp Hr/Mi	Eqp Cost	Material	Mat Used	Mat Cost	Contractor Cost	Overhead Cost	Total Cost
098/White	10/07/20	104,761	10.00	$270.60									$270.60
098/White	10/08/20	104,760	10.00	$270.60									$270.60
006/Hockett	10/08/20	104,763	10.00	$270.60									$270.60
006/Hockett	10/09/20	104,764	9.00	$337.23									$337.23
006/Hockett	10/13/20	105,170	10.00	$270.60									$270.60
146/Copeland	10/14/20	105,163	5.50	$121.77	0242	5.50	$467.50	Road Base 6	83.00	$726.90			$1,316.17
006/Hockett	10/19/20	105,146	10.00	$270.60	0205	10.00	$900.00	CAS	120.00	$1,032.00			$2,202.60
006/Hockett	10/19/20	105,146						Road Base 6	80.00	$700.62			$700.62
006/Hockett	10/20/20	105,141	10.00	$270.60	0205	10.00	$900.00	CAS	34.00	$292.40			$1,463.00
146/Copeland	10/21/20	105,136	10.00	$221.40	0201	10.00	$850.00	PTR	66.40	$464.80			$1,536.20
146/Copeland	10/27/20	105,680	10.00	$221.40									$221.40
003/Romero	10/29/20	105,670	7.00	$202.37									$202.37
006/Hockett	11/02/20	105,664	10.00	$270.60									$270.60
003/Romero	11/03/20	105,661	11.50	$350.09	0208	3.00	$381.00						$731.09
Misc. Labor Sub Total			**1,016.50**	**$28,386.08**			**$9,831.50**			**$5,612.90**	**$0.00**	**$0.00**	**$43,830.48**
2020-18 / Arkansas River Bridge Replace Sub Total			**1,611.50**	**$45,385.14**			**$53,227.50**			**$11,616.48**	**$81,741.71**	**$0.00**	**$191,970.84**
								Production Units	0.00	Hourly		**Cost per Unit**	$0.00

Comprehensive Detail by Project/Task

2020-18 / Arkansas River Bridge Replace	Labor Hrs	Labor Cost	Equipment	Eqp Hr/Mi	Eqp Cost	Material	Mat Used	Mat Cost	Contractor Cost	Overhead Cost	Total Cost
Grand Total	1,611.50	$45,385.14			$53,227.50			$11,616.48	$81,741.71	$0.00	$191,970.84

	NRD Proposal Request	Lake and Partner Matching Contribution	Total Cost for Item
Labor Costs			
Public Works & Road and Bridge Operators		$ 46,000.00	$ 46,000.00
Public Works Admin and Finance Tracking		$ 3,000.00	$ 3,000.00
Contractor Costs			
Engineering Consulting Project Management	$ 155,000.00		$ 155,000.00
Inspections	$ 2,500.00		$ 2,500.00
Upper Arkansas River Restoration Project	$ 20,000.00		$ 20,000.00
Equipment Costs	$ 54,000.00		$ 54,000.00
Concrete Mixer			
Crane			
Excavator			
Compactor			
Material Costs	$ 30,000.00		$ 30,000.00
Bridge and Foot			
Grout			
Rock			
Wash Rock			
Overhead Costs			

TOTAL	$ 310,500.00

Culvert County Road 5A Replacement - Bridge/Box Culvert

Notes

Lake County Public Works would manage on site labor crew to install

Lake County will track engineering, personnel, meterials, and equipment

Lake County does not have an in house engineer, inspector, or other project management dedicated staff. We contract out for these services more and more with increased responsibilities and projects and limited staff numbers. These numbers are based on consultant costs incurred through our May Queen culvert replacement work done with Turquoise Reservoir water stakholders.

River work to be done upstream and downstream of culvert replacement locations similar to May Queen and CTY RD 9 work. This site will integrate DRMS and TU work in tributary gulches. This site is downstream from Sugarloaf Dam and has seen ipacts from high releases in the past. This fish passage improvement will feed the recent work done in 2019 at the Lake Fork (work done right below Sugarloaf Dam in partnership with USFS and Upper ARkansas River Restoration Project).

Lake has limited equipment for other annual projects and grading thorughout the County. In order to complete multiple projects it is necessary to rent large pieces of equipment. The County Public Works crew is not large enough to complete all these projects in one years time. We will have to consider various year mobilization costs for each project.

Based on actual costs on a similar sized project done in partnership with water stakeholders

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Water-quality change following remediation using structural bulkheads in abandoned draining mines, upper Arkansas River and upper Animas River, Colorado USA

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ABSTRACT

Water-quality effects after remediating abandoned draining mine tunnels using structural bulkheads were examined in two study areas in Colorado, USA. A bulkhead was installed in the Dinero mine tunnel in 2009 to improve water quality in Lake Fork Creek, a tributary to the upper Arkansas River. Although bulkhead installation improved pH, and manganese and zinc concentrations and loads at the Dinero mine tunnel, water-quality degradation was observed at the nearby Nelson tunnel. Only manganese concentrations improved in Lake Fork Creek downstream from the tunnel. To improve water quality in Cement Creek, a tributary of the Animas River, multiple bulkheads were installed in mine tunnels during 1996–2003 and a water treatment plant operated from 1989 to 2003 to treat drainage from several draining tunnels. After bulkhead installation and cessation of active water treatment (about 2003), water quality (pH and dissolved copper, manganese, and zinc concentrations) degraded at the mouth of Cement Creek. The patterns and timing were similar to post-bulkhead increased discharge and trace-metal loads at non-bulkheaded tunnels indicating the bulkheads might have been the cause. Pre-1989 water-quality data for Cement Creek are scarce, although limited historical data indicate possible, slight improvement in only manganese concentrations after bulkhead installation. Increased zinc loads in Lake Fork Creek and decreased pH through time in Cement Creek may indicate increased groundwater discharge to the streams after bulkhead installation. In these two study areas, bulkheads did not substantially improve downstream water quality.

1. Introduction

Abandoned draining mine features including adits and tunnels (horizontal access to mine workings), shafts (vertical access to mine workings), and seeps and runoff from mine waste and tailings are a persistent water-quality problem worldwide (Blowes et al., 2003; 2014; Sheoran and Sheoran, 2006, p. 61 in Wolkersdorfer, 2008). Water interacts with mineralized rock containing pyrite and other sulfides in these features and generates mining-impaired water (mine drainage) that is sometimes acidic and may contain elevated concentrations of various trace metals and metalloids (Nordstrom et al., 2015). In the State of Colorado, over 23,000 abandoned mines impair water quality in about 2,900 stream kilometers (km) (Colorado Department of Public Health and Environment, 2019).

Remediation of mine drainage remains a challenge. Recommended technologies for solid wastes include removal, consolidation, or capping to minimize percolation or generation of mine drainage from the wastes (Colorado Department of Natural Resources Division of Minerals and Geology, 2002; International Network for Acid Prevention, 2014). Remediation alternatives for draining adits and shafts include operation of water-treatment plants to chemically treat the drainage (Walton-Day, 2003), installation of structural bulkheads to physically limit water discharge from mine workings (Colorado Department of Natural Resources Division of Minerals and Geology, 2002; Johnson and Hallberg, 2005) and combinations of bulkheads and engineering controls to limit infiltration of surface water into underground mine workings (Marks et al., 2008).

Installation of structural bulkheads to reduce discharge from mines is often cited as a preferred alternative because this approach avoids long-term operation and maintenance costs associated with water-treatment plants (Bureau of Land Management, 2006; Younger et al., 2002). A structural bulkhead is an engineered concrete structure extending from

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floor to ceiling in a mine tunnel with enough thickness to withstand lithostatic pressure of overlying rocks, hydrostatic pressure of the mine pool formed when the bulkhead is sealed, and additional pressure that could occur during a mine blowout (Einarson and Abel, 1990; Sorenson and Brown, 2015). Mine blowout occurs when water impounded behind a collapse or debris in an upgradient part of the mine is abruptly released. Although bulkheads physically limit mine discharge, they are known to leak (p. 24 in Gusek and Figueroa, 2009) and generally do not completely stop discharge from draining mine tunnels.

There are three primary goals associated with installation of a structural bulkhead in a draining mine tunnel: (1) to limit the discharge of poor-quality water from the tunnel (Bureau of Land Management, 2006; Sorenson and Brown, 2015); (2) to protect existing or future infrastructure in front of the mine-tunnel opening and (or) downstream water bodies from the effects of blowouts from the mine workings (Bureau of Land Management, 2006; Stratus Consulting, 2009); and (3) to improve water quality by limiting some of the physical and chemical changes that degrade water quality in underground mine tunnels.

Underground mining and drainage tunnels lower the elevation of the water table thereby increasing contact of pyrite-bearing mineralization to atmospheric oxygen (Fig. 1a). Oxygen, infiltrating water from precipitation and snowmelt, and micro-organisms, fuel generation of acid mine drainage (Nordstrom et al., 2015) through the overall reaction (Blowes et al., 2014):

$$FeS_2 + \frac{15}{4}O_2(aq) + \frac{7}{2}H_2O(aq) \rightarrow 2SO_4^{2-} + Fe(OH)_3(s) + 4H^+(aq) \quad (1)$$

The products of this reaction drive dissolution of metal-sulfide minerals and formation of secondary, variably soluble sulfate minerals, degrading water quality in the mine and its discharge to the surface (Fig. 1a) (Alpers et al., 1994; Blowes et al., 2003, 2014; Jambor et al., 2000; Nordstrom, 2011). Seasonal wetting and drying in underground workings exacerbate acid mine drainage and formation of secondary sulfate minerals. During the dry season, secondary sulfate minerals accumulate underground; during the wet season, infiltrating water promotes forward progress of reaction (1), and soluble secondary sulfate minerals that accumulated during the dry season dissolve, causing a wet-season flush of more degraded water compared to other times of year (Alpers et al., 1994; Blowes et al., 2003, 2014; Nordstrom and Alpers, 1999; Nordstrom et al., 2015; U.S. Environmental Protection Agency, 1994). Groundwater backed up behind bulkheads may re-submerge mineralized bedrock, greatly decreasing dissolved-oxygen influx and limiting the acid mine drainage reaction, thereby potentially improving water quality of the impounded mine pool water and bulkhead leakage (Sorenson and Brown, 2015; Walton-Day and Mills, 2015; Wolkersdorfer, 2008) (Fig. 1b). Saturation of mine workings also may decrease or eliminate seasonal wetting and drying (4 in Fig. 1b), limiting formation and dissolution of secondary sulfate minerals, further improving water quality. Though where accumulations of soluble sulfate minerals are extreme, their dissolution upon flooding could greatly degrade water quality (Jambor et al., 2000; Nordstrom and Alpers, 1999). Water-quality improvement may also be limited by the relation between the elevation of the final water table and pyrite-bearing rock in the mine workings. The elevated post-bulkhead water table may reroute water from the mine pool through permeable fractures and strata to non-bulkheaded workings, and may increase flow in existing springs or cause emergence of new springs (6 in Fig. 1b) potentially off setting bulkhead-related water-quality improvement (Cowie and Roberts, 2020). Water-quality and discharge monitoring at the tunnel outflow and surrounding area before and after bulkhead installation documents the effects of the bulkhead.

In Colorado, USA, at least 26 structural bulkheads had been installed in mines as of 2015 (Appendix B; Bureau of Reclamation, 2015). Monitoring data documenting water-quality effects of bulkheads are not always readily or publicly available. Lake Fork Creek located in the upper Arkansas River watershed (Fig. 2) and Cement Creek, in the upper Animas River watershed (Fig. 3), are two areas having available data. In the Lake Fork Creek watershed, the Bureau of Land Management (2006) installed a bulkhead in the Dinero mine tunnel (hereinafter Dinero tunnel) in 2009. In the Cement Creek watershed, four bulkheads were installed in two tunnels from 1996 to 2003. Three were installed in the American tunnel between 1996 and 2002 by Sunnyside Gold Corporation (Sunnyside Gold Corporation, 2003), and one was installed in the Mogul mine tunnel in 2003 by the Gold King Mining Corporation (Bonita Peak Community Advisory Group, 2019a; Bureau of Reclamation, 2015) (Fig. 4).

The objective of this paper is to examine water-quality changes in the two mining districts to assess whether bulkhead installation improved downstream water quality. For the Dinero tunnel, which drains into Lake Fork Creek, water-quality and discharge data for four sampling sites are discussed for the period 2006–2017 (Fig. 2). To evaluate the American and Mogul tunnel bulkheads, water-quality and discharge data collected near the mouth of Cement Creek from 1971, 1981, and 1995–2015 are presented. Discussion includes discharge and water-quality data compiled from multiple sources (Walton-Day et al., 2020) from 1988 to 2015 for five mine tunnels including the American tunnel and the Mogul, Red and Bonita, Black Hawk, and Gold King mine tunnels. Herein, all are referred to simply as tunnels (e.g. Mogul tunnel).

2. Study areas and methods

2.1. Upper Arkansas River watershed, Dinero tunnel

The Dinero tunnel is one of five mining tunnels in the Sugar Loaf mining district in the upper Arkansas River watershed (Fig. 2). Elevation ranges from about 2,920 meters (m) at the confluence of Colorado Gulch with Lake Fork Creek to over 3,400 m on the ridge comprising the watershed boundary (Fig. 2). Mean annual precipitation (1981–2010) is 48 centimeters (cm) of which at least half occurs as snow (Sugarloaf RSVR Colorado at https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?co8064 accessed 30 Nov 2020). Surface hydrology is dominated by snowmelt with 70% of runoff occurring in May through July (Walton-Day and

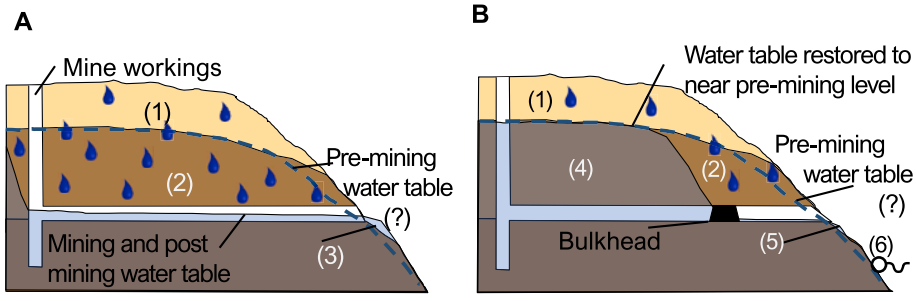

Fig. 1. Diagram showing (A) schematic cross section of mineralized rock and mine workings during and after mining. Notable features are (1) leached, mineralized rock above the historical water table; the lower post-mining water table caused by mine workings and tunnels that (2) exposes pyrite in mineralized rock to oxygen and infiltrating water and generates acid mine drainage (3) that flows to and may degrade surface water. (B) After bulkhead emplacement the water-table elevation increases behind the bulkhead and (4) some of the mineralized rock is re-submerged beneath the water table limiting the extent of acid mine drainage generation potentially causing (5) decreased flow of degraded water from the tunnel and rerouting some flow to other non-bulkheaded mine tunnels and existing or new springs (6). After Schmidt (2007).

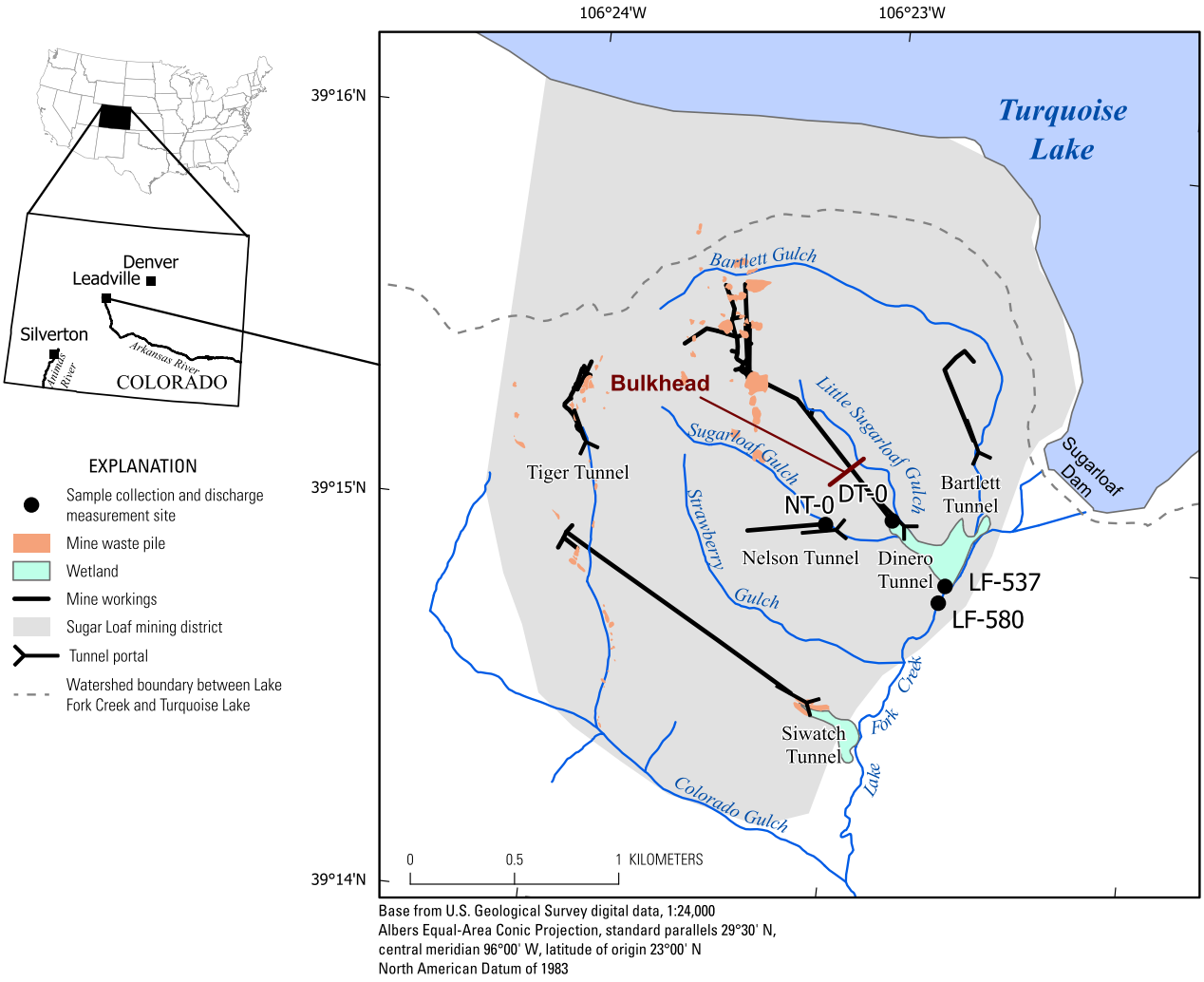

Fig. 2. Map showing location of upper Arkansas River watershed study area in Colorado, USA, Sugar Loaf mining district, mine-waste piles, mine tunnels, and sampling sites at the Dinero tunnel (DT-0), Nelson tunnel (NT-0), channel draining wetland downstream from Dinero tunnel (LF-537), and Lake Fork Creek downstream from Dinero tunnel (LF-580). The extent of tunnels was digitized from published maps (Singewald, 1955) and by compilation from mineral surveys (e.g. U.S. Surveyor General's Office, 1912).

Mills, 2015). Annual mean streamflow at the U.S. Geological Survey (USGS) streamgage Arkansas River at Leadville, located about 3 km directly east of Dinero tunnel, varied from about 1 to 3 cubic meters per second (m^3/s), was punctuated by wet (2011 and 2014) and dry (2012) years, but showed no trend during the study period (Supplemental Fig. S1a).

In the Sugar Loaf mining district, silver and some gold, lead, and zinc were mined from Tertiary quartz-sulfide veins in crystalline, Precambrian bedrock (schist, gneiss, and granite) mostly from 1880 until the 1920s (Singewald, 1955). The primary mine tunnels (Fig. 2) total approximately 6 km in length. The Dinero tunnel provided drainage and access to higher elevation mine workings at its northwest end, and is a major contributor to degraded water quality, primarily elevated manganese and zinc concentrations in Lake Fork Creek (Walton-Day et al., 2005; Bureau of Land Management, 2006), a tributary to the upper Arkansas River. A bulkhead for Dinero tunnel was chosen as the preferred remediation approach and was installed and closed in 2009 (Bureau of Land Management, 2006). The bulkhead is located approximately 390 m into the tunnel at an elevation of 2,984 m. Elevation of ground surface above the bulkhead is 3,049 m.

Controls on groundwater occurrence and flow in the Dinero area are not well understood. Groundwater flow likely is dominantly fracture controlled in the Precambrian rocks. In general, snowmelt likely provides high rates of seasonal recharge to a shallow, active groundwater system that exists over a deeper, inactive groundwater system (Johnson and Yager, 2006; Manning and Caine, 2007; Mayo et al., 2003; Snow, 1968; Walton-Day and Poeter, 2009). There is a groundwater divide near the watershed divide between the area containing most of the mine workings and Turquoise Lake (Fig. 2) (Walton-Day and Poeter, 2009). Some groundwater in the Sugar Loaf mining district likely discharges to surface streams (Bartlett, Little Sugarloaf, Sugarloaf, Strawberry, and Colorado Gulches (Fig. 2), and also directly to Lake Fork Creek between Sugarloaf Dam and LF-580 where previous work indicated inflow of trace-metal rich groundwater to Lake Fork Creek (p. 45 in Walton-Day et al., 2005). Underground mine workings provide preferential pathways for groundwater flow.

Water-quality data were collected near the Dinero tunnel as part of an extensive monitoring program to understand the water-quality effects of bulkhead installation (Walton-Day et al., 2013; Walton-Day and Mills, 2015). Herein, discussion includes data collected in 2006 (four times between May and October) and from 2010 to 2014 and 2016–2017 (in spring and autumn each year) at sites DT-0 (Dinero tunnel), LF-537, LF-580, and NT-0 (Nelson mine tunnel) (Fig. 2). Raw data are stored in the USGS National Water Information System (NWIS) (U.S. Geological Survey, 2019a and can be retrieved using USGS site IDs (see "Data Availability" section). Water from DT-0 discharges into the

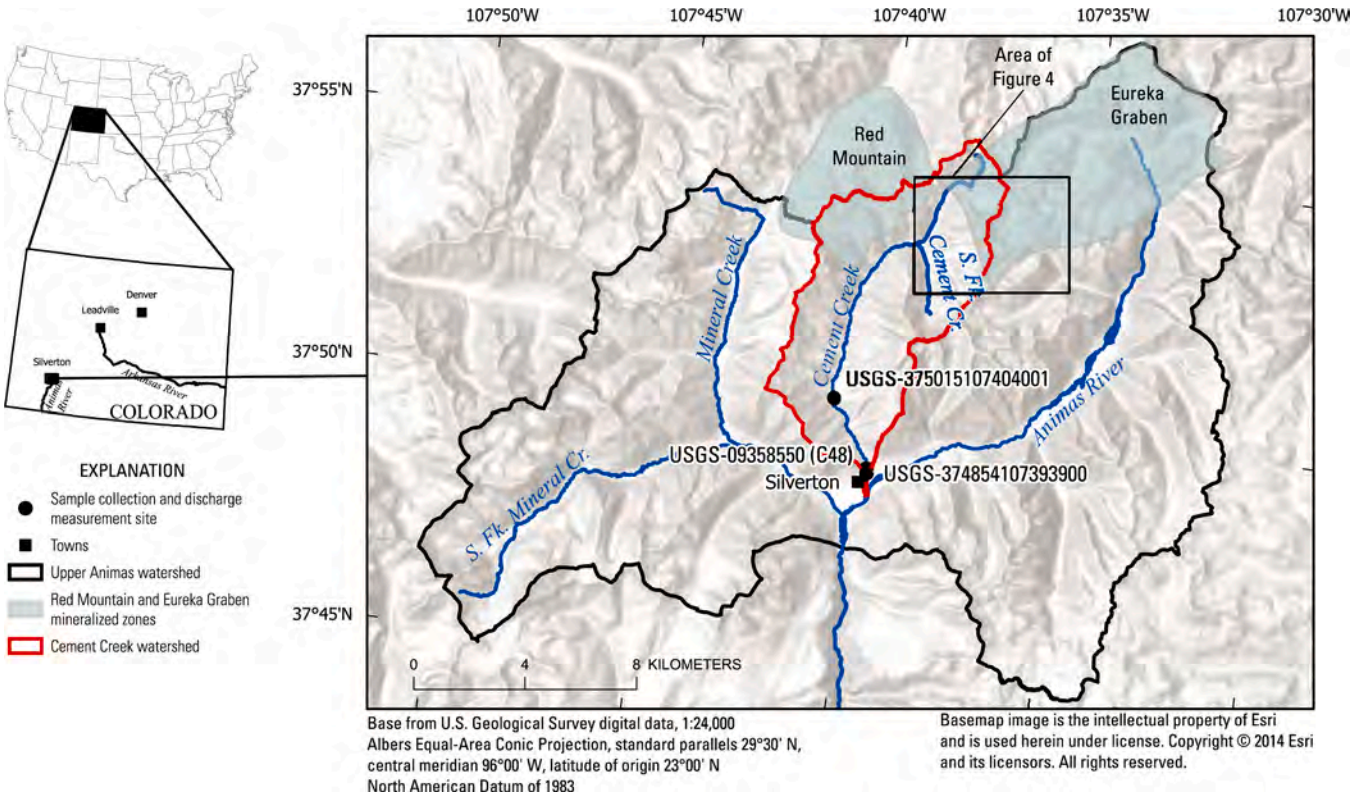

Fig. 3. Map showing location of upper Animas River and Cement Creek watersheds in southwestern Colorado, USA, sample monitoring sites, and mineralized areas.

wetland located between the Dinero tunnel and Lake Fork Creek (Fig. 2). Site NT-0 discharges to Little Sugarloaf Gulch that flows into the same wetland, which is also fed by Sugarloaf Gulch, near Dinero tunnel. The wetland drains to Lake Fork Creek upstream from site LF-580 via surface flow at LF-537 and via seeps and groundwater on the eastern edge of the wetland (Fig. 2). Data presented are discharge, pH, and dissolved (<0.45 μm) manganese and zinc concentrations. Sample collection, analytical methods, and quality-assurance information are presented in Walton-Day and Mills (2015). Metal loads were calculated by multiplying instantaneous discharge measured at the time of sample collection by metal concentration and are presented as kilograms per day (kg/day). Discharge, hydrogen ion (from pH), and manganese and zinc concentrations and loads were compared before and after the Dinero bulkhead closure using a two-sample permutation test with the R package 'perm' (https://www.rdocumentation.org/packages/perm/versions/1.0-0.0). For p-values $\leq$ 0.05, the difference in the means for the two groups were considered statistically significant.

2.2. Upper Animas River watershed, Cement Creek

Cement Creek is tributary to the upper Animas River, upstream from Silverton, Colorado (Figs. 3 and 4). Elevation ranges from about 2,860 m at C48 to more than 4,000 m on the ridge comprising the watershed boundary. Mean annual precipitation (from 1981 to 2010) is 67 cm (Silverton Colorado at https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?co7656, accessed 30 Nov 2020). Similar to the Dinero area, most precipitation occurs as snow, and surface hydrology is dominated by melting of the seasonal snowpack. Annual mean streamflow at USGS streamgage Cement Creek at Silverton, Colorado (station 09358550, C48) varied from about 0.5 to 1.6 m^3/s, was punctuated by wet (1995, 1997, 1999, 2005, 2008, 2011, and 2014–2015) and dry years (2002 and 2012–2013), but showed no trend during the study period (Supplemental Fig. S1b).

Cement Creek drains the central part of the collapsed and mineralized Silverton volcanic caldera consisting of Tertiary-age extrusive and intrusive volcanic rocks (von Guerard et al., 2007). Extensive hydrothermal alternation and mineralization associated with the caldera and its collapse form the basis for historical mining in the region. Mining in the upper Animas River watershed occurred from the early 1870s through 1991 and was extensive with over 300 mine, mill, mill tailing, and smelter sites documented (Church, 2007, Figs. 2 and 5 in Church et al., 2007a; Jones, 2007). Polymetallic (silver, lead, zinc, copper, ± gold) sulfide veins in fractures and fissures in the Eureka Graben area were the target of the mines in upper Cement Creek (Figs. 3–4) (Bove et al., 2007). Mine tunnels (Fig. 4) total over 60 km in length (Bonita Peak Community Advisory Group, 2019b). Cement Creek is influenced by both acid mine drainage from mined and mineralized areas (Eureka Graben and Red Mountain areas, Figs. 3–4), and acid rock drainage from acid-generating hydrothermally altered areas resulting in low pH stream water (pH = 4–5) having elevated metal concentrations (Bove et al., 2007; Mast et al., 2007).

In the Cement Creek area, groundwater flow is likely fracture controlled (Simon Hydro-Search, 1992, 1993). Similar to the Dinero study area, snowmelt recharge provides most groundwater recharge (Caine and Wilson, 2011). Prior to mining, groundwater is estimated to primarily have moved southwest from the Sunnyside basin to discharge along Cement Creek (Fig. 4) (Simon Hydro-Search, 1992).

Remediation and reclamation in the Cement Creek watershed have been ongoing since the early 1980s and include consolidation and capping of mine-waste deposits, passive treatment, and hydrologic controls (Bonita Peak Community Advisory Group, 2019a, table 5 in Church et al., 2007b; Lange, 2019). Water treatment of American tunnel discharge started in the early 1980s and consisted of addition of hydrated lime ($Ca(OH)_2$) and flocculant, precipitation of solids, and settling in a series of four settling ponds in the Gladstone area (Fig. 4) (Colorado Department of Health, 1988; Standard Metals Corporation, 1981). From 1996 to 2003, water treatment expanded to include Cement Creek upstream from Gladstone (upper Cement Creek, including

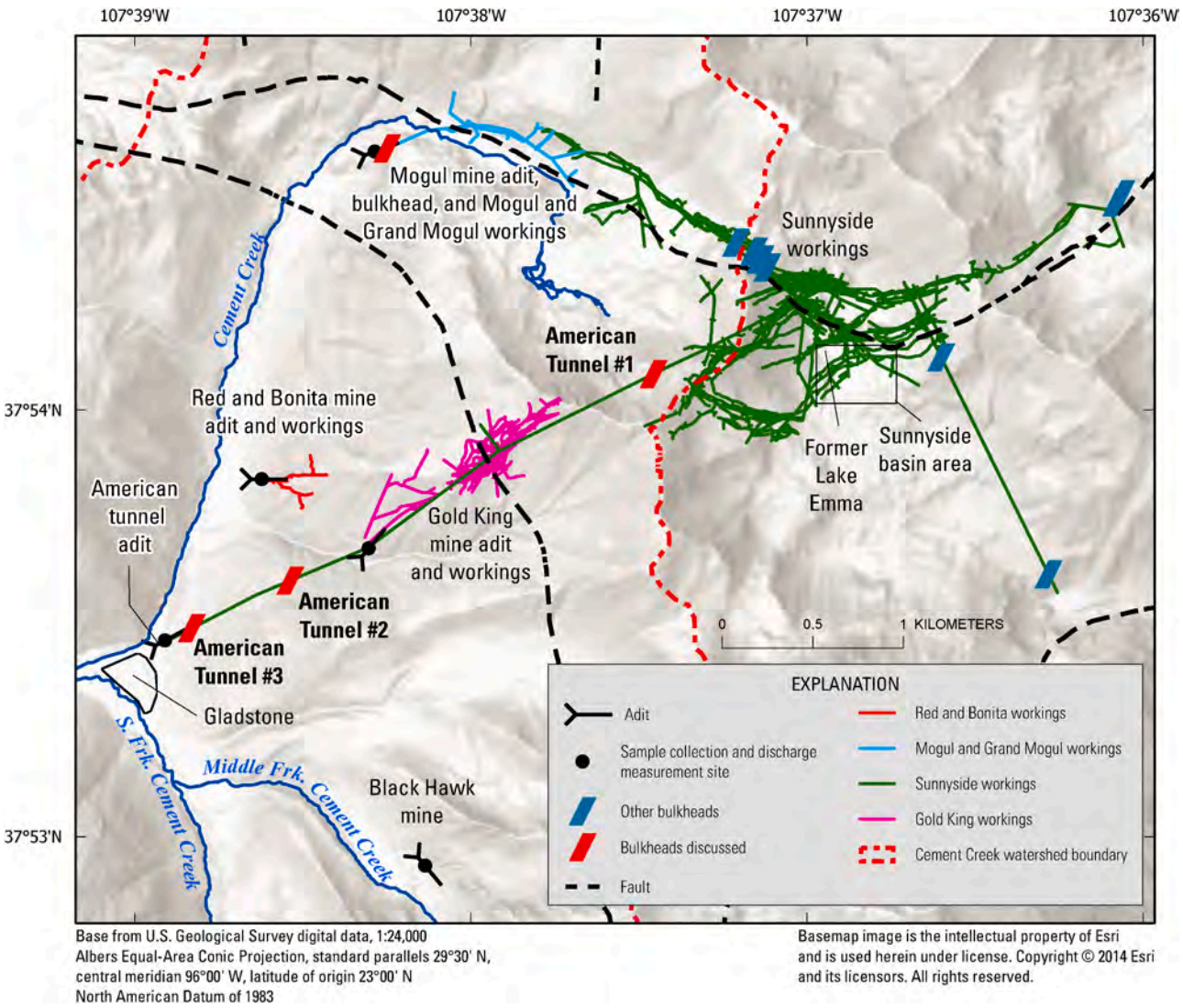

Fig. 4. Map showing mine workings for Mogul and Grand Mogul, Red and Bonita, Gold King, and Sunnyside mines, the Black Hawk mine, bulkhead locations, and surface drainage. Water from the American tunnel, Mogul, Red and Bonita, and Gold King tunnels discharges towards Cement Creek upstream from Gladstone. Faults represented as black dashed lines are from Yager and Bove (2007).

discharge from the Mogul, Red and Bonita, and Gold King tunnels) (Fig. 4), up to the capacity of the treatment plant; during 2003–2004 Gold King effluent was sometimes treated (Bonita Peak Community Advisory Group, 2019a). All active treatment of these sources ceased by July 2004 (Bonita Peak Community Advisory Group, 2019a). In summary, *most importantly, nearly continuous, active treatment of the American tunnel occurred from 1989 through 2003 with upper Cement Creek (upstream from Gladstone) being wholly (low discharge) or partially (high discharge) treated from 1996-2003, and the Gold King tunnel discharge discontinuously treated during 2003 and 2004.*

The focus herein is on Cement Creek and the four bulkheads installed into tunnels draining into Cement Creek: (1) American tunnel #1 (AT#1) bulkhead, the most upgradient bulkhead in the tunnel between the overlying Sunnyside and Gold King mine workings, closed in September 1996; (2) American tunnel #2 (AT#2) bulkhead, located downgradient from the overlying Gold King mine workings, closed in August 2001; (3) American tunnel #3 (AT#3), the most downgradient bulkhead, closed in December 2002; and (4) Mogul tunnel bulkhead closed in August 2003 (Bonita Peak Community Advisory Group, 2019a; Sorenson and Brown, 2015). The American tunnel extends northeast from its mouth (elevation about 3,240 m) near Gladstone upgradient to the Sunnyside mine workings (Fig. 4) and was completed as a development and exploration tunnel in 1961 (Burbank and Luedke, 1969; Sorenson and Brown, 2015). Additional draining mine tunnels discussed include the Red and Bonita (portal at 3,340 m) and Gold King (portal at 3,487m), that drain into Cement Creek, and the Black Hawk (portal at 3,535 m) that drains into the South Fork Cement Creek via the Middle Fork (Fig. 4) (Sorenson and Brown, 2015). The AT#1 bulkhead and multiple bulkheads to the east in the Sunnyside mine workings (Fig. 4) were designed to promote groundwater flow towards Cement Creek. The expectation was that groundwater would discharge along Cement Creek in a reach between the Mogul mine and 4–5 km south, rather than to the upper Animas River watershed east of the Cement Creek watershed divide (Lange, 2019; Simon Hydro-Search, 1992, 1993).

Water-quality data were compiled for samples collected at five sites in the vicinity of the USGS streamgage near the mouth of Cement Creek (USGS station 09358550 and site C48 on Fig. 3). Data including dissolved (<0.45 μm) copper, manganese, and zinc concentrations and pH were retrieved from the Water Quality Portal (WQP) (https://www.waterqualitydata.us/data retrieved April 2019; see "Data Availability" section). Mast (2018) describes data aggregation and quality assurance for this data set. Data for two additional samples were retrieved from NWIS including a sample collected on October 4, 1971, at USGS site ID

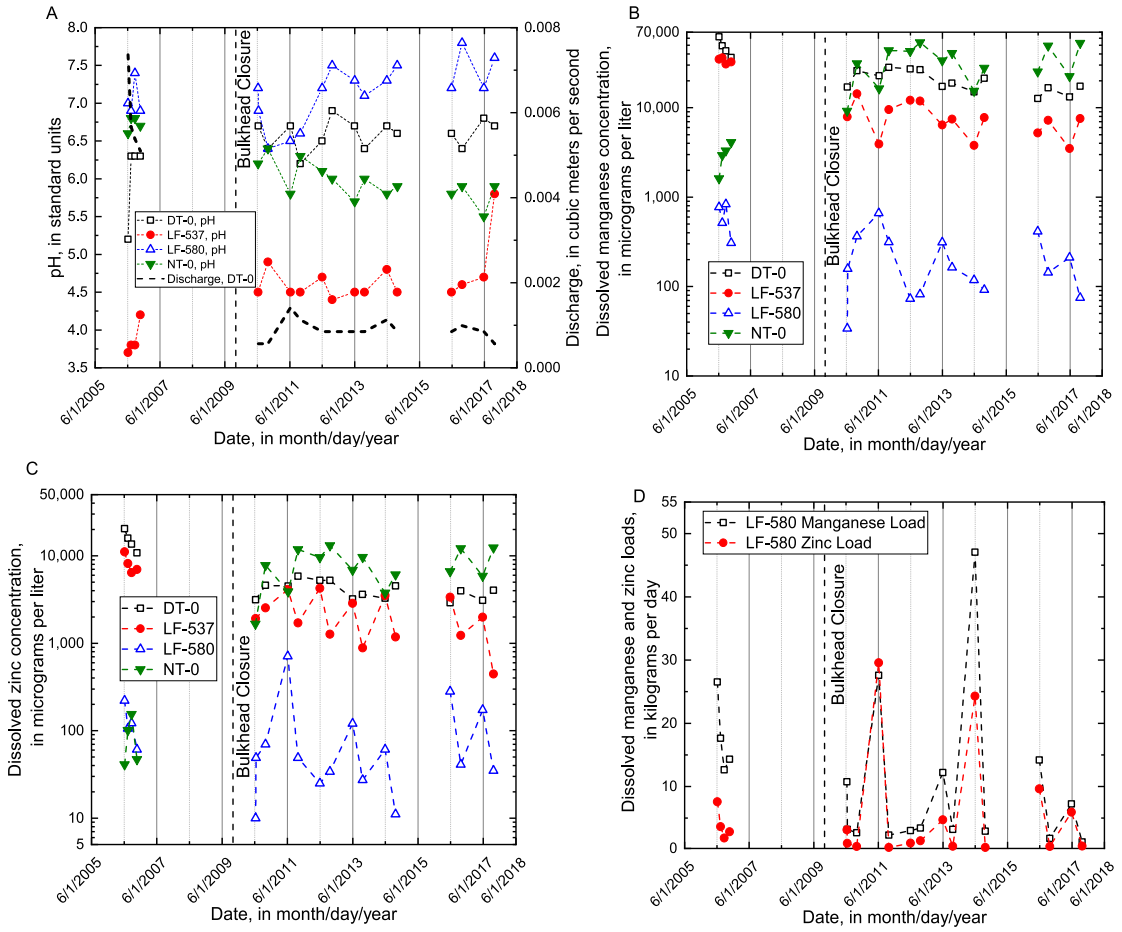

Fig. 5. Graphs showing variation in (A) in pH and discharge, (B) dissolved manganese concentrations, (C) dissolved zinc concentrations, and (D) dissolved zinc and manganese loads for sites at the Dinero tunnel (DT-0), LF-537 draining the Dinero wetland, LF-580 on Lake Fork Creek, and Nelson tunnel (NT-0).

374854107393900 located 0.5 km downstream from C48, and a sample collected on September 24, 1981, at USGS site ID 375015107404001, 2 km upstream from C48 (Fig. 3). Daily mean streamflow values for station 09358550 (C48) also were retrieved from NWIS. This analysis excluded samples collected after the Gold King mine spill occurred in August 2015 (Bureau of Reclamation, 2015).

Annual discharge-weighted-mean (DWM) concentrations of copper, manganese, zinc, and pH for these data in Cement Creek were estimated for 1995–2015. Discharge weighting of concentrations helps to remove the influence of year-to-year streamflow variability on underlying concentration trends. DWMs were computed using a period-weighted approach, which interpolates concentrations between sampling events to estimate solute loads (Aulenbach et al., 2016). In high-elevation streams, the period-weighted approach works well because solute concentrations exhibit a pronounced annual pattern of dilution during snowmelt that minimizes changes in solute concentrations between sampling events. In addition, metal concentrations in Cement Creek changed dramatically over the study period, complicating development of regression equations to predict concentrations based on streamflow. To estimate DWM concentrations, daily concentrations were computed by linear interpolation of concentrations between sampling events, which averaged 18 samples per year and ranged from 10 to 38. The estimated daily concentrations were multiplied by the daily mean discharge (providing loads), which were then summed over the year and divided by the sum of the daily discharge values to yield an annual DWM concentration in micrograms per liter (μg/L). Time-series graphs of the DWM concentrations reproduced the overall trends in the discrete sample data (Supplemental Fig. S2). Loads were calculated for samples collected during 2004–2015 to help provide context for the loads at the mine tunnels. Average daily loads were calculated by multiplying the raw data concentration times the mean daily discharge for the day of sample collection, converting to kg/day, and averaging over the total number of samples.

Discharge and dissolved concentrations of copper, manganese, and zinc for the American tunnel (1988–2015), the Mogul tunnel (1992–2015), the Red and Bonita tunnel (1997–2015), the Gold King tunnel (1993–2015), and the Black Hawk tunnel (1991–2005) were compiled from multiple sources (Walton-Day et al., 2020). Metal loads were calculated as described for the Dinero tunnel.

3. Results and discussion

3.1. Discharge and water-quality responses to bulkhead closure

3.1.1. Upper Arkansas River watershed, Dinero tunnel

The discharge and water-quality responses to closure of the Dinero tunnel bulkhead were mixed. After bulkhead closure, mean discharge decreased at DT-0 by 85% and increased at LF-537, LF-580, and NT-0 by as much as 200% (Fig. 5, Table 1, Supplemental Table S1). Mean pH values increased after bulkhead closure at DT-0 and LF-537 but decreased at LF-580 and NT-0 (Fig. 5, Table 1, Supplemental Table S1). Mean dissolved manganese concentrations decreased after bulkhead

Table 1
Statistical comparison of pre- and post-bulkhead discharge and water quality, Dinero study area. Percent change is the difference in mean concentration or load between periods and p-value is from the 2-sample permutation test comparing the 2 periods. Values in bold are significant at 95% confidence. Before closure, n = 4. After closure n = 14 except at LF-580 where n = 15. [DT-0, Dinero tunnel; LF-537, sample site draining wetland downstream from DT-0; LF-580, sample site on Lake Fork Creek downstream from DT-0 and LF-537; NT-0, Nelson tunnel; Dis., dissolved; Conc., concentration; %, percent; <, less than].

Site	Discharge		pH as hydrogen ion concentration		Mean Dis. Manganese Conc.		Mean Dis. Zinc Conc.		Mean Dis. Manganese Load		Mean Dis. Zinc Load	
	% change	p-value	% change	p-value	% change	p-value	% change	p-value	% change	p-value	% change	p-value
DT-0	**−85**	**< 0.05**	**−85**	**< 0.05**	**−58**	**< 0.05**	**−73**	**< 0.05**	**−94**	**< 0.05**	**−96**	**< 0.05**
LF-537	66	0.68	**−82**	**< 0.05**	**−77**	**< 0.05**	**−73**	**< 0.05**	**−75**	**< 0.05**	−32	0.64
LF-580	120	0.85	11	0.91	**−65**	**< 0.05**	−12	0.88	−47	0.20	40	0.90
NT-0	**200**	**0.05**	**580**	**< 0.05**	**1,000**	**< 0.05**	**9,200**	**< 0.05**	**3,100**	**< 0.05**	**23,000**	**< 0.05**

closure by as much as 77% at DT-0, LF-537, and LF-580 but increased at NT-0 by 1,000% (Fig. 5, Table 1, Supplemental Table S1). Similarly, mean dissolved zinc concentrations decreased after bulkhead closure by as much as 73% at DT-0, LF-537, and LF-580, but increased at NT-0 by 9,200% (Fig. 5, Table 1, Supplemental Table S1). Mean dissolved manganese loads decreased by as much as 94% at DT-0, LF-537, and LF-580, but increased at NT-0 by 3,100% (Fig. 5, Table 1, Supplemental Table S1). Finally, mean dissolved zinc loads decreased by up to 96% at DT-0 and LF-537, but increased at LF-580 and NT-0 by 40% and 23,000% (Fig. 5, Table 1, Supplemental Table S1).

At the Dinero tunnel portal (DT-0), water quality improved after bulkhead closure evidenced by statistically significant ($p < 0.05$) decreases in discharge, manganese and zinc concentrations and loads, and increases in pH (Table 1; Fig. 5a–c). In addition, bulkhead installation seems to have reversed seasonal concentration patterns. Before bulkhead closure (2006 values), the lowest pH and greatest manganese and zinc concentrations occurred during spring runoff coincident with the greatest discharge. The highest pH and lowest metal concentrations occurred during low flow in summer and fall (Fig. 5a-c). In contrast, after bulkhead closure (2010–2017), pH values were higher, and metal concentrations were lower during high flow than during base flow (Fig. 5a-c). Higher concentrations during snowmelt prior to bulkhead installation may indicate that seasonal wetting and drying in exposed mine workings was likely contributing to a spring flush of low pH, metal-rich water (Fig. 1a). After bulkhead closure, water levels and chemistry were more stable, limiting pyrite oxidation as mine workings and rocks became submerged (Fig. 1b).

Water quality also improved after bulkhead closure at LF-537, the wetland outflow, though not as dramatically as at DT-0. At LF-537, significant ($p < 0.05$, Table 1) water-quality improvement included increased pH and decreased manganese and zinc concentrations and manganese loads (Fig. 5a-c). The pH at LF-537 is less than at Dinero tunnel because other acid sources, primarily Sugarloaf Gulch and Little Sugarloaf Gulch, discharge into the wetland. Further, precipitation of iron oxyhydroxides is a reaction that generates acidity (Walton-Day and Mills, 2015) that likely occurs in the wetland. Overall, the bulkhead appeared to improve water quality at LF-537.

Farther downstream, Lake Fork Creek (LF-580) exhibited mixed results with pH decreasing, manganese and zinc concentrations and manganese load decreasing, but mean zinc load increasing (Table 1, Fig. 5a-d). Only the decrease in manganese concentration was statistically significant (Table 1).

Despite decreases in zinc concentrations, zinc loads actually increased at LF-580 after the bulkhead due to interannual variability in runoff. For example, the greatest elevated zinc and manganese concentrations and loads occurred during the spring of 2011 (concentrations and loads) and 2014 (loads) (Fig. 5c and d), years that were characterized by above average snowfall and spring and annual runoff (Supplemental Fig. S1a; Walton-Day et al., 2013; Walton-Day and Mills, 2015; U.S. Geological Survey, 2019b). In addition, post-bulkhead mean zinc loads (5.57 kg/d) were greater than the sum of loads from DT-0, LF-537, and NT-0 (about 1.7 kg/d) indicating other sources are contributing zinc to LF-580 (Supplemental Table S1). Manganese loads show a similar pattern (Supplemental Table S1). The source of this additional loading at LF-580 is not definitively known but is likely related to additional groundwater and trace-metal input along the west side of Lake Fork Creek upstream from LF-580 where previous studies noted groundwater inflow (p. 45 in Walton-Day et al., 2005), and/or additional runoff of acid-mine drainage from upstream mining features into the wetland after bulkhead closure.

Manganese concentrations from all samples (pre- and post-bulkhead) at site LF-580 met both chronic and acute hardness-based water-quality standards for protection of aquatic life in segment COARUA05a, which includes Lake Fork Creek (p. 174 in Colorado Department of Public Health and Environment Water Quality Control Commission, 2020). Zinc concentrations for almost all samples exceeded both the acute and chronic hardness-based standards, and only two samples in the post bulkhead period (10.0 µg/L on 10 June 2010 and 11.1 µg/L on 30 September 2014) (Fig. 5c) met both the acute and chronic zinc standards. Together these data indicate statistically significant ($p < 0.05$) improvement only in manganese concentrations and attainment of zinc water-quality standards for two of 15 samples at Lake Fork Creek monitoring site LF-580 after bulkhead closure.

After bulkhead closure, the Nelson tunnel (NT-0) exhibited stastically significant decreases in pH and increases in discharge and dissolved manganese and zinc concentrations and loads (Table 1; Fig. 5a-c) indicating water-quality degradation. The Nelson tunnel is a collapsed draining mine tunnel having more limited workings than Dinero tunnel (Fig. 2). Previous work concluded that a fracture and associated vein connect the Nelson tunnel to the mine pool behind the Dinero bulkhead, which caused impounded water from Dinero to reroute to NT-0 after bulkhead closure (Fig. 2 in Walton-Day and Mills, 2015). Over the entire study period, seasonal concentration patterns at NT-0 (Fig. 5b and c) did not show first-flush effects. The absence of a seasonal first flush may indicate that material generating mine drainage in the Nelson tunnel is submerged within the mine pool, minimizing the annual wetting and drying cycles common in open mine workings.

3.1.2. *Cement Creek, upper Animas River watershed*

3.1.2.1. Pre- and post-bulkhead water quality at the mouth of Cement Creek. Interpreting effects of bulkhead installation in Cement Creek is complicated by overlap between the timing of bulkhead installation (1996–2003) and active water treatment (1989–2003). Two pre-treatment samples collected near or at the mouth of Cement Creek during September and October before treatment and bulkhead closure (1971 and 1981) were compared to samples collected in September and October, 2004–2015, after treatment ceased and bulkheads were closed (Fig. 6a–d). After bulkhead closure, these data showed decreased mean pH values (from about 4 to about 3.2), mean manganese concentrations (from about 5,000 to 3,800 µg/L), and mean zinc concentrations (from about 2,500 to 2,100 µg/L). Mean copper concentrations increased (from about 120 to 170 µg/L). The decrease in stream pH indicates no improvement from the bulkheads. The greater pre-bulkhead manganese

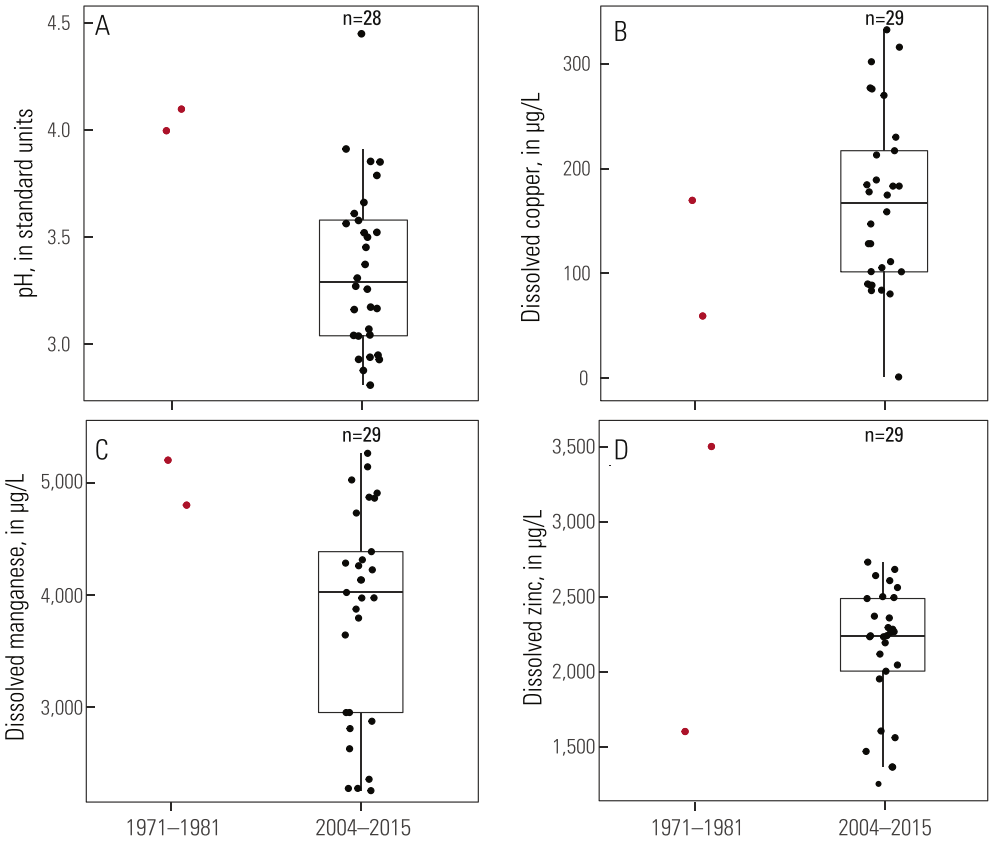

Fig. 6. Graphs comparing (A) pH, and dissolved (B) copper, (C), manganese, and (D) zinc concentrations (in micrograms per liter [µg/L]) at the mouth of Cement Creek in samples collected before active water treatment and bulkhead installation (1971 and 1981) to samples collected after cessation of water treatment and after bulkhead installation (2004–2015). The number of samples (n) indicated for each boxplot. Central line in boxplot is median, lower and upper boundaries of box are 25th and 75th percentiles (inter-quartile range) of the data, and lower and upper whiskers extend to the largest and smallest values no further than 1.5 times the interquartile range. Values beyond this range are shown beyond the whisker. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

concentrations (Fig. 6c) are clearly separated from lower post-bulkhead values, evidence that the bulkheads improved water quality with respect to manganese. In contrast, pre-bulkhead zinc and copper mean concentrations generally fall within the range of data from 2004 to 2015, indicating no substantial change in concentration after bulkhead installation (Fig. 6b). These results indicate the difficulty of drawing any firm conclusions from only two pre-treatment data points, but generally indicate that pH decreased through time and manganese concentrations may have improved slightly after bulkhead installation. Results are inconclusive for copper and zinc.

3.1.2.2. Mine tunnel hydrographs. Mine tunnel hydrographs indicate the range and timing of discharge changes at the tunnels as bulkheads were closed. At the American tunnel, closure of bulkhead AT#1 in 1996 decreased discharge from values greater than 0.1 to about 0.03 m^3/s (Fig. 7). Discharge slowly increased to less than 0.06 m^3/s in late 2002 when closure of AT#2 decreased discharge to less than 0.01 m^3/s (Fig. 7). Subsequently, discharge increased and seemed to stabilize near 0.02 m^3/s in late 2003 when closure of AT#3 decreased discharge to between 0.005 and about 0.01 m^3/s for the remainder of the study period, representing as much as a 95% decrease from initial conditions (Fig. 7). At the Mogul mine portal, discharge increased by almost 100 times (9,100%) from 1992 to 2001 (Table 2, Fig. 7), and decreased after closure of the Mogul bulkhead in 2003 to 0.003 m^3/s in 2008 (still more than 1,000% greater than in 1992) (Table 2, Fig. 7, Walton-Day et al., 2020). At Red and Bonita, discharge increased from no flow (1997–2001) to a maximum of about 0.03 m^3/s in July 2015 (Table 2, Fig. 7). Increasing discharge is most notable starting in 2005 after closure of all four bulkheads (Table 2, Fig. 7), though increased discharge was noted as early as July 2003 (Bonita Peak Community Advisory Group, 2019a). At Gold King tunnel, discharge increased from no flow in 1994 to about 0.02 m^3/s in 2006, generally decreasing after 2006 to values less than 0.005 m^3/s in 2015. At Black Hawk tunnel,

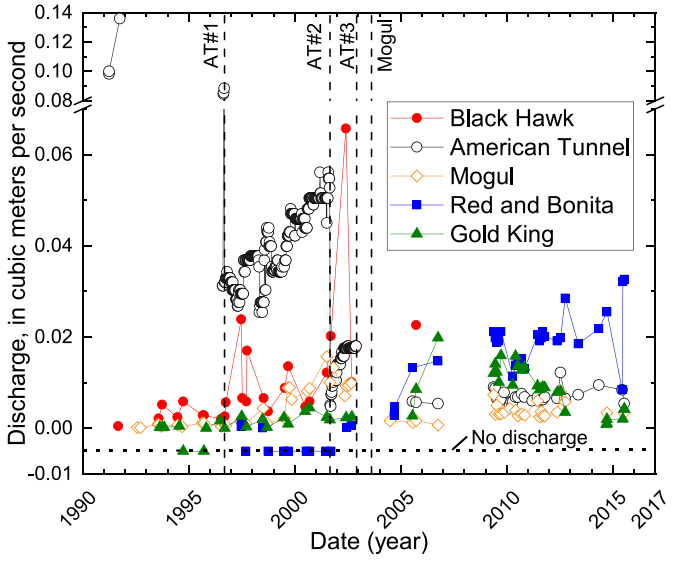

Fig. 7. Graph showing variation in discharge from the American tunnel and the Black Hawk, Mogul, Red and Bonita, and Gold King mine tunnels. Vertical lines represent closure of the American tunnel #1 bulkhead (AT#1), American tunnel #2 bulkhead (AT#2), American tunnel #3 bulkhead (AT#3), and the Mogul bulkhead (Mogul). Horizontal line near bottom of graph indicates data points where no discharge was specifically noted in original data records. Data from Walton-Day et al., (2020).

discharge increased 4,000% from 1991 to 2005 with one greater but unrepeated measurement during 2002 (Table 2, Fig. 7).

The discharge responses of non-bulkheaded flowing mine tunnels in Cement Creek relate to the timing of bulkhead closure at the American

Table 2
Portal elevations, and minimum and maximum values and dates of occurrence for discharge, pH, and copper, manganese, and zinc loads in the American tunnel and Black Hawk, Gold King, Mogul, and Red and Bonita mine tunnels, 1988–2015. Discharge, pH, and load data from Walton-Day et al. (2020), elevation data from Sorenson and Brown (2015) and Google Earth (Black Hawk) [PE, portal elevation; m, meters; m^3/s, cubic meters per second; Min, minimum; Mult., multiple; Max., maximum; kg/d, kilograms per day].

	American Tunnel PE = 3,236 m	Red and Bonita PE = 3,340 m	Mogul PE = 3,475 m	Gold King PE = 3,487 m	Black Hawk PE = 3,536 m
Discharge (m3/s)					
Min. value	0.0048	No flow	0.00017	No Flow	0.000481
Date of min.	14 Sep 2001	Mult. 1997–2001	30 July 1992	29 Sep 1994	7 Sep 1991
Max. value	0.136	0.0326	0.0157	0.0198	0.0657
Date of max.	2 Oct 1991	15 July 2015	9 July 2001	3 Oct 2006	31 May 2002
pH (standard units)					
Min. value	3.8	1.7	1.1	0.9	5.6
Date of min.	29 June 1998	29 June 1998	7 July 1998	29 June 1998	19 Sep 1997
Max. value	9.12	6.5	4.8	5.13	7.64
Date of max.	18 Nov 1988	14 July 2009	19 July 2002	14 Apr 2010	7 Sep 1991
Copper load (kg/d)					
Min. value	0.00248	0.00569	0.0024	0.00739	0.00036
Date of min.	17 Feb 2010	14 July 2009	4 Oct 2006	3 Nov 1993	3 Aug 1993
Max. value	0.732	0.0999	13.2	22.0	0.0388
Date of max.	15 Oct 1997	21 July 2005	3 Sep 1999	2 July 1997	10 Sep 1999
Manganese load (kg/d)					
Min. value	1.5	0.117	0.128	0.0921	0.0749
Date of min.	4 Sep 2001	26 June 1997	30 July 1992	3 Nov 1993	7 Sep 1991
Max. value	228	83.0	28.5	88.9	11.1
Date of max.	2 Aug 2001	2 Oct 2012	9 July 2001	3 Oct 2006	20 Sep 2005
Zinc load (kg/d)					
Min. value	0.87	0.22	0.434	0.0809	0.0237
Date of min.	4 Sep 2001	20 June 2002	23 Sep 1992	3 Nov 1993	7 Sep 1991
Max. value	140	39.5	83.5	57	1.81
Date of max.	2 Aug 2001	2 Oct 2012	1 Oct 1999	1 July 1999	20 Sep 2005

tunnel and Mogul mine and indicate the hydrologic effects of the bulkhead closures. Most of this discussion is derived from Sorenson and Brown (2015) though other data presented herein (Black Hawk) are also interpreted. Three primary sources of water to American tunnel were the basis for locations of the American tunnel bulkheads: (1) the veins and fractures associated with the Sunnyside mine workings and located east of AT#1; (2) water bearing fractures and faults located between AT#1 and AT#2; and (3) diffuse seepage located between AT#2 and the portal (Fig. 4) (Sorenson and Brown, 2015). AT#1 was intended to back up and impound fracture-related groundwater within the Sunnyside workings. Bulkheads located in the Sunnyside workings east of the watershed divide (Fig. 4) were intended to prevent groundwater impounded in the Sunnyside workings by AT#1 from discharging at the Mogul mine or into the upper Animas River downstream from the Sunnyside basin (Sorenson and Brown, 2015). Final recorded elevation of the water behind the AT#1 bulkhead was 3,557 m measured 14 May 2001 (Sorenson and Brown, 2015). This water level is greater than elevation of all other tunnels (Table 2). Black Hawk tunnel (having the highest portal elevation = 3,536 m) and Mogul tunnel (3,475 m) showed marked increases in discharge after 2001 with minor increases shown for Gold King tunnel (3,487 m) (Fig. 7). This increased discharge from the Mogul and Gold King tunnels has been attributed to the mine pool impounded behind AT#1 (Sorenson and Brown, 2015). The elevation and timing of discharge from Black Hawk tunnel indicate that increased discharge at that tunnel is also likely related to water impounded behind AT#1. Even though Red and Bonita portal elevation (3,340 m) is lower than the AT#1 water level, Red and Bonita tunnel remained dry before AT#2 was closed and is likely not hydrologically connected to the Sunnyside mine pool.

Bulkhead AT#2 was designed to limit water draining into American tunnel between AT#1 and AT#2 and closed in August 2001. Groundwater impounded behind the bulkhead equilibrated at an elevation of 3,357 m, recorded in August 2002, greater than the elevation of Red and Bonita mine tunnel portal (3,340 m); water impounded behind AT#2 is responsible for the increased Red and Bonita mine-tunnel discharge observed starting in 2003 (Sorenson and Brown, 2015). Because the water elevation behind AT#2 (3,357 m) is less than that at Mogul (3,475 m) (Sorenson and Brown, 2015), discharge at the Mogul mine was relatively constant after closure of AT#2 (Fig. 7, Walton-Day et al., 2020).

Closure of AT#3 (December 2002) was designed to limit diffuse seepage between AT#2 and AT#3 from discharging at the American tunnel portal (Sorenson and Brown, 2015). Closure of the Mogul tunnel bulkhead (2003) was designed to limit discharge at the mouth of the Mogul mine. There were no discharge data for the tunnels in the period between installation of these two bulkheads (most of 2003). After these two bulkheads were installed, discharge decreased at American tunnel and Mogul tunnel, but continued increasing at both the Gold King and Red and Bonita tunnels (Fig. 7) (Sorenson and Brown, 2015).

A possible alternate explanation for changing discharge in the tunnels is short-term climate variation of wet years versus dry years. However, climate is likely not the cause of discharge variations because if it were a controlling factor, the hydrographs at different non-bulkheaded tunnels would be showing similar patterns through time, which is generally not the case. In addition, none of the peak discharge years for the tunnels shown on Table 2, for which there is discharge record at USGS station 09358550 (2001, 2002, 2006, 2015; Supplemental Fig. S1b), are wet years on the hydrograph; 2002 was notably a dry year.

3.1.2.3. Water quality at Cement Creek during and after active treatment and bulkhead installation. Water quality at the mouth of Cement Creek exhibited large changes in the period from 1996 through 2015 (Fig. 8). Metal loads at some of the tunnels also exhibited large changes during the same time period (Table 2, Fig. 8). Raw and DWM values for pH, and dissolved copper, manganese, and zinc generally show similar long-term

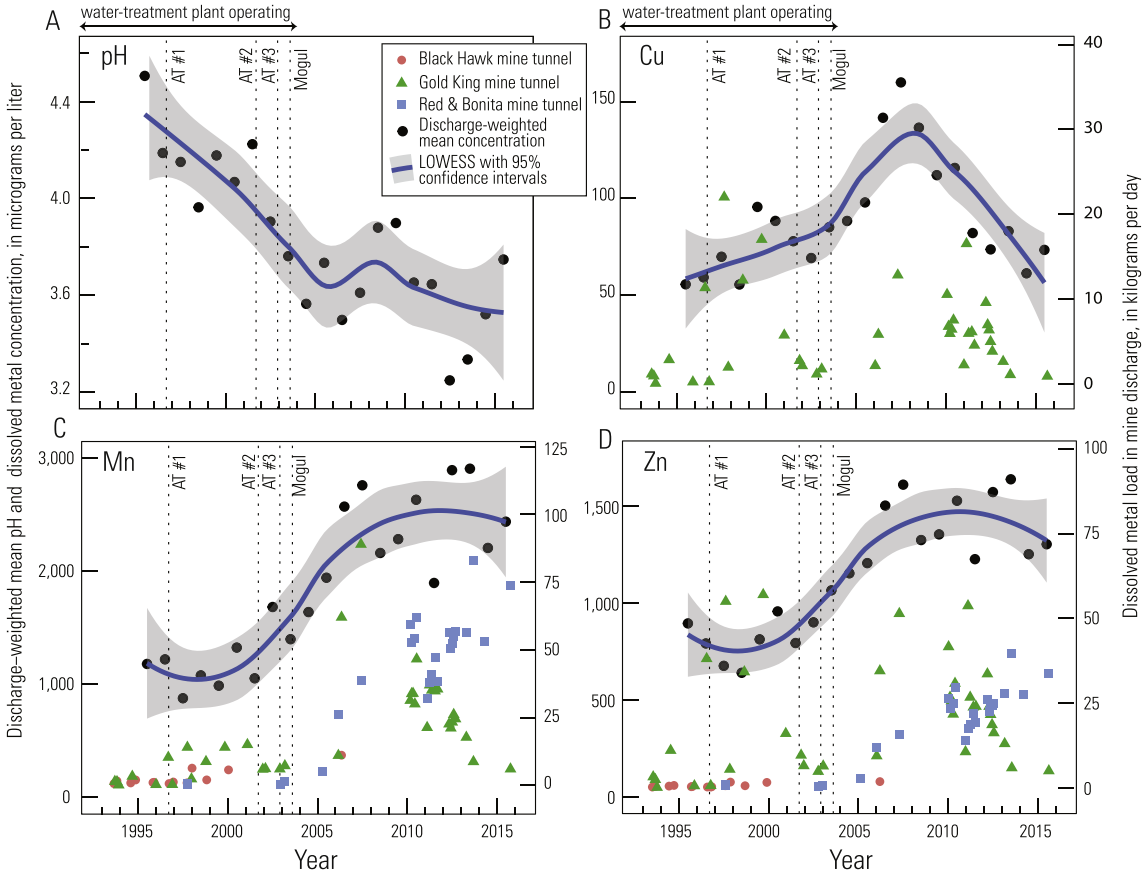

Fig. 8. Graphs showing variation in (A) discharge-weighted-mean (DWM) pH at the mouth of Cement Creek, (B) DWM concentrations of copper (Cu) at the mouth of Cement Creek and copper loads from the Gold King mine, (C) DWM concentrations of manganese (Mn) at the mouth of Cement Creek and manganese loads from the Black Hawk, Red and Bonita, and Gold King mine tunnels, (D) DWM concentrations of zinc (Zn) at the mouth of Cement Creek and zinc loads from the Black Hawk, Red and Bonita, and Gold King mine tunnels. All annual average DWM values are represented individually as black dots and as a LOWESS (locally weighted scatter plot smoothing) line with 95% confidence intervals. Vertical lines represent closure of the American tunnel #1 bulkhead (AT#1), American tunnel #2 bulkhead (AT#2), American tunnel #3 bulkhead (AT#3), and the Mogul bulkhead (Mogul).

patterns, although the DWM curves have lower values than the raw data (Supplemental Fig. S2, Fig. 8). Discharge weighting gives more weight to higher flow, more dilute concentration samples, resulting in lower DWM concentrations compared to the raw-data mean concentrations.

The DWM pH of Cement Creek decreased from about 4.5 to 3.6 during 1996–2015 (Fig. 8). Mine tunnel pH varied from as low as 0.9 at the Gold King tunnel in June 1998 (a year when all tunnels except Black Hawk tunnel demonstrated minimum pH) to 9.12 in November 1988 at the American tunnel. The high value may be related to water-treatment adjustments (Walton-Day et al., 2020 and sources therein). The DWM dissolved copper concentrations increased from about 50 to 150 µg/L between 1996 and 2009, decreasing to about 50 µg/L in 2015 (Fig. 8b). Maximum dissolved copper loads from mine tunnels ranged from less than 0.1 kg/d to about 22 kg/d (at Gold King in 1997) (Table 2). The DWM dissolved manganese concentrations increased from about 1,000 to 3,000 µg/L from 1996 to 2012–2013 (Fig. 8c). Maximum dissolved manganese loads from mine tunnels ranged from about 11 to 89 kg/d with as much as 228 kg/d at American tunnel in 2001 (Table 2). The DWM dissolved zinc concentrations increased from about 900 to 1,600 µg/L from 1996 to 2013 (Fig. 8d). Maximum dissolved zinc loads from mine tunnels ranged from about 2 to 84 kg/d with as much as 140 kg/d at American tunnel in 2001 (Table 2). DWM manganese and zinc concentrations show similar concentration patterns through time with slight decreases from 1996 to 2000, followed by increases in DWM concentrations (and raw data) from about 2000 through 2012–2013 (Fig. 8, Supplemental Fig. S2). Average daily metal loads at the mouth of Cement Creek for the period 2004–2015 were about 10 kg/d for copper, 200 kg/d for manganese, and 120 kg/d for zinc.

The timing of pH decreases in Cement Creek is not obviously related to patterns and timing of changes in discharge or pH values at the various mine tunnels (Fig. 7, Table 2). In addition to the mine tunnels, there are numerous sources of low pH water in Cement Creek related to mining. As well, naturally occurring low pH water also derives from unmined mineralization and hydrothermal alteration in the watershed (Mast et al., 2007; Yager and Bove, 2007; Wirt et al., 2007). The decreased pH through time might indicate increased unsampled groundwater discharge occurred in South Fork after bulkhead installation, as also evidenced by increased discharge at the Black Hawk tunnel during this time. This idea warrants additional investigation.

Increased mine-tunnel discharge in non-bulkheaded tunnels caused increased metal loads from the mine tunnels that coincide with, and likely contributed to, some of the changes in water quality at the mouth of Cement Creek (Fig. 8b-d). Loads from the mine tunnels, rather than their concentrations are presented because loads quantify the most important sources of metals to the receiving stream (Kimball et al., 2002; Walton-Day et al., 2005). As previously described, active water treatment removed most of the metal load from the American tunnel during 1989–2003, and some of the load from the Mogul, Red and Bonita, and Gold King tunnels when Cement Creek (1996–2003) and Gold King were being treated (2003–2004). The increased discharge at the Black Hawk tunnel (1996–2002) that drains to the South Fork of Cement Creek (Figs. 4 and 7) was not treated. The increased loads of manganese and less strongly zinc that occurred with increased Black Hawk tunnel discharge (Figs. 7 and 8c-d) coincide with the onset of gradual increases

in DWM manganese and zinc at the mouth of Cement Creek that started around 2000 and are a possible cause for some of these increases (Fig. 8c-d). Elevated copper loads at Gold King tunnel during this period were not consistently captured at the treatment plant, and likely contributed to increasing DWM copper concentrations at the mouth of Cement Creek as did minor (untreated) copper loads at the Black Hawk tunnel (Table 2).

After water treatment ended in 2004, untreated discharge and metal loads from the American, Mogul, Red and Bonita, and Gold King tunnels moved downstream and appear to influence water quality at the mouth of Cement Creek. After 2003, the pattern of copper load from the Gold King tunnel closely mimicked the pattern of DWM copper concentrations at the mouth of Cement Creek, which increased until 2009 but then decreased to values similar to those in 1995 (Fig. 8b). The other four tunnels (American, Black Hawk, Mogul, and Red and Bonita) had copper loads that were less than 5 percent of the Gold King tunnel during this time (2003–2015) and are not shown (Table 2, and data in Walton-Day et al., 2020). The post-2003 patterns of manganese and zinc DWM concentrations at the mouth of Cement Creek are coincident with increasing loads at the Red and Bonita and Gold King tunnels (Fig. 8c-d). The American and Mogul tunnels have zinc and manganese loads that are generally less than 50% of the loads at the Red and Bonita and Gold King tunnels at this time and are not shown (data in Walton-Day et al., 2020). Slight decreases in DWM manganese and zinc concentrations from 2013 to 2015 may have been caused by decreased loading from the Gold King tunnel during this time (Fig. 8c-d). During this time, the DWM manganese and zinc concentration decreases are not as steep as the decrease in the DWM copper because the Red and Bonita tunnel provides manganese and zinc load, but minimal copper load (Fig. 8b-d).

The coincidence in the timing of load increases starting in 2003 from the Gold King and Red and Bonita tunnels with increases in DWM metal concentrations at the mouth of Cement Creek provides evidence that the changes in discharge and loads from these tunnels contributed to the observed increases in copper, manganese, and zinc DWM concentrations at the mouth of Cement Creek. Additional evidence is provided by the large copper and zinc loads at the Gold King tunnel during 1996–2000, that are of similar magnitude to those that occurred during 2004–2015 (Fig. 8b and d). Because of partial treatment of upper Cement Creek in the 1990s, these loads did not fully contribute to water quality at the mouth of Cement Creek. When treatment ceased by 2004, the loads from this tunnel were transported downstream and were partly responsible for increasing copper and zinc DWM concentrations observed at the mouth of Cement Creek (Fig. 8b and d). Finally, the mean daily metal loads calculated for 2004–2015 at the mouth of Cement Creek (copper, 10 kg/d; manganese, 200 kg/d; zinc, 120 kg/d) are in the range of metal-load values for the tunnels, particularly Gold King and Red and Bonita (Fig. 8b-d) indicating that the loads from the tunnels substantially contributed to the loads and thus the concentration increases observed at the mouth of Cement Creek. The lower copper load at the mouth of Cement Creek compared to some tunnel loads likely indicates copper attenuation between upper Cement Creek and the mouth of Cement Creek (Kimball et al., 2002).

4. Summary and conclusions

The water-quality response in two different study areas in Colorado after bulkhead installation for remediation of abandoned draining mines indicated mixed water-quality responses, with only limited improvement in receiving waters. In Lake Fork Creek (upper Arkansas River watershed), a bulkhead installed in Dinero tunnel in 2009 caused significant water-quality improvement (pH and zinc and manganese concentrations and loads) at the Dinero tunnel mouth (DT-0) but significant water-quality degradation at the nearby Nelson tunnel (NT-0). At the downstream-most site on Lake Fork Creek, LF-580, limited water-quality improvement included statistically significant decreased manganese concentrations and attainment of zinc water-quality standards for two of 15 samples after bulkhead closure. At LF-580, increased post-bulkhead zinc loads may indicate increased post-bulkhead, unsampled groundwater contributions from multiple sources upstream from LF-580.

In Cement Creek (upper Animas River watershed) four bulkheads were installed and closed between 1996 and 2003. Water treatment (1989–2003) overlapped with the period of bulkhead installation and complicated interpretation of bulkhead effects. Comparison of limited pre-treatment data with post-bulkhead data from near the mouth of Cement Creek indicates possible improvement in manganese concentrations, decreasing pH through time, and is inconclusive for copper and zinc concentrations. There is no consistent and robust evidence that bulkheads caused substantial positive or negative long-term changes in water quality. In contrast, the lowest concentrations of copper, manganese, and zinc occurred during active treatment (1989–2003). After bulkheads were installed, and active water treatment ceased (2004), water quality in Cement Creek degraded. The timing of water-quality degradation was similar to timing of increased discharge and metal loads from non-bulkheaded tunnels that occurred in response to bulkhead installation in other tunnels, evidence that increased loading from the tunnels contributed to water-quality degradation at the mouth of Cement Creek. In both study areas, data potentially indicate increased, unsampled groundwater discharge after bulkhead installation that caused increased zinc loads at site LF-580 after Dinero bulkhead installation, and decreased pH over time at Cement Creek. Greater understanding of this result could be a topic for future investigations. Overall, the lack of substantial water-quality improvement in these two areas from bulkhead installation indicates that other treatment techniques might warrant consideration.

Data availability

Data for the four sites discussed in the Dinero tunnel section are available from the National Water Information System (NWIS) (https://doi.org/10.5066/F7P55KJN) using USGS site identification numbers 391504106225200 (DT-0); 391454106224201 (LF-537); 391452106224201 (LF-580); and 391501106230601 (NT-0). Data for the mouth of Cement Creek are available from the Water Quality Portal (WQP) (https://www.waterqualitydata.us/) using site identifiers 21COL001_WQX-CEM49, ARSG-CC48, CORIVWCH_WQX-323, USEPA_REGION8-CC48, and USGS-09358550. Data for two additional samples, USGS site ID 374854107393900, October 4, 1971, and USGS site ID 375015107404001, September 24, 1981, are available from NWIS at https://doi.org/10.5066/F7P55KJN. Data for the five mine tunnels in Cement Creek are available from Walton-Day et al. (2020) at https://doi.org/10.5066/P9FE667O.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.apgeochem.2021.104872.

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Water-quality change following remediation using structural bulkheads in abandoned draining mines, upper Arkansas River and upper Animas River, Colorado USA

Supplemental Information

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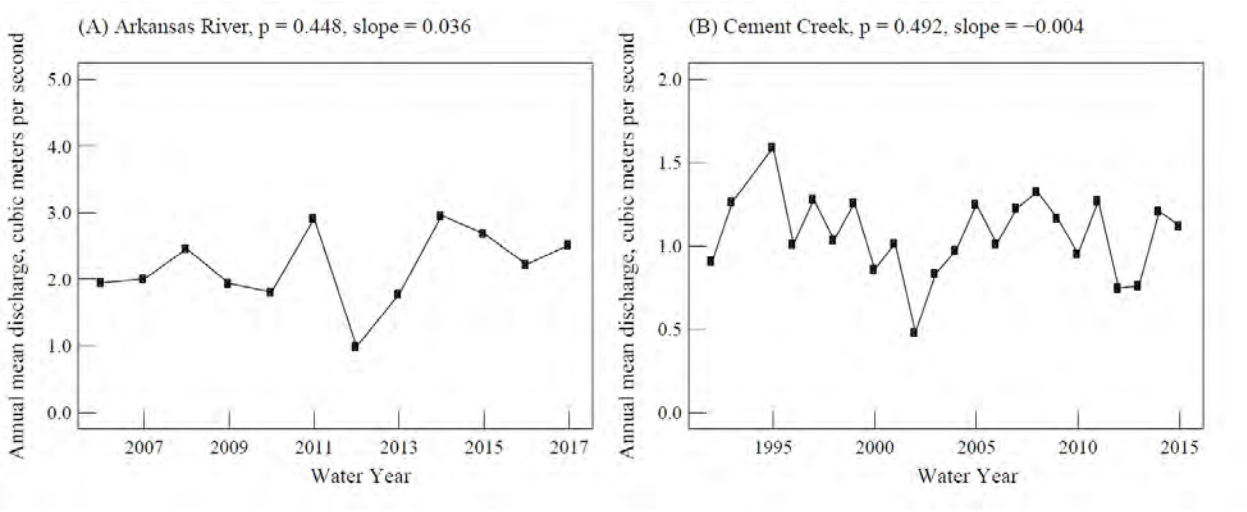
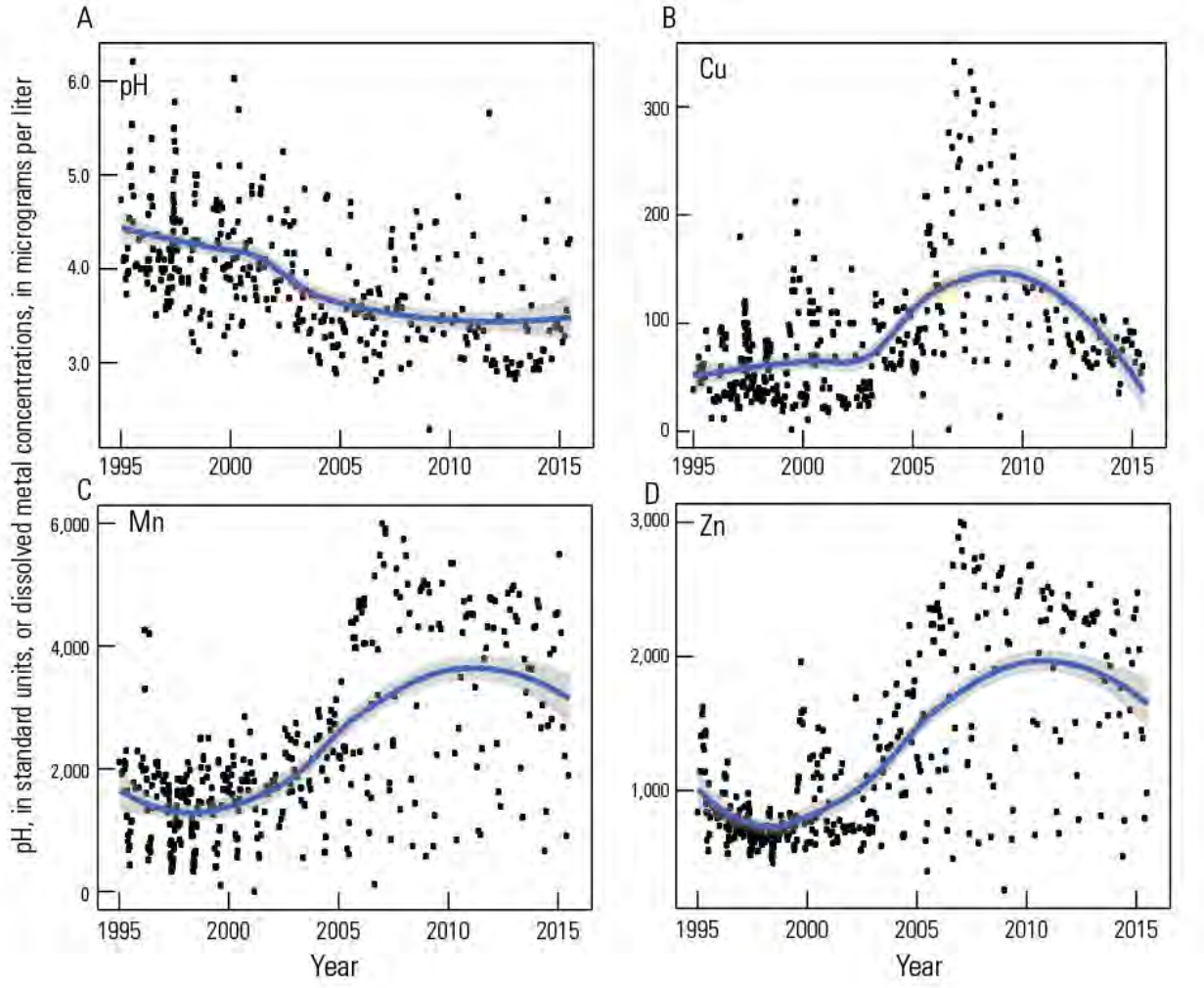


Supplemental Figure S1. Graphs showing (A) annual mean discharge (by water year, Oct. through Sept.) at the Arkansas River near Leadville, Colorado, U.S. Geological Survey (station 07081200) streamgage near the Dinero study area (data from https://waterdata.usgs.gov/co/nwis/annual/?referred_module=sw&site_no=07081200&por_07081200_17776=344903,00060,17776,1968,2020&start_dt=2006&end_dt=2017&year_type=W&format=html_table&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=parameter_selection_list) and (B) annual mean discharge (by water year, Oct. through Sept.) at the Cement Creek at Silverton, Colorado, U.S. Geological Survey (station 09358550) (data from https://waterdata.usgs.gov/co/nwis/annual/?referred_module=sw&site_no=09358550&por_09358550_19575=345987,00060,19575,1992,2020&start_dt=1993&end_dt=2015&year_type=W&format=html_table&date_format=YYYY-MM-DD&rdb_compression=file&submitted_form=parameter_selection_list). There are no data available prior to 1992 for this site, and record for 1992 is not for entire year, so it was omitted from the graph.

Supplemental Table S1. Mean discharge, pH, and dissolved manganese and zinc concentrations and loads before and after bulkhead closure in the Dinero tunnel at four sample sites, Lake Fork Creek, upper Arkansas River watershed, Colorado. Mean pH calculated from hydrogen ion concentration. **Bold** indicates post bulkhead value is less than pre-bulkhead value. Before closure, n=4. After closure n=14 except at LF-580 where n=15. [DT-0, Dinero tunnel sample site; LF-537, sample site draining wetland downstream from DT-0; LF-580, sample site on Lake Fork Creek downstream from DT-0 and LF-537; NT-0, Nelson tunnel sample site; Dis., dissolved; m^3/s, cubic meters per second; Conc., concentration; µg/L, micrograms per liter; kg/d, kilograms per day]

Site	**Mean discharge (m^3/s)**		**Mean pH (standard units)**		**Mean Dis. Manganese Conc. (µg/L)**		**Mean Dis. Zinc Conc. (µg/L)**		**Mean Dis. Manganese Load (kg/d)**		**Mean Dis. Zinc Load (kg/d)**	
	Pre-bulk-head	Post-bulk-head	Pre-bulk-head	Post-bulk-head	Pre-bulk-head	Post-bulk-head	Pre-bulk-head	Post-bulk-head	Pre-bulk-head	Post-bulk-head	Pre-bulk-head	Post-bulk-head
DT-0	0.0059	**0.00088**	5.71	6.55	47,800	**20,000**	15,200	**4,090**	24.9	**1.53**	7.96	**0.31**
LF-537	0.0020	0.0033	3.84	4.59	33,600	**7,760**	8,160	**2,230**	5.72	**1.45**	1.39	**0.95**
LF-580	0.38	0.82	7.01	**6.96**	608	**215**	128	**113**	17.8	**9.52**	3.97	5.57
NT-0	0.00021	0.00063	6.72	**5.89**	2,990	33,200	85.8	7,940	0.055	1.75	0.002	0.42



Supplemental Figure S2. Graphs showing variation in (A) pH at the mouth of Cement Creek, (B) dissolved copper (Cu) concentrations at the mouth of Cement Creek; (C) dissolved of manganese (Mn) concentrations at the mouth of Cement; and (D) dissolved zinc (Zn) concentrations at the mouth of Cement Creek. LOWESS (locally weighted scatter plot smoothing) line with 95% confidence intervals.

AMENDED: CENTRAL COLORADO CONSERVANCY PROPOSAL TO THE NATURAL RESOURCE TRUSTEES FOR THE UPPER ARKANSAS RIVER CALIFORNIA GULCH NATURAL RESOURCE DAMAGES (9/28/2021)

EXECUTIVE SUMMARY

The Central Colorado Conservancy (CCC) is requesting funding from the Natural Resource Trustees (Trustees) for the Upper Arkansas River California Gulch Restoration Plan in the amount of $900,000 over two (2) years to protect five (5) parcels containing 126 acres in Lake County and an additional 0.7 miles of Arkansas River frontage. The funding will be used to acquire the parcels in fee title and protect them under perpetual conservation easement. All five of the parcels at a total of 126 contiguous acres will be included in the recently established Shawn Andrick Memorial Preserve (Andrick Preserve) along the Arkansas River in southern Lake County. The parcels will allow for inclusive public access and have excellent connectivity with other protected land. This project builds on recent funding support from NRD Trustees and has several years of broader development, funding, and partner support behind it. **CCC hopes to build on the successes in permanent land protection accomplished with past funding support from the NRD Trustees to amplify the positive impacts of habitat conservation, land stewardship and water security for the benefit of riparian health, wildlife, and the public.**

The acquisition of these parcels will permanently restrict development and protect crucial upland and riparian habitat in Lake County at the headwaters of the Arkansas River. The parcels include shortgrass prairie and sagebrush steppe upland habitat, and in conjunction the current Andrick Preserve, would protect close to three miles of Arkansas River frontage with associated wetland habitat.

The parcels have high connectivity with other protected land within the existing Andrick Preserve to the north and south along the Arkansas River and also with Bureau of Land Management (BLM) and Forest Service (USFS) land to the east. Four of the five parcels are visible from the Top of the Rockies (ToR) Scenic Byway on Highway 24 and are supported by current and draft goals for the ToR Action Plan (Conlin, 2012), and they are identified as one of the highest priorities for protection by Lake County Open Space Initiative (LCOSI; Conlin, 2019).

The conservation easements on all five parcels will be held by Colorado Open Lands (COL), a 501(c)3 nonprofit accredited land trust. Lake County Government will hold the public access easement on Andrick Preserve and they will manage that public access. Through all of these parcels, Lake County residents and visitors will be able to access the Arkansas River for fishing, trails and open space within the acquired parcels and in adjoining protected land, and hunting areas in the adjoining public land. This project will build on existing partnerships with Lake County Government, LCOSI, COL, Trout Unlimited (TU), Gates Family Foundation, and Climax Mine that were initiated in the establishment and protection of the Shawn Andrick Memorial Preserve (phase I and II completed April and July 2021).

We anticipate total project costs will be $900,000 to cover land acquisition, conservation easement establishment, and operational and transactional costs (Table 1). Of this total cost, $802,000 of NRD funding would be applied primarily to land acquisition and remaining funds would be applied toward costs of conservation easement establishment. Additional funding sources include Great Outdoors

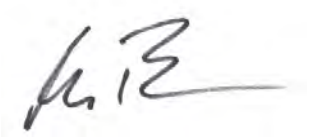
Colorado (GOCO – already contributed $500,500 to the Andrick Preserve), Keep it Colorado (Transaction Cost Assistance Program), CCC cash and in-kind staffing support, onX (Access and Stewardship Grants) and other partners engaged and supportive of the Lake County Open Space Initiative (LCOSI). The matching funds listed below in Table 1 are identified as either secured, pledged, applied or intend to apply.

Table 1: Project costs

NRD Trustees proposal request	**$900,000**
Central Colorado Conservancy (secured and pledged)	$200,000
Keep it Colorado (intend to apply)	$37,000
onX (applied)	$30,000
Great Outdoors Colorado (intend to apply)	$183,000
Total project cost	$1,350,000

We appreciate the opportunity to permanently conserve up to 323 acres of land and 3 miles of Arkansas River in Lake County—preserving habitat that supports wildlife populations, protects the health of the headwaters of the Arkansas River, and provides inclusive public access to for the community and visitors to enjoy the Arkansas River Basin's natural resources.

Project Offeror



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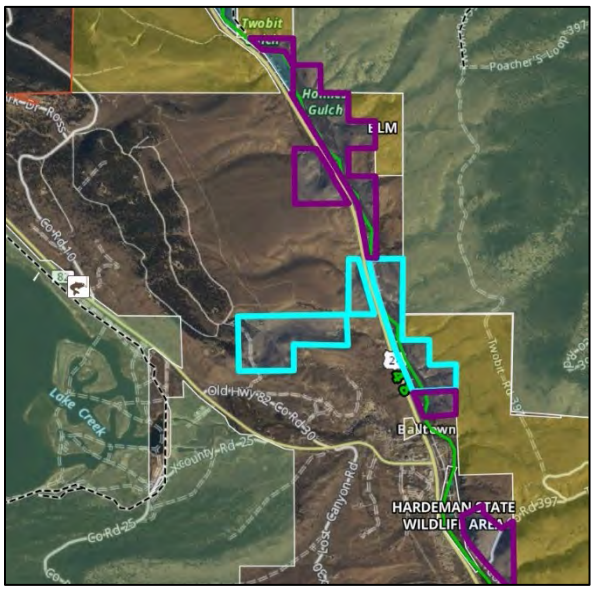
SCOPE OF WORK

Target Natural Resources

Land protection through the acquisitions and conservation easements proposed here will conserve high-priority locations in the Arkansas River headwaters, including upland and riparian wildlife habitats, in Lake County (Figure 1). CCC and partner work will protect 0.7 miles of Arkansas River frontage and associated wetland habitat. These wetland complexes (approximately 45 acres) support brown trout and other fish species, while providing valuable habitat for many Tier I and II species identified in the Colorado Parks and Wildlife (CPW) Sate Wildlife Action Plan (CPW, 2015), including cinnamon teal, mallard, and bald eagle. This stretch of the River also contains microhabitats that accommodate greenback cutthroat trout, the state fish of Colorado and listed as threatened by the U.S. Fish and Wildlife Service. The proposed acquisition properties also include seven different land-cover types according to the Southwest Regional Gap Analysis Project classification scheme (Lowry et al., 2005), including montane-subalpine grassland, mixed conifer forest and woodland, alpine-montane wet meadow, sagebrush steppe, and Rocky Mountain cliff and canyon. These habitat types are exemplary of the habitat types in Lake County and those natural resources damaged through mining activity in the region. Conservation of these properties will benefit black bear, mountain lion, osprey, bald eagle, great blue heron, greater sage-grouse, bighorn sheep, elk, moose, and boreal toad (according to CPW Species Activity Map, n.d.). The properties will also protect significant stretches of the waterways that are crucial to ecosystem health in the region.

Figure 1: Current extent of Shawn Andrick Memorial Preserve (purple) with the location of the proposed additional parcels (teal).



The connectivity of these properties to other protected lands grows the impact their protection can have on supporting natural resource health, and wildlife populations in particular, in the area. The two parcels to be included in the Andrick Preserve will support CCC's goal of owning and protecting a stretch of contiguous land along the Arkansas River. The proposed additional parcels and those already protected by CCC in the Andrick Preserve almost all border either Arkansas Headwaters Recreation Area (AHRA) State Park, BLM, or Forest Service land.

Acquiring these parcels will support the health of wildlife by providing additional contiguous land that is protected for habitat—particularly for access to crucial water resources and open space.

Connectivity of the properties to State and Federal land also improves the public benefit from protection of this land. The properties will be made available for inclusive, public use including passive enjoyment of the viewshed from the Top of the Rockies Scenic Byways and from existing public trails, and for more active uses of fishing, access to hiking trails on these and adjacent public lands, and access to hunting areas on adjacent public lands. The public access easement will be held, and the access

managed, by Lake County Government. Partners including CCC, COL, and Lake County Government, will follow a collaborative management planning process to develop the management plan for the parcels, inviting participation and input from all stakeholders (e.g. LCOSI, adjacent public land representatives) and relevant experts (e.g. CPW wildlife biologists). This planning process will not be funded with NRDT funds.

Objectives

This proposed project will acquire 323 acres of land to permanently protect through conservation easement in order to provide important benefits to natural resources and increase opportunities for natural resource-based recreation in central and south Lake County.

Objective 1: Central Colorado Conservancy acquires five parcels (126.03 acres) in fee title

Objective 2: Protect all five parcels through conservation easement with COL

Objective 3: Expand a public access agreement with Lake County Government

Objective 4: Develop a management plan for the Andrick Preserve parcels in collaboration with project partners

Table 2: Timeline for project objectives (where blue cells are objectives that will be wholly or partially funded by NRD Trustee funds)

2022				2023			
Spring	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Parcel acquisition, easement establishment, public access agreements and all associated due diligence							
				Management plan development			

Operational Plan

We are requesting $900,000 from the NRD Trustees and will provide at least $450,000 of matching funds from CCC and other partners (see Table 3).

Table 3. List of project contributors.

Contributor	Amount (all cash)	Status
Central Colorado Conservancy	$200,000	Secured
Great Outdoors Colorado	$183,000	Intend to apply
Keep it Colorado	$37,000	Intend to apply
onX	$30,000	Applied

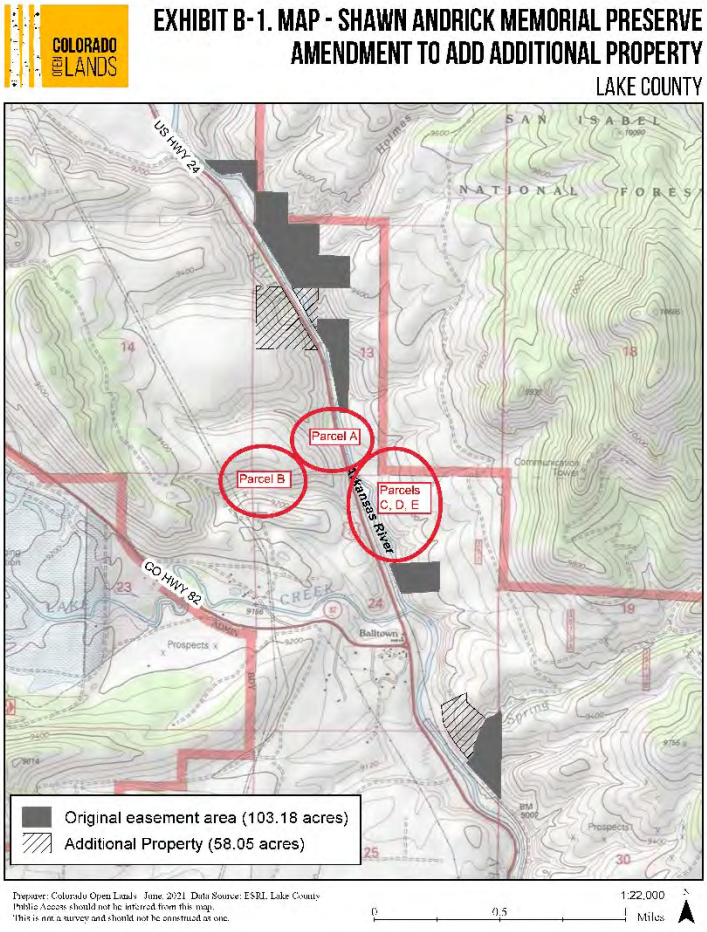
NRDT funds will be applied to property acquisition and conservation and public access easement establishment. Matching funds will be applied to conservation and public access easement establishment and public access management plan development. GOCO administers a trust fund of Colorado Lottery revenues to help preserve and enhance the state's natural resources. Keep in Colorado administers a Transaction Cost Grant Program designed to support conservation easement holders and landowners by providing financial assistance for transaction costs for ready-to-go conservation projects. onX, a company that produces mobile phone applications for hunting, offers grants to organizations that protect land for public access. Additional matching funds will be raised by CCC through project-specific donations by supporting individuals and businesses.

This proposal matches the goal of the Restoration Plan/Environmental Assessment (RP/EA) for the Upper Arkansas River Watershed to protect habitat as an alternative to restoration. Funding from the Trustees will support the acquisition of properties with habitats that are equivalent to the injured resources and preserve their natural resource benefits and prevent development in perpetuity through conservation easements. Furthermore, the acquisition and protection of these parcels will address the RP/EA habitat protection Tier 1 and 2 descriptions through provisioning:

1) Connectivity to other protected land.
2) High-priority location for LCOSI.
3) Threat of development that would exist without protection.
4) Inclusion of Arkansas River frontage and the Iowa Gulch and their associated riparian habitats.
5) Connectivity with other land parcels that were protected with NRDT funding.
6) Planned management for public access.

This project proposal thoroughly addresses the description and objectives of habitat protection projects that provide alternatives to restoration. This project also complements other land protection work in Lake County by CCC, the State of Colorado, Lake County, and other land trust organizations operating in the Upper Arkansas River region (as evidenced by recent Andrick Preserve acquisitions and easements).

Following completion of project objectives, CCC and COL will conduct annual monitoring of the properties to ensure compliance with the conservation and access easements. This includes ensuring that the uses and potential impacts on the properties from public access are not causing harm to the natural resources on the property, and ameliorating any harm should it occur. Monitoring of the project sites will be conducted by the key collaborators on the project (CCC, COL, Lake County), and supported by other non-NRDT funds.



Parcels Proposed for Acquisition

Listed below are the property descriptions (legal descriptions can be provided) and short narratives for the parcels identified for acquisition through this project (see map to right):

1. Parcel A

Twenty-five acres (25 ac.) of valuable property in the canyon and along the river that includes acreage on both sides of the Arkansas River and Hwy 24. In addition to valuable riverfront, this property provides a clear link from the Malenky properties to the northern part of the current Andrick Preserve, allowing for a more continuous recreation and protected areas. Finally, this property provides the potential for linking up a number of others currently on the market. **This parcel is currently on the open market. CCC has made an offer (9/24/21)**

Looking north to parcel A from parcel C. Arkansas River and associated wetlands.

2. Parcel B

While not on the river, this property provides a valuable linkage from the Andrick Preserve to grasslands and shelter for a variety of wildlife, and can expand Lake County recreation opportunities to include upland sites. Additionally, this area is key wintering habitat for deer and elk, and provides a corridor to the Andrick Preserve and other public lands to the east and west. **Landowner has verbally agreed to the sale price and proposed timeline (close in 2022).**



Parcel B showing east-west corridor and mining tailings and relics.

3. Parcels C, D, E

Three properties (40.62 ac.) of Arkansas riverfront and eastern uplands that extends current Andrick Preserve boundaries north (see map on left for all proposed Andrick additions). Valuable wetland/riparian sites and connectivity potential. **All three properties are currently on the open market.**

BUDGET

Please see attached for complete budget showing total request ($900,000). The majority of expenses are for the actual acquisitions themselves, along with associated transaction costs. Other costs are related to standard operating fees (i.e. staff time) for conducting land deals for the two land trusts on the project (CCC, COL).

Key Staff

Adam Beh, Executive Director, Central Colorado Conservancy. Adam will serve as the lead on the project, and will oversee all of the land deals and associated due diligence requirements. He will be responsible for all communication and collaboration with project partners. Adam will spend 10% of time on the project, with an additional 10% provided as in-kind support.

Ben Lenth, Community Conservation Program Manager, Colorado Open Lands. Ben will lead all of the conservation easement supervision and due diligence, and will work closely with Adam on review of relevant legal documents. He will also serve as one of the key contributors (with CC and Lake County) to the land management plans developed for all of the project sites.

Board of County Commissioners (BOCC), Lake County Government. Currently, Commissioner Sarah Mudge has been the primary collaborator serving on behalf of Lake County BOCC on recent Andrick Preserve investments. Commissioners Jeff Fiedler and Kayla Marcella are also key in helping CCC address local priorities for conservation and development in the landscape. BOCC and relevant Lake County personnel (Public Works) will manage the public access components of this project, as they are the ones charged with providing to their constituents and communities in the county.

Kyle Clifton, Conservation Projects Manager, Central Colorado Conservancy. Kyle will help manage land transaction due diligence activities, and support partnership development among all parties. Kyle will also contribute to the development of a land management plan for Andrick Preserve. She will spend up to 10% of her time on the project.

PUBLIC COMMUNICATION STRATEGY

CCC plans to continue partner, collaborator and community engagement in this project in the same way we have been doing for the recent Andrick Preserve acquisitions. CCC has a Communications and Development Manager (Jes Walton) on staff, and she provides regular communication and outreach pieces to keep our constituents informed of progress on our work. We also have regular quarterly community meetings (Coffee with the Conservancy) that allows us to talk directly to our constituents on progress and to answer any questions the community may have on our work. Additionally, the entire Andrick Preserve project and associated CCC-COL-Lake County partnership has been built on a foundation of mutual respect, open communication, and compromise when relevant to meet partner objectives. CCC is open to continued collaboration and communication with Colorado Department for Public health and the Environment (CDPHE), as there are opportunities for shared communication stories across a number of collaborative CCC-CDPHE projects (Andrick Preserve, Sands Lake restoration, etc.).

RELATIONSHIP TO THE RANKING CRITERIA

This project meets the following objectives identified in the screening and ranking criteria as follows:

Screening Requirements:

1. Compliance with SPP requirements
   This proposal meets the requirements laid out in the RFP, including CCC being a 501(c)3 nonprofit, nationally accredited and state certified land trust. We have proven to have the financial and technical capacity to complete land acquisition projects. CCC has also proven success in bringing in matching funds to support project work, and plans to solicit this support from key partners in the conservation community (e.g. GOCO).
2. Compliance with laws
   CCC is a nationally-accredited, state-certified land trust with a proven track record of doing business above board and following all federal, state and local laws. CCC has no legal cases or challenges, and we continue with our positive relationships with partners, collaborators and landowners throughout the region.
3. Public health and safety
   This land acquisition project poses no threat to the health and safety of the public.
4. Eligibility for NRDA funding
   There is incredible potential for linking valuable wetland and riparian sites to a larger functional system that supports wildlife habitat, in-stream flows, wetland/riparian ecology, public benefit and enjoyment and open spaces for the project area. Historical releases from the California Gulch site had caused great damage to this part of the Arkansas River, and this proposal will build on the great work done over the last several decades on restoration, protection and enhancement of the river. By protecting the lands adjacent to and connected to this section of the Arkansas River, NRDT will help realize their objectives for improving this area through acquisitions of natural areas.

Ranking Criteria

1. Public support
   These properties have been identified by LCOSI prioritization documents, Lake County Comprehensive Plan, CCC strategic plan and local Lake County media outlets (e.g. Leadville Herald Democrat).
2. Likelihood of success
   Objectives are clear and measurable in that CCC proposes to acquire seven (7) properties to transfer to a conservation easement, and then to give a public access easement to Lake County government. CCC has a proven track record of completing acquisition and easement projects in Lake, Chaffee, Park, Fremont, Gunnison and Saguache counties. CCC has already completed the NRDT-funded Andrick Preserve project that protects 166 acres and 2 miles of Arkansas River. CCC is celebrating its 20th year as an accredited land trust in October, 2021.
3. Technical feasibility
   The project is in line with a normal conservation workload for CCC. Additionally, all landowners and/or real estate brokers have been contacted and have provided verbal commitments to move forward. Since CCC has completed numerous land deals in the past, we follow a clean protocol for delivering on project work.
4. Multiple natural resource benefits

This project proposal benefits riparian and wetland health and function, wildlife habitat, soil health, and helps to manage human impacts through proposed public access and recreation.

5. Time to provide benefits
   Benefits will accrue immediately upon completion as perpetual conservation easements that are collaboratively managed (CCC and funders require a collaborative management plan to be developed within 12 months of closing) can support future restoration and enhancement projects that will provide ecosystem benefits continuously.
6. Duration of benefits
   Long-term benefits of wetland/riparian ecosystem health and function will be realized in perpetuity (with good adaptive management practices). Additional social and community benefits will also continue in perpetuity due to the requirements for locally-led recreation management by Lake County.
7. Non NRD-match
   Matching funds are offered at 50% of the proposal request, with a significant amount either in hand, pledged or applied.
8. Protection of implemented project
   CCC will serve as the fee title owner and will convey the conservation easements (CE) on all properties to COL. The public access easements (AE) will be conveyed to Lake County. All of these deeds will be held in perpetuity. Draft CEs and AEs will be provided to NRDT reviewers before closing.
9. Project alignment with regional planning
   This proposal aligns with existing land and resource management plans, as laid out in the narrative above.
10. Public access
    Public access will be allowed and supported on all 323 acres proposed for protection.

APPENDIX A: DESCRIPTION OF CENTRAL COLORADO CONSERVANCY AND RESOURCE CAPACITY

Central Colorado Conservancy (CCC) is a nationally-accredited, state-certified 501(c)3 nonprofit land trust concerned with protecting the lands, waters and quality of life of Central Colorado as our communities face pressure and rapid growth. CCC was formally incorporated in 2001, and has 38 conservation easements and fee-title acquisitions in their portfolio, protecting over 5000 acres in Central Colorado. CCC envisions a Central Colorado supported by thriving communities that have safeguarded their rural character, lands, waters and wildlife with future generations in mind.

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APPENDIX C: FULL PROJECT BUDGET (SEE ATTACHED)

APPENDIX D: CENTRAL COLORADO CONSERVANCY ORGANIZATIONAL STATUS (SEE ATTACHED)

APPENDIX E: LETTERS OF SUPPORT (SEE ATTACHED)

REFERENCES

Colorado Parks and Wildlife (2015). State Wildlife Action Plan: A Strategy for Conserving Wildlife in Colorado. Retrieved from: https://cpw.state.co.us/Documents/WildlifeSpecies/SWAP/CO_SWAP_FrontMatter_and_Chapter1.pdf

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CENTRAL COLORADO CONSERVANCY

Protecting the Lands and Waters that Sustain Us

Amended Project Budget (NRD Trustees)

Arkansas River Acquisitions, Lake County, CO

9/27/2021

	Request to NRD Trustees	Conservancy Match (50%)	Project Total	Request by Project		
ITEM				**Parcel A (25.41 ac)**	**Parcel B (60 ac.)**	**Parcels C-E (40.62 ac)**
Land Acquisition	**$802,000**	$413,000	$1,215,000	$175,000	$640,000	$400,000
Appraisals	**$30,000**	$15,000	$45,000	$15,000	$15,000	$15,000
Baseline Documentation	**$4,000**	$2,000	$6,000	$2,000	$2,000	$2,000
Closing Costs	**$5,000**	$2,500	$7,500	$2,500	$2,500	$2,500
Environmental Assessment	**$4,000**	$2,000	$6,000	$2,000	$2,000	$2,000
Legal Fees	**$20,000**	$10,000	$30,000	$10,000	$10,000	$10,000
Mapping/Survey	**$6,000**	$3,000	$9,000	$3,000	$3,000	$3,000
Stewardship Fund	**$5,000**	$2,500	$7,500	$2,500	$2,500	$2,500
CCC project fee	**$24,000**	$0	$24,000	$8,000	$8,000	$8,000
TOTALS	**$900,000**	$450,000	$1,350,000	$220,000	$685,000	$445,000

CENTRAL COLORADO CONSERVANCY PROPOSAL TO THE NATURAL RESOURCE TRUSTEES FOR THE UPPER ARKANSAS RIVER CALIFORNIA GULCH NATURAL RESOURCE DAMAGES (9/3/2021)

EXECUTIVE SUMMARY

The Central Colorado Conservancy (CCC) is requesting funding from the Natural Resource Trustees (Trustees) for the Upper Arkansas River California Gulch Restoration Plan in the amount of $5,227,500 over two (2) years to protect seven (7) parcels containing 323 acres in Lake County and approximately three (3) miles of Arkansas River frontage. The funding will be used to acquire the parcels in fee title and protect them under perpetual conservation easement. Of these acquisitions, six of the parcels at a total of 146 acres (126 contiguous) will be included in the Shawn Andrick Memorial Preserve (Andrick Preserve) along the Arkansas River in southern Lake County. The seventh parcel of 177 acres (Dawson Ranch) is located six miles south of Leadville just south of California Gulch, and includes a working ranch and a seasonal tributary to the Arkansas River (Iowa Gulch). All seven parcels will allow for inclusive public access and have excellent connectivity with other protected land. This project has several years of development, funding, and broad partner support behind it. **CCC hopes to build on the successes in permanent land protection accomplished with past funding support from the NRD Trustees to amplify the positive impacts of habitat conservation, land stewardship and water security for the benefit of riparian health, wildlife, and the public.**

The acquisition of these parcels will permanently restrict development and protect crucial upland and riparian habitat in Lake County at the headwaters of the Arkansas River. The Andrick Preserve parcels include shortgrass prairie and sagebrush steppe upland habitat, and in conjunction the current Andrick Preserve, would protect close to three miles of Arkansas River frontage with associated wetland habitat. The parcels have high connectivity with other protected land within the existing Andrick Preserve to the north and south along the Arkansas River and also with Bureau of Land Management (BLM) and Forest Service (USFS) land to the east.

Additionally, the Dawson Ranch includes sagebrush steppe and wetland and riparian habitat associated with a seasonal stream and a long stretch of Iowa Gulch, an ephemeral waterway that had been degraded from sediment and contaminated mine waste released from the Sherman Mine near Leadville. While the entire Upper Arkansas River Basin is experiencing unprecedented population growth and development, the proximity of this parcel to Leadville makes it particularly threatened by development.

All seven parcels (Andrick Preserve additions and Dawson Ranch) are visible from the Top of the Rockies Scenic Byway on Highway 24, and they are located in areas identified as high priority for protection by Lake County Open Space Initiative (LCOSI).

The conservation easements on all seven parcels will be held by Colorado Open Lands (COL), a 501(c)3 nonprofit accredited land trust. Lake County Government will hold the public access easement on both the Andrick Preserve and Dawson Ranch, and they will manage that public access. Through all of these parcels, Lake County residents and visitors will be able to access the Arkansas River for fishing, trails and open space within the acquired parcels and in adjoining protected land, and hunting areas in the

adjoining public land. This project will build on existing partnerships with Lake County Government, LCOSI, COL, Trout Unlimited (TU), Gates Family Foundation, and Climax Mine that were initiated in the establishment and protection of the Shawn Andrick Memorial Preserve, funded in part by NRD Trustees funding (phase I and II completed April and July 2021).

We anticipate total project costs will be $5,277,500 to cover land acquisition, conservation easement establishment, and operational and transactional costs (Table 1). Of this total cost, $4,965,000 of NRD funding would be applied primarily to land acquisition and remaining funds would be applied toward costs of conservation easement establishment. Additional funding sources include Great Outdoors Colorado (GOCO – already contributed $500,500 to the Andrick Preserve), Gates Family Foundation, CCC in-kind staffing support, Climax Mine and other partners engaged and supportive of the Lake County Open Space Initiative (LCOSI). The matching funds listed below in Table 1 are estimates with an intention for CCC to apply to the respective agencies and organizations for funding.

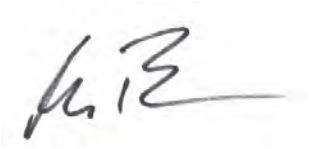
Table 1: Project costs**

NR Trustees proposal request	$5,277,500
Matching funds (secured and intended)	$620,000 ($60,000 in-kind)
Total project cost	$5,897,500

**CCC recognizes the other valuable proposals the NRD Trustees will receive for riparian/wetland restoration, mitigation and forest health work from partners and collaborators with whom CCC is currently engaged (ARWC, TU, CPW, other Lake County initiatives). If this proposal cannot be funded in full in order to accommodate these other partner proposals, CCC presents an alternative tiered request for NRD Trustees funding support (see budget for detail on different tiers).

We appreciate the opportunity to permanently conserve up to 323 acres of land and 3 miles of Arkansas River in Lake County—preserving habitat that supports wildlife populations, protects the health of the headwaters of the Arkansas River, and provides inclusive public access to for the community and visitors to enjoy the Arkansas River Basin's natural resources.

Project Offeror



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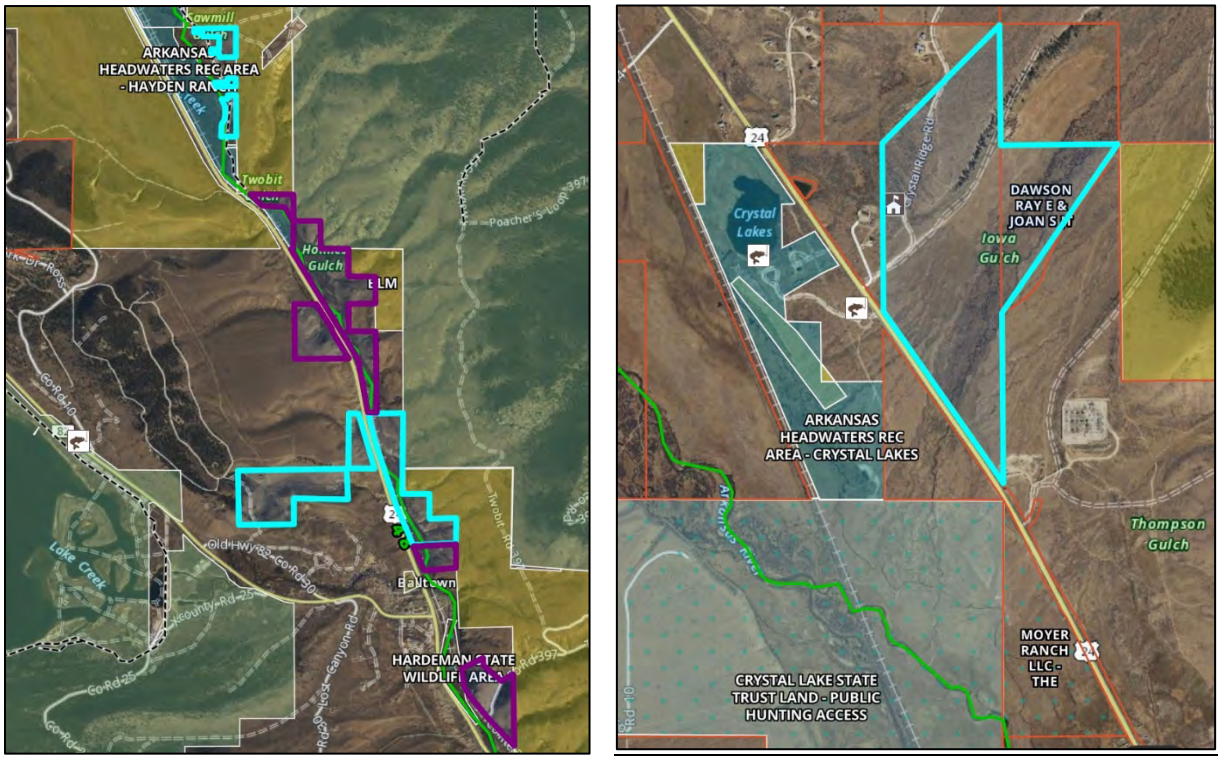
Adam Beh - Executive Director
Central Colorado Conservancy
128 East 1st Street
Salida, CO 81201
adam@centralcoloradoconservancy.org
719-539-7700 (office)
970-443-4884 (cell)

SCOPE OF WORK

Target Natural Resources

Land protection through the acquisitions and conservation easements proposed here will conserve high-priority locations in the Arkansas River headwaters, including upland and riparian wildlife habitats, in Lake County (Figures 1 and 2). CCC and partner work will protect 0.7 miles of stream and associated wetland habitat in the Iowa Gulch, and the proposed additions to Andrick Preserve will protect nearly three (3) miles of the Arkansas River and associated wetland habitat. These wetland complexes (approximately 45 acres) support brown trout and other fish species, while providing valuable habitat for many Tier I and II species identified in the Colorado Parks and Wildlife (CPW) Sate Wildlife Action Plan (CPW, 2015), including cinnamon teal, mallard, and bald eagle. This stretch of the River also contains microhabitats that accommodate greenback cutthroat trout, the state fish of Colorado and listed as threatened by the U.S. Fish and Wildlife Service. The proposed acquisition properties also include seven different land-cover types according to the Southwest Regional Gap Analysis Project classification scheme (Lowry et al., 2005), including montane-subalpine grassland, mixed conifer forest and woodland, alpine-montane wet meadow, sagebrush steppe, and Rocky Mountain cliff and canyon. These habitat types are exemplary of the habitat types in Lake County and those natural resources damaged through mining activity in the region. Conservation of these properties will benefit black bear, mountain lion, osprey, bald eagle, great blue heron, greater sage-grouse, bighorn sheep, elk, moose, and boreal toad (according to CPW Species Activity Map, n.d.). The properties will also protect significant stretches of the waterways that are crucial to ecosystem health in the region.



Figures 1 &2: Map on right shows current extent of Shawn Andrick Memorial Preserve (purple) with the location of the proposed additional parcels A-F (teal). Map on right shows Dawson Ranch (teal).

The connectivity of these properties to other protected lands grows the impact their protection can have on supporting natural resource health, and wildlife populations in particular, in the area. The two parcels to be included in the Andrick Preserve will support CCC's goal of owning and protecting a stretch of contiguous land along the Arkansas River. The proposed additional parcels and those already protected by CCC in the Andrick Preserve almost all border either Arkansas Headwaters Recreation Area (AHRA) State Park, BLM, or Forest Service land. The 180-acre parcel is adjacent to BLM land and separated only by Highway 24 from AHRA Crystal Lake State Park land, Crystal Lake State Trust Land, and privately owned land protected under perpetual conservation easement held by CCC. Acquiring these parcels will support the health of wildlife by providing additional contiguous land that is protected for habitat—particularly for access to crucial water resources and open space.

Connectivity of the properties to State and Federal land also improves the public benefit from protection of this land. The properties will be made available for inclusive, public use including passive enjoyment of the viewshed from the Top of the Rockies Scenic Byways and from existing public trails, and for more active uses of fishing, access to hiking trails on these and adjacent public lands, and access to hunting areas on adjacent public lands. The public access easement will be held, and the access managed, by Lake County Government. Partners including CCC, COL, and Lake County Government, will follow a collaborative management planning process to develop the management plan for the parcels, inviting participation and input from all stakeholders (e.g. LCOSI, adjacent public land representatives) and relevant experts (e.g. CPW wildlife biologists). This planning process will not be funded with NRDT funds.

Objectives

This proposed project will acquire 323 acres of land to permanently protect through conservation easement in order to provide important benefits to natural resources and increase opportunities for natural resource-based recreation in central and south Lake County.

Objective 1: Central Colorado Conservancy acquires seven parcels (323.03 acres) in fee title

Objective 2: Protect all eight parcels through conservation easement with COL

Objective 3: Expand a public access agreement with Lake County Government

Objective 4: Develop a management plan for the Andrick Preserve and Dawson Ranch parcels in collaboration with project partners

Table 2: Timeline for project objectives (where blue cells are objectives that will be wholly or partially funded by NRD Trustee funds)

2022				2023			
Spring	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**
Parcel acquisition, easement establishment, public access agreements and all associated due diligence							
				Management plan development			

Operational Plan

We are requesting $5,277,500 from the NRD Trustees and will provide at least $620,000 of matching funds from CCC and other partners (see Table 3).

Table 3. List of project contributors.

Contributor	Amount (cash or in-kind)	Status
Central Colorado Conservancy	$52,000 (in-kind); $8,000 (cash)	Secured
Great Outdoors Colorado	$500,000	Intend to apply
Climax Mine (Freeport McMoRan)	$30,000	Intend to apply
Gates Family Foundation	$30,000	Intend to apply

NRDT funds will be applied to property acquisition and conservation and public access easement establishment. Matching funds will be applied to conservation and public access easement establishment and public access management plan development. GOCO administers a trust fund of Colorado Lottery revenues to help preserve and enhance the state's natural resources. The Gates Family Foundation is a philanthropic foundation that provides grants to protect and steward land and water resources in Colorado. Additional matching funds will be raised by CCC through project-specific donations by supporting individuals and businesses.

This proposal matches the goal of the Restoration Plan/Environmental Assessment (RP/EA) for the Upper Arkansas River Watershed to protect habitat as an alternative to restoration. Funding from the Trustees will support the acquisition of properties with habitats that are equivalent to the injured resources and preserve their natural resource benefits and prevent development in perpetuity through conservation easements. Furthermore, the acquisition and protection of these parcels will address the RP/EA habitat protection Tier 1 and 2 descriptions through provisioning:

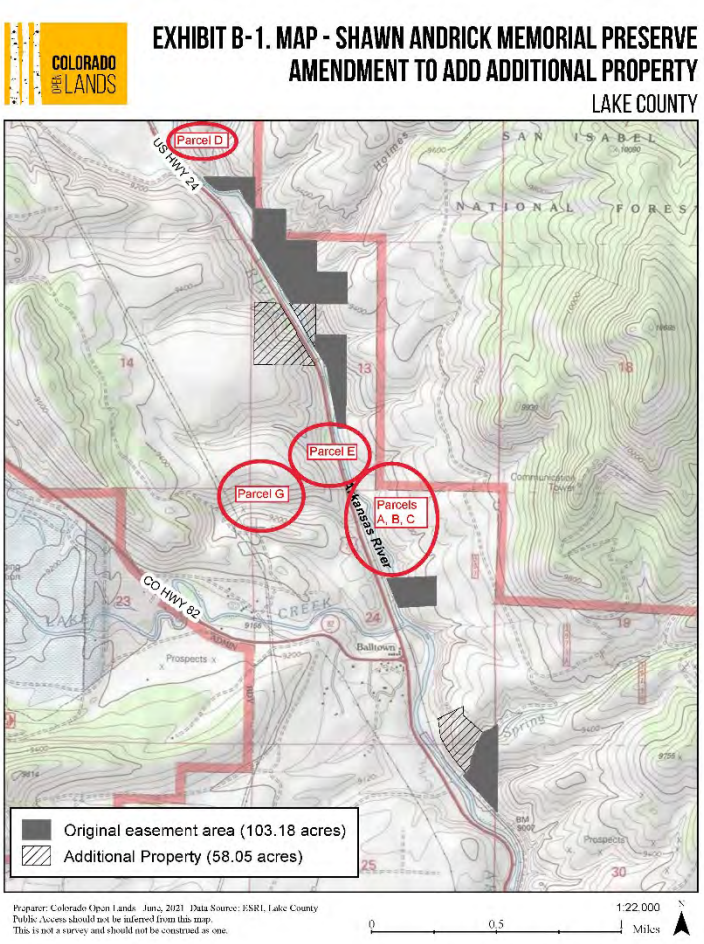
1) Connectivity to other protected land.
2) High-priority location for LCOSI.
3) Threat of development that would exist without protection.
4) Inclusion of Arkansas River frontage and the Iowa Gulch and their associated riparian habitats.
5) Connectivity with other land parcels that were protected with NRDT funding.
6) Planned management for public access.

This project proposal thoroughly addresses the description and objectives of habitat protection projects that provide alternatives to restoration. This project also complements other land protection work in Lake County by CCC, the State of Colorado, Lake County, and other land trust organizations operating in the Upper Arkansas River region (as evidenced by recent Andrick Preserve acquisitions and easements).

Following completion of project objectives, CCC and COL will conduct annual monitoring of the properties to ensure compliance with the conservation and access easements. This includes ensuring that the uses and potential impacts on the properties from public access are not causing harm to the natural resources on the property, and ameliorating any harm should it occur. Monitoring of the project sites will be conducted by the key collaborators on the project (CCC, COL, Lake County), and supported by other non-NRDT funds.

Parcels Proposed for Acquisition

Listed below are the property descriptions (legal descriptions can be provided) and short narratives for the parcels identified for acquisition through this project (landowner names in parentheses):



1. Parcels A, B, C (Malenky)

Three properties (40.62 ac.) of Arkansas riverfront and eastern uplands that extends current Andrick Preserve boundaries north (see map on left for all proposed Andrick additions). Valuable wetland/riparian sites and connectivity potential. **All three properties are currently on the open market.**

2. Parcel D (Bocksteigel)

Twenty acres (20 ac.) at the northernmost access point (from CR 5 at Kobe, and adjacent to AHRA and BLM property. This will provide the cleanest northern access to the Andrick Preserve. Additionally, CCC will purchase a water right (~43 acre feet) that may be valuable for Lake County water management investments. **This property is not on the market, but landowner has verbally committed to selling at an agreed upon price.**

3. Parcel E (Hennis)

Twenty-five acres (25 ac.) of valuable property in the canyon and along the river that includes acreage on both sides of the Arkansas River and Hwy 24. In addition to valuable riverfront, this property provides a clear link from the Malenky properties to the northern part of the current Andrick Preserve, allowing for a more continuous recreation and protected areas. Finally, this property provides the potential for linking up a number of others currently on the market. **This property is currently on the open market.**

Looking north to Hennis from Malenky property. Arkansas River and associated wetlands.

4. Parcel F (Dawson Ranch)
   In addition to providing wildlife habitat (especially winter range for ungulates), the 177-acre parcel is also currently used for cattle grazing and has a productive hay field. Agricultural natural resources in the region were also harmed by historical mining activity, and conserving the resources they provide is an additional public benefit that could be gained from protecting this property. There is potential to partner with Lake County in a novel capacity on agricultural education for Lake County residents, in addition to managing the public access for outdoor recreation and scenic enjoyment. **CCC has met with landowners and have verbally agreed to the documented sale price.**


Dawson Ranch with Sawatch Range and productive hay field.

5. Parcel G (Ferguson)

   While not on the river, this property provides a valuable linkage from the Andrick Preserve to grasslands and shelter for a variety of wildlife, and can expand Lake County recreation opportunities to include upland sites. Additionally, this area is key wintering habitat for deer and elk, and provides a corridor to the Andrick Preserve and other public lands to the east and west. **Landowner has verbally agreed to the sale price and proposed timeline (close in 2022).**



Ferguson property showing east-west corridor and mining tailings and relics.

BUDGET

Please see attached for complete budget showing total request ($5,277,500), as well as an alternative tiered request in case the full project cannot be funded. The majority of expenses are for the actual acquisitions themselves, along with associated transaction costs. Other costs are related to standard operating fees (i.e. staff time) for conducting land deals for the two land trusts on the project (CCC, COL).

Key Staff

Adam Beh, Executive Director, Central Colorado Conservancy. Adam will serve as the lead on the project, and will oversee all of the land deals and associated due diligence requirements. He will be responsible for all communication and collaboration with project partners. Adam will spend 10% of time on the project, with an additional 10% provided as in-kind support.

Ben Lenth, Community Conservation Program Manager, Colorado Open Lands. Ben will lead all of the conservation easement supervision and due diligence, and will work closely with Adam on review of relevant legal documents. He will also serve as one of the key contributors (with CC and Lake County) to the land management plans developed for all of the project sites.

Board of County Commissioners (BOCC), Lake County Government. Currently, Commissioner Sarah Mudge has been the primary collaborator serving on behalf of Lake County BOCC on recent Andrick Preserve investments. Commissioners Jeff Fiedler and Kayla Marcella are also key in helping CCC address local priorities for conservation and development in the landscape. BOCC and relevant Lake County personnel will manage the public access components of this project, as they are the ones charged with providing to their constituents and communities in the county.

Kyle Clifton, Conservation Projects Manager, Central Colorado Conservancy. Kyle will help manage land transaction due diligence activities, and support partnership development among all parties. Kyle will also contribute to the development of a land management plan for Andrick Preserve and Dawson Ranch. She will spend up to 10% of her time on the project.

PUBLIC COMMUNICATION STRATEGY

CCC plans to continue partner, collaborator and community engagement in this project in the same way we have been doing for the recent Andrick Preserve acquisitions. CCC has a Communications and Development Manager (Jes Walton) on staff, and she provides regular communication and outreach pieces to keep our constituents informed of progress on our work. We also have regular quarterly community meetings (Coffee with the Conservancy) that allows us to talk directly to our constituents on progress and to answer any questions the community may have on our work. Additionally, the entire Andrick Preserve project and associated CCC-COL-Lake County partnership has been built on a foundation of mutual respect, open communication, and compromise when relevant to meet partner objectives. CCC is open to continued collaboration and communication with Colorado Department for Public health and the Environment (CDPHE), as there are opportunities for shared communication stories across a number of collaborative CCC-CDPHE projects (Andrick Preserve, Sands Lake restoration, etc.).

RELATIONSHIP TO THE RANKING CRITERIA

This project meets the following objectives identified in the screening and ranking criteria as follows:

Screening Requirements:

1. Compliance with SPP requirements
   This proposal meets the requirements laid out in the RFP, including CCC being a 501(c)3 nonprofit, nationally accredited and state certified land trust. We have proven to have the financial and technical capacity to complete land acquisition projects. CCC has also proven success in bringing in matching funds to support project work, and plans to solicit this support from key partners in the conservation community (e.g. GOCO).
2. Compliance with laws
   CCC is a nationally-accredited, state-certified land trust with a proven track record of doing business above board and following all federal, state and local laws. CCC has no legal cases

or challenges, and we continue with our positive relationships with partners, collaborators and landowners throughout the region.

3. Public health and safety
   This land acquisition project poses no threat to the health and safety of the public.
4. Eligibility for NRDA funding
   There is incredible potential for linking valuable wetland and riparian sites to a larger functional system that supports wildlife habitat, in-stream flows, wetland/riparian ecology, public benefit and enjoyment and open spaces for the project area. Historical releases from the California Gulch site had caused great damage to this part of the Arkansas River, and this proposal will build on the great work done over the last several decades on restoration, protection and enhancement of the river. By protecting the lands adjacent to and connected to this section of the Arkansas River, NRDT will help realize their objectives for improving this area through acquisitions of natural areas.

Ranking Criteria

1. Public support
   These properties have been identified by LCOSI prioritization documents, Lake County Comprehensive Plan, CCC strategic plan and local Lake County media outlets (e.g. Leadville Herald Democrat).
2. Likelihood of success
   Objectives are clear and measurable in that CCC proposes to acquire seven (7) properties to transfer to a conservation easement, and then to give a public access easement to Lake County government. CCC has a proven track record of completing acquisition and easement projects in Lake, Chaffee, Park, Fremont, Gunnison and Saguache counties. CCC has already completed the NRDT-funded Andrick Preserve project that protects 166 acres and 2 miles of Arkansas River. CCC is celebrating its 20th year as an accredited land trust in October, 2021.
3. Technical feasibility
   The project is in line with a normal conservation workload for CCC. Additionally, all landowners and/or real estate brokers have been contacted and have provided verbal commitments to move forward. Since CCC has completed numerous land deals in the past, we follow a clean protocol for delivering on project work.
4. Multiple natural resource benefits
   This project proposal benefits riparian and wetland health and function, wildlife habitat, soil health, and helps to manage human impacts through proposed public access and recreation.
5. Time to provide benefits
   Benefits will accrue immediately upon completion as perpetual conservation easements that are collaboratively managed (CCC and funders require a collaborative management plan to be developed within 12 months of closing) can support future restoration and enhancement projects that will provide ecosystem benefits continuously.
6. Duration of benefits
   Long-term benefits of wetland/riparian ecosystem health and function will be realized in perpetuity (with good adaptive management practices). Additional social and community benefits will also continue in perpetuity due to the requirements for locally-led recreation management by Lake County.
7. Non NRD-match

Current matching funds ~12% can be increased at NRDT request. There are a number of funding sources that can support such an exciting project, and CCC can commit more staff time to pursuing these opportunities in 2021-2022.

8. Protection of implemented project
   CCC will serve as the fee title owner and will convey the conservation easements (CE) on all properties to COL. The public access easements (AE) will be conveyed to Lake County. All of these deeds will be held in perpetuity. Draft CEs and AEs will be provided to NRDT reviewers before closing.
9. Project alignment with regional planning
   This proposal aligns with existing land and resource management plans, as laid out in the narrative above.
10. Public access
    Public access will be allowed and supported on all 323 acres proposed for protection.

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DR 0160 (02/16/11)
COLORADO DEPARTMENT OF REVENUE
DENVER CO 80261-0013

CERTIFICATE OF EXEMPTION FOR STATE SALES/USE TAX ONLY

THIS LICENSE IS NOT TRANSFERABLE

USE ACCOUNT NUMBER for all references	LIABILITY INFORMATION	ISSUE DATE
98068002	N 062101	Apr 27 2017

CENTRAL COLORADO CONSERVANCY
ATTN: MACKIE ANDREW J EXEC
PO BOX 942
SALIDA CO 81201-0942

Executive Director
Department of Revenue

▲ DETACH HERE ▲

GENERAL INFORMATION

Revenue ONLINE

The following services are available at *www.Colorado.gov/RevenueOnline* under **Business**.

Sales:

- Verify a Sales Tax License
- View Local Sales Tax Rates
- View Business Location Rates
- Find Local Taxes by Address
- View Sales Tax Rate Charts

Try Revenue Online today!

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Attend our free sales tax classes. Live classes, online CPE and Webinars are available. To sign up, visit *www.TaxSeminars.state.co.us*

September 2, 2021

Susan Newton & NRD Trustees
Upper Arkansas River Watershed NRDA Project
Colorado Department of Public Health and Environment
Hazardous Materials and Waste Management Division
Susan.newton@state.co.us

Dear Ms. Newton and the NRD Trustees,

Colorado Open Lands wishes to offer its enthusiastic support to Central Colorado Conservancy's proposal to the NRD Trustees for funding to purchase, protect, and provide access to three parcels of land comprising over 300 acres in southern Lake County. This effort will build on the existing partnership between Central Colorado Conservancy and Lake County, in which numerous lots on the Arkansas River were purchased by the Conservancy, protected by a conservation easement by Colorado Open Lands, and soon to be opened to the public with an access easement held by Lake County.

The benefits of this project are numerous and match local priorities. The wetlands and Arkansas River frontage included in these parcels are the most important habitat types in this landscape, with a rich diversity of vegetation, a water source for wildlife, and the provision of ecological services including filtering water and attenuating floods. These properties are located in areas rich in wildlife and provide connectivity between public and private protected properties, creating a landscape-scale conservation effort. By providing public access to these properties, the Conservancy and Lake County are building public open space offerings to citizens and visitors to Lake County, which is particularly important as the county's economy and demographics continue to change. Finally, the Dawson Ranch, as an agricultural property, provides an opportunity to continue agricultural land uses in creative ways.

Central Colorado Conservancy's success in acquiring the first two phases of this project, the "Andrick Preserve", and Lake County's willingness to provide and manage public access, gives us great confidence in this proposal, and COL would be proud to again partner on this next set of properties. This type of project seems to be an ideal outcome following the California Gulch superfund mitigation efforts, one that will leave a permanent, positive legacy for the community in Lake County and for all Coloradoans.

Please contact me if I can provide any additional information.

Sincerely,

Ben Lenth
blenth@coloradoopenlands.org

Lake County Government
Board of County Commissioners

505 Harrison Avenue • PO Box 964 • Leadville, Colorado 80461 • (719) 293-0177

Date: September 3, 2021

Susan Newton & NRD Trustees
Upper Arkansas River Watershed NRDA Project
Colorado Department of Public Health and Environment
Hazardous Materials and Waste Management Division
Susan.newton@state.co.us

Dear Ms. Newton and the NRD Trustees,

I am writing on behalf of the Lake County Board of County Commissioners in support of the Central Colorado Conservancy (CCC) proposal for further acquisition and protection of lands in Lake County. As you know, Lake County and CCC share priorities in the current partnership to manage Lake County parcels already acquired with NRD Trustee support. In expanding the reach of conservation in Lake County under the current climate of development pressure, our community will maintain the natural resources and access that contribute to our quality of life as well as our economy.

Furthermore, any potential water right acquisition in concert with land acquisition could support developing priorities of the Lake County Water Enterprise and Augmentation Plan regarding agriculture, recreation, and the Arkansas Headwaters natural environment.

Sincerely,

Sarah Mudge
Lake County Board of County Commissioners, Chair

CENTRAL COLORADO CONSERVANCY

Protecting the Lands and Waters that Sustain Us

Project Budget - Arkansas River Acquisitions, Lake County, CO

September 3, 2021

	Total Request to Trustees	Tier 1			Tier 2	Tier 3
ITEM	**Total**	Parcels A-C (40.62 ac)	Parcel D (20 ac.)	Parcel E (25.41 ac)	Parcel F - Dawson Ranch (177 ac.)	Parcel G (60 ac.)
Land Acquisition	**$4,965,000**	$1,750,000	$700,000	$175,000	$1,700,000	$640,000
Appraisals	**$80,000**	$20,000	$15,000	$15,000	$15,000	$15,000
Baseline Documentation	**$10,000**	$2,000	$2,000	$2,000	$2,000	$2,000
Closing Costs	**$10,000**	$2,000	$2,000	$2,000	$2,000	$2,000
Environmental Assessment	**$10,000**	$2,000	$2,000	$2,000	$2,000	$2,000
Legal Fees	**$50,000**	$10,000	$10,000	$10,000	$10,000	$10,000
Mapping/Survey	**$12,500**	$2,500	$2,500	$2,500	$2,500	$2,500
Stewardship Fund	**$75,000**	$15,000	$15,000	$15,000	$15,000	$15,000
CCC project fee	**$52,500**	$22,500	$7,500	$7,500	$7,500	$7,500
COL transaction costs	**$12,500**	$2,500	$2,500	$2,500	$2,500	$2,500
Funding request subtotals	**$5,277,500**	**$1,828,500**	**$758,500**	**$233,500**	**$1,758,500**	**$698,500**
In-kind items						
Donated staff time	**$52,500**	$22,500	$7,500	$7,500	$7,500	$7,500
In-kind Subtotals	**$52,500**	**$22,500**	**$7,500**	**$7,500**	**$7,500**	**$7,500**
Project Totals	**$5,330,000**	$1,851,000	$766,000	$241,000	$1,766,000	$706,000

Total Proposal Request	**$5,277,500**								
Tier 1 only	**$2,820,500**	Protect 86.03 acres and Ark River frontage; secure easier public access from north; connect 80% of And							
Tier 2 only	**$1,758,500**	Protect 177 acres of working lands, grassland, sage, ephemeral stream, historical dairy farm, Lake Coun							
Tier 3 (connects w/Tier 1)	**$698,500**	Extends Andrick Preserve to west, including 60 acres of grassland, sage-stepp, ephemeral stream, wildli							

rick properties in continuity		
ty agricultural heritage		
fe habitat		

Executive Summary

PROPOSAL NAME: Mount Shavano State Fishery Low-Head Dam Removal

PROJECT DESCRIPTION:
Colorado Parks and Wildlife (CPW) maintains a low head dam on the Arkansas River near the Mt. Shavano State Fish Hatchery that was historically used to divert water for the hatchery. The diversion has not been used since 2000 after the Arkansas River and subsequently the hatchery became positive for whirling disease. The Mt. Shavano Hatchery relies on a spring water collection system and is currently not using the diversion due to the high costs and biosecurity risks of treating whirling disease positive surface water. CPW does not intend to relinquish this diversion point and plans to execute a project that mitigates existing health and safety risks without precluding the ability to divert water in the future.

However, the structure and the existing boat chute are barriers to upstream fish migration. The Arkansas River was designated a Gold Medal trout fishery by CPW in 2016 and is currently the longest stretch of Gold Medal water in the state. The river is home to brown trout, rainbow trout, and native white suckers. All river fishes have an innate instinct to migrate long distances upstream to spawn. Diversions limit the amount of genetic diversity by essentially dividing the population into two segments. The ability of fish to move freely in a river also helps to prevent overpopulation by balancing the amount of habitat and forage with the number of fish it can support.

The structure has always been a safety concern for whitewater recreation and has been involved in several fatalities and countless near-drownings. This section of the river is slower, meandering and a perfect place for novice boaters to learn. These boaters include recreational fly fishers, stand-up paddleboarders, inner-tubers, and families on rafts.

Because of the impacts of this diversion, CPW is proposing to restore the river to its natural state by completely removing the diversion and boat chute and install several natural-looking cross-vane and/or constructed rock riffle structures that will allow for fish passage and safe boat passage. The removal of the existing diversion structure will allow for free passage of fish 85 miles upstream to the headwaters of the East Fork of the Arkansas River. These rock structures will also improve upon the fish habitat by creating deeper overwintering pools and reducing shear stress on the banks which causes erosion.

This project will have the multiple benefits of restoring the river to its natural state, increasing public access, improving fish populations, restoring aquatic habitat, and enhancing angling opportunities.

PROJECT OFFEROR: Colorado Parks and Wildlife

POINT OF CONTACT:

Travis Black
Deputy Regional Manager
4255 Sinton Road
Colorado Springs, CO 80907
719-227-5208
travis.black@state.co.us

TOTAL PROJECT COST: $1,662,600

AMT OF NRD FUNDING REQUESTED: $831,300

MATCHING FUND SOURCES:

SOURCE	TYPE	VALUE	STATUS
CPW	Various Cash Funds	$831,300	IN PROGRESS
CWCB	GRANT	TBD	IN DEVELOPMENT FOR UPCOMING GRANT(S)
RESTORE	GRANT	TBD	IN DEVELOPMENT FOR UPCOMING GRANT(S)
PARTNERS	GRANTS/DONATIONS	TBD	IN DEVELOPMENT, DEPENDS ON GRANT APPLICATION DUE DATES

Travis Black Digitally signed by Travis Black Date: 2021.09.02 16:21:28 -06'00'

SIGNATURE OF AUTHORIZED OFFEROR

9-2-2021

DATE

Scope of Work

TARGET NATURAL RESOURCES:

The target natural resources that will be affected is the mainstem of the Arkansas River. The removal of the low-head dam will allow for fish passage and open up 85 miles of river to fish that are stranded below the structure. Although the actual structure is located just outside of Salida, by opening up the river to fish passage this will have a direct effect on the Arkansas River adjacent to the California Superfund Site. The removal of the structure will also allow for safe recreational boat passage.

DESCRIPTION OF THE AREA ADDRESSED BY THE PROPOSAL:

The directly impacted area will include 0.7 miles of the Arkansas River above and below the low-head dam. The project may include the installation of constructed riffles and/or cross vane structures upstream and downstream of the dam. This will adjust the grade of the river back to its original condition. The constructed riffles and cross vane structures will improve the habitat for both fish and invertebrates and provide additional winter pool habitat for the fish. Through the stakeholder process, CPW will work with its designated engineering consultant and stakeholders to determine the best rock structures to construct: cross vanes, constructed riffles, or a combination of both. Indirectly, the removal of the dam will provide an additional 85 miles of habitat for fish stranded below the structure.

The mining activity had a direct effect on the fishery and the invertebrates in the mainstem of the Arkansas River. The removal of the dam will in turn directly benefit the fishery by allowing free movement past the structure. The constructed riffles will improve invertebrate habitat by creating critical interstitial spaces between rocks and improving dissolved oxygen conditions.

Figure 1. Vicinity Map

Figure 2. AREA MAP. The red line along the shoreline delineates the length of river where constructed riffles and/or cross vanes will be constructed.

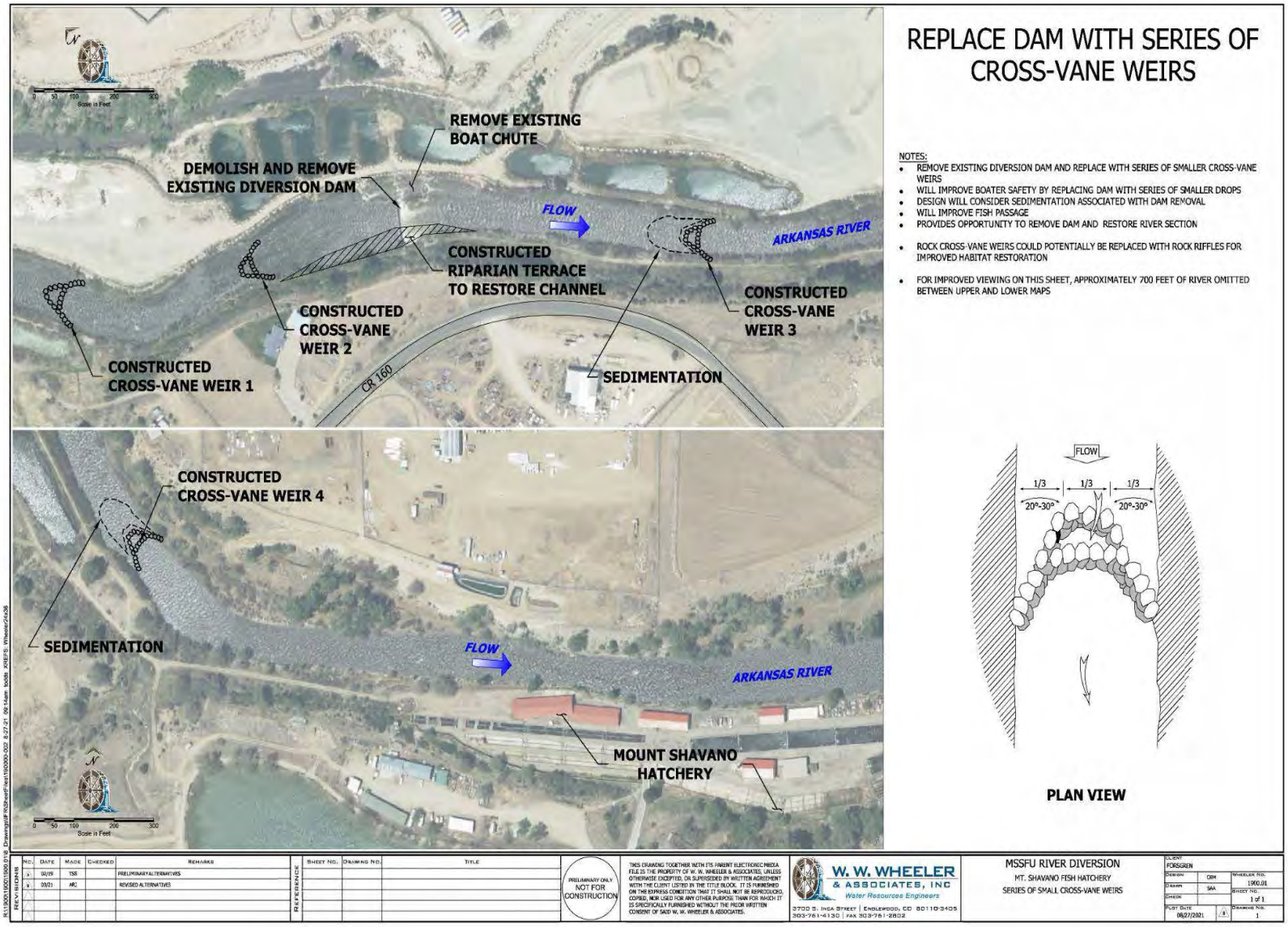


Figure 3. Conceptual Design showing location of low head dam and cross-vanes.

OBJECTIVES:

CPW has completed the conceptual design (Figure 3) and cost estimates (see Table 2) for the project. The first objective will be to complete the 100% construction design plan sets and bid documents during 2022. Project advertising and bids will take place during the spring of 2023. Contractor selection will occur during the summer of 2023 and the majority of construction taking place from August - October 2023 (some revegetation work may need to occur the following spring).

The overall objectives of the project are to improve fish passage by removing the existing barrier, improve boat passage and significantly decrease the existing safety issues by removing the hazardous low-head dam, and improve overall recreational opportunities.

OPERATIONAL PLAN:

Project Construction Implementation:

The anticipated construction sequence is presented below; however, the construction sequence will be further evaluated as the final design deliverables are developed. The major construction components of the project will be obtaining the permits, water control, and sedimentation control. The project will likely be completed in three phases. First, the downstream cross vane will be constructed downstream of the existing diversion dam. The downstream cross vane will be constructed above the existing channel grade to provide sediment storage upstream of the structure. Following construction of the downstream cross vane, diversion dam/boat chute removal will begin. We anticipate removal will be completed in segments to reduce the volume of sediment released at one time. The upstream cross vanes will likely be constructed following or concurrent with the removal of the low head dam. The project will be constructed during low flow periods in the river to improve constructability and reduce sediment transport. Temporary construction diversions may be implemented at each cross vane location to facilitate water management and boulder placement. Following construction, we anticipate the project will have a revegetation component to help reclaim the disturbed banks and existing boat chute location.

Describe in detail whom the Offeror will collaborate to accomplish the scope of work. Provide letters of support. For conceptual and preliminary design, CPW has Forsgren Associates, Inc. and W.W. Wheeler & Associates, Inc. under contract to provide consulting design services.

Support for this project has been received by Chaffee County Board of Commissioners, Trout Unlimited, Butala Sand and Gravel (land owner adjacent to the structure), Salida Fire Department, Envision Chaffee County, Greater Arkansas Nature Association, Arkansas River Conservation Cooperative, Arkansas River Outfitters Association and Colorado Parks and Wildlife. The support letters for this project list a variety of reasons including, safety, fish passage, environmental concerns and improved recreational opportunities.

Describe the type and name(s) of donors and what they are contributing in equivalent dollar amount of match if in-kind or actual dollar amount if cash.

Many of the potential partners indicated interest in providing funding, which is further detailed in subsequent sections.

Describe to what degree the proposal matches the goals of the RP/EA.

The main goal of the Restoration Plan and Environmental Assessment (RP/EA) "is to compensate the public through environmental restoration for injuries to natural resources that have been caused by releases of hazardous substances into the environment." This proposal seeks to fulfill that goal by remediating a human-caused environmental and recreational impact on the Arkansas River. The Mt. Shavano low head dam impacts the environment by preventing the upstream migration of fish and a recreational impact by creating a safety hazard for recreational and commercial whitewater recreationists. The mining activities impacted the rainbow and brown trout fishery of the Arkansas River mainstem and this project will help to improve those populations by allowing fish passage.

Describe how the proposal will be coordinated with complementary, similar existing, or other proposed projects in the area, if any.

The Granite Diversion Structure was a $9.1 million dollar cooperative project with Colorado Springs Utilities, Aurora Water, Colorado Parks and Wildlife and the Colorado Water Conservation Board. This project removed a dam structure that was not passable by fish or boat. The new structure provides water entities with improved delivery to the front range, fish passage and boat passage. The scope of work on this project was very large with many interested parties. It has been reviewed and deemed a success by all and the public.

Another similar project to this request was work completed near Buena Vista on the Helena Diversion Structure. This antiquated structure was problematic for the owners of the water right, fish passage and recreational boating. Unfortunately, this structure was the site of a boating fatality prior to reconstruction. It was reconstructed to include a better headgate, fish passage and boat chute.

CPW is not aware of other projects along the upper Arkansas River. However, CPW hopes that this project will be the impetus for future projects around the state to address safety issues and fish passage on various low-head dam structures, both private and publicly owned. With well thought out engineering, planning and construction, we hope to set a good example of what can be accomplished.

Describe the operation, maintenance and monitoring (OMM) requirements and the entity(ies) accepting those responsibilities for the duration of the project and a minimum of 10 years thereafter, if applicable. Describe the plans or methods and schedule for how

the project will be monitored to evaluate whether it is successful in achieving the restoration objectives.

CPW will be responsible for all operation, maintenance and monitoring requirements for the duration of the project and thereafter. Plans, methods and schedule are detailed below in the next section.

Describe the 6 and 12 month warranty inspections which are required following substantial completion of the proposed project. Detail the funding source, cost, and entity responsible for conducting the long- term operation, maintenance and monitoring. This shall include an Annual Report documenting the OMM.

CPW will accept ultimate responsibility for overseeing the construction and long-term maintenance and monitoring associated with the proposed improvements. The construction of the project and any significant maintenance, which is planned and budgeted to occur within the first five years of operation, will be performed by a contractor under the direction of CPW, including the 6 and 12 month warranty inspections. Monitoring and annual reporting of the project goals and effectiveness, and potentially minor maintenance activities, will be performed by CPW for the initial ten years, and potentially in perpetuity.

From a fisheries perspective, CPW will monitor fish passage by marking fish below the area and see if these fish are captured upstream. CPW also monitors river recreational usage, rafting and kayaking permits, and various health and safety incidents in and around the Arkansas Headwaters Recreation Area. If the improvements do not meet the recreational safety goals immediately after construction, or there are changes or alterations to the river morphology that impact the goals after construction, CPW expects there will be reports of incidents that will inform appropriate corrective action.

The constructed cross vane structures and/or riffles will also be inspected periodically, annually, at a minimum, and after high flow events to determine if repair and/or adjustments are required to maintain project objectives associated with boater safety and fish passage. If repairs are needed, sufficient equipment will be utilized to move/readjust boulders to re-establish the cross vane/riffles geometry and functionality.

Permits/Approvals/Certifications: Describe all permits, licenses, approvals, professional engineers stamps of engineering design and as-built documents that will be required to complete the project and describe current status/progress towards obtaining these permits/approvals.

All necessary permits, which may include:
ACOE 404 Permit
Senate Bill 40 - Senate Bill 40 (33-5-101-107, CRS 1973 as amended) requires any agency of the state to obtain wildlife certification from the Colorado Parks and Wildlife when the agency plans construction in "...any stream or its bank or tributaries...". The project will

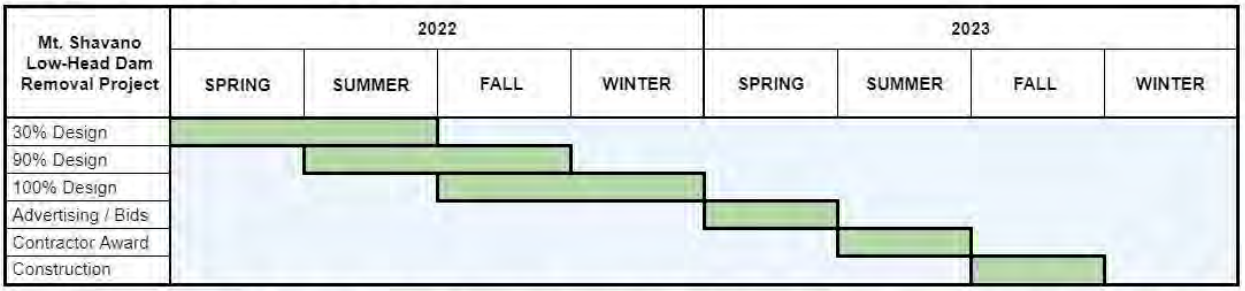
comply with SB 40, requiring CPW experts to review the project for impacts and propose mitigation, and prepare a Wildlife Certification Report prior to any construction.

Floodplain Development Permit

All construction and as-built drawings/documents shall be stamped by a professional engineer registered in the State of Colorado (PE stamp), as required.
Current Status: CPW will apply for the 404, SB40, and Floodplain Development permits after the 30% level design documents are completed in the fall of 2021.

CPW will coordinate with the Division of Water Resources to evaluate impacts associated with potential increases to evaporative surface area or significant attenuation of flows.

Project Schedule: Provide a timeline which identifies project phases, milestones, midpoint and pre-final inspections.



Monthly Invoice and Status Report: Describe which activities in the operational plan will be tracked, how they will be counted, and how they will be reported in the monthly invoice.

Invoices for Engineering Consulting services are typically billed monthly and once paid, will show up in our internal project tracking database. We will also enter general project status updates on at least a monthly basis. CPW aquatic biologists will monitor the fish passage aspect of this project.

Project Documentation and Deliverables: Provide a list of documentation and deliverables that will be supplied for the proposed project and throughout the duration of the project including the OMM phase.

During the design phases of the project, CPW anticipates the following documents and deliverables will be supplied: Drawings, technical specifications, any modeling analyses performed and associated files, design report, correspondence documenting Corps 404, other permit approvals, and final project cost estimates. A document outlining the recommended inspection activities, recommended maintenance activities, and frequency of inspection and maintenance activities will be provided. Construction bidding results and evidence of project award can also be provided, if necessary. Annual status reports will be prepared documenting the operation with respect to boater safety, recreational use, fish passage and other project goals.

Budget Spreadsheet

The complete itemized budget is provided in the appendices. The table below summarizes the costs associated with various expenditure categories.

The total capital cost of the project is estimated to be $1,662,600 and includes over $1.26 million in eligible construction related expenses, however, CPW is only requesting an NRD grant for $831,300. There are approximately $399,700 in estimated project expenses associated with contractor performed engineering, design, permitting, and administration that will be used as part of the matching funds.

Additionally, CPW anticipates providing approximately $18,000 worth of administration services; CPW is not seeking to claim these services as in-kind matching funds. CPW will also be providing approximately $32,000 of operation and maintenance support directly, as well as an additional $57,000 in contractor supplied O&M expenses, neither of which are eligible for grant funding or in-kind matching contributions, but do reflect an additional value of nearly $107,000 that CPW and its partners will bring to the project.

Mount Shavano State Fishery Low-Head Dam Removal Project Summary Budget Table	
Capital Construction - Total	$1,662,600
Capital Construction - Contractor Design, Permitting, Administrative	$399,700
Capital Construction - Total Eligible for NRD Use	$1,262,900
Amount of Funding Requested from NRD	$831,300
Amount Provided as Matching Funds	$831,300
Unclaimed Administrative Contributions (CPW & Partners)	$49,700
Project O&M Costs - Total	$89,000
Unclaimed/Ineligible Project Support - Total	$106,700
Project Total Estimated Lifecycle Cost	$1,769,300

CPW has a core team that includes project managers, biologists, engineers, public communication specialists, accountants, and several other key support staff. CPW will also be working in partnership with many other public and private entities. The project team will include a consulting firm to lead the final design effort.

CPW is prepared to fund the matching contribution of $831,300 in full using a variety of sources available to the agency, including enterprise-based cash funds for wildlife and state parks, or grants from Great Outdoors Colorado, lottery revenues, or other state-based funding programs. However, CPW will be soliciting financial support from its various project partners and hopes to use any available contributions as part of the matching fund package. In addition to this NRD grant, other grant opportunities will also be pursued to develop a total project funding package that may include CWCB grant funds, RESTORE grant funds, CPW cash, partner cash, and other external grants and donations.

The project budget does not include provisions for land acquisition as that is not expected to be a required element of the project. If unforeseen conditions arise and land acquisition is required, it will be funded through a separate and independent mechanism.

Public Communication Strategy

Describe the process that will be used to demonstrate inclusiveness, communication, and opportunities for public input over the course of the project.

To gather public input on the proposed dam removal, CPW will host public meetings in Salida and invite anyone interested to view storyboards with photos and maps explaining the project.

We will use an "open house" style of meeting with CPW experts on hand to discuss various aspects of the removal and the restoration of the river and the protection of the aquatic habitat as well as the potential impact to public and commercial uses of the river.

This will also give CPW a chance to gather feedback from the public to inform our decisions about the dam removal and the restoration.

CPW will use our formidable social media platforms -- 282,000 followers on Facebook, 173,000 on Instagram and 38,000 on Twitter -- as well as traditional news releases and news letters to which we have thousands of subscribers and electronic outreach on television and radio outlets to raise awareness and educate the public of the risks to the public from low-head dam structures and the impact on aquatic life caused by them.

We will create and schedule social media posts using photos and videos to illustrate the dangers to people and fish with messages crafted around the following facts:

- Low-head dams pose a serious danger to vessel operators including pleasure rafting and fishing boats. Surface currents below low-head dams can suck vessels toward the face of the dam. Currents above low-head dams can sweep vessels over the dam. The recirculating currents and turbulent waters below these dams can swamp vessels and drown boaters.

- Removing this low-head dam is especially important because of its location on the Arkansas River, one of the nation's most popular locations for whitewater rafting and kayaking and perhaps the most commercially rafted river in the U.S. averaging 225,000 rafting customers each year.

- Historically, low-head dams were built to divert water from streams to support industrial, municipal, and agricultural water usage and engineered to prevent erosion and degradation of stream channels. However, this dam interferes with recreational boating, rafting and tubing as well as interrupting aquatic habitat and blocking upstream movement of fish for spawning.

- The threat to the public from this dam is only going to grow due to Colorado's exploding popularity as a place to live and a recreation destination. It is a prime example of DNR's ongoing efforts to create a low-head dam inventory to better identify the hazards, educate the recreating public and reduce fatalities and injuries at and around these structures.

- We will feature engineers talking about the hydraulics of this dam and aquatic biologists talking about the threat to fish blocked from historic migration patterns by low-head dams and how habitat would improve by removing the structures.

Finally, we will encourage the public to learn more about boating safety principles on Colorado Parks and Wildlife's Rafting, Kayaking, and Canoeing page.

Relationship to the Ranking Criteria

Provide a summary of how this project meets each of the objectives indicated by the Screening and Ranking Criteria contained in Section VI.B.1 and VI.B.2 below.

1. Screening Criteria
The following Screening Criteria will be used to ensure project proposals are eligible to move forward in the process. Project proposals passing 'Screening Criteria' will be subject to further review using the criteria set forth in the Ranking Criteria. No additional consideration will be given to proposals the Trustee Council determines are not qualified (or do not pass Screening Criteria)

a. Compliance with the SPP requirements: The project proposal must comply with the requirements of this solicitation.

This application has been developed in close conformance to the requirements described in the SPP and is intended to demonstrate the project complies with all eligibility and application requirements. If additional information is needed to clarify or confirm aspects of

the project or application, CPW will be happy to furnish any requested information. CPW is a state governmental agency with the financial and technical capability to manage this project with the responsibility of prime contractor and facilitate an effective and collaborative effort with multiple project partners. The project lies within the geographical region required for project eligibility and closely aligns with the goals of the Restoration Plan and Environmental Assessment for the Upper Arkansas River Watershed.

b. Compliance with laws: The project must comply with all applicable federal, state, local laws, rules, regulations and permits.

CPW will work closely with all applicable federal, state, and local agencies to secure appropriate permits and approvals prior to initiation of construction activities. CPW will comply with the terms and conditions of all permits/approvals throughout the life of the project.

c. Public health and safety: The project cannot pose a threat to the health and safety of the public.

This project is intended to mitigate an existing health and safety threat associated with a low-head dam in a heavy-use public recreational area. CPW screened multiple alternatives for reducing the health and safety threat. Several alternative mitigation/partial dam removal options were evaluated and determined to provide less benefit and less risk reduction. Complete removal of the low head dam is more costly but provides the greatest reduction in threat to the health and safety of the public (and also the maximum ecological benefit).

d. Eligibility for NRD Funding: The Trustee Council will focus on the connection or "nexus" between the natural resources that the proposed project(s) would restore, replace, or acquire the equivalent of the natural resources and/or services injured by the historical releases from the Site.

There is a significant connection to the natural resource goals associated with CPW's proposed project and the resources and services that were injured by the historic mining activities in the Upper Arkansas Watershed. Although there were certainly impacts in and around the mining activities, rainbow and brown trout populations were severely impacted for many miles downstream. Those activities had significant impacts on the hydrology and aquatic and riparian habitat for several miles, impacting the fishery and recreational use. Many local communities, including Buena Vista, Poncha Springs, and Salida, benefit from the fishing and recreational industries supported by a healthy river. A number of historic projects have been completed to restore the river and benefit these communities, however, there are still opportunities to continue improving along the Upper Arkansas River corridor. The project described in this application will restore and improve one of the sections that is most impactful to the local communities injured by the historic mining activities. If CPW is unable to secure funding to execute a complete dam removal project, a less costly but less beneficial project may be implemented and the local communities would not enjoy the full benefit from

a robust restoration project that simultaneously maximizes benefits for recreational use and the fishery.

2. Ranking Criteria
The Trustee Council has developed the following Ranking Criteria to evaluate and rank proposed projects. These criteria reflect the Trustee Council's requirements and priorities for restoration.

a. Public Support: The degree of public support for the proposal.

There is a high degree of public support for the proposed project. The existing low head dam creates a recreational hazard and a barrier to fish migration. This project will have the multiple benefits of restoring the river to its natural state, improving recreational water use and safety, improved fish populations, fish habitat, and improved angling opportunities. This segment of the Arkansas river is heavily used by kayakers, rafters, anglers, and many others that enjoy recreation and wildlife supported by a healthy river corridor. This project will balance and maximize the uses and benefits to all.

b. Likelihood of Success: The level of expected return of natural resources and natural resource services. Proposed project restoration goals should be clear and measurable. The proposal should describe the ability to monitor and evaluate the success of the project; the ability to correct any problems that arise during the course of the proposed project alternative; and the capability of individuals or organizations expected to implement the alternative.

This project has a high likelihood of success. The existing low head dam creates an artificial barrier and recreational hazard. By restoring this section of the river to a more natural condition, the goals of the project will be readily achieved. The project will be designed for the full range of expected flows and will provide a stable long term solution. The project restoration goals will be monitored and measured as presented in previous sections.

c. Technical Feasibility: The project must be technically feasible and procedurally sound.

The project will be designed considering the full range of natural and operational conditions that are likely to occur. The project seeks to remove an artificial barrier and to restore natural processes within the constraints of the project boundaries. The geomorphology of the river and the proposed structures will be evaluated to ensure a feasible design that may be physically constructed and will comply with the terms and conditions of all applicable permits and authorizations.

d. Multiple Natural Resource Benefits: The extent to which a proposed project benefits more than one natural resource or natural resource service.

The proposed project will provide simultaneous benefits to the in-stream and riparian habitat as well as improving the recreational beneficial use of surface water. Improvements to water quality may be an incidental benefit. The project area lies within the Arkansas Headwaters Recreation Area, which provides nationally renowned whitewater rafting and kayaking experiences as well as a world-class fishery both above and below the Mount Shavano low-head dam. This project will restore the aquatic habitat, and improve the connection of aquatic, riparian, and recreational resources between two existing segments, thus creating a vast stretch where multiple natural water resource benefits can be realized.

e. Time to Provide Benefits: The time it takes for benefits to be provided to the target ecosystem or public.

The benefits of this project will be realized as soon as the construction is complete. Fish passage and boater safety will be established as soon as the low-head dam is removed and the cross vanes/riffles are installed. The improvements to fish passage and migration are also expected to manifest in improved sustainability and resilience of fish and aquatic life populations along the entire connected river corridor.

f. Duration of Benefits: The expected sustainability and duration of benefits from the proposed project. Long-term benefits are the objective. Proposed projects are expected to provide long-term sustainable benefits.

This project will reestablish the natural functions of the river and will be sustained well into the future, if not forever.

g. Non-NRDs Match: A minimum of 50% match to NRD funds is required. Match may consist of cash from non-NRD sources or in-kind services; some degree of cash match is preferable. Points will be awarded based on percentage of cash match.

CPW leadership is committed to this project and is prepared to fund the 50% match from wildlife cash, or other available agency funding buckets, but may be contingent on statewide priorities. However, CPW intends to partner with other groups and organizations to raise funds in hopes of building a bigger partnership and reducing the strain on CPW funds.

h. Protection of Implemented Project: Consider the opportunities to protect the implemented project and resulting benefits over time. Project proposals involving fee title acquisition of property for open space should identify the fee title owner and include a commitment to grant a conservation easement or other mechanism allowing the Trustees to ensure that the acquisition provides continued natural resource benefits. If a conservation easement is proposed, the project proponent must identify the easement holder and provide a draft of the conservation easement prior to closing on the easement. Project proposals that afford long-term protection will be given Preference.

Property acquisition is not necessary to protect the improvements associated with this project. The majority of work lies in the river channel and is intended to remove an existing man-made structure that requires maintenance and access and replacing it with a natural structure that requires little to no maintenance. It should also be noted there is already public access to this site and the proposed project will protect the health and safety of the public as it continues to enjoy and benefit from the resource. Any necessary construction and maintenance easements will be acquired.

i. Project Alignment with Regional Planning: Proposals aligned with existing land and resource management plans or that can be incorporated into a holistic land and natural resource management Plan.

Several resource management plans exist in the Arkansas River Basin including the BLM Browns Canyon Resource Management Plan and the Eastern Colorado Resource Management Plan. These plans align well with this project as they have goals to maintain, restore, and/or improve habitat, fish and wildlife populations, ecosystem health, ecological processes and overall biodiversity.

The 2019 Arkansas Headwaters Recreation Area Final Management Plan and Environmental Assessment directs staff to look at wildlife management and fisheries management. In section 1.9 in reference to wildlife management we are to "provide for continued wildlife habitat protection and improvement projects. Mitigate conflicts between recreation users and wildlife species to ensure species' continued existence." The plan also points out that any conflicts that arise should be resolved in favor of the fishery, aligning this project and the management plan.

Additionally, the proposed project has garnered support from many local government, public, and privately owned entities. This demonstrates how the improvements to boater safety and aquatic habitat that would be achieved through this project are aligned with the local social, economic, and land use goals.

j. Public Access: If proposed project is a real estate transaction (fee title or conservation easement), is there public access to the resources addressed in the proposal. Full points will be awarded If public access is not relevant.

The project area is already accessible to the public, however the proposed project will improve safety and increase public access to the full river width. Due to safety issues, only the boat chute is currently accessible for public use. Upstream boating traffic is required to steer river left to enter the boat chute several hundred yards upstream, and can return to the remaining river downstream after clearing the chute and dangerous hydraulic created by the dam structure. Although the boat chute allows for safe passage at most flows, paddleboarders and rafters have been obstructed, flipped, or separated from their vessels during high and low flows. This project will improve safety and increase public access on the entire width of the river by removing the hazardous dam.

Appendices

DESCRIPTION OF THE OFFEROR'S ORGANIZATION (SUGGESTED ONE PAGE LIMIT)

The mission of Colorado Parks and Wildlife is to perpetuate the wildlife resources of the state, to provide a quality state park system, and to provide enjoyable and sustainable outdoor recreation opportunities that educate and inspire current and future generations to serve as active stewards of Colorado's resources.

CPW is a nationally recognized leader in conservation, outdoor recreation and wildlife management. The agency manages 42 state parks, all of Colorado's wildlife, more than 350 state wildlife areas and a host of recreational programs. CPW issues hunting and fishing licenses, conducts research to improve wildlife management activities, protects high priority wildlife habitat through acquisitions and partnerships, provides technical assistance to private and other public landowners concerning wildlife and habitat management and develops programs to understand, protect and recover threatened and endangered species.

CPW also administers the state's trail program and registers boats, snowmobiles, off-highway vehicles and river outfitters. Parks and Wildlife employees and their partners work together to provide ongoing and outstanding customer service through recreational programs, amenities and services. Regulations are established by the Colorado Parks and Wildlife Commission.

CPW is an enterprise agency, relying primarily on license sales, state parks fees and registration fees to support its operations, including: 42 state parks and more than 350 wildlife areas covering approximately 900,000 acres, management of fishing and hunting, wildlife watching, camping, motorized and non-motorized trails, boating and outdoor education. CPW's work contributes approximately $6 billion in total economic impact annually throughout Colorado.

OFFEROR AGENCIES, ORGANIZATIONS, AND INDIVIDUALS MUST MEET THE FOLLOWING STANDARDS OF RESPONSIBILITY:

The Offeror selected must be responsible for project costs including personnel, fringe benefits, supplies, operating expenses, travel, equipment, and capital items. The Offeror must provide the necessary financial, material, equipment, facility, personnel resources, and expertise, to meet all contractual requirements, and provide all services requested herein. Offeror must provide evidence that it possesses the necessary resources; or must present acceptable plans to subcontract for them; or must document commitment from, or an explicit arrangement with, a satisfactory source to provide them.

As a state agency CPW has adequate resources necessary to implement and manage a project of this scope including in-house engineering, water resources, biologists and administrative staff. CPW will be required to comply with all state fiscal and procurement rules. However, that would not preclude the agency from receiving this grant.

The Offeror must present a resume indicating experience with analogous projects and/or the capacity to perform the scope of work. The resume shall include the project description and objectives, the contracting entity, the cost of the project, the schedule for implementation, cost overruns and technical difficulties encountered. In addition, the Offeror shall indicate its experience with developing funding sources for matching with the NRD funds.

- CPW has designed, reviewed, and implemented scores of river restoration, fish passage, and habitat restoration projects across the state. The following are two project examples and others are available upon request.

- One project that shows experience in this type of project is the Granite DIversion Structure. This was a $9.1 million dollar project with Colorado Springs Utilities, Aurora Water, Colorado Parks and Wildlife and the Colorado Water Conservation Board. This project removed a dam structure that was not passable by fish or boat. The new structure provides water entities improved delivery to the front range, fish passage and boat passage. The scope of work on this project was very large with many interested parties. It has been reviewed and deemed a success by all and the public.

- Another similar project to this request was work done near Buena Vista on the Helena Diversion Structure. This antiquated structure was problematic for the owners of the water rights, fish passage and recreational boating. This structure before it was reconstructed was the site of a boating fatality. It was reconstructed to include a better headgate, fish passage, and boat chute. A qualified engineering firm and construction firm were selected through state guidelines to complete this project. Those companies worked alongside Colorado Parks and Wildlife staff to make sure all requirements were met in this project.

FULL BUDGET TABLE

The following budget table itemizes the major project component costs and is based upon the current conceptual level design and therefore includes some degree of uncertainty. The potential cost split between items funded with NRD grant monies versus matching contributions are shown for illustrative purposes and the assignment of actual costs to various funding sources will be based on actual invoiced amounts. The total project includes over $1.26 million in eligible construction related expenses, however, CPW is only requesting an NRD grant for $831,300. There are approximately $399,700 in estimated project expenses associated with contractor performed engineering, design, permitting, and administrative tasks that will be used as part of the matching funds. Records and accounting will be maintained to demonstrate the disbursement of funds is within compliance with all NRD grant requirements.

Mount Shavano State Fishery Low-Head Dam Removal Project
Budget Spreadsheet

Item/Line No	Measure	Qty	Contractor Furnished Goods and Services		Item Cost	Eligible for NRD NRD grant use?	% of Item Requested for NRD Grant Funding Use	% of Item Used for Matching Funds	% of Item Provided As Unclaimed Proj Support
1	LS	1	Mobilization, Bonds, Insurance, Etc.	10%	$76,754.60	Yes	-	100	-
2	LS	1	Stormwater Management - Erosion & Sediment Control	5%	$43,446.00	Yes	-	100	-
3	LS	1	Temporary Diversion for Water Management	$50,000.00	$50,000.00	Yes	-	100	-
4	LS	1	Sediment Mitigation	$50,000.00	$50,000.00	Yes	-	100	-
5	LS	1	Remove and Dispose of Existing Diversion Structure	$40,000.00	$40,000.00	Yes	100	-	-
6	CY	10,000	Miscellaneous Earthwork Cut and Fill	$15.00	$150,000.00	Yes	100	-	-
7	CY	678	Rock Boulders Placement	$290.00	$196,620.00	Yes	100	-	-
8	SY	4,840	Riparian Restoration	$47.00	$227,480.00	Yes	100	-	-
9	EA	1	Site Reclamation	$10,000.00	$10,000.00	Yes	79	21	-
10	EA	1	Unforseen Items	20%	$144,820.00	Yes	50	50	-
11	LS	1	Engineering Design	23%	$199,851.60	Match Only	-	100	-
12	LS	1	404 Permitting	23%	$199,851.60	Match Only	-	100	-
13	EA	5	Annual Maintenance	$11,400.00	$57,000.00	No	-	-	100
14	LS	1	Construction Contingency	30%	$273,709.80	Yes	50	50	
15			***Subtotal: Capital Construction***		***$1,662,533.60***				
16			Subtotal: Construction/ContractorO&M Costs		$1,719,533.60				
			CPW Adminstrative and O&M Contributions						
17	Hrs	60	Contractor Bidding, Negotation, Awards, etc.	52	$3,120.00	Match Only			100
18	Hrs	90	Contractor Oversight	52	$4,680.00	Match Only			100
19	Hrs	800	Aquatic Monitoring and Reporting (10 yrs @ 80hrs/yr)	40	$32,000.00	No			100
20	Hrs	100	Stakeholder Process	52	$5,200.00	Match Only			100
21	Hrs	60	404 Permitting Support	52	$3,120.00	Match Only			100
22	Hrs	20	Real Estate/Legal Review	52	$1,040.00	Match Only			100
23	Hrs	10	Water Rights Evaluations	52	$520.00	Match Only			100
24			Subtotal: CPW/Partner Admin Contributions		$49,680.00				

Project Total Estimated Lifecycle Cost	**$1,769,300**		
Total Eligible for NRD Use		**$1,262,830**	
Funding Category Total		**$831,300**	**$831,300**	**$106,700**

APPLICATION/ASSURANCES:

If applicable, provide proof of organizational status and if the Offeror claims non-profit tax-exempt status under section 501 (c)(3) of the IRS code, then the Offeror shall submit proof of status.

Colorado Parks and WIldlife is a State tax exempt entity. See certificate below.

DR 0160 (02/16/11)
COLORADO DEPARTMENT OF REVENUE
DENVER CO 80261-0013

CERTIFICATE OF EXEMPTION FOR STATE SALES/USE TAX ONLY

THIS LICENSE IS NOT TRANSFERABLE

USE ACCOUNT NUMBER for all references	LIABILITY INFORMATION	ISSUE DATE
09802565	G 010180	May 14 2014

1525 Sherman ST

STATE OF COLORADO/ OFFICE OF STATE CONTROLLER
1525 SHERMAN ST FL 5TH
DENVER CO 80203

Executive Director
Department of Revenue

▲ DETACH HERE ▲

GENERAL INFORMATION

Revenue ONLINE

The following services are available at *www.Colorado.gov/RevenueOnline* under **Business**.

Sales:

- Verify a Sales Tax License
- View Local Sales Tax Rates
- View Business Location Rates
- Find Local Taxes by Address
- View Sales Tax Rate Charts

Try Revenue Online today!

www.Colorado.gov/RevenueOnline

Scan this code with your smartphone or tablet to access Revenue Online

Attend our free sales tax classes. Live classes, online CPE and Webinars are available. To sign up, visit *www.TaxSeminars.state.co.us*

LETTERS OF SUPPORT - CPW has received the following letters of support.

Chaffee County Board of Commissioners

P.O. Box 699/104 Crestone Ave.
Salida, CO 81201
719.539.2218/www.chaffeecounty.org

August 19, 2021

Natural Resources Damages

Dear Trustees,

I am writing this letter in support of removing the low head dam located on the Arkansas River just north of Salida. All across our nation, low head dams have proven to be hazardous to both nature and people alike. I believe strongly that the removal of the low head dam will have significant environmental and recreational benefits along this widely utilized stretch of the Arkansas River.

From an environmental perspective, low head dams block the upstream migration of fish and other species which impacts their reproductive cycles. Removal of the dam would provide for upstream movement of both fish and invertebrates that is essential to their survival. Removal of the dam will also help improve the habitat and restore the natural riparian buffers that are crucial for wildlife in this area. Along with improving habitat conditions, removal of the dam will improve water quality by allowing the water to flow more naturally, therefore allowing for a more normal sediment load, increasing the dissolved oxygen, and reducing concentrations of oxygen in the water.

Recreationally, removal of the low head dam will increase the safety of navigating this section of the river by all boaters. This stretch of river is incredibly popular with newer boaters and boaters looking to take their family on a float. This low head dam is a dangerous structure in an otherwise low consequence stretch of river. Currently, the dam creates a strong hydraulic that is difficult for new river users to identify from upstream and has the potential to drown anyone who accidently goes over it. There is an existing boat chute on river left, but the chute has proven to cause issues with boats, stand up paddle boards, kayaks and inner tubes getting through at all different water levels.

These are only a few reasons why I hope you consider removing the low head dam located on the Arkansas River. There have been plenty of success stories throughout the country to support the positive impact of a river system void of low head dams. Removing the low head dam today will likely save a life in the future.

Thank you for your time.

Greg Felt
Chaffee County Commissioner

Drew Peternell, Director, Colorado Water Program

August 23, 2021

Natural Resource Damages Program
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South
Denver, Colorado 80246

Re: Mt. Shavano Fish Hatchery Low-head Dam

Dear Trustees:

Trout Unlimited ("TU") is writing in support of the removal of the Mt. Shavano Fish Hatchery low-head dam on the Arkansas River. Low-head dams are widely known to be damaging to natural resources and hazardous to river-based recreationalists. The Mt. Shavano Fish Hatcher low-head dam is no exception. Removal of this structure will produce significant environmental and recreational benefits.

TU is a national, non-profit fisheries conservation organization. TU's mission is to protect and restore cold water fish populations and the rivers and streams they inhabit. Nationwide, TU works to promote fishing opportunities, and TU members participate in recreational fishing across the country and across Colorado, including on the Arkansas River.

The environmental benefits of removing the Mt. Shavano Fish Hatchery low-head dam would be numerous. As it currently stands, the dam blocks the upstream migration of fish and other species, thus interrupting their reproductive cycles. Removal of the dam would considerably improve migration and reproduction of fish and other species. Likewise, removal of the dam will help to restore natural flow conditions in the Arkansas River, thus improving water quality, restoring more natural sediment loading in the river, boosting dissolved oxygen levels, and improving riparian vegetation buffers along the river's banks. The resulting benefits to fish and wildlife habitat will be significant.

From a recreational perspective, removal of the Mt. Shavano Fish Hatchery low-head dam would have considerable benefits. This section of the Arkansas River is extremely popular for float anglers and other types of boaters. The dam currently creates a strong hydraulic, presenting a major safety hazard for all boaters, especially boaters with less river experience. Removal of the dam would vastly improve river safety and could likely prevent future fatalities.

Trout Unlimited: America's Leading Coldwater Fisheries Conservation Organization
Post Office Box 770450, Steamboat Springs, Colorado 80477
(303) 204-3057 • drew.peternell@tu.org • www.tu.org

For these reasons, Trout Unlimited strongly urges you to provide funding towards the removal of the Mt. Shavano Fish Hatchery low-head dam. Thank you for considering these comments.

Sincerely,

Drew Peternell

8/19/2021

Dear Trustees,

My name is Tom Eve and I am the land owner adjacent to this structure on the river. I am fully supportive of this project and will provide access to the river through our property for demolition and construction.

I am writing this letter in support of removing the low head dam located on the Arkansas River just north of Salida. All across our nation, low head dams have proven to be hazardous to both nature and people alike. I believe strongly that the removal of the low head dam will have significant environmental and recreational benefits along this widely utilized stretch of the Arkansas River.

From an environmental perspective, low head dams block the upstream migration of fish and other species which impacts their reproductive cycles. Removal of the dam would provide for upstream movement of both fish and invertebrates that is essential to their survival. Removal of the dam will also help improve the habitat and restore the natural riparian buffers that are crucial for wildlife in this area. Along with improving habitat conditions, removal of the dam will improve water quality by allowing the water to flow more naturally, therefore allowing for a more normal sediment load, increasing the dissolved oxygen, and reducing concentrations of oxygen in the water.

Recreationally, removal of the low head dam will increase the safety of navigating this section of the river by all boaters. This stretch of river is incredibly popular with newer boaters and boaters looking to take their family on a float. This low head dam is a dangerous structure in an otherwise low consequence stretch of river. Currently, the dam creates a strong hydraulic that is difficult for new river users to identify from upstream and has the potential to drown anyone who accidently goes over it. There is an existing boat chute on river left, but the chute has proven to cause issues with boats, stand up paddle boards, kayaks and inner tubes getting through at all different water levels.

These are only a few reasons why I hope you consider removing the low head dam located on the Arkansas River. There have been plenty of success stories throughout the country to support the positive impact of a river system void of low head dams. Removing the low head dam today will likely save a life in the future.

Sincerely,

Tom Eve

CEO Butala Sand and Gravel

SALIDA FIRE DEPARTMENT

124 E Street • P.O. Box 86 • Salida, CO. 81201
Phone 719-539-2212 • Fax 719-539-9086
www.cityofsalida.com

Dear Trustees,

I am writing this letter in support of removing the low head dam located on the Arkansas River just north of Salida. All across our nation, low head dams have proven to be hazardous to both nature and people alike. I believe strongly that the removal of the low head dam will have significant environmental and recreational benefits along this widely utilized stretch of the Arkansas River.

From an environmental perspective, low head dams block the upstream migration of fish and other species which impacts their reproductive cycles. Removal of the dam would provide for upstream movement of both fish and invertebrates that is essential to their survival. Removal of the dam will also help improve the habitat and restore the natural riparian buffers that are crucial for wildlife in this area. Along with improving habitat conditions, removal of the dam will improve water quality by allowing the water to flow more naturally, therefore allowing for a more normal sediment load, increasing the dissolved oxygen, and reducing concentrations of oxygen in the water.

Recreationally, removal of the low head dam will increase the safety of navigating this section of the river by all boaters. This stretch of river is incredibly popular with newer boaters and boaters looking to take their family on a float. This low head dam is a dangerous structure in an otherwise low consequence stretch of river. Currently, the dam creates a strong hydraulic that is difficult for new river users to identify from upstream and has the potential to drown anyone who accidently goes over it. There is an existing boat chute on river left, but the chute has proven to cause issues with boats, stand up paddle boards, kayaks and inner tubes getting through at all different water levels.

As a 28 year employee of the Salida Fire Department and 10 years as Fire Chief, I have witnessed the carnage and heartache this dam has caused. Many lives have been lost over the years due to this feature. We have conducted several rescues at this site that put rescuers lives in danger.

These are only a few reasons why I hope you consider removing the low head dam located on the Arkansas River. There have been plenty of success stories throughout the country to support the positive impact of a river system void of low head dams. Removing the low head dam today will likely save a life in the future.

Thank you for your time.

Sincerely,

Doug Bess

Doug Bess/Fire Chief

To: Natural Resource Trustees

From: Envision Chaffee County

RE: Letter of Support for Salida Low Head Dam

Date: August 24, 2021

Trustees,

We are writing this letter in support of removing the low head dam located on the Arkansas River just north of Salida. All across our nation, low head dams have proven to be hazardous to both nature and people alike. We believe strongly that the removal of the low head dam will have significant environmental and recreational benefits along this widely utilized stretch of the Arkansas River.

From an environmental perspective, low head dams block the upstream migration of fish and other species which impacts their reproductive cycles. Removal of the dam would provide for upstream movement of both fish and invertebrates that is essential to their survival. Removal of the dam will also help improve the habitat and restore the natural riparian buffers that are crucial for wildlife in this area. Along with improving habitat conditions, removal of the dam will improve water quality by allowing the water to flow more naturally, therefore allowing for a more normal sediment load, increasing the dissolved oxygen, and reducing concentrations of oxygen in the water.

Recreationally, removal of the low head dam will increase the safety of navigating this section of the river by all boaters. The Arkansas river between Buena Vista and Salida is the most rafted river in the US. Chaffee County seeing an estimated 4 million visitors a year and recreation being over a third of the county's economic base. This stretch of river is incredibly popular with newer boaters and boaters looking to take their family on a float. This low head dam is a dangerous structure in an otherwise low consequence stretch of river. Currently, the dam creates a strong hydraulic that is difficult for new river users to identify from upstream and has the potential to drown anyone who accidently goes over it. There is an existing boat chute on river left, but the chute has proven to cause issues with boats, stand up paddle boards, kayaks and inner tubes getting through at all different water levels.

These are only a few reasons why I hope you consider removing the low head dam located on the Arkansas River. There have been plenty of success stories throughout the country to support the positive impact of a river system void of low head dams. Removing the low head dam today will likely save a life in the future.

Thank you for your time.

Sincerely,

CindyLW

Cindy Williams
Co-Lead, Envision Chaffee County

Greater Arkansas River Nature Association

PO Box 1522
Salida, Colorado
81201

719.539.5106
www.garna.org
info@garna.org

August 26, 2021

Colorado Natural Resources Trustees
Ralph L. Carr Judicial Building
1300 Broadway, 10th Floor
Denver, CO 80203

Re: Arkansas Headwaters Recreation Area (AHRA) Low Head Dam Removal

Dear Trustees,

The Greater Arkansas River Nature Association (GARNA) supports removal of the low head dam located on the Arkansas River just north of Salida. Across the nation, low head dams have proven to be hazardous to both nature and people alike. GARNA strongly believes that the removal of the low head dam will have significant environmental and recreational benefits along this widely utilized stretch of the Arkansas River.

GARNA, a 501(c)3 non-profit in the Upper Arkansas Valley of Colorado, uses community collaboration to inspire a conservation ethic by providing educational opportunities and experiences so that those who live, work, and play on the Upper Arkansas River are motivated to take care of the natural resources and leave a legacy of responsible use of the natural environment. We've accomplished our mission for 25 years through formal partnerships with public land management agencies, including Colorado Parks and Wildlife and AHRA.

From an environmental perspective, low head dams block the upstream migration of fish and other species which impacts their reproductive cycles. Removal of the dam would provide for upstream movement of both fish and invertebrates that is essential to their survival. Removal of the dam will also help improve the habitat and restore the natural riparian buffers crucial for wildlife in this area. Along with improving habitat conditions, removal of the dam will improve water quality by allowing the water to flow more naturally, normalizing sediment load, increasing the dissolved oxygen, and reducing concentrations of oxygen in the water.

Recreationally, removal of the low head dam will increase the safety of navigating this section of the river by all boaters. As someone who boats this stretch often, I personally know how popular the section is with newer boaters and boaters with young children. The low head dam is a dangerous structure in an otherwise low consequence stretch of river. Currently, the dam creates a strong hydraulic that is difficult for new river users to identify from upstream and has the potential to drown anyone who accidently goes over it. As a child growing up in Salida, I remember at least one tragic death of a kayaker who went over the dam. There is an existing boat chute on river left, but the chute has proven to cause issues with boats, stand up paddle boards, kayaks and inner tubes getting through at all different water levels.

Personally, and as GARNA's Executive Director, I hope you will consider removing the low head dam located on the Arkansas River. There have been plenty of success stories throughout the country to support the positive impact of a river system void of low head dams. Removing the low head dam today will likely save a life in the future.

Thank you for your time.

Sincerely,

Dominique Naccarato
GARNA Executive Director
Dominique@garna.org

ECHO CANYON
RIVER EXPEDITIONS

Dear Trustees,

I am writing this letter in support of removing the low head dam located on the Arkansas River just north of Salida. I think it goes without saying that there is a better solution for our residents, visitors, wildlife, and habitat.

From an environmental perspective, low head dams block the upstream migration of fish and other species which impacts their reproductive cycles. Removal of the dam would provide for upstream movement of both fish and invertebrates that is essential to their survival. Removal of the dam will also help improve the habitat and restore the natural riparian buffers that are crucial for wildlife in this area. Along with improving habitat conditions, removal of the dam will improve water quality by allowing the water to flow more naturally, therefore allowing for a more normal sediment load, increasing the dissolved oxygen, and reducing concentrations of oxygen in the water.

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These are only a few reasons why I hope you consider removing the low head dam located on the Arkansas River. There have been plenty of success stories throughout the country to support the positive impact of a river system void of low head dams. Removing the low head dam today will likely save a life in the future.

Thank you for your time.

Sincerely,

Andrew C. Neinas
President / Arkansas River Conservation Cooperative
Past President / Arkansas River Outfitters Association
Past Chairman / Colorado River Outfitters Association

Upper photo: The Upper Arkansas River in 1996 immediately downstream from California Gulch, a U.S. EPA Superfund Site in Leadville, Colorado. Lower photo: The same site in 2015 after remediation and restoration.

Assessing remediation and restoration effectiveness in the Upper Arkansas River, Colorado

William H. Clements

Department of Fish, Wildlife and Conservation Biology

Colorado State University

Fort Collins, CO 80523

Assessing remediation and restoration effectiveness in the Upper Arkansas River, Colorado

1. Executive Summary

Principal Investigator: Dr. William H. Clements, Colorado State University

Project Description: Stream restoration projects that are designed to either improve water quality or habitat offer unique opportunities to quantify remediation and restoration effectiveness. For the last 32 years (1989-present) researchers at Colorado State University (CSU) have monitored responses of macroinvertebrate communities to improvements in water quality and habitat in the Upper Arkansas River (UAR). In collaboration with Colorado Parks and Wildlife (CPW), we have also quantified long-term changes in feeding habits, prey utilization, and density of brown trout populations (*Salmo trutta*). This dataset represents the longest continuous record and most comprehensive assessment of aquatic communities and associated water quality in North America. Because data were collected from reference and treatment sites before and after remediation and/or restoration, we can employ a powerful before-after control-impact (BACI) experimental design to directly link changes in aquatic communities to improvements in water quality and habitat. Our long-term data provide an extraordinary opportunity to quantify the success of new remediation and restoration projects in the UAR.

Previous studies of mining-contaminated watersheds in the western U.S. have shown that aquatic communities rapidly respond to reductions in metal concentrations (Clements et al. 2010, Mebane et al. 2015, Herbst et al. 2018, Clements et al. 2021). However, responses to improvements in habitat have not been well documented. The "Field of Dreams" hypothesis proposes that because of the well-established relationship between habitat heterogeneity and species diversity (Lepori et al 2005), habitat improvements should enhance recovery of disturbed watersheds. The purpose of this study is to continue our long-term assessment of the UAR,

focusing on new restoration projects in the watershed. The study design and adaptability of sampling methods we have employed over the last 32 year will allow us to continue monitoring the effectiveness of these projects. Target natural resources that will be monitored during this project include water quality, instream habitat (e.g., substrate composition), brown trout populations and their prey (benthic macroinvertebrates), and terrestrial subsidies from streamside riparian habitats. In collaboration with CPW, we will continue to monitor feeding habits and population density of brown trout. ***The specific objectives of this proposed research are to:*** 1) contrast the long-term responses of aquatic communities to remediation treatments (e.g., those that improve water quality) and restoration treatments (e.g., those that improve habitat); 2) quantify changes in aquatic and terrestrial prey resources after habitat restoration; and 3) characterize brown trout utilization of these prey resources.

Project Offeror: Colorado State University

Point-of-Contact: Kellie Reifstenzel, Sr. Research Administrator, Sponsored Programs, 2002 Campus Delivery, Colorado State University, Fort Collins, CO 80523

Email: kellie.reifstenzel@colostate.edu; Phone: (970) 491-6684

Total Project Cost: $733,183

Amount of NRDA Funding Requested: $480,500

Matching Funds: $252,683

Authorized Offeror: Tracey Trujillo, CRA, Warner College of Natural Resources

1401 Campus Delivery, Fort Collins, CO 80523-1401

Email: tracey.trujillo@colostate.edu; Phone: 970-491-8280

Signature of the Authorized Offeror: Tracey Trujillo

2. Scope of Work

a. Target Natural Resources

Target natural resources that will be monitored during this project include water quality, instream habitat (e.g., substrate composition), brown trout populations and their aquatic prey resources (i.e., benthic macroinvertebrates), and terrestrial subsidies from streamside riparian habitats.

i. Background and justification for the project

Biological monitoring programs for aquatic ecosystems are generally designed to assess status and trends and to identify physical and chemical alterations that adversely impact communities. A less common goal is to quantify responses following improvements in water quality or habitat. Historically, the ability to measure the effectiveness of stream remediation and restoration projects has been hindered by poor study designs and a failure to implement effective pre- and post-restoration monitoring (Bernhardt et al. 2005). This issue is especially problematic given the high cost of stream restoration, which in the continental U.S. exceeds $1 billion per year. Annual expenditures to identify, clean up, and monitor hazards at abandoned mine sites in the U.S. is approximately $300 million, with 90% of these funds used to address environmental hazards. Beyond these initial costs, many abandoned mines require perpetual on-site treatment, estimated to cost over $60 million per year (Gestring and Sumi 2013). Demonstrating the success of stream restoration projects associated with abandoned mines is critical for maintaining public support for these programs.

The limited number of long-term studies conducted to measure responses to remediation or restoration has significantly impeded our ability to evaluate their success, despite broad agreement for the importance of long-term research (Clements et al. 2010; Clements et al. 2021). Long-term assessments of aquatic ecosystems are especially important for measuring restoration

success within the context of climate change. For example, increases in metal concentrations over a 30-y period in the Snake River, a mineralized watershed in central Colorado, were directly associated with changes in hydrologic characteristics resulting from climate change (Todd et al. 2012). More importantly, interactions between climate change and water quality may offset the potential benefits of restoration and remediation projects (Floury et al. 2013).

Long-term monitoring of chemical and biological conditions in the Upper Arkansas River (UAR) over the last 32 years has documented significant improvements in water quality, benthic macroinvertebrates, and brown trout populations (Clements 1994; Clements et al. 2021). However, episodic increases in metal concentrations occur, and significant differences in benthic communities between upstream reference sites and downstream metal-impacted sites persist. There is also evidence that brown trout populations in this system are limited by prey resources and may be approaching carrying capacity. Continued long-term monitoring of the UAR will enable us to compare responses to improvements in water quality to those associated with improved habitat. Although macroinvertebrates and brown trout in the UAR showed rapid responses to reduced metal concentrations (Clements et al. 2010), we observed significant variation in the recovery of benthic communities and fish populations following habitat restoration. This difference between remediation and restoration responses underlies the challenges associated with establishing specific restoration goals. Because the UAR has a long history of metals exposure, and because water chemistry continues to change due to ongoing metals treatment, seasonal and episodic events, and climate change, the ability of the UAR to recover from future perturbations is uncertain (Wolff et al. 2019). Continued biomonitoring of the UAR will improve our ability to characterize biological recovery and to predict effects of future disturbances on the aquatic resources in this ecosystem.

ii. Study site description and map of the area

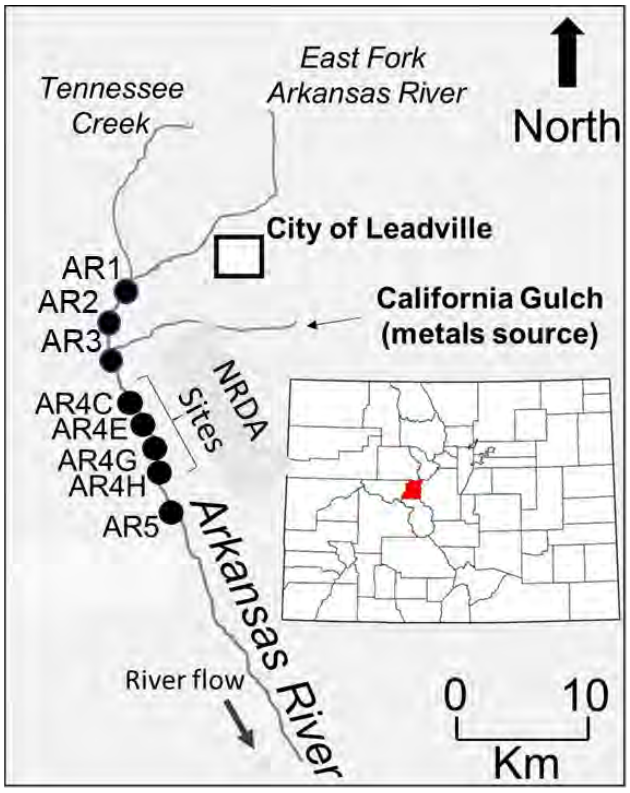

Figure 1. Map of sampling locations on the Upper Arkansas River showing the 4 long-term monitoring sites (AR1, AR2, AR3, AR5) and the 4 NRDA sites.

The project will focus on proposed restoration activities within an 18 km reach of the Upper Arkansas River (**Fig. 1**), from the confluence of the East Fork of the Arkansas River and Tennessee Creek (AR1), through the NRDA sites and downstream to Kobe (AR5). The Upper Arkansas River is a 5th order Rocky Mountain stream located 110 km southwest of Denver, Colorado. Historical mining in watershed in the late 19th and early 20th century resulted in significant water quality impacts and degraded habitat. In 1983, California Gulch (CG), a tributary to the UAR, and much of the surrounding watershed was designated a USEPA Superfund Site. High concentrations of metals were discharged from CG and the Leadville Mine Drainage Tunnel, resulting in impaired benthic macroinvertebrate communities and reduced brown trout populations. Remediation of metals contamination in the watershed began in the early 1990's, and significant improvements in macroinvertebrates and brown trout were observed following completion of water treatment facilities, removal of waste tailings, and stabilization of eroding banks (Clements et al. 2010). Following these improvements in water quality, a large-scale habitat restoration project was initiated in 2013. The primary goals of this project were to "restore, replace, or acquire the equivalent of the injured

natural resources" that resulted from historical mining operations. Restoration activities were conducted throughout a 12 km reach and included the installation of instream structures to increase habitat heterogeneity, bank stabilization, and planting streamside riparian vegetation (Richer et al. 2019).

iii. Summary of our long-term results

Water quality and metal bioaccumulation- Long-term changes in metal concentrations in the UAR reflected responses to both remediation and restoration treatments. Because the UAR is contaminated by multiple metals (e.g., Cd, Cu, Zn), we used a hardness-based estimate of metal toxicity to determine potential effects. Cumulative criterion units (CCUs) express metal concentrations relative to individual criterion values and summarizes effects of multiple metals (Clements et al. 2000). We observed highly significant decreases in CCUs from 1989-2019, with the greatest changes occurring immediately downstream from CG (**Fig. 2A**). These decreases were most apparent early in the study, coinciding with remediation activities at CG and Leadville Mine Drainage Tunnel. Although metal concentrations were significantly reduced at all downstream stations, we observed significant temporal variation over the 32-year record and CCUs frequently exceeded 1.0, the theoretically protective concentration for aquatic life. CCUs at station AR3 remained elevated after remediation of CG and were consistently greater than those measured at the reference station and at stations located downstream. Additional improvements in water quality occurred after restoration of the NRDA sites. These results suggest that in addition to improving habitat, restoration treatments also improved water quality.

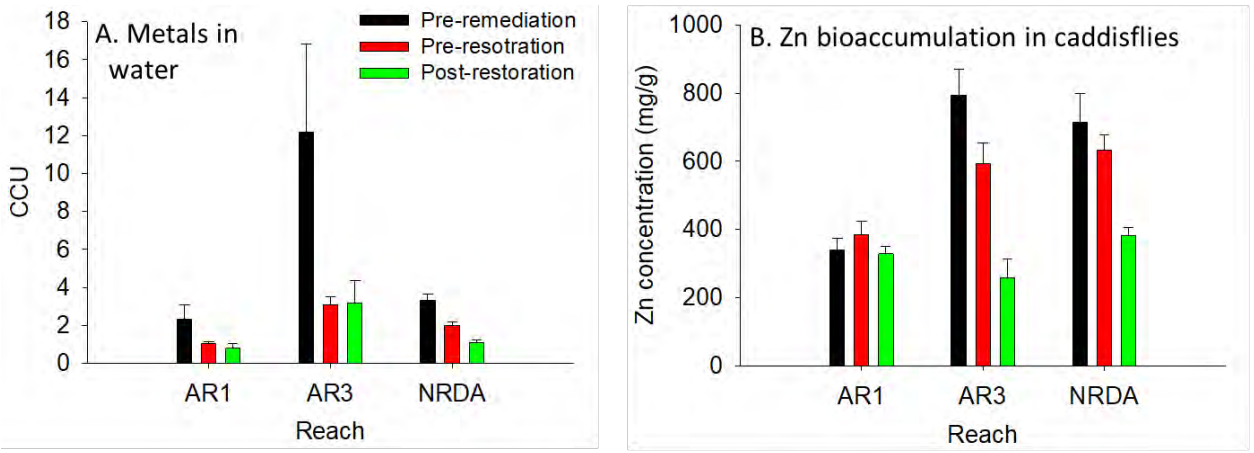

Figure 2. Metal concentrations in water (A) and Zn concentrations measured in the caddisfly *Arctopsyche grandis*, a major prey item of brown trout and riparian consumers (B). Data were collected at upstream reference (AR1), metal-impacted (AR3) and restoration (NRDA) reaches before remediation (1989-1999), before restoration (2000-2014) and after restoration (2015-2017) in the Arkansas River.

To quantify long-term changes in metal bioavailability and potential exposure to fish and riparian consumers (e.g., spiders, birds, bats), we measured concentrations of metals in the caddisfly *Arctopsyche grandis*, a dominant prey item in the diet of brown trout and riparian consumers. Concentrations of Zn measured in caddisflies varied significantly among sites and between remediation and restoration treatments (**Fig. 2B**). As expected, the largest decreases in caddisfly metal concentrations occurred at station AR3 after remediation of CG; however, significant declines in Zn bioaccumulation were also observed after restoration, suggesting that improvements in habitat contributed to lower metal uptake by caddisflies. Although concentrations of Zn in *Arctopsyche* at downstream sites approached those measured at the reference site, levels of Cd remained elevated (Clements, unpublished data). Because caddisfly larvae account for >30% of the total prey consumed by brown trout, and because caddisfly adults are important prey for many riparian consumers, these organisms play an important role in the transfer of metals to higher trophic levels (Clements and Rees 1997).

Long-term trends in benthic macroinvertebrates and brown trout- Macroinvertebrates and brown trout populations in the UAR rapidly responded to improvements in water quality. The total abundance of organisms at station AR3, immediately downstream from CG, increased by approximately 3X between 1989 and 2000 (**Fig. 3A**). Because macroinvertebrate samples were collected before and after remediation and restoration, we compared responses to improvements in water quality to those associated with improvements in habitat. Although we observed marginal increases in abundance during the post-restoration period (2015-2019), the greatest increases in macroinvertebrate abundance and taxa richness were associated with improvements in water quality.

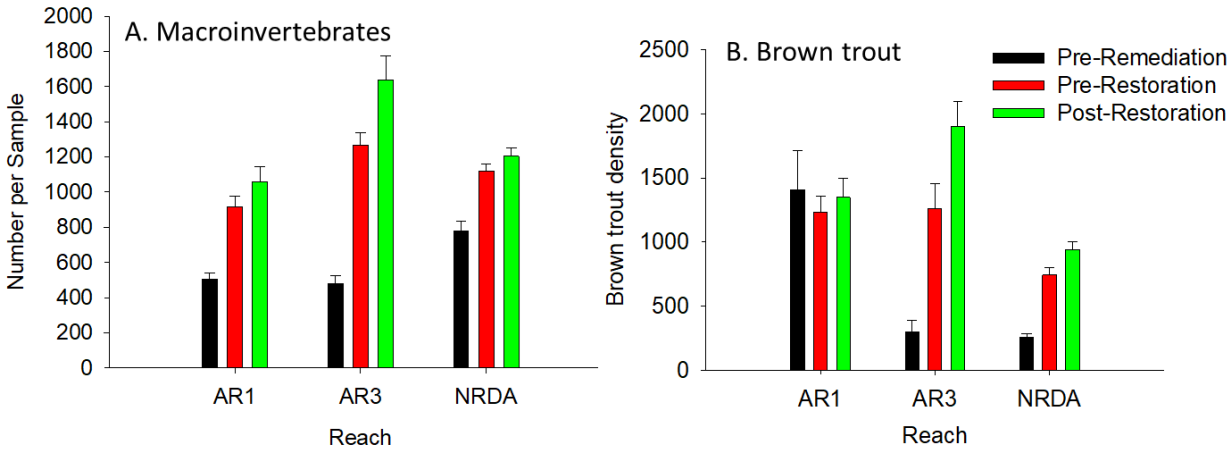

Figure 3. Total macroinvertebrate abundance (A) and brown trout density (B) measured at upstream reference (AR1), metal-impacted (AR3) and restoration (NRDA) reaches before remediation (1989-1999), before restoration (2000-2014) and after restoration (2015-2017) in the Arkansas River.

Density and biomass of brown trout increased significantly after both remediation and restoration at the downstream sites in the UAR; however, as with macroinvertebrates the responses associated with improvements in water quality were much greater (**Fig. 3B**). Associated with increases in brown trout populations, we observed a highly significant inverse relationship between trout density and the biomass of prey organisms consumed per fish. We

believe the most likely explanation for this result was that increased density of brown trout after restoration increased competition and overall prey consumption, thereby reducing the prey available to individual fish. This relationship suggests that there may be a bioenergetic cost of increasing trout density and that trout populations are approaching carrying capacity in the UAR. In other words, habitat restoration increased refugia, spawning habitat, and foraging positions (Richer et al. 2019), but prey resources were ultimately responsible for the growth of individual fish. Therefore, achieving specific restoration targets in the UAR may be challenging because of potential ecological feedbacks between prey resources and trout. Biomonitoring programs that measure prey availability and utilization are critically important for evaluating and predicting responses of brown trout populations to future habitat restoration in the UAR.

b. Objectives of the Proposed Project

Previous studies of mining-contaminated streams have shown that benthic macroinvertebrate communities rapidly respond to reductions in metal concentrations (Clements et al. 2010, Mebane et al. 2015, Herbst et al. 2018, Clements et al. 2021). However, responses of benthic communities to improvements in habitat have not been well documented. The "Field of Dreams" hypothesis proposes that because of the well-established relationship between habitat heterogeneity and species diversity (Lepori et al 2005), habitat improvements should enhance ecological recovery. The primary goal of the present study is to continue our pre- and post-restoration assessment of benthic invertebrates, prey resources and terrestrial subsidies, focusing on future (proposed) remediation and restoration activities. In collaboration with Colorado Parks and Wildlife, we will continue to monitor feeding habits and changes in population density of brown trout. ***The specific objectives of this proposed research are to:*** 1) contrast the long-term

responses of benthic macroinvertebrates and brown trout populations to remediation treatments (those designed to improve water quality) and restoration treatments (those designed to improve habitat); 2) quantify changes in aquatic and terrestrial prey resources after habitat restoration; and 3) characterize brown trout utilization of these prey resources after habitat restoration.

c. Operational Plan

i. Study design and sampling methods

Application of a Before-After Control-Impact (BACI) study design- We have established four long-term sampling stations on the UAR located upstream (AR1, AR2) and downstream (AR3, AR5) from California Gulch (CG), the major source of metal loading into the UAR (**Fig. 1**). To evaluate the effects of habitat restoration on benthic macroinvertebrates, terrestrial input, and brown trout populations, four sampling stations (AR4C, AR4E, AR4G, AR4H) were established within the NRDA restoration reach. Additional sampling locations necessary to characterize responses to future remediation and restoration projects will be finalized after consultation with the Trustees and project managers. Because these data will be collected before and after future projects are completed, we can employ a powerful Before-After Control-Impact (BACI) study design to demonstrate a direct causal relationship between restoration and the responses of our proposed restoration targets. Because our previous long-term analyses have shown that water quality, metal bioavailability, and macroinvertebrate communities vary seasonally, samples will be collected in late spring and early fall.

Routine water quality sampling and metals analyses- Routine water quality characteristics (conductivity, pH, water temperature, hardness) will be measured at all sampling stations

upstream and downstream from CG and within the habitat restoration reach. Water samples will be collected for dissolved metals analyses and analyzed using inductively coupled plasma mass spectrometry (ICP-MS) or inductively coupled argon plasma emission spectroscopy (ICAPES). All water quality data will be integrated into an existing database containing over 10,000 historical records compiled by Colorado State University, Colorado Parks and Wildlife, Colorado Mountain College-Leadville, the USGS, and the U.S. EPA.

Benthic macroinvertebrates- Benthic macroinvertebrates will be collected from all sites using previously described methods (Clements et al. 2010). Briefly, replicate (n = 5 per site) benthic samples will be collected seasonally (spring and late summer) using a modified Hess sampler (0.1 m^2). Samples will be rinsed through a 350 μm sieve in the field and organisms retained will be preserved in 80% ethanol. In the laboratory, benthic samples will be sorted using a standard 300-count subsampling protocol (Moulton et al. 2000). Samples will be sorted and identified to the lowest practical level of taxonomic resolution (genus for most aquatic insects; family for chironomids) using regional (Ward et al. 2002) and North America (Merritt et al. 2008) keys.

Metal bioaccumulation in the caddisfly Arctopsyche grandis- To quantify bioavailability and the potential transfer of metals to brown trout and riparian consumers, we will measure metal concentrations in *Arctopsyche grandis*, an abundant and widely distributed caddisfly (Trichoptera) in the Upper Arkansas River. We will focus on *Arctopsyche* sp. because of its importance in the diet of brown trout, tolerance to metals, and relatively large body size, thereby ensuring that sufficient biomass of organisms can be collected from both reference and metal-contaminated sites. Replicate (n = 3) samples typically containing 3-8 individuals will be

collected concurrently with benthic samples described above. In the laboratory, samples will be rinsed in deionized water to remove inorganic materials and then dried for 24 h at 60 ºC. Samples will be digested in trace-element grade nitric acid (HNO_3) and heated in a water bath at 90 °C for 4-6 hours. After cooling, hydrogen peroxide (H_2O_2) will be added to complete the digestion process and Milli-Q water will be added to ensure that all samples are diluted to 10 ml. Metal concentrations in the caddisflies will be measured as described above.

Brown trout populations and prey utilization- In collaboration with Colorado Parks and Wildlife, feeding habits and population density of brown trout will be measured at reference stations, metal-impacted stations, and in the NRDA restoration reach using bank electroshocking. Brown trout lengths (mm) and weights (g) will be measured for each fish. Estimates of trout density (number of fish per hectare) and biomass (kg per hectare) will be based on trout greater than 1 year of age (generally $\geq$ 120 mm). To quantify feeding habits of brown trout, stomach contents will be removed from a subset of trout (25 per station) using gastric lavage. Prey organisms will be sieved through a 350 µm screen and preserved in 80% ethanol in the field. Trout will be placed in a live well to recover before being returned to the stream. In the laboratory, stomach contents will be identified using taxonomic methods previously described.

To quantify the input of brown trout prey from riparian vegetation, we will collect adult aquatic and terrestrial insects from streamside riparian areas at each site using pan traps (100 cm x 41 cm x 15 cm) placed along the stream bank. Pan traps (n = 3) will be deployed for two consecutive 24-hour periods in mid-August, coinciding with fish sampling. We also chose this time period because inputs of terrestrial insects into rivers are generally greatest during summer (Saunders and Fausch 2012). Each pan trap will be filled with 4 L of stream water and

approximately 5 ml of unscented, biodegradable surfactant to reduce surface tension of the water and trap flying insects. To quantify inputs from different riparian habitats, pan traps will be deployed in willows, grasses, and gravel bars. Organisms in pan traps will be preserved in 80% ethanol and identified in the laboratory.

Statistical analyses- All univariate statistical analyses will be conducted using R statistical computing (R Development Core Team, 2013; v4.0.2) or SAS (SAS institute, version SAS 9.4). Differences in benthic community metrics and concentrations of Zn in *Arctopsyche* among sites, treatments (pre-remediation, pre-restoration, post-restoration) and years will be analyzed using general linear models (PROC GLM). Abundance metrics and metal concentrations will be log-transformed to satisfy assumptions of normality and homogeneity of variance. Generalized linear models will be used to test for statistically significant differences in benthic macroinvertebrates, aquatic and terrestrial invertebrate inputs, and brown trout populations and diet. To measure long-term changes in benthic community composition based on dominant taxa and functional feeding groups, we will analyze data with non-metric multi-dimensional (NDMS) scaling and other multivariate techniques using Primer-e software (Quest Research Limited; v7).

ii. *Collaborations*

Researchers in the Department of Fish, Wildlife and Conservation Biology will collaborate with Colorado Parks and Wildlife to sample brown trout populations upstream and downstream from the former U.S. EPA Superfund Site and within the NRDA restoration reach.

iii. ***Matching funds***

The principal investigator is on a 9-month academic year appointment. Matching funds for this project (~52%) will be provided through in-kind support from the principal investigator's summer salary. The total cash equivalent of this match including salary, fringe benefits, and associated indirect costs for the duration of the project is **$252,683**.

iv. ***Construction designs:*** NA

v. ***Relationship of this project to the goals of the RP/EA***

A fundamental goal of the 2010 Restoration Plan and Environmental Assessment was to establish a well-designed monitoring plan that would allow the Trustees to evaluate and quantify the success of restoration activities in the Upper Arkansas River. Our proposed project directly addresses this goal by monitoring target aquatic resources (water quality, macroinvertebrates, riparian subsidies, and brown trout populations) that are expected to respond to future improvements in water quality and habitat. Because we have sampled these resources for over 30 years, we can employ a Before-After Control-Impact (BACI) design, considered the "gold standard" in stream bioassessments, to quantify restoration effectiveness and establish a direct causal relationship between restoration activities and the target aquatic resources.

vi. ***Coordination with other projects in the area***

For the last 32 years (1989-present), researchers at Colorado State University have collaborated with Colorado Parks and Wildlife to monitor biological responses to improvements in water quality and stream habitat at locations upstream and downstream from California Gulch and the

NRDA restoration reach. This dataset represents the longest continuous record and most comprehensive assessment of aquatic communities and associated water quality in North America. The study was complemented by an 11-year sampling program (2010-2021) that was designed to assess responses of aquatic and terrestrial prey resources to improvements in habitat. These long-term data provide the necessary context to assess effectiveness of different restoration projects and an unprecedented opportunity to quantify responses to large-scale habitat improvements. A primary objective of our proposed study will be to coordinate with future projects funded by the NRDA program and establish a sampling plan that will optimize our ability to measure restoration success. The work will focus on restoration projects that are designed to either directly or indirectly affect the aquatic and terrestrial resources identified above. The adaptability of our sampling methods and our ability to modify our approach to measure effectiveness of new restoration projects is a major strength of the proposal.

vii. ***Operation and maintenance requirements:*** NA

viii. ***Permits and approvals:*** NA

ix. ***Project schedule and timeline***

Task	Spring 2022	Summer/Fall 2022	Spring 2023	Summer/Fall 2023	Spring 2024	Summer/Fall 2024	Spring 2025	Summer/Fall 2025	Summer/Fall 2026
Field sampling	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	
Annual reports		**X**		**X**		**X**		**X**	
Professional presentations		**X**		**X**		**X**		**X**	
Final report									**X**
Final long-term database									**X**

x. ***Invoices and status reports:***

All invoices will be submitted by the Colorado State University Budget Office. Status reports associated with these invoices will detail all sampling activities and reflect progress analyzing water quality samples, macroinvertebrates, brown trout prey resources, and brown trout feeding habits. Our sampling plan will allow us to track both short- and long-term changes in water quality, macroinvertebrate communities, and brown trout populations. Routine water quality and metals analyses will be completed within 1-2 months after collection. Macroinvertebrate, terrestrial insect, and brown trout diet samples will be sorted, processed, and identified within 6 months after collection.

xi. ***Project documentation and deliverables***

The study will provide valuable insights for optimizing the design of stream restoration projects and monitoring programs, as well as adaptive management for the Upper Arkansas River restoration project. The study will produce a manuscript that will be published in a peer-review journal and a final report that includes recommendations for adaptive management. Results will also be presented at a professional conference. Quarterly reports will be submitted that will include an invoice for all expenses and narrative description of the work completed during the reporting period. The project will also develop a comprehensive database that includes all monitoring targets along with spatiotemporal information.

Specific deliverables for the project will include:

- Peer-review manuscripts
- Final report for submission to CDPHE
- Professional presentations at a conferences
- Quarterly reports including an invoice and narrative
- Comprehensive database for the long-term monitoring project

3. Budget Spreadsheet (detailed budget spreadsheet provided in Appendix Section 6c)

Category		2022	2023	2024	2025	2026	Total costs
Personnel	Clements	$0	$0	$0	$0	$11,903	
	Fringe (26.7%)	$0	$0	$0	$0	$3,178	
	Lab and Field Technician	$36,000	$36,000	$36,000	$36,000	$0	
	Fringe (48.2%)	$9,612	$9,612	$9,612	$9,612	$0	
	Student hourly	$9,000	$9,000	$9,000	$9,000	$9,000	
	Fringe (0.20%)	$18	$18	$18	$18	$18	
Total personnel		$54,630	$54,630	$54,630	$54,630	$24,099	
Supplies		$3,500	$3,500	$3,500	$3,500	$500	
Travel		$2,500	$2,500	$2,500	$2,500	$1,000	
Other direct		$10,000	$10,000	$10,000	$10,000	$8,000	
Total direct		$70,630	$70,630	$70,630	$70,630	$33,599	
Indirect costs (52%)		$36,728	$36,728	$36,728	$36,728	$17,471	
Total costs		**$107,358**	**$107,358**	**$107,358**	**$107,358**	**$51,070**	**$480,500**
Matching funds							
	Clements salary	$32,802	$32,802	$32,802	$32,802	$0	
	Clements fringe	$8,758	$8,758	$8,758	$8,758	$0	
	Indirect	$21,611	$21,611	$21,611	$21,611	$0	
	Total matching	$63,171	$63,171	$63,171	$63,171	$0	**$252,683**
Time commitments (months)							
	Clements	2.6	2.6	2.6	2.6	1.0	
	Lab and Field Technician	12.0	12.0	12.0	12.0	0.0	
	Undergraduate students	3.75	3.75	3.75	3.75	3.75	

4. Public Communication Strategy

In addition to the traditional opportunities for communicating our results through peer-reviewed publications and at professional meetings, our findings will be made available through town hall meetings and other outreach events in Leadville, CO. Our program at CSU has a long history of including diverse and underrepresented groups in our research projects, and the Arkansas River project has directly funded the research of 23 graduate students, 100 undergraduate students, and 2 high school teachers (https://warnercnr.source.colostate.edu/long-term-monitoring-shows-successful-restoration-of-mining-polluted-streams/). Educational and outreach programs will convey findings from our long-term research to local water quality managers, teachers, and students, providing information about heavy metal pollution in the watershed and informing public officials about environmental policy considerations.

5. Relationship to Ranking Criteria

a. Public Support- A primary goal of this project is to measure the success of proposed remediation and restoration projects in the UAR. Demonstrating and communicating the success of restoration projects is critical for maintaining public support for these programs.

b. Likelihood of Success- Our research group has been monitoring all of the target natural resources described in this proposal for over 30 years. We are confident that if our target natural resources are affected by future restoration activities, we will be able to quantify these responses. Therefore, the project has a very high likelihood of success.

c. Technical Feasibility- For similar reasons, the technical feasibility of the project is also quite high. We are very familiar with the UAR system and have refined our field and lab techniques to the extent that most of the sampling and analyses are relatively routine. However, the methods

we have developed are highly adaptable and can be modified to accommodate future restoration projects and changes in restoration objectives.

d. Multiple Natural Resource Benefits- This project is designed to measure the effects of remediation and restoration activities on multiple natural resources, including water quality, instream habitat (e.g., substrate composition), brown trout populations and their prey resources (i.e., benthic macroinvertebrates), and terrestrial subsidies from streamside riparian habitats.

e. Time to Provide Benefits- Based on our previous findings we anticipate that responses of macroinvertebrates to improvements in water quality and instream habitat will be relatively rapid following completion of remediation and restoration activities. Other resources (e.g., brown trout populations and terrestrial prey resources) may require additional monitoring beyond this 5-year study.

g. Non-NRDs Match- We will be providing a 52% non-NRD match to support this 5-year project.

h. Protection of Implemented Project- NA

i. Project Alignment with Regional Planning- NA

j. Public Access- NA

6. Appendices

a. References

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b. Description of the Offeror's Organization- Colorado State is a public land-grant university and the flagship university of the Colorado State University System. Undergraduate enrollment in 2020 was approximately 28,000 students that were distributed across eight colleges and 55 academic departments. The principal investigator is a full professor in the Department of Fish, Wildlife and Conservation Biology within the Warner College of Natural Resources. Research in the Department focuses on applied ecology, quantitative methods, and human dimensions in the conservation and management of fish and wildlife.

i. Principal Investigator's Summary Curriculum Vitae

William H. Clements, Ph.D.
Department of Fish, Wildlife, and Conservation Biology
Colorado State University, Fort Collins, CO 80523
E-mail: william.clements@colostate.edu

EDUCATION

Ph.D.	1988	Zoology	Virginia Tech
M.S.	1982	Biology	Florida State University
B.S.	1978	Biology	Florida State University

PROFESSIONAL EXPERIENCE

Current Position: Professor and Chair of the Undergraduate Major in Fish, Wildlife, & Conservation Biology

Previous Positions:
Associate Professor, Colorado State University. 1995 to 2001
Assistant Professor, Colorado State University. 1989-1995
Postdoctoral Fellow, Miami University. 1988-1989.
Pre-Doctoral Research Fellow, Virginia Tech. 1987-1988.

RESEARCH INTERESTS

Aquatic ecology and ecotoxicology; community responses of aquatic organisms to contaminants; stressor interactions in aquatic ecosystems; effect of climate change and UV radiation on streams

AWARDS, HONORS, AND ELECTED OFFICES

President, Society of Environ. Toxicology and Chemistry (Rocky Mtn. Chapter), 2016-2017
Presidential Citation, Society of Environmental Toxicology and Chemistry, 2015.
Board of Directors, Society of Environmental Toxicology and Chemistry, 2012-2015
Science Advisory Board, U.S. Environmental Protection Agency, 2010-2015.
Presidential Citation, Society of Environmental Toxicology and Chemistry, 2006.
Board of Directors, Society of Environmental Toxicology and Chemistry, 2003-2006.
Visiting Scientist Award, Natl. Institute of Water & Atmospheric Research, New Zealand. 1997
Jack E. Cermak Advising Award, Colorado State University. 1996.
President, Society of Environ. Toxicology and Chemistry (Rocky Mtn. Chapter), 1994-1995
Harry E. Troxell Distinguished Service-to-Students Award, CNR, Colorado State Univ. 1993.
Faculty Development Award. College of Natural Resources, Colorado State University. 1992.
Faculty Development Research Award. The Graduate School, Colorado State University. 1991.

PUBLICATIONS

Books

Newman, M.C. and **W.H. Clements** 2008. *Ecotoxicology: A Comprehensive Treatment*. Taylor and Francis, Boca Raton, FL, 852 pp.

Clements, W.H. and M.C. Newman 2002. *Community Ecotoxicology*. John Wiley and Sons, Chichester, United Kingdom, 336 pp.

Relevant Journal Articles, 2018-2021

([1]indicates current/former students or postdoctoral fellows)

Clements. W.H., D.B. Herbst, M.I. Hornberger, C.A. Mebane and T.M. Short. 2021 Long-term monitoring reveals convergent patterns of recovery from mining contamination across four western watersheds Freshwater Science. 40: 407–426.

Cadmus[1], P., C. J. Kotalik[1], A. L. Jefferson, S. H. Wheeler, A. E. McMahon, and **W. H. Clements**. 2020. Size-dependent sensitivity of aquatic insects to metals. Environmental Science & Technology 54: 955−964.

Wolff, B.A., S.B. Duggan and W.H. Clements. 2019. Resilience and regime shifts: Do novel communities impede ecological recovery in a historically metal-contaminated stream? J Appl Ecol 56:2698-2709.

Kotalik[1] C.J. P. Cadmus[1], **W. H. Clements**. 2019. Indirect effects of iron oxide on stream benthic communities: capturing ecological complexity with controlled mesocosm experiments. Environ. Sci. Technol 53:11532-11540.

Garman, E.R., J.S. Meyer, C.M. Bergeron, T.A. Blewett, **W.H. Clements**, M. Elias, K.J. Farley, F. Gissi, A.C. Ryan. 2019 Validation of bioavailability-based toxicity models for metals. Environ Toxicol Chem 53:11532-11540.

Clements W.H., P. Cadmus[1] C.J. Kotalik[1] and B.A. Wolff[1]. 2019. Context-dependent responses of aquatic insects to metals and metal mixtures: a quantitative analysis summarizing 24 years of stream mesocosm experiments. Environ Toxicol Chem 38:2486-2496.

Flanders J.R., G. Long B. Reese, N.R. Grosso, **W.H. Clements** and R.G. Stahl, Jr 2019. Assessment of potential mercury toxicity to native invertebrates in a high-gradient stream. Integ. Environ. Assess. Manag. 15:374–384.

Kotalik[1], C. J. and **W.H. Clements** 2019. Stream mesocosm experiments show significant differences in sensitivity of larval and emerging adults. to metals. Environ. Sci. Technol. 53: 8362−8370.

Dabney[1] B.L., **Clements W.H**., Williamson J.L. & Ranville J.F. 2018. Influence of metal contamination and sediment deposition on benthic invertebrate colonization at the North Fork Clear Creek Superfund Site, Colorado, USA. Environ. Sci. Technol. 52:7072-7080.

Rohr, J. R., E. Bernhardt, M. W. Cadotte, and **W. Clements**. 2018. The ecology and economics of restoration: when, what, where, and how to restore ecosystems. Ecology and Society 23(2):15. https://doi.org/10.5751/ES-09876-230215.

Cadmus[1] P, Guasch H, Herdrich AT, Bonet B, Urrea G, **Clements WH**. 2018. Structural and functional responses of periphyton and macroinvertebrate communities to ferric Fe, Cu, and Zn in stream mesocosms. Environ Toxicol Chem 37:1320–1329

Iwasaki[1] Y, Schmidt TS, **Clements WH**. 2018. Quantifying differences in responses of aquatic insects to trace metal exposure in field studies and short-term stream mesocosm experiments. Environ. Sci. Technol. 52:4378-4384.

RELEVANT RESEARCH FUNDING

Clements W.H. and E. Richer. 2019-2021. Post-restoration assessment of the upper Arkansas River: a watershed-level analysis of responses to improvements in habitat and water quality. Colorado Parks and Wildlife. $166,352.

Ranville, J., C.Vulpe, **W.H Clements**, and J. Meyer. 2014-2018. Investigating biogeochemical controls on metal mixture toxicity using stable isotopes and gene expression. National Institute of Environmental Health Sciences. $834,818.

Clements, W.H. and C. Myrick. 2016-2018. Biotic and abiotic factors that influence selenium bioaccumulation and food chain transfer in aquatic ecosystems. Colorado Parks and Wildlife. $124,489.

Clements, W.H., Hall, E.K., Warner, K.A. and Wolff, B. 2017-2018. Developing a comprehensive understanding of metal impacts on stream ecosystems in Colorado. The Water Center, Colorado State University. $25,000.

Clements, W.H. 2015-2018. Development and validation of rapid assessment techniques for determining effects of petroleum hydrocarbons on stream communities. Colorado Parks and Wildlife. $169,466.

Clements, W.H. 2018-2021. A quantitative assessment of restoration effectiveness in the Arkansas River, Colorado. Colorado Parks and Wildlife. $239,867.

Clements, W.H. 2015-2017. Development and validation of rapid bioassessment assessment techniques for determining effects of petroleum spills on aquatic ecosystems. Energy Institute, Colorado State University. $15,000.

Clements, W.H. and L. Pejchar. 2014-2017. Stream and riparian community integrity in the Piceance Basin: an assessment of restoration effectiveness. Chevron Corp. $194,789.

Clements, W.H. 2012-2017. Mechanisms of metal uptake and transfer in stream and riparian communities. U.S. Geological Survey. $217,573.

Clements, W.H. 2013-2015. Responses of stream communities to elevated levels of total dissolved solids. U.S. Geological Survey. $100,082.

Clements, W.H. 2013-2014. Responses of benthic macroinvertebrates to metals in stream mesocosms. International Zinc Association. $25,000.

Ranville, J., J. Shine, **W.H Clements**, and J. Meyer. 2011-2014. Remediation effectiveness for mining sites: hysteresis and metal mixtures effect. National Institute of Environmental Health Sciences. $854,818.

Vörösmarty, C.J., Poff, L., Wollheim, W. Fekete, B., **Clements, W.H.**, Green, M., Gettel, G. 2010-2013. Impact of climate change and variability on the Nation's water quality and ecosystem state. U.S. Environmental Protection Agency, EPA STAR Program, $799,554.

Clements, W.H., Vieira, N.K., Noon, B., and Wang, H. 2005-2009. Ecological thresholds and responses of stream benthic communities to heavy metals. U.S. EPA STAR Program. $293,238.

Clements, W.H. 2005-2009. Integration of hydrological and landscape techniques to assess impacts of heavy metal pollution in Rocky Mountain streams. USGS, $199,774.

Clements, W.H., J.S. Baron, D.S. McKnight, and J.S. Meyer. 2002-2005. The influence of climate-induced alterations in dissolved organic matter on metal toxicity and UV radiation in Rocky Mountain streams. U.S. EPA STAR Program. $896,212.

Clements, W.H. 2001-2004. Evaluating recovery of stream ecosystems from mining pollution: integrating population, community, and ecosystem responses. U.S. Environmental Protection Agency STAR Program. $300,578.

Ranville, J., D. Macalady, P. Ross, and **W.H. Clements**. 1998-2002. Particle size distribution and toxicity of metal-contaminated sediments. U.S. EPA STAR Program. $372,795.

Clements, W.H. 1995-2000. The influence of previous exposure to a mixture of heavy metals on tolerance: a mechanistic evaluation at different levels of biological organization. N.I.E.H.S. Superfund Basic Research Program. $652,500.

Burton, G.A., D. Krane, T.Tiernan, P. Landrum, W. Stubblefield, and **W. Clements**. 1998-2000. Sediment contamination assessment methods: validation of standardized and novel approaches. U.S. EPA STAR Program. $449,448.

Clements, W.H., B.T. Johnson. 1994-1998. Effects of sediment contaminants on macroinvertebrate and fish assemblages in lower lakes at Rocky Mountain Arsenal. U.S. Fish and Wildlife Service, Rocky Mountain Arsenal. $333,367.

Clements, W.H. 1992-1995. Toxicity and bioaccumulation of chemical mixtures in sediments: responses of benthic invertebrates and fish. N.I.E.H.S. Superfund Basic Research Program. $207,716

INVITED LECTURES AND PRESENTATIONS, 2010- present

Plenary Lecture, Biological Effects of Emerging Priority Pollutants, Girona, Spain, March 2010.
Society of Environmental Toxicology and Chemistry, Boston, MA, November 2011.
North American Benthological Society, Providence, RI, May 2011.
National Institute of Water and Atmospheric Research, Hamilton, New Zealand, May 2012
Society of Environmental Toxicology and Chemistry, Long Beach, CA, November 2012.
Keynote Address, SETAC Midwest Chapter, La Crosse, WI, March 2013.
Ecotoxicity Technical Advisory Panel, Stresa, Italy, June 2013.
Society of Environmental Toxicology and Chemistry, Nashville, TN, November 2013.
Plenary Address, Office of Water Science, Brisbane, Australia, August 2014.
Distinguished Lecture, Swiss Federal Inst. of Aquatic Sci. and Tech, Zurich, October 2014.
U.S. Environmental Protection Agency, Office of Water, Washington DC, September 2015
Society of Environmental Toxicology and Chemistry, Salt Lake City, UT, November 2015.
Society of Freshwater Science, Sacramento, CA. May 2016.
Society of Environmental Toxicology and Chemistry, Orlando, FL. November 2016.
Plenary Lecture, Society of Environmental Toxicology & Chemistry, Darwin, AU. July 2019

TEACHING AND ADVISING

Ecology (LIFE 320): Biennially since 1990.
Design of Research Projects (FW 370): Annually since 1989.
Ecotoxicology (FW 544): Biennially since 1990.
Honors Ecology (LIFE 320): Biennially since 2011
Conservation of Marine & Desert Organisms (FW473): co-taught annually since 2016

c. Detailed Budget

Coeus Proposal Development - Budget Summary

Proposal Number: 150048 **Budget Version : 1**

Proposal Title: Assessing the Effectiveness of Restoration Activities on the Arkansas River

Investigator Name: William H Clements

Period : 1 01 Jan 2022 - 31 Dec 2022

Comments:

	Personnel Category	Start Date	End Date	EB Rate	Vac Rate	Percentage Charged/ Effort	Fringe Benefits	Total Cost to Sponsor	Cost Sharing	Total Cost of Project
Senior Personnel										
William H Clements	Faculty Salary	01/01/22	12/31/22	26.70%	0.00%	0.0 / 21.66	$0.00	$0.00	$32,801.62	$32,801.62
						Total Senior Personnel	$0.00	$0.00	$32,801.62	$32,801.62
Undergraduate Students										
Summary	Student Hourly Salary	01/01/22	12/31/22	0.20%	0.00%		$18.00	$9,000.00		$9,000.00
						Total Undergraduate Students	$18.00	$9,000.00	$0.00	$9,000.00
Other Personnel										
TBN Admin. Pro. - 1(0)	TBN Admin Pro Salary	01/01/22	12/31/22	26.70%	0.00%	100.0 / 100.0	$9,612.00	$36,000.00		$36,000.00
						Total Other Personnel	$9,612.00	$36,000.00	$0.00	$36,000.00
Fringe Benefits								$9,630.00	$8,758.03	$18,388.03
Total Salaries & Wages & Fringe Benefits								$54,630.00	$41,559.65	$96,189.65
Materials and Supplies										
Materials and Supplies-supplies								$3,500.00		$3,500.00
						Total Materials and Supplies		$3,500.00	$0.00	$3,500.00
Professional Services/Consultant										
Consulting Agreement - addt'l justification req'd-Timberline Aquatics, Inc. will provide taxonomic assistance								$10,000.00		$10,000.00
						Total Professional Services/Consultant		$10,000.00	$0.00	$10,000.00
Travel - Domestic										
Budget Travel-travel								$2,500.00		$2,500.00
						Total Travel - Domestic		$2,500.00	$0.00	$2,500.00
Total Direct Costs								$70,630.00	$41,559.65	$112,189.65
F&A (Indirect) Costs										
ON-CAMPUS								$36,727.60	$21,611.02	$58,338.62
						Total F&A (Indirect) Costs		$36,727.60	$21,611.02	$58,338.62
TOTAL COST								$107,357.60	$63,170.67	$170,528.27

Coeus Proposal Development - Budget Summary

Proposal Number: 150048 **Budget Version : 1**

Proposal Title: Assessing the Effectiveness of Restoration Activities on the Arkansas River

Investigator Name: William H Clements

Period : 2 01 Jan 2023 - 31 Dec 2023

Comments:

	Personnel Category	Start Date	End Date	EB Rate	Vac Rate	Percentage Charged/ Effort	Fringe Benefits	Total Cost to Sponsor	Cost Sharing	Total Cost of Project
Senior Personnel										
William H Clements	Faculty Salary	01/01/23	12/31/23	26.70%	0.00%	0.0 / 21.66	$0.00	$0.00	$32,801.62	$32,801.62
						Total Senior Personnel	$0.00	$0.00	$32,801.62	$32,801.62
Undergraduate Students										
Summary	Student Hourly Salary	01/01/23	12/31/23	0.20%	0.00%		$18.00	$9,000.00		$9,000.00
						Total Undergraduate Students	$18.00	$9,000.00	$0.00	$9,000.00
Other Personnel										
TBN Admin. Pro. - 1(0)	TBN Admin Pro Salary	01/01/23	12/31/23	26.70%	0.00%	100.0 / 100.0	$9,612.00	$36,000.00		$36,000.00
						Total Other Personnel	$9,612.00	$36,000.00	$0.00	$36,000.00
Fringe Benefits								$9,630.00	$8,758.03	$18,388.03
Total Salaries & Wages & Fringe Benefits								$54,630.00	$41,559.65	$96,189.65
Materials and Supplies										
Materials and Supplies-supplies								$3,500.00		$3,500.00
						Total Materials and Supplies		$3,500.00	$0.00	$3,500.00
Professional Services/Consultant										
Consulting Agreement - addt'l justification req'd-Timberline Aquatics, Inc. will provide taxonomic assistance								$10,000.00		$10,000.00
						Total Professional Services/Consultant		$10,000.00	$0.00	$10,000.00
Travel - Domestic										
Budget Travel-travel								$2,500.00		$2,500.00
						Total Travel - Domestic		$2,500.00	$0.00	$2,500.00
Total Direct Costs								$70,630.00	$41,559.65	$112,189.65
F&A (Indirect) Costs										
ON-CAMPUS								$36,727.60	$21,611.02	$58,338.62
						Total F&A (Indirect) Costs		$36,727.60	$21,611.02	$58,338.62
TOTAL COST								$107,357.60	$63,170.67	$170,528.27

Coeus Proposal Development - Budget Summary

Proposal Number: 150048 **Budget Version : 1**

Proposal Title: Assessing the Effectiveness of Restoration Activities on the Arkansas River

Investigator Name: William H Clements

Period : 3 01 Jan 2024 - 31 Dec 2024

Comments:

	Personnel Category	Start Date	End Date	EB Rate	Vac Rate	Percentage Charged/ Effort	Fringe Benefits	Total Cost to Sponsor	Cost Sharing	Total Cost of Project
Senior Personnel										
William H Clements	Faculty Salary	01/01/24	12/31/24	26.70%	0.00%	0.0 / 21.66	$0.00	$0.00	$32,801.62	$32,801.62
						Total Senior Personnel	$0.00	$0.00	$32,801.62	$32,801.62
Undergraduate Students										
Summary	Student Hourly Salary	01/01/24	12/31/24	0.20%	0.00%		$18.00	$9,000.00		$9,000.00
						Total Undergraduate Students	$18.00	$9,000.00	$0.00	$9,000.00
Other Personnel										
TBN Admin. Pro. - 1(0)	TBN Admin Pro Salary	01/01/24	12/31/24	26.70%	0.00%	100.0 / 100.0	$9,612.00	$36,000.00		$36,000.00
						Total Other Personnel	$9,612.00	$36,000.00	$0.00	$36,000.00
Fringe Benefits								$9,630.00	$8,758.03	$18,388.03
Total Salaries & Wages & Fringe Benefits								$54,630.00	$41,559.65	$96,189.65
Materials and Supplies										
Materials and Supplies-supplies								$3,500.00		$3,500.00
						Total Materials and Supplies		$3,500.00	$0.00	$3,500.00
Professional Services/Consultant										
Consulting Agreement - addt'l justification req'd-Timberline Aquatics, Inc. will provide taxonomic assistance								$10,000.00		$10,000.00
						Total Professional Services/Consultant		$10,000.00	$0.00	$10,000.00
Travel - Domestic										
Budget Travel-travel								$2,500.00		$2,500.00
						Total Travel - Domestic		$2,500.00	$0.00	$2,500.00
Total Direct Costs								$70,630.00	$41,559.65	$112,189.65
F&A (Indirect) Costs										
ON-CAMPUS								$36,727.60	$21,611.02	$58,338.62
						Total F&A (Indirect) Costs		$36,727.60	$21,611.02	$58,338.62
TOTAL COST								$107,357.60	$63,170.67	$170,528.27

Coeus Proposal Development - Budget Summary

Proposal Number: 150048 **Budget Version : 1**

Proposal Title: Assessing the Effectiveness of Restoration Activities on the Arkansas River

Investigator Name: William H Clements

Period : 4 01 Jan 2025 - 31 Dec 2025

Comments:

	Personnel Category	Start Date	End Date	EB Rate	Vac Rate	Percentage Charged/ Effort	Fringe Benefits	Total Cost to Sponsor	Cost Sharing	Total Cost of Project
Senior Personnel										
William H Clements	Faculty Salary	01/01/25	12/31/25	26.70%	0.00%	0.0 / 21.66	$0.00	$0.00	$32,801.62	$32,801.62
						Total Senior Personnel	$0.00	$0.00	$32,801.62	$32,801.62
Undergraduate Students										
Summary	Student Hourly Salary	01/01/25	12/31/25	0.20%	0.00%		$18.00	$9,000.00		$9,000.00
						Total Undergraduate Students	$18.00	$9,000.00	$0.00	$9,000.00
Other Personnel										
TBN Admin. Pro. - 1(0)	TBN Admin Pro Salary	01/01/25	12/31/25	26.70%	0.00%	100.0 / 100.0	$9,612.00	$36,000.00		$36,000.00
						Total Other Personnel	$9,612.00	$36,000.00	$0.00	$36,000.00
Fringe Benefits								$9,630.00	$8,758.03	$18,388.03
Total Salaries & Wages & Fringe Benefits								$54,630.00	$41,559.65	$96,189.65
Materials and Supplies										
Materials and Supplies-supplies								$3,500.00		$3,500.00
						Total Materials and Supplies		$3,500.00	$0.00	$3,500.00
Professional Services/Consultant										
Consulting Agreement - addt'l justification req'd-Timberline Aquatics, Inc. will provide taxonomic assistance								$10,000.00		$10,000.00
						Total Professional Services/Consultant		$10,000.00	$0.00	$10,000.00
Travel - Domestic										
Budget Travel-travel								$2,500.00		$2,500.00
						Total Travel - Domestic		$2,500.00	$0.00	$2,500.00
Total Direct Costs								$70,630.00	$41,559.65	$112,189.65
F&A (Indirect) Costs										
ON-CAMPUS								$36,727.60	$21,611.02	$58,338.62
						Total F&A (Indirect) Costs		$36,727.60	$21,611.02	$58,338.62
TOTAL COST								$107,357.60	$63,170.67	$170,528.27

Coeus Proposal Development - Budget Summary

Proposal Number: 150048 **Budget Version : 1**

Proposal Title: Assessing the Effectiveness of Restoration Activities on the Arkansas River

Investigator Name: William H Clements

Period : 5 01 Jan 2026 - 10 Dec 2026

Comments:

	Personnel Category	Start Date	End Date	EB Rate	Vac Rate	Percentage Charged/ Effort	Fringe Benefits	Total Cost to Sponsor	Cost Sharing	Total Cost of Project
Senior Personnel										
William H Clements	Faculty Salary	01/01/26	12/10/26	26.70%	0.00%	8.33 / 8.33	$3,178.02	$11,902.71		$11,902.71
						Total Senior Personnel	$3,178.02	$11,902.71	$0.00	$11,902.71
Undergraduate Students										
Summary	Student Hourly Salary	01/01/26	12/10/26	0.20%	0.00%		$18.00	$9,000.00		$9,000.00
						Total Undergraduate Students	$18.00	$9,000.00	$0.00	$9,000.00
Fringe Benefits								$3,196.02	$0.00	$3,196.02
Total Salaries & Wages & Fringe Benefits								$24,098.73	$0.00	$24,098.73
Materials and Supplies										
Materials and Supplies-supplies								$500.00		$500.00
						Total Materials and Supplies		$500.00	$0.00	$500.00
Professional Services/Consultant										
Consulting Agreement - addt'l justification req'd-Timberline Aquatics, Inc. will provide taxonomic assistance								$8,000.00		$8,000.00
						Total Professional Services/Consultant		$8,000.00	$0.00	$8,000.00
Travel - Domestic										
Budget Travel-travel								$1,000.00		$1,000.00
						Total Travel - Domestic		$1,000.00	$0.00	$1,000.00
Total Direct Costs								$33,598.73	$0.00	$33,598.73
F&A (Indirect) Costs										
ON-CAMPUS								$17,471.34		$17,471.34
						Total F&A (Indirect) Costs		$17,471.34	$0.00	$17,471.34
TOTAL COST								$51,070.07	$0.00	$51,070.07

Budget Justification

1. Personnel

Principal investigator: One month of summer salary ($11,903) for the principal investigator is requested for year 5 of the project.

Lab technician: Salary is requested for one full-time ($36,000 per year) laboratory technician for years 1-4 of the project. This is a salaried position at $3000 per month. The lab technician will be responsible for field sampling, taxonomic identification of aquatic and terrestrial insect samples, and chemical analysis of water samples.

Student hourly. Our project will support 1 undergraduate student hourly research assistant (600 hours per year each at $15.00 per hour). The student will be responsible for field assistance, sorting macroinvertebrate samples, data entry, and routine laboratory maintenance.

2. Materials and Supplies

Funds are requested for expendable laboratory supplies (e.g., chemicals for analysis of water quality samples, sample containers, macroinvertebrate sorting materials, ethanol, vials, and labels), field meters (pH, conductivity, dissolved oxygen), and macroinvertebrate sampling materials.

3. Domestic Travel

Domestic travel funds are requested to support field research conducted on the Arkansas River. These travel funds will cover vehicle mileage to the field site and per diem costs for overnight field trips. Funds are also requested for the principal investigator to attend and present results of this research at the annual meeting of the Society of Environmental Toxicology and Chemistry (airfare, hotel, meeting registration).

4. Other Direct Costs

Timberline Aquatics, Inc. will provide taxonomic assistance with the identification of aquatic insect samples. Researchers at Timberline Aquatics have been responsible for taxonomic identification of all of the previous samples collected in the Arkansas River over the past 9 years. This will ensure that the level of identification for benthic invertebrates will be consistent with previous studies on the Arkansas River.

5. Indirect Costs

Indirect costs for the project are calculated at 52% of Total Direct Costs.

d. Letter of Support

COLORADO
Parks and Wildlife
Department of Natural Resources

CPW Aquatic Toxicology Laboratory
Aquatic Research Group
317 West Prospect Rd
Fort Collins CO 80526 USA
P 970-472-4332 | F 970-472-4457

To: CDPHE, UAR NRDA Trustee Council and review panel for 2021 Project Proposals for the Upper Arkansas River California Gulch Watershed Natural Resource Damages

From: Dr. Pete Cadmus, Senior Aquatic Toxicology Research Scientist, Colorado Parks and Wildlife's Aquatic Toxicology Laboratory in Fort Collins, Colorado, USA

Re: Letter of support for the proposal titled "Assessing restoration effectiveness in the Upper Arkansas River: integrating long-term monitoring with a before-after control-impact study design to quantify success" by Dr. William H. Clements et al.

I write to encourage funding of the "Assessing restoration effectiveness in the Upper Arkansas River: integrating long-term monitoring with a before-after control-impact study design to quantify success" proposal submitted by Colorado State University (CSU)'s Dr. William H. Clements. Below I will outline the historical ecotoxicological efforts of the state government in returning fisheries to this watershed, I will explain why the data gathered by Dr. Clements since 1989 is of the highest quality, and I will explain why it is useful to water managers, water quality managers and fisheries managers. I will close recommending this project for funding and state that Colorado Parks and Wildlife (CPW) staff will (a) maintain our intended annual sampling of the upper Arkansas River (UAR) sites, (b) coordinate sampling dates with the Clements lab to (c) allow gastric lavage of Salmonids. Additionally, CPW will provide the needed fish sampling data to the Clements laboratory in a format usable for the statistics described in the proposal.

Colorado's mining rush of the late 1800s and the early 1900s left many rivers and streams fishless by the mid 1900s. The agencies that would later become Colorado Parks and Wildlife and Colorado Department of Public Health and Environment (CDPHE) worked hand in hand from the late 1960s to today to develop safe surface water standards, prioritize acid mine drainage mitigation, and determine what species or age classes of trout could be stocked to replace those lost to mine pollution. Although native Salmonids may be too sensitive to ever occupy river systems downstream of historical mining activities, Colorado did foster a return of healthy fisheries to mine polluted sites. It was research that informed these management decisions. The success can be showcased in the presence of healthy fisheries, some designated "Gold Medal" status, in the Animas River, Clear Creek, and Eagle River basins. But it is especially true for the headwaters of the Arkansas River in the areas surrounding Leadville, Colorado.

Since 1989 Will Clements' laboratory has sampled the UAR every spring and fall (ideal seasons for macroinvertebrate data) using the best available science and techniques for biomonitoring benthic macroinvertebrates. His methodologies are truly quantitative, they allow in-stream variance to be calculated (not a physical average). They provide ideal resolution for Before-After-Control-Impact studies beyond what is used in other mine impacted watersheds in Colorado. The control of seasonal variability, consistent methods, consistent scientists, consistent microhabitat and ability to characterize in-stream variance make this study an ideal before-after-control-impact biomonitoring project and allows solid inference above and beyond any others in the UAR and Colorado. This is likely the longest running benthic macroinvertebrate biomonitoring project focused on effects of mining disturbance in North America. Data and results from

this biomonitoring effort have been frequently used or cited in government publications and scientific publications in predicting the response of mine reclamation efforts.

The UAR will face changes in temperature and water flow as a result of climate change and demands on water. The scientific literature and independent research at CPW suggests this has potential to exacerbate stresses of mine pollution. The UAR has seen habitat restoration efforts and will likely see alterations, both natural and anthropogenic, in the decades to come. The research conducted by the Clements Laboratory has served as and will continue to be a valuable resource in predicting responses of aquatic ecosystems to these and other disturbances and is an ideal tool for assessing effectiveness of chemical and physical restoration efforts. The UAR basin and its residents directly benefit from this insight. Additionally, the lessons learned from this research have great inference in other Colorado watersheds effected by mine pollution. It is my professional opinion that this research is an invaluable resource that should continue. 23,000 abandoned or active mines exist in Colorado. Federal, state and local agencies are continually investing in the reclamation or restoration of these sites. I have observed Dr. Clements' work influence the prioritization, methods and predictions of effects when planning abandoned mine site restorations.

Colorado Parks and Wildlife is not a "collaborator" with this proposed research project in that CPW will receive no funding if this grant is awarded to Colorado State University and its collaborators. If this grant is awarded to CSU, numerous CPW staff have agreed to coordinate fish sampling of UAR stations with Will Clements and his colleagues to ensure CSU has the ability to retain gastric lavage samples annually. These samples have proven informative in determining the diet of trout in the Arkansas River which further informs the effectiveness of riparian restoration and fish forage behavior. Colorado Parks and Wildlife biologists will maintain our annual or biannual sampling of UAR sites and will release the available results to Dr. Clements' laboratory in a format that allows him to continue the statistical analysis proposed in the proposal. This support is not a "Partnership Contribution" as our activities would be conducted regardless of the grant award to CSU.

I provide this opinion as my professional judgment having worked in the fields of environmental toxicology and aquatic ecotoxicology since 2001 and having spent significant time studying the UAR. My opinions are mine and not the formal opinions of Colorado Parks and Wildlife. Please feel free to contact me with questions or clarifications.

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Big Cottonwood Post-Fire Long-Term Recovery & Restoration Proposal

Solicitor: Colorado Department of Public Health & Environment

Funding Source: Upper Arkansas River California Gulch Natural Resource Damages

Project Offeror: River Science

Project Manager:
Chelsey Nutter
430 Main Street
Canon City, CO 81212
719-221-8213
chelsey@river.science

Total Project Cost: $227,788.00

NRD Request: $113,444.00

Matching Funds: $114,344.00

Chelsey R. Nutter

Chelsey R. Nutter, Project Manager

1. Executive Summary

The Hayden Peak Fire of July 2016 burned 16,700 acres that included nine drainages to the Arkansas River. All creeks showed elevated flow levels, sediment transport, and some damage to infrastructure, agricultural lands, and private property. In 2018, two years post-fire, a devastating flood wreaked havoc on Big Cottonwood Creek and its tributaries. According to precipitation data, the flood was determined to be a 25-year rain event with runoff estimates of 3,500 CFS of clear water. Field survey data and detailed hydraulic modeling showed strong evidence that this event behaved more like a 10,200 CFS flood event. The dramatic increase in flow was due to large amounts of debris distributed in the floodwaters from the burn scar.

For the past three years, River Science, in partnership with the Arkansas River Watershed Collaborative (ARWC) and other local partners, worked to address issues caused by the Hayden Pass Fire and subsequent flooding. Recovery response focused initially on the protection of life and property and building community trust and engagement. Now, five years post-fire and three years post-flood, we believe that our focus can now shift towards rehabilitation, restoration, and improvement of this area's riparian systems and habitat. To date, we have completed extensive community outreach, hydraulic and hydrologic modeling, risk assessments, and long-term recovery planning. Our project is shovel-ready and poised to move directly into implementation, providing the needed focus on water quality improvement, reducing high-risk sediment loading into the Arkansas River, and improving riparian and aquatic habitat.

Specifically, this project will focus on restoring fluvial processes of Big Cottonwood Creek utilizing Process-Based Restoration (PBR) techniques. Pre-fire, Big Cottonwood Creek was a healthy riparian system with a narrow, winding, and slow-moving creek. Landowners reminisce about the creek's beauty and abundant wildlife (16 beaver dams, brook trout, bears, etc.). Functionally, this creek's natural beaver ponds created several natural grade controls that slowed flows, trapped sediment, and tied it to the floodplain and groundwater system. Today the stream shows little evidence of ever being a small, winding creek with a connected floodplain. The post-fire flood events have carved deep incisions throughout the Big Cottonwood Creek channel. Such conditions have, and will continue to, cause several hydrologic, hydraulic, and habitat concerns.

PBR uses simple, cost-effective, hand-built structures that mimic beaver dams (beaver dam analogs) and large wood accumulations (i.e., post-assisted log structures). When strategically introduced to a stream, these structural elements can amplify natural hydrologic, geomorphic, and biological processes that accelerate the recovery of incised creeks and address limiting factors. Specifically, these treatments can widen the incised channel and use that generated material to lift, or aggrade, the channel bed. With many of the creeks' hydraulic, hydrologic, and habitat issues stemming from the deep incision, PBR offers a way to accelerate this channel bed aggradation and a chance to improve the conditions in a few years as opposed to hundreds of years.

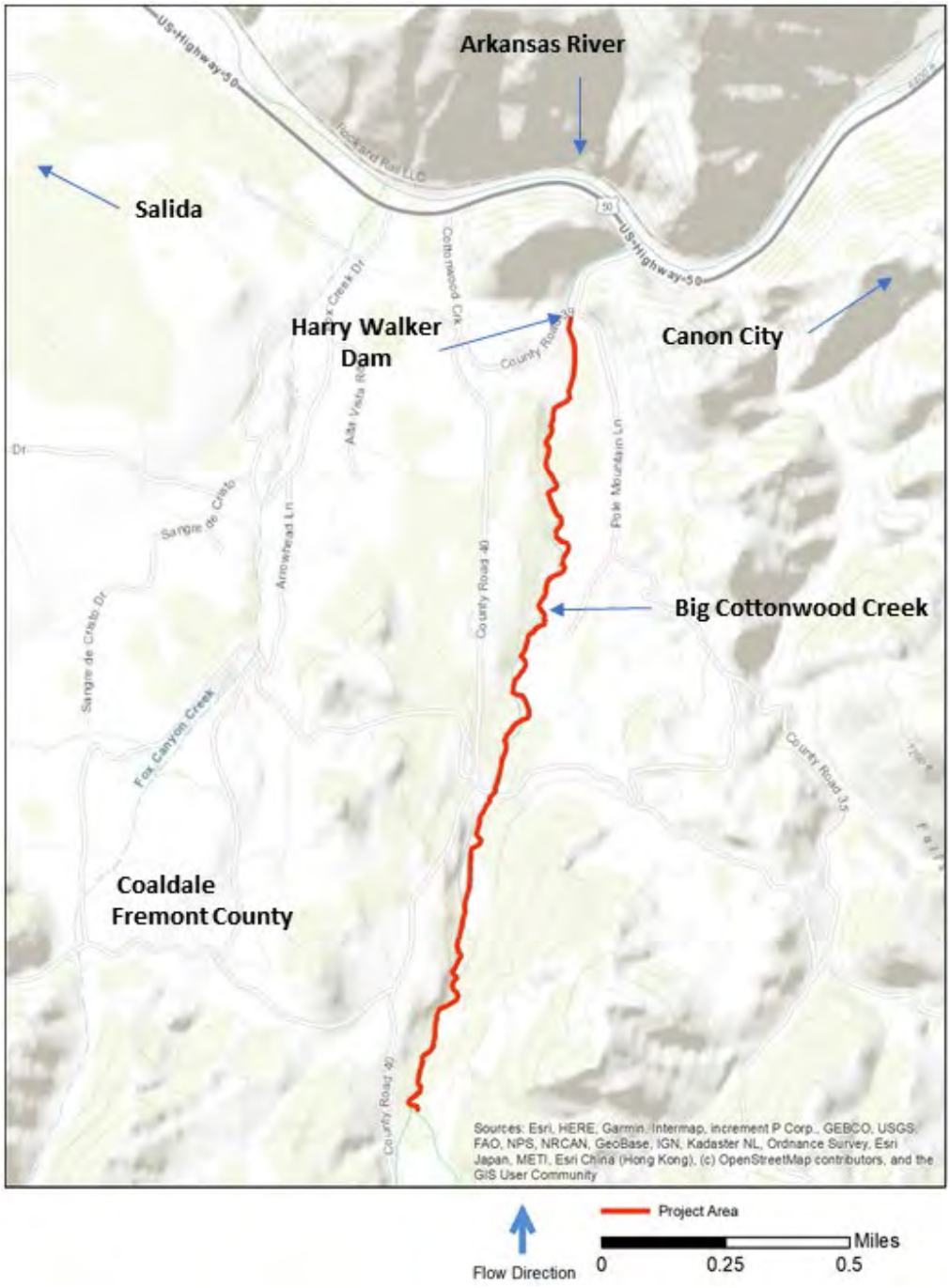
Fire and the State of Colorado's water are inseparable. As wildfire becomes more prevalent and drought persists, our State must examine how many post-fire impacted rivers and streams negatively influence our State's hydraulics, hydrology, water quantity, and water quality. As outlined above, several issues of degradation caused by post-fire flooding have left the creek's processes and habitat lacking.

Providing little to no recovery immediately post-fire and flood leaves many streams and rivers degraded for a significant amount of time. In an age where we must better manage our water and watersheds, we must consider restoring post-fire flood conditions and help return creeks to their proper health and hydrological function.

We believe our proposal directly meets the objectives of this RFP, specifically addressing the following statement: "the Trustees' objective for the Funds is to select proposals that contain projects that restore, rehabilitate, protect, or enhance areas that are related to, proximal to, or have an ecological nexus to, the natural resources and related services injured as a result of releases of hazardous substances from the Site" (CDPHE, 2021).

2. Scope of Work

As of the fall of 2021, there remain several concerns in these post-fire impacted creeks, specifically around disconnected floodplains that exacerbate future flood (and fire), poor water quality, riparian health, and habitat conditions. A full recovery of these systems could take hundreds if not thousands of years. We propose working with the natural environment to help speed up recovery through techniques that mimic natural processes. PBR has a proven track record of success in other states but has been stifled in Colorado due to potential water rights impacts. We have a unique opportunity to implement these cost-effective, low-tech technologies without the fear of water rights impacts since we propose work within a fire impacted stream. The objective is to return the creek to pre-existing conditions and restore a degraded system that is vital to this community and the entire Upper Arkansas River Basin.



2.1. Target Natural Resources

2.1.1. Hydraulic & Hydrologic Concerns

Numerous areas have deep incisions (8-12 feet shown in Figures 2A, 2C, 2D), undermined banks and trees, and significant head cuts that continue to propagate upstream (Figure 2B). These massive head cuts and deep incision causes steep and unstable banks that are dangerous to private landowners and the public. Hydraulic concerns are focused on the incised channels and increased sediment transport due to concentrated flows. These concentrated flows continue to cut the channel down, cause bank failures, and deliver enormous amounts of sediment downstream (including to the Arkansas River). While the fire burned several thousand acres above these drainages, several thousand acres of unburned forest still exist upstream. The potential for future fires and flooding is of concern to this already degraded system which would exacerbate future flood conditions and damages.

Figure 2. Post-fire flood events on the Big Cottonwood Creek have caused: A) large head cuts that continue to cause incision, and B) numerous areas of incision that range from 8-12 feet, C) large numbers of undermined trees, and D) significant bank erosion and sediment sources.

Hydraulic model simulations were used to explore the stream's changes. Simulations were performed in the same low-flow conditions with the pre-fire elevation data of 2016 and current 2021 elevation data (Figure 3). Model results show a drastic reduction in the existing topography's ability to spread flow and significantly higher shear stress values. Calculating the total inundation area pre-fire, Big Cottonwood Creek had 11.1 acres inundated with 1.95 acres ponded. Post-fire and flood show 6.3 acres inundated and 0.3 acres ponded. This equates to a ~40% reduction in low flow inundation and ~85% reduction in ponded areas.

As shown in Figures 3A and 3C, the 2016 channel geometry had several areas of floodplain connectivity and lower shear stress values compared to the 2021 conditions shown in Figures 3b and 3D. Inundation extent changes for all sections of Big Cottonwood Creek below USFS Wilderness designation are shown in Appendix A. These hydraulic conditions will continue to cause deeper incisions and bank failures, which will increase sediment generated and transported (diminishing water quality). As much of the upstream watersheds remain unburned, this area can experience another wildfire. The post-fire flood events could be more devastating in the future, given these creeks confined and concentrated flows. Further, the riparian system is not prepared to withstand future post-fire flooding.

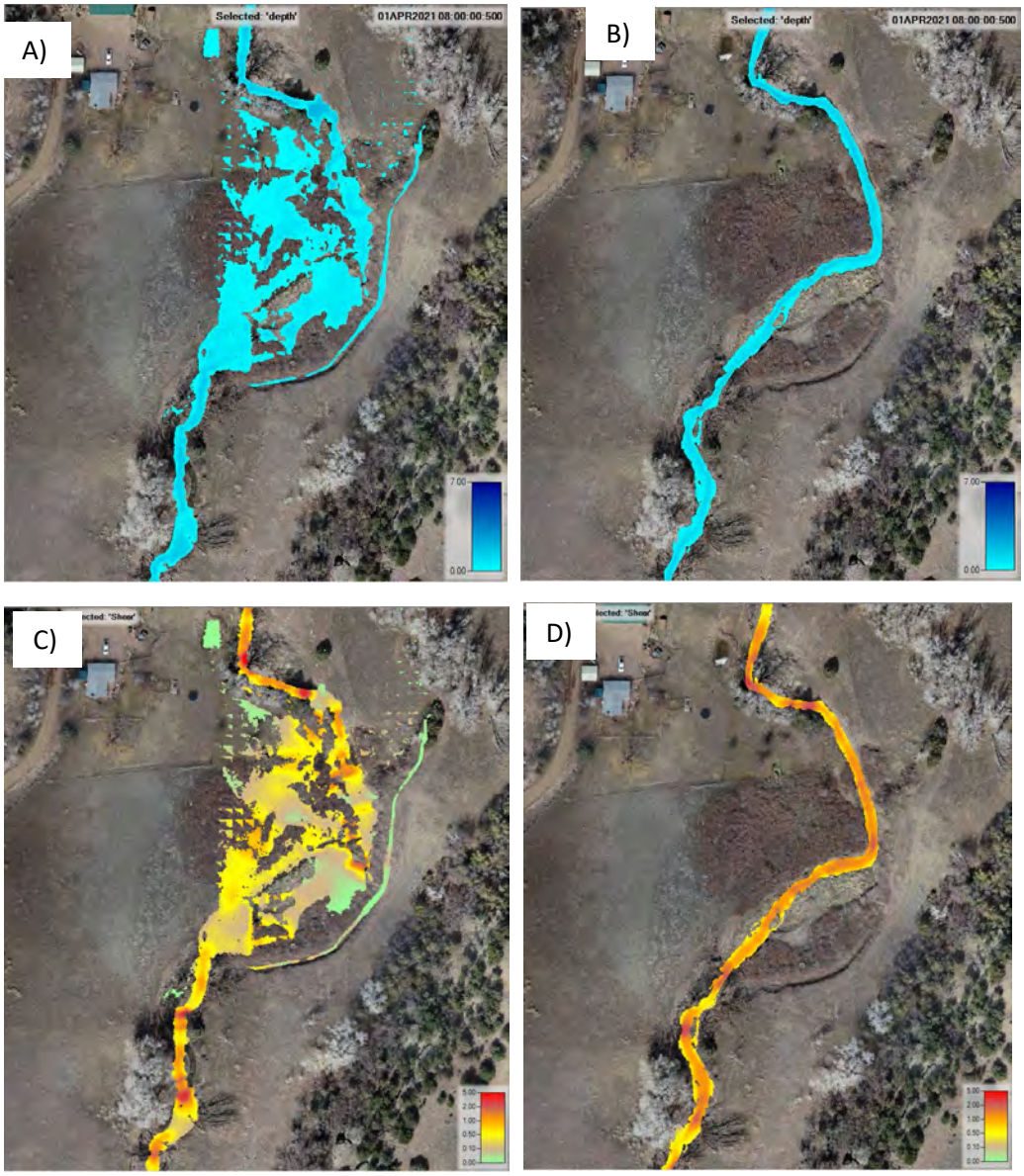


Figure 3. Hydraulic modeling results that show: A) pre-fire and flood events depth and C) shear stress, and post-fire and B) flood depth and D) shear stress.

Hydrologic concerns of this creek are centralized around the residence time of the passing water, groundwater infiltration, and groundwater storage. While incision has caused the channel bed to become several feet lower in most areas, it will naturally draw groundwater faster and lower the water table. A lowering water table will create impacts to residents on wells (many already reporting degraded water quality from their wells) as well as agriculture fields that rely on sub-irrigated lands. Further, the complete lack of channel structure or geomorphic units (i.e., pools, large boulders, and riffle-pool runs), this creek's flow is faster with less residence time to fill/replenish the aquafer and less timing available to irrigators.

2.1.2. Riparian Health and Habitat Concerns

As discussed in the section above, the hydraulic simulations of pre-and post-fire topographic conditions showed that the area of inundation was reduced from 11.1 acres to 6.3 acres, respectively. This reduction in available habit quantity is a striking difference and a metric to highlight the significant incision. However, habitat quality is another concern. The hydraulic conditions that exist create high amounts of fine sediment loads into the system (i.e., bank failures) and high amounts of sediment transport due to the concentrated flows. Recent field observations showed a total lack of pools upstream of the Harry Walker Dam to the USFS property (a 4-mile stretch) created by large amounts of sediment in the system that fills in any temporary pool. The creek is consistently alternating between riffle and run sections with very fast-moving waters along these miles.

Water quality has been documented on Big Cottonwood Creek over the last three years as part of River Watch of Colorado. Typical parameter readings (pH, dissolved oxygen, alkalinity, and hardness) show the creeks' water quality is within acceptable parameters, but with room for improvement. However, sediment loads are related to post-fire as fine sediments fill in the channel substrate voids, which degrades habitat for macroinvertebrates (the backbone to larger aquatic life and health). Field data in Big Cottonwood Creek and the Arkansas just downstream of the Big Cottonwood confluence showed significant impacts on aquatic life following the 2018 flood events. Results of macroinvertebrate kick net sampling in 2019 show that the Arkansas River upstream of the fire impacts consisted of a diverse and healthy population of macroinvertebrates with 1,153 bugs counted. The same sampling was done in the Arkansas below Big Cottonwood Creek confluence with smaller diversity and a count of 416 macroinvertebrates. Within Big Cottonwood Creek and tributaries, 2019 sampling found no macroinvertebrates. This was attributed to the lack of suitable substrate due to high loads of fine sediment and high-velocity conditions due to a complete lack of typical structure (i.e., downed trees, large boulders, pools, etc.). Today, macroinvertebrates (Mayfly and Caddisfly) have been identified in Big Cottonwood Creek, but these poor stream conditions still exist and will likely continue as the frequent bank failures generate large amounts of fine sediment that blanket the bottom substrate and fill in any temporary pools.

2.1.3. Harry Walker Dam Concerns

Harry Walker Dam is located at the downstream end of Big Cottonwood Creek where the CR-39 bridge crosses the creek (Figure 4A, pre-fire condition). Over the last several decades, the Harry Walker reservoir has been filling with sediment and losing capacity. However, the reservoir acted as a detention basin for the post-fire flood events and trapped large amounts of debris and sediment, protecting the Arkansas River just downstream. Since the 2018 flood event, this reservoir has filled with sediment and has become super-aggraded with several nearby sediment bars up to 5-6 feet above the dam crest elevation (Figure 4B, post-fire conditions). The result is that the Harry Walker Dam is constantly overtopping, and the dam crest creates a waterfall with a 15-foot vertical drop.

In its current condition, the dam's infrastructure would not be able to act as a catchment basin for future flood events. Further, if the apron fails, the reservoir's trapped sediment will begin to flush downstream to the Arkansas River. The elevated post-fire sediment loads have already degraded the Arkansas River's fishery, recreation/tourism, and impacted water quality downstream of Big Cottonwood Creek. Allowing the dam's apron to fail will release large amounts of fine sediment into the Arkansas River. Such large amounts, and the extended time to flush the sediment trapped behind the dam will greatly degrade the fishery for several years, potentially create a hazard. While dredging the reservoir would be expensive (historic estimates done by the local NRCS were well above $500,000), this reservoir could provide improvements for sediment storage for improved water quality to the Arkansas as well as valuable future aquatic and terrestrial habitat. We propose to continue to work with

the County, State Dam Engineer, and the Land & Reservoir Owner to develop feasible solutions to this issue. Although, we will not be requesting funding for implementation of this issue in this proposal, we feel that a continued watch, collaboration, and movement toward a viable solution is critical.

Figure 4: Harry Walker Dam A) aerial image taken in 2016 pre-fire/flood showing capacity, and B) post-fire/flood showing sedimentation and braided channels overtopping the dam crest.

2.1.4 Recovery Response Techniques

Following the Stream Evolution Model shown in Figure 9, Big Cottonwood Creek may likely widen and aggrade overtime to one day become a well-connected floodplain. However, this evolution from the current stage (2 or 3) to pre-fire conditions (ranging from stage 7, 8, 0, and 1) may take hundreds, possibly thousands of years. During this time, Big Cottonwood Creek would continue to suffer from the impairments listed above. However, targeted restoration aimed at accelerating this stream evolution could be done with cost-effective process-based restoration (PBR) methods as outlined by Wheaton et al. (2019).

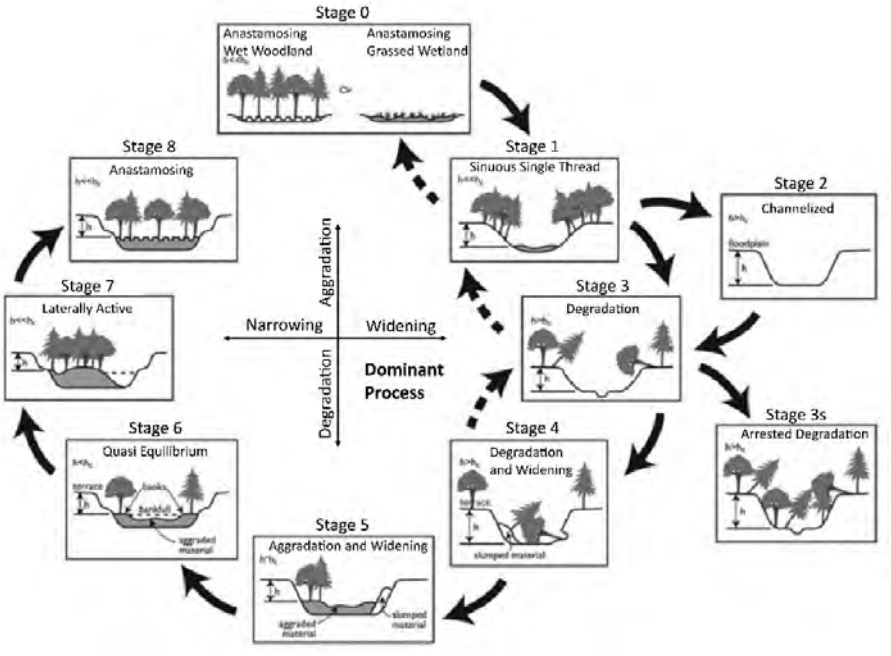


Figure 9. Stream evolution model (SEM) proposed by Cluer and Thorne (2014) illustrating approximate stages and pathways associated with recovery to Stage 0. Restoration in Big Cottonwood Creek could accelerate recovery trajectories.

According to Joe Wheaton and Stephen Bennet, PBR uses simple, cost-effective, hand-built structures that mimic beaver dams (beaver dam analogs) and large wood accumulations (i.e., post-assisted log structures). When strategically introduced to a stream, these structural elements can amplify natural hydrologic, geomorphic, and biological processes that accelerate the recovery of incised creeks and address limiting factors. Specifically, these treatments can widen the incised channel and use that generated material to lift, or aggrade, the channel bed. With many of the creeks' hydraulic, hydrologic, and habitat issues stemming from the deep incision, PBR offers a way to accelerate this channel bed aggradation and a chance to improve the conditions in a few years as opposed to hundreds of years.

2.1.5 Restoration Elements (Process-Based Restoration Techniques)

PBR focuses on using the creek's flow and stream power to help perform the restoration labor. Through carefully planned treatments, hand-built structures in series can be used to restore the lacking geomorphic processes. For example, using local and natural materials, a channel spanning treatment (Figure 5C, D, F, H) can be used as a grade control structure. The structure would trap sediment, raise the channel bed elevation, slow the flow's velocity, and reduce fine sediment. Other treatments can force flow into banks (Figure 5A, B, E, and G) that accelerate bank erosion and migration that can supply downstream the channel spanning grade control structures with new sediment sources, which helps widen and aggrade the channel. Such treatments provide much-needed structure to the creek by providing pools, shelter, slower water for the struggling macroinvertebrate life, and potentially future habitat and quality conditions necessary for the Greenback Cutthroat Trout. These treatments that aim to widen and aggrade the channel will also help to reduce the issues listed above in section 2.1.2 (Riparian Health & Habitat Concerns).

Figure 5: Images of PBR treatments that show Channel-Spanning BDAs and PALS, bank-attached PALS, and mid-channel PALS.

2.2 Objectives

Our primary objectives include:

- Reconnect the floodplain to spread and slow flood waters (creating healthy systems for future post-fire landscape)
- Reduce frequent bank failures which introduce large amounts of fine sediment into the system
- Expand low-flow inundation extent (initially 11.1 acres and now 6.3 acres)
- Increase structure and geomorphic diversity (i.e., pools, slow moving water, ponded areas)
- Reduce velocity to increase aquatic habitat
- Restore deep incisions by trapping sediment to increase the elevation of the creek bed
- Mitigate steeper grades and faster flows which reduce water residence time and infiltration
- Increase and restore habitat for aquatic and terrestrial wildlife
- Reduce risk of dangerous bank conditions for private and public access
- Provide viable habitat for the introduction of the Greenback Cutthroat Trout
- Serve as a model that can be transferable across the State to address long-term recovery needs post-fire. We believe these techniques will speed up the recovery process and help heal damaged landscapes by working with the natural system. Additionally, these methods and procedures can be utilized for any type of damage recovery. We hope to develop a demonstration that will serve as a catalyst for long-term recovery efforts throughout the State and specifically in the Arkansas River Basin

2.3 Operational Plan

2.3.1 Plan of Action

Task 1: Community Outreach & Partner Engagement

Description

Although we have been building partnerships within this community over the past few years, it is important to start all projects with community outreach. We will hold meetings within the community to assure that all are aware of the project, benefits, and anticipated outcomes. We continuously meet with landowners who are already aware of and support our proposed recovery work. We will expand this engagement to include partners and others within the community.

Methods/Procedure:

- One on one meetings & agreements with Landowners where work will commence
- Information provided through our extensive community email list and on our website
- Outreach with past and potential partners including Fremont County, Trout Unlimited, Colorado Parks & Wildlife, Upper Arkansas Water Conservancy District, Bureau of Land Management, US Forest Service, Canon City Water District, etc.

Deliverable

Successful delivery of information and engagement to community members and partners.

Task 2: Expert Consulting & Project Preparedness

Description

Luckily, we have spent the last three years preparing for this project with extensive modeling, engagement, and implementation planning. With that said, we want to move into implementation with the highest level of knowledge and preparedness. Therefore, we would like to bring out the experts in Process-Based Restoration to review our proposal on the ground before implementation. Mr. Joe Wheaton (Utah State Professor) is an expert on PBR. We have worked with Joe for many years and highly respect his keen eye on the ground. Mr. Wheaton has provided this level of consulting for other projects, which assures a high level of success for these types of

projects. Additionally, we will need to work with landowners and other partners to finalize permitting and land access agreements. Lastly, we will purchase all materials required for implementation.

Methods/Procedure:

- Field visit with Joe Wheaton
- Follow up implementation planning meeting with Joe Wheaton
- Individual Landowner Agreements
- Army Corps of Engineers 401 Permit (already initiated conversations)
- Contract with Colorado Correction Industries (have a good working relationship with CCI)
- Purchase all needed materials and equipment

Deliverable:
Final Implementation Plan (includes maps, photos, modeling, contracts, permits).

Task 3: Process-Based Restoration Implementation

Description
Lead SWIFT Crew in the implementation of all treatments along 1.8 miles of Big Cottonwood Creek. Construct BDAs and PALs according to final implementation plan.

Methods/Procedure:

- Construct treatments in each reach according to implementation plan
- Utilize SWIFT Crew for a three-week period to complete implementation

Deliverable
Successful completion of treatment implementation documented through progress reports as described in Task 5

Task 4: Monitoring & Maintenance

Description
Due to the nature of these hand-built structures, monitoring and maintenance are mandatory. Although the cost is low, River Science must maintain structures for the first few years until they are established. A primary component of this project is to document these treatments to serve as a model for other communities and projects. We anticipate a 10-year monitoring schedule to provide the crucial data needed for this project. We have partnered with Canon City High School (CCHS) through our year-long course- River Science. Students who take this course will help monitor this project for the next 10-years. Our partnership with CCHS provides hands-on experience for students while also providing low-cost labor for monitoring needs.

Methods/Procedure:

- Monitoring may include surveys (drone & land), cross-section flow, depth, & width, water quality parameters (pH, temp, turbidity, etc.), riparian & habitat health indicator assessments.
- Maintenance may include reconstruction of damaged structures, development of new structures, removal of structures.
    - Years 1-2: Monthly monitoring and maintenance
    - Years 3-5: Seasonal monitoring and maintenance (limited maintenance, reduces every year)
    - Years 5-10: Seasonal monitoring (not included in the budget)

Deliverable

Annual monitoring reports and annual plans. Each year River Science will update the monitoring plan based on annual results.

Task 5: Project Management

Description
The project manager will serve as the point of contact and will be responsible for grant administration, working with funders & partners, managing personnel and sub-contractors, managing permits & agreements, scheduling, task management, progress, and monitoring reports, and overall project compliance.

Methods/Procedure:

- Serve as point of contact for funders, partners, landowners, and contractors
- Assure compliance with permitting and performance
- Prepare and submit progress reports and communicate regularly with partners
- Responsible for grant tracking and budget management
- Accountable for project management, scheduling, task management

Deliverable
6-month progress reports & final reporting and inspections provided to CDPHE through the project's duration. Project reports will include photos, maps, modeling, and narrative on project progress, success & limitations. A final report will be provided, which may also serve as a template for other restoration projects in the Upper Arkansas Basin or throughout the State.

2.3.2 Resources and Partners

During the fire and floods, this region and creek have received much attention from local stakeholders such as the Arkansas Basin Roundtable, local businesses, US Forest Service officials, NRCS officials, Colorado Parks and Wildlife officials, Arkansas River Headwater Association, and Colorado Trout Unlimited. Many of these groups have a shared interest in seeing the restoration of this creek for various reasons. A significant component in post-fire impacted drainages is the social aspect of when the residents who have experienced flooding are willing to transition away from flood mitigation and into creek restoration. In talking with several landowners and seeing new land modifications (i.e., field preparation, restoration of old ponds, and some introduction of rocks to make pools), many landowners have transitioned into a restoration desire.

Aside from local interests to restore this area, several partners are interested in Big Cottonwood Creek becoming a secondary creek for the threatened Greenback Cutthroat Trout, Hayden Creek lineage. These fish are rare, and CPW only puts them in streams with a physical barrier to prevent crossbreeding with other trout. Big Cottonwood is a timely opportunity since the Harry Walker Dam is a fish barrier with minimal (if any) current fish population and is close to the species native area. Restoration of this creek could be a valuable habitat to this fish that many other creeks do not offer.

Specifically, for this phase of the project, River Science will be able to complete the treatments with in-house staff and through a contract with a CCI (SWIFT Crew). River Science will partner with CCHS and River Watch to assist with the 10-year monitoring of the project. CCHS will provide in-kind services through our River Science course. Additional partners will be essential as we move toward the established recovery of this creek and begin to explore the introduction of the Greenback Cutthroat Trout. We are continuing to build partnerships with Trout Unlimited and Colorado Parks and Wildlife, who are enthusiastic about this project and the opportunity for Greenback Cutthroat Trout. Our partner, the Arkansas River Watershed Collaborative, is highly supportive of our continued efforts to restore the health and function of this creek. All partners are willing to supply letters of support upon request.

Due to the nature of grant deadlines, we have not at this point secured outside funding for the 50% match requirement. With this said, we are confident that we can confirm the required match by the time we plan to initiate the project in 2022. The Colorado Water Conservation Board has funded the first two phases of recovery response at Big Cottonwood Creek. We have had long-standing support from the CWCBs Watershed Restoration Program, and we will be submitting a grant proposal to this program on November 1st, 2021. Chris Sturm, program manager, advocates for PBR restoration and has been a valued partner for post-fire recovery. We have a proven track record of securing CWCB funds for multiple projects. We may also apply for funding through CWCB's Water Plan Grants on December 1st, 2021. Lastly, we have received funding through the Colorado Parks & Wildlife Wetlands for Wildlife Program. A new round of funding will be available in early 2022.

2.3.3 Schedule, Permitting, OMM, Complementary Projects, Treatment Mapping

Big Cottonwood Long-Term Recovery Schedule																
	2022												2023	2024	2025	2026
Task	Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec				
1																
2																
3																
4																
5																

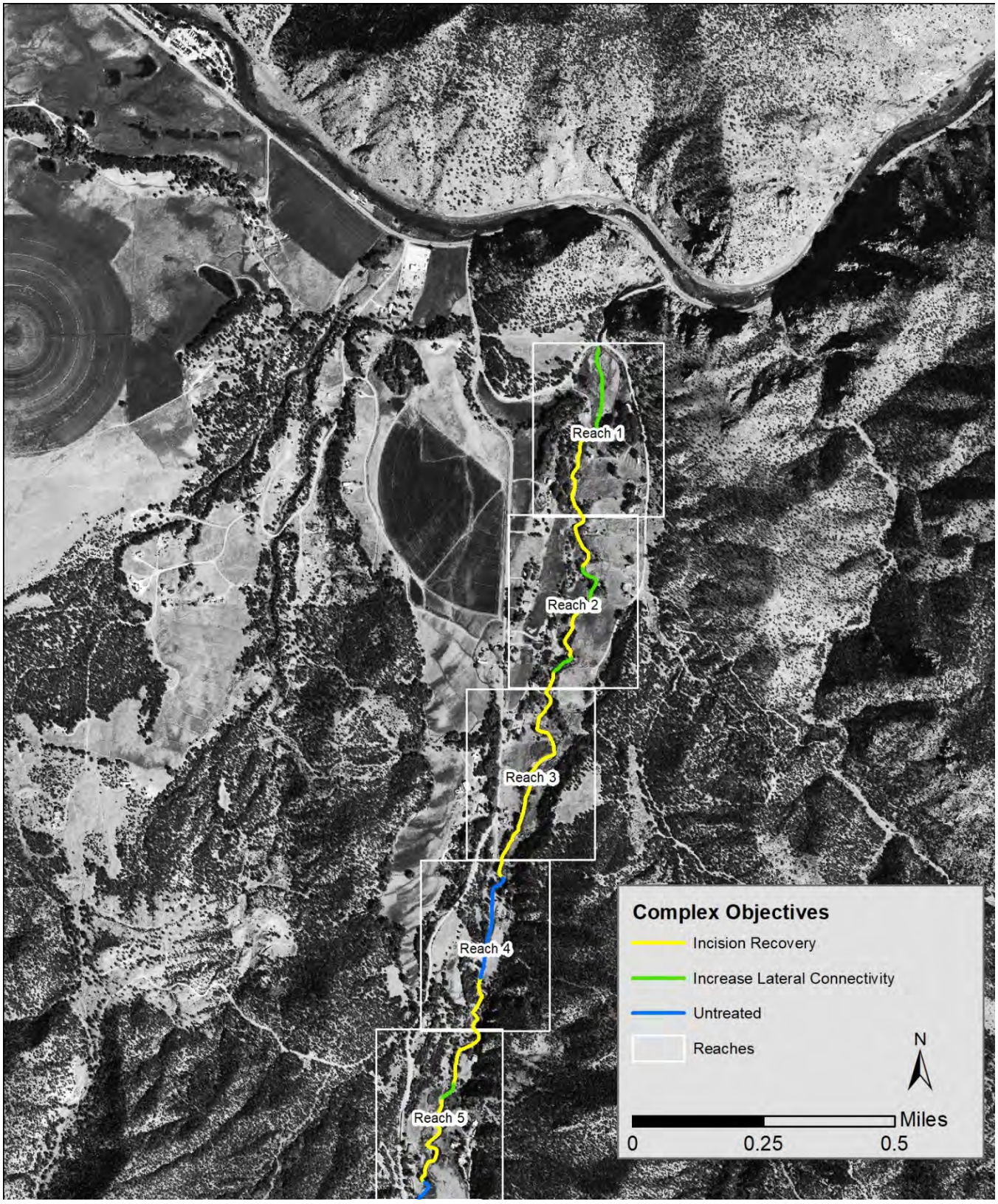
We propose to start this project in March of 2022 or after receiving NTP. We will begin with tasks 1 & 2, community engagement & project preparedness. Task 3- Implementation will move fast if we work with a SWIFT crew; we anticipate approximately six weeks for implementation. We have had great success working with SWIFT crews in the past on restoration-based projects. Typically, a SWIFT Crew consists of 15-18 inmates lead by 2-3 officers. The crews usually work a four-day workweek and camp on-site. The amount of work that they accomplish in a short time is unprecedented. We blocked off two months for implementation to provide adequate time for any surveying, equipment rental, and land use modifications that may arise. The bulk of our time will be spent on monitoring and maintenance. We propose a five-year monitoring & maintenance plan as described in the scope of work above. Additional monitoring will be completed for ten years funded by River Science.

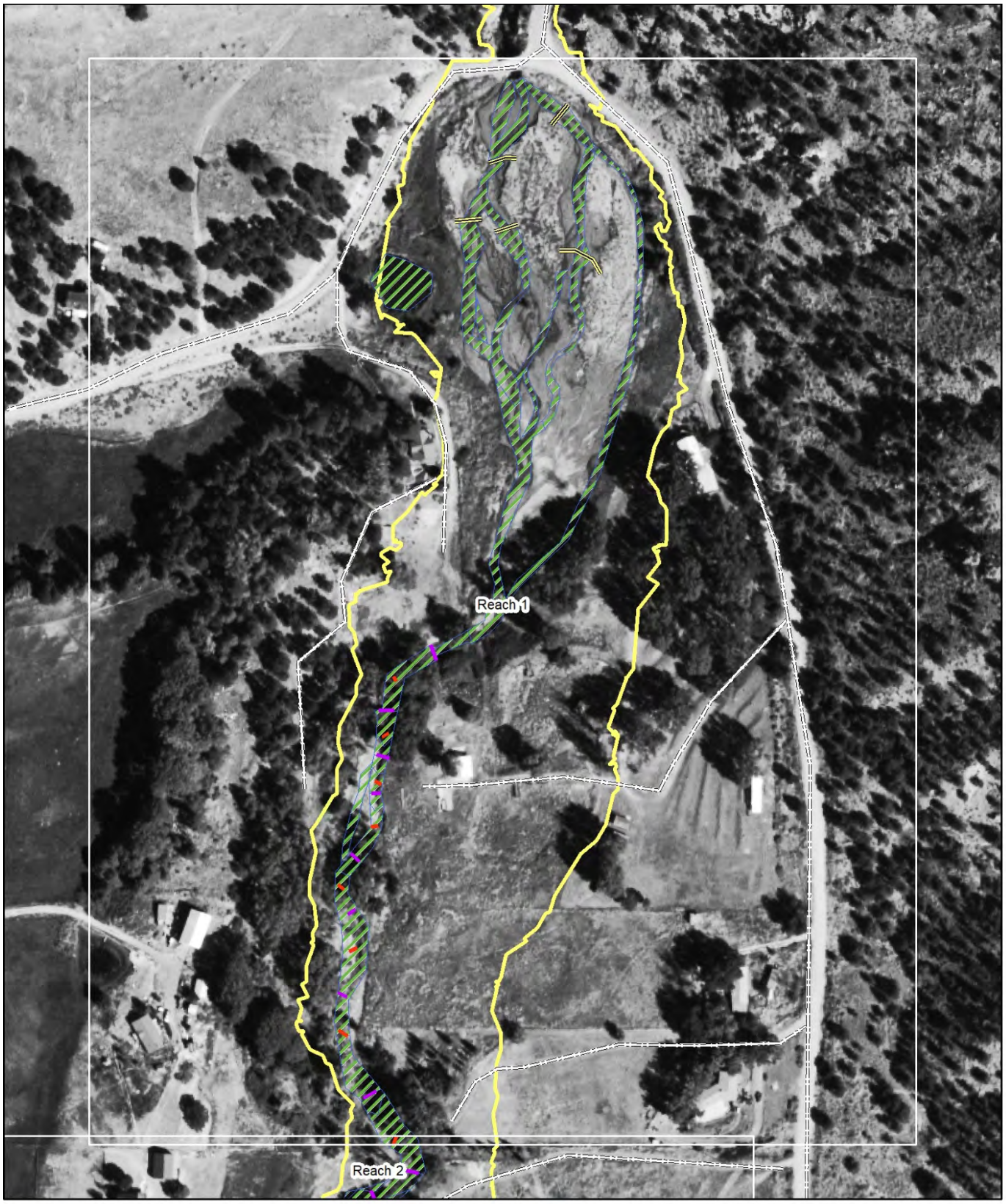
Our treatment methods mimic the natural environment and are hand-built structures. The materials used to create these structures are raw materials typically sourced on-site (trees, limbs, rocks, branches). Our treatments are not intended to be permanent; instead, they work with the natural system to kick-start and accelerate processes. Therefore, no engineering design or engineering stamp of approval is needed for the techniques we will utilize and permitting/legal considerations are limited. We have been in conversations with the Army Corps of Engineers to work under the nationwide 404 permit. Due to the unique methods and materials utilized, our primary contractual needs focus on contracts with sub-contractors (CCI) and License to Enter Agreements with Landowners.

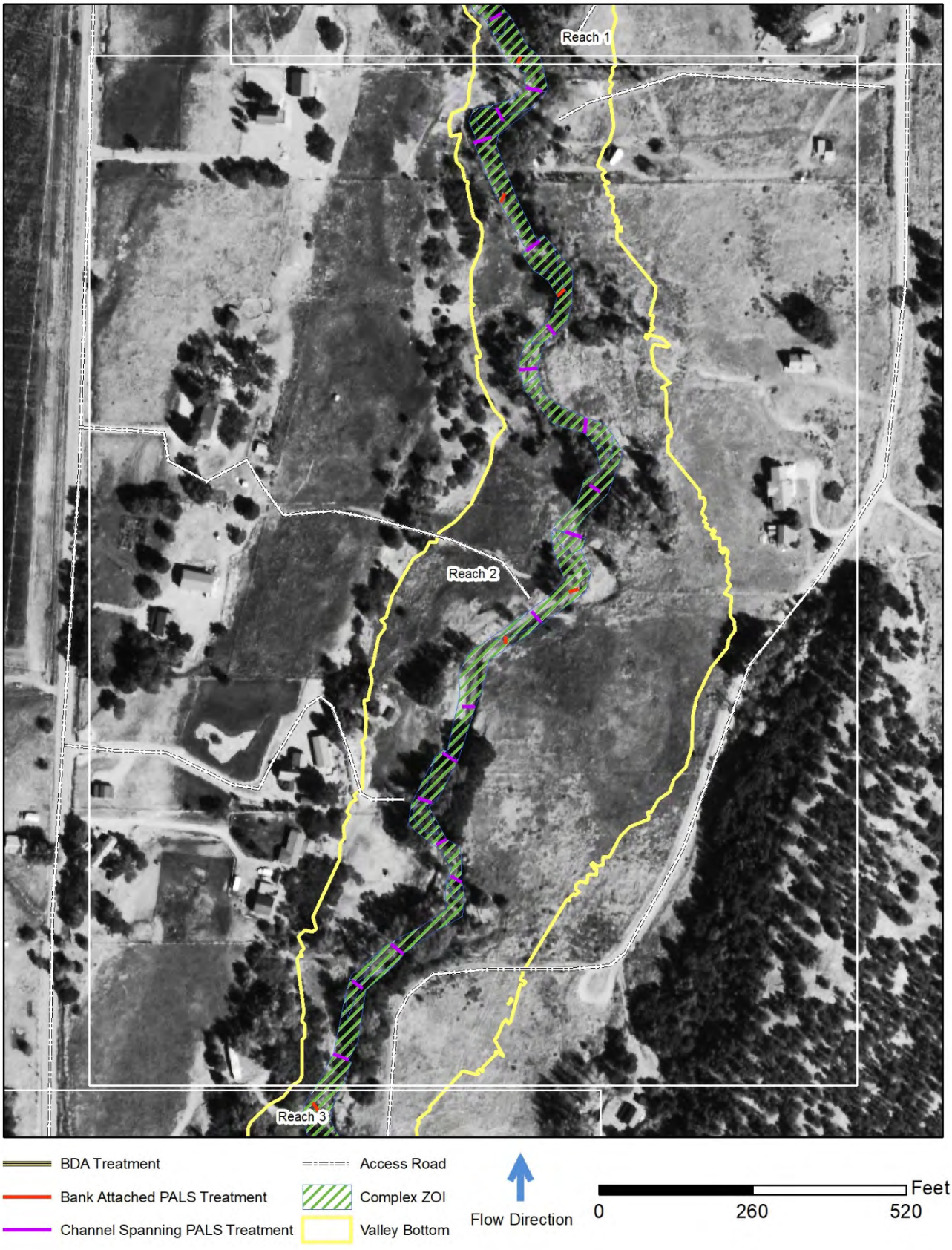
Our OMM plan is outlined in the SOW. Monitoring will take place monthly for the first three years and seasonally for the next seven years. Funding is requested through this proposal for the first five years of monitoring, as this is a critical element of this project. Information gathered from this project can be transferable to other projects focused on natural resource damage mitigation and can serve as a model for recovery.

This proposal is the final chapter for recovery from the Hayden Pass Fire. For the past five years, partners have worked to protect this community and its resources from the devastating effects of fire & flood. The work we are proposing is beneficial to multiple projects and programs that depend on the health and vitality of the Arkansas River, including the Voluntary Flow Program, Gold Medal Fishery, municipal, agricultural, environmental, and recreational water supply, and much more.

Restoration of Big Cottonwood Creek will extend from Harry Walker Dam through five reaches of private property. An overview map of the project and an associated treatment reaches are provided below. Additional modeling of how treatment methods were established can be found in Appendix A.




Reach 1
Reach 2
BDA Treatment
Bank Attached PALS Treatment
Channel Spanning PALS Treatment
Access Road
Complex ZOI
Valley Bottom
Flow Direction
0
260
520
Feet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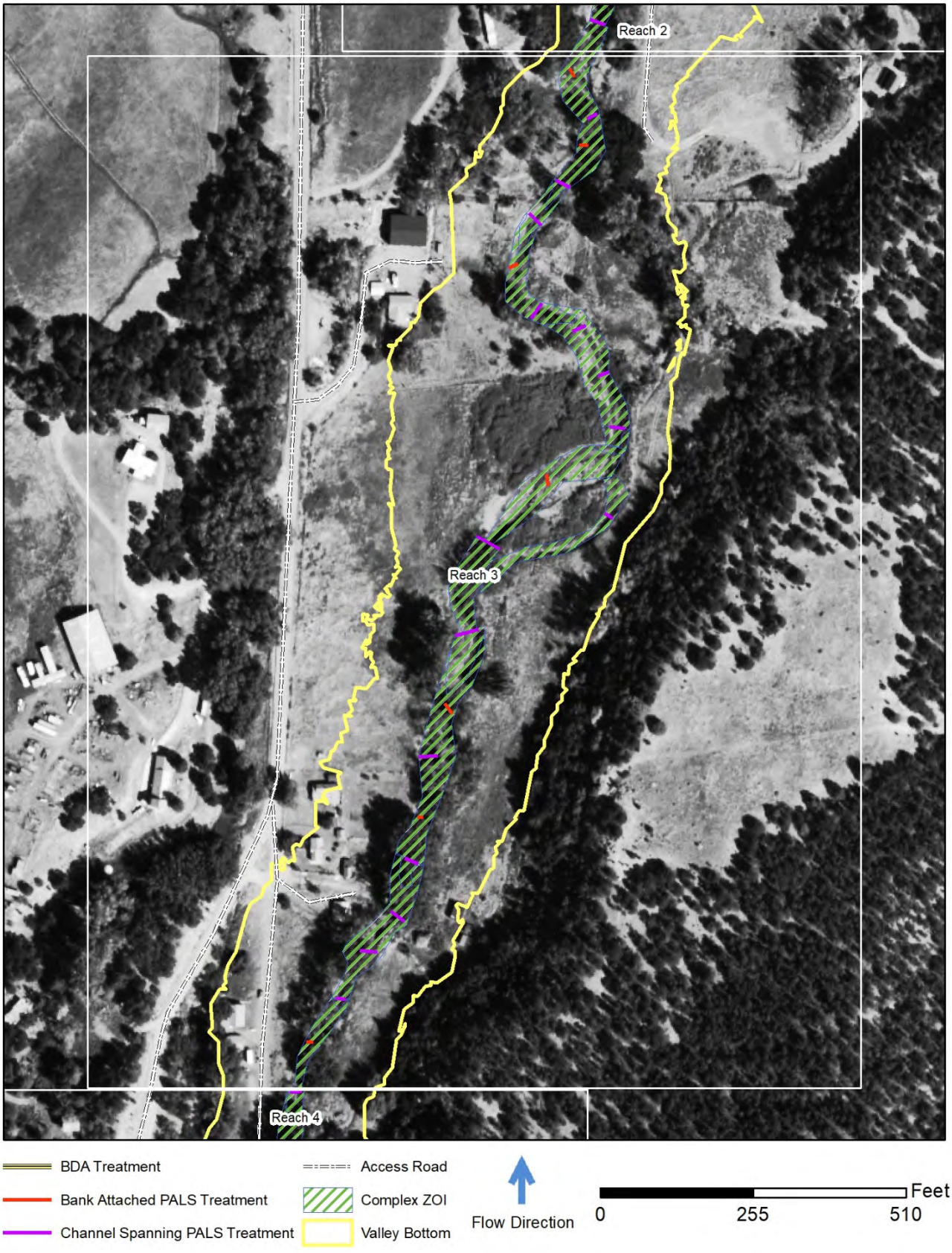
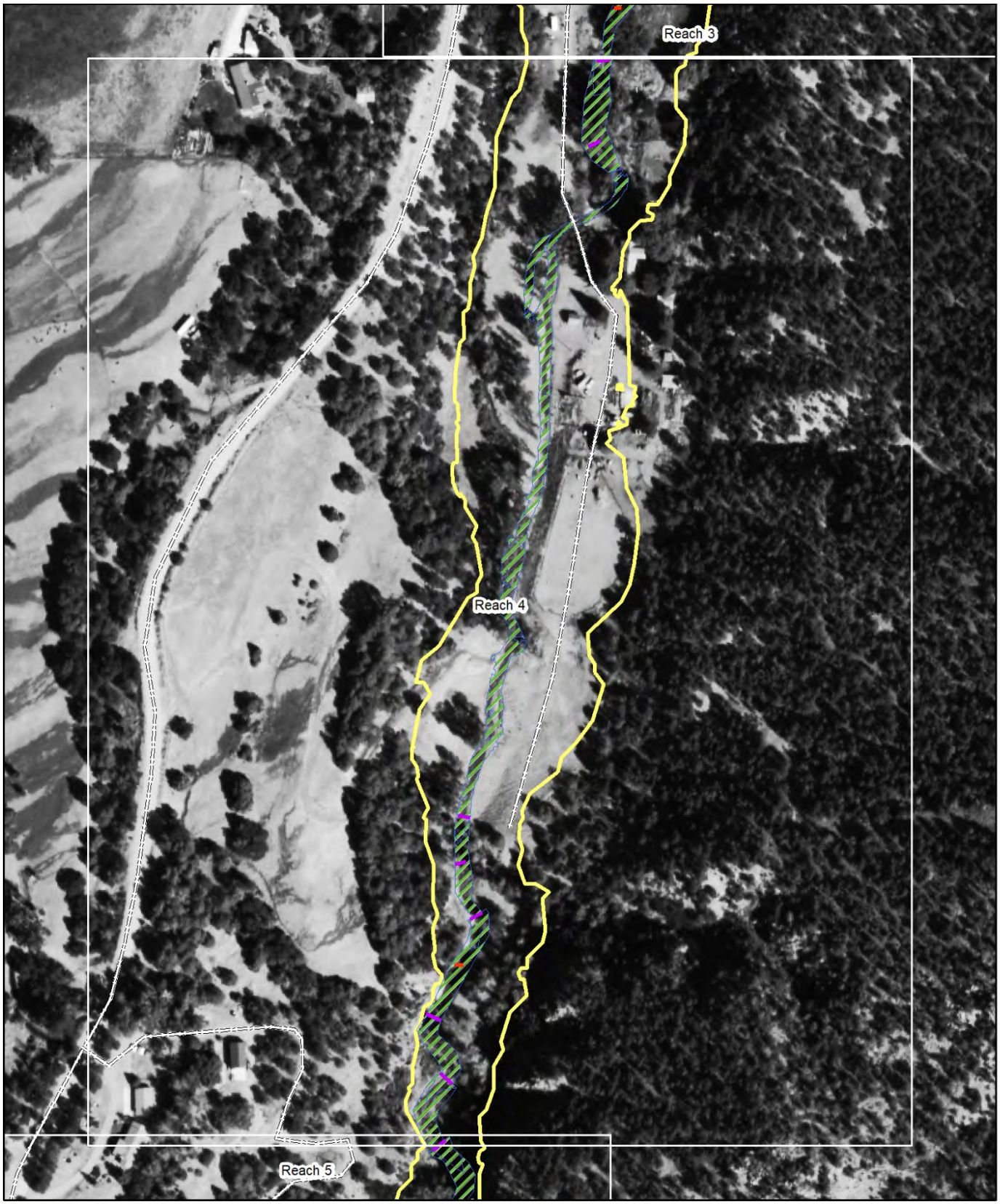
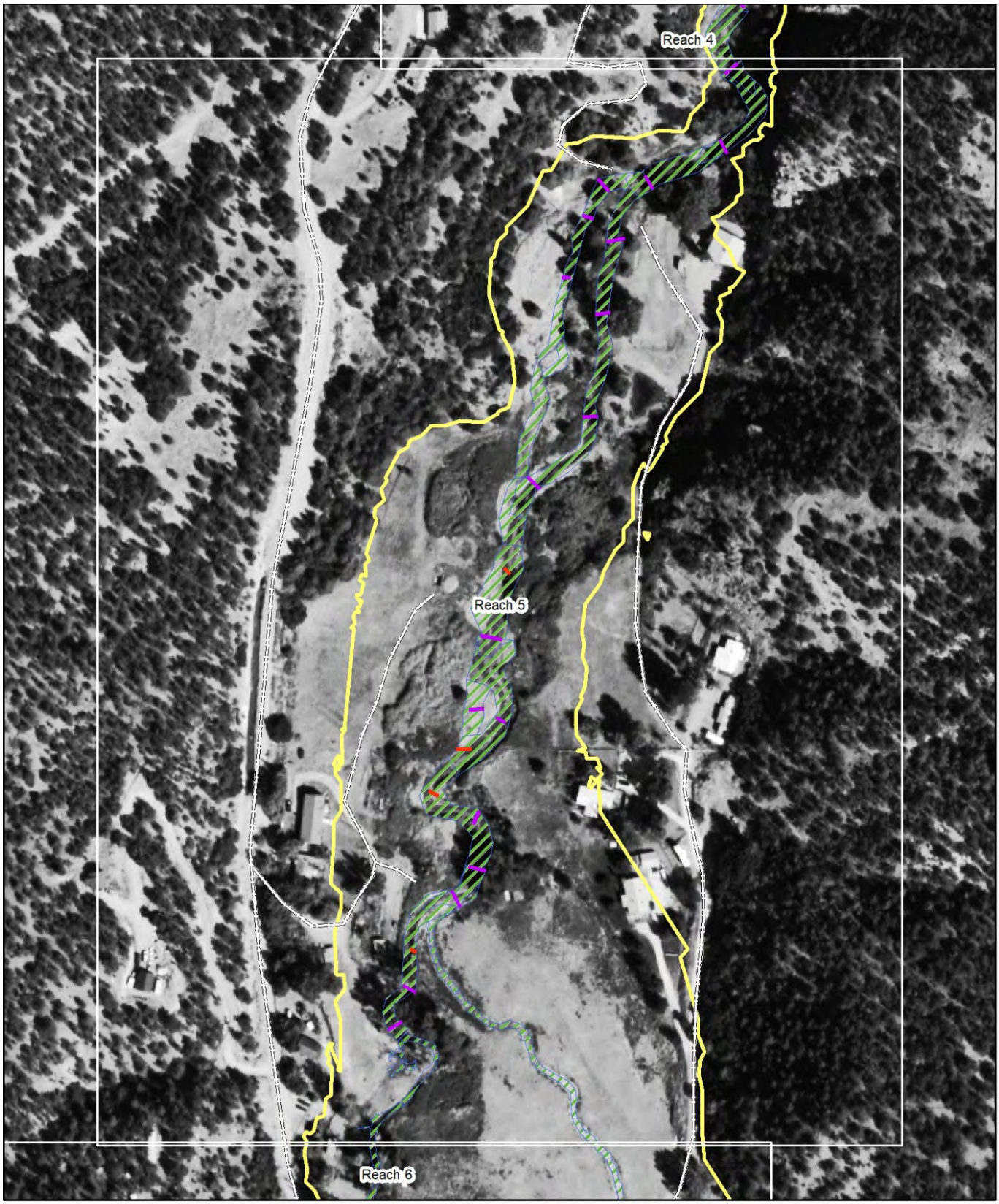

Reach 2
Reach 3
Reach 4
BDA Treatment
Bank Attached PALS Treatment
Channel Spanning PALS Treatment
Access Road
Complex ZOI
Valley Bottom
Flow Direction
0
255
510
Feet


Reach 3
Reach 4
Reach 5
BDA Treatment
Bank Attached PALS Treatment
Channel Spanning PALS Treatment
Access Road
Complex ZOI
Valley Bottom
Flow Direction
0
255
510
Feet


Reach 4
Reach 5
Reach 6
BDA Treatment
Bank Attached PALS Treatment
Channel Spanning PALS Treatment
Access Road
Complex ZOI
Valley Bottom
Flow Direction
0
255
510
Feet

The detailed reference maps above provide project objective maps that shows the treatment goals for a particular section of river (i.e., incision recovery, lateral connectivity, no treatment). Within each of the five reaches, River Science has prepared potential restoration treatments that would target a specific reach's degradation. These treatments were placed/designed using available elevation datasets to strategically increase the current post-fire inundation from the 6.3 acres back to the pre-fire conditions of approximately 11 acres. The figures show the estimated valley bottom (i.e., the active and inactive floodplain), the envisioned treatments, and the treatment's hydraulic and geomorphic Zone of Influence (ZOI). The ZOI is not a representation of post-treatment low-flow inundation and not meant to be compared to the Figures of Appendix A. Rather, the ZOI is a generic representation of possible channel migration and how treatments will deflect water during small frequent floods. As shown in the Figures, bank attached and channel spanning PALS and/or BDAs are alternated in relative proximity. This approach is designed to quickly cause channel migration to generate materials that will be quickly trapped downstream by channel spanning PALS and/or BDAs to cause frequent channel widening and trapped sediment for channel aggradation. These treatments would require several iterations and several years to reach their full potential. However, the tradeoff in time is the benefit of low-cost restoration.

3. Budget Narrative

The project will be managed by Chelsey Nutter of River Science. Chelsey is responsible for the overall compliance, progress, reporting, and task management of the project. Chelsey will be the primary point of contact for funders, landowners, partners, and contractors. Executive Director Luke Javernick will act as the foreman for all construction, monitoring, and maintenance. Luke will lead the Colorado Corrections SWIFT crew in the implementation of treatments. Luke will also be responsible for the maintaining structures and monitoring (surveys, flow measurements, water quality sampling, etc.). Luke will utilize the Canon City High School River Science Class to assist with monitoring and maintenance of the project. Joe Wheaton will serve as a consultant for the project as the leading expert in PBR implementation. Chelsey and Luke have a proven track record of managing and implementing post-fire recovery projects. They have served as project managers, hydrologist, and engineers on multiple projects including Spring Creek Fire Recovery, Decker Fire Recovery, and the Van Norman Restoration Project. Please see Appendix A for a full description of River Science qualifications.

4. Public Communications Strategy

The public communications strategy is outlined in the scope of work under Task 1- Community Outreach & Partner Engagement. Outreach will be conducted on an individual basis with participating landowners. Information will be provided to the community through our extensive community outreach email list which has been developed over the past 3 years. Additionally, information and progress will be reported on our website for easy access for community members. Chelsey will serve as a point of contact for all inquiries concerning the project.

5. Meeting the Needs of the NRD RFP & Ranking Criteria

This proposal highlights Big Cottonwood Creek's continued struggles 5-years post-fire. These include significant hydrologic, hydraulic, and habitat concerns that start in this creek, but extend into the Arkansas River and the economies that it supports. Specifically, the deep and pervasive channel incision (8-12 feet deep) causes significant concerns to human safety, degradation to our water quality and quantity, and a total lack of habitat. As outlined in this proposal, the restoration of this creek is important to landowners and several other stakeholders (e.g., CO Parks and Wildlife, Trout Unlimited, etc.). The identified restoration would aim to widen and aggrade the creek's channel, thereby reducing incision. In addition, restoration and habitat planning could provide a viable habitat for the nationally threatened Greenback Cutthroat Trout. The Harry Walker Dam provides the necessary fish barrier to protect this species from crossbreeding while providing a habitat near this species native habitat.

We believe that our proposal directly addresses the objectives outlined in this RFP to restore, rehabilitate, protect, or enhance riparian habitat, aquatic habitat, terrestrial habitat, & water quality. Big Cottonwood Creek is in the Upper Arkansas Basin between Canon City & Salida. We have an opportunity to help mitigate a future disaster that could once again harm the Arkansas River while providing much needed habitat improvement for this creek. Finally, this proposal illustrates Big Cottonwood Creek as an example of post-fire and flooding conditions. In recent

years, Colorado fires have added several hundred (or more) miles of creeks every year that will experience flooding like Big Cottonwood Creek. With Colorado's finite water and the continued stresses on these resources, we must consider the hydrological degradation of our water sources and look to opportunities to restore such systems for our water, economy, recreation, and habitat. Given the identified needs, the support of landowners and partners, and the opportunity to add a valuable habitat for the Greenback Cutthroat trout, the restoration of Big Cottonwood Creek is a viable project and could be used as a demonstration project for post-fire full recovery.

To date, we have laid the foundation for a successful project through years of community outreach, securing funding sources, and developing comprehensive plans for recovery. Our project is shovel-ready and utilizes new techniques that are low-cost, and low-tech, to provide restoration for degraded systems. PBR techniques have had wild success in other states. We now can implement these techniques in a Colorado Creek and demonstrate the benefits of working with the natural environment. Every year we experience new devastating fires, we need to build the methods and procedures we will use to help restore these systems for future generations. Our techniques will only improve over time and are based on sustainable practices. Our proposal complements numerous projects throughout the region and provides a demonstration for one of our most pressing natural resource issues: fire & floods. We look forward to the opportunity to work with the NRD Trustees to implement a restoration project that will provide direct benefit to the Upper Arkansas Basin while also serving as demonstration project for the State.

Additional information about the work we have completed with our partners ARWC can be found at https://www.arkcollaborative.org/hayden-pass-fire.html

Restored riparian ponds provide a refuge for fish and wildlife in a burn scar near Hailey, Idaho. Restored riparian ponds help to rebuild and protect critical riparian habitat after fire. Our long-term recovery plan provides the background and resources needed to complete similar projects in the Hayden Pass Fire area.
Photo: Joe Wheaton/ Utah State University

Thank you for your consideration of our proposal. We look forward to the opportunity to work with you.

Sincerely,

River Science

Appendix A

Big Cottonwood Post-Fire Long-Term Recovery & Restoration Proposal

Task		Expense					River Science Personnel						Match Cash & In-Kind	NRD Request
							Exec. Director		Project Manager		Administrative			
		Description	Rate	Unit Type	Unit Multiplier	Total	Rate= $125/hr		Rate= $85/hr		Rate= $25/hr			
							Hours	Subtotal	Hours	Subtotal	Hours	Subtotal		
Task 1- Community Outreach & Engagement														
1-A	Landowner Engagment Meetings					$ -	20	$ 2,500	10	$ 850		$ -	$ -	$ 3,350
1-B	Community Outreach (Email, Website, Meetings)					$ -	10	$ 1,250	10	$ 850		$ -	$ -	$ 2,100
1-C	Partner Outreach					$ -	20	$ 2,500	10	$ 850		$ -	$ -	$ 3,350
1-D	Travel	Milage	$ 0.54	Mile	800	$ 432.00	0			$ -			$ -	$ 432
Subtotal Task 1						$ 432		$ 6,250		$ 2,550		$ -	$ -	$ 9,232
Task 2- Expert Consulting & Project Prepardness														
2-A	Expert Field Visit & Meeting	Joe Wheaton Consuling Visi	$ 7,000	Each	1	$ 7,000	25	$ 3,125	10	$ 850		$ -	$ -	$ 10,975
2-B	Materials & Equipment	Rock, Post Pounder, etc.	$ 10	Foot	4752	$ 47,520		$ -		$ -		$ -	$ 47,520	$ -
2-C	Travel	Milage	$ 0.54	Mile	160	$ 86.40		$ -		$ -			$ -	$ 86
Subtotal Task 2						$ 54,606		$ 3,125		$ 850		$ -	$ 47,520	$ 11,061
Task 3- PBR Implementation														
1-A	PBR Implementation	CCI Labor	$ 3,400	Day	8	$ 27,200.00	140	$ 17,500	20	$ 1,700		$ -	$ 27,200	$ 19,200
1-D	Travel	Milage	$ 0.54	Mile	1600	$ 864.00							$ 864	$ -
Subtotal Task 1						$ 28,064		$ 17,500		$ 1,700		$ -	$ 28,064	$ 19,200
Task 4- Monitoring & Maintanence														
1-A	Maintanence (3 years)	Materials & Equipment	$ 5	foot	4752	$ 23,760.00		$ -	20	$ 1,700		$ -	$ 23,760	$ 1,700
1-B	Monitoring					$ -	352	$ 44,000	10	$ 850		$ -	$ -	$ 44,850
1-C	Labor	CCHS	$ 25	Hour	480	$ 12,000.00							$ 12,000	$ -
1-D	Travel	Milage	$ 0.54	Mile	3520	$ 1,900.80								$ 1,901
Subtotal Task 1						$ 37,661		$ 44,000		$ 2,550		$ -	$ 35,760	$ 48,451
Task 3- Project Management														
3-A	Reporting, Consulting, Permitting, Agreements							$ -	300	$ 25,500	120	$ 3,000	$ 3,000	$ 25,500
Subtotal Task 5						$ -		$ -		$ 25,500		$ 3,000	$ 3,000	$ 25,500
Grand Total						$ 120,763		$ 70,875		$ 33,150		$ 3,000	$ 114,344	$ 113,444

Total Project Cost: $ 227,788

Organizational Capability

River Science History of Accomplishments

River Science is a relatively new organization but already has a rich history of accomplishments, including working on several projects funded through this CWCB & CPW. River Science has worked in partnership with the Upper Arkansas Water Conservancy District and the Arkansas River Watershed Collaborative on multiple post-fire recovery projects, including the Hayden Pass Fire and Flood Recovery Project and the Spring Creek Fire and Flood Recovery Project. River Science contributed data collection, modeling, stakeholder engagement, and river restoration recommendations towards these projects, which catalyze this current proposal's development. Additionally, one of the State's most recognizable programs - River Watch - is now under the direction of River Science, and the Canon City Highschool granted River Science with its own River Science course. River Science has a rich history of river restoration involvement and complex river system projects through its founder and executive director - Luke Javernick.

Staffing/ Project Team / Volunteers

Luke Javernick
Luke founded River Science in 2016. Luke is an award-winning (Marie Sklodowska-Curie Action) river scientist who spent the early part of his career studying and improving rivers in New Zealand, Colorado, Oregon, and Italy. Using physical model experiments, Luke's post-doc research focused on utilizing low cost, low-tech PBR techniques to improve river processes, health, and management. Luke is passionate about leveraging open-source software, low-cost hardware, and advanced computing to collect affordable data at a meaningful scale to provide valuable information to our clients and projects. Luke's vision, ambition, and creative approaches have helped launch River Science into a successful nonprofit with strong partnerships across Colorado.

Chelsey Nutter
Chelsey has a rich history of working on water-related projects in the Arkansas River Basin, receiving the Arkansas River Basin Hero Award from the Inter-Basin Compact Committee/ CWCB in 2019. She served as the Executive Director of the Arkansas River Watershed Collaborative and the Projects Manager for the Upper Arkansas Water Conservancy District. With over ten years of experience managing water projects and programs, Chelsey brings a comprehensive knowledge of water rights, water administration, restoration, and stakeholder engagement. Chelsey has a BS in Land Use & Geographic Information Systems from the Metropolitan State College of Denver and a Public & Nonprofit Administration MBA from Adams State College.

Volunteers
River Science will have access to a committed group of volunteers through the River Science Class at Canon City Highschool. Approximately 20 students will provide in-kind labor (data collection, collection system implementation, etc.) during multiple field trips to the outdoor learning lab each semester. In addition to volunteer time during field trips, River Science has two Canon City Highschool Interns and an AmeriCorps Intern who will work on this project.

INTERNAL REVENUE SERVICE
P. O. BOX 2508
CINCINNATI, OH 45201

DEPARTMENT OF THE TREASURY

Date: AUG 04 2016

UVIATION WORLD WATER INC
5535 MEMORIAL DRIVE ST F 350
HOUSTON, TX 77007

Employer Identification Number:
81-1950889
DLN:
17053133332036
Contact Person:
RENEE RAILEY NORTON ID# 31172
Contact Telephone Number:
(877) 829-5500
Accounting Period Ending:
December 31
Public Charity Status:
170(b)(1)(A)(vi)
Form 990/990-EZ/990-N Required:
Yes
Effective Date of Exemption:
March 24, 2016
Contribution Deductibility:
Yes
Addendum Applies:
No

Dear Applicant:

We're pleased to tell you we determined you're exempt from federal income tax under Internal Revenue Code (IRC) Section 501(c)(3). Donors can deduct contributions they make to you under IRC Section 170. You're also qualified to receive tax deductible bequests, devises, transfers or gifts under Section 2055, 2106, or 2522. This letter could help resolve questions on your exempt status. Please keep it for your records.

Organizations exempt under IRC Section 501(c)(3) are further classified as either public charities or private foundations. We determined you're a public charity under the IRC Section listed at the top of this letter.

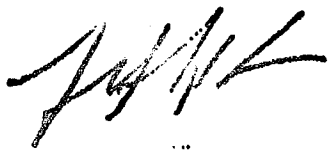
If we indicated at the top of this letter that you're required to file Form 990/990-EZ/990-N, our records show you're required to file an annual information return (Form 990 or Form 990-EZ) or electronic notice (Form 990-N, the e-Postcard). If you don't file a required return or notice for three consecutive years, your exempt status will be automatically revoked.

If we indicated at the top of this letter that an addendum applies, the enclosed addendum is an integral part of this letter.

For important information about your responsibilities as a tax-exempt organization, go to www.irs.gov/charities. Enter "4221-PC" in the search bar to view Publication 4221-PC, Compliance Guide for 501(c)(3) Public Charities, which describes your recordkeeping, reporting, and disclosure requirements.

UVIATION WORLD WATER INC

Sincerely,



Jeffrey I. Cooper
Director, Exempt Organizations
Rulings and Agreements

Form **W-9**
(Rev. October 2018)
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification

▶ Go to *www.irs.gov/FormW9* for instructions and the latest information.

Give Form to the requester. Do not send to the IRS.

Print or type. See Specific Instructions on page 3.

1 Name (as shown on your income tax return). Name is required on this line; do not leave this line blank.
Uviation World Water Inc

2 Business name/disregarded entity name, if different from above
River Science

3 Check appropriate box for federal tax classification of the person whose name is entered on line 1. Check only **one** of the following seven boxes.

☐ Individual/sole proprietor or single-member LLC ☐ C Corporation ☐ S Corporation ☐ Partnership ☐ Trust/estate

☐ Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=Partnership) ▶

Note: Check the appropriate box in the line above for the tax classification of the single-member owner. Do not check LLC if the LLC is classified as a single-member LLC that is disregarded from the owner unless the owner of the LLC is another LLC that is **not** disregarded from the owner for U.S. federal tax purposes. Otherwise, a single-member LLC that is disregarded from the owner should check the appropriate box for the tax classification of its owner.

☑ Other (see instructions) ▶ 501c3

4 Exemptions (codes apply only to certain entities, not individuals; see instructions on page 3):
Exempt payee code (if any) 1
Exemption from FATCA reporting code (if any) A
(Applies to accounts maintained outside the U.S.)

5 Address (number, street, and apt. or suite no.) See instructions.
425 Main Street Suite 10

Requester's name and address (optional)

6 City, state, and ZIP code
Canon City, CO 81212

7 List account number(s) here (optional)

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on line 1 to avoid backup withholding. For individuals, this is generally your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the instructions for Part I, later. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN*, later.

Note: If the account is in more than one name, see the instructions for line 1. Also see *What Name and Number To Give the Requester* for guidelines on whose number to enter.

Social security number
[ ][ ][ ] - [ ][ ] - [ ][ ][ ][ ]

or

Employer identification number
8 1 - 1 9 5 0 8 8 9

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me); and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding; and
3. I am a U.S. citizen or other U.S. person (defined below); and
4. The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions for Part II, later.

Sign Here Signature of U.S. person ▶ [signature] Date ▶ 4/3/20

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Future developments. For the latest information about developments related to Form W-9 and its instructions, such as legislation enacted after they were published, go to *www.irs.gov/FormW9*.

Purpose of Form

An individual or entity (Form W-9 requester) who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) which may be your social security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following.

- Form 1099-INT (interest earned or paid)
- Form 1099-DIV (dividends, including those from stocks or mutual funds)
- Form 1099-MISC (various types of income, prizes, awards, or gross proceeds)
- Form 1099-B (stock or mutual fund sales and certain other transactions by brokers)
- Form 1099-S (proceeds from real estate transactions)
- Form 1099-K (merchant card and third party network transactions)
- Form 1098 (home mortgage interest), 1098-E (student loan interest), 1098-T (tuition)
- Form 1099-C (canceled debt)
- Form 1099-A (acquisition or abandonment of secured property)

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN.

If you do not return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See What is backup withholding, *later.*

LOST LAKE MANAGEMENT

USFS- SALIDA RANGER DISTRICT

TABLE OF CONTENTS:

1. **Executive Summary: LOST LAKE MANAGEMENT**

• **Project Description:** Relocation of a popular destination trail and parking area. Relocation is critical to ensure long term health and stability of the watershed, forest, and wildlife health. Current conditions entail a braided trail system through riparian area, sediment loss through the wetlands, and continued resource damage from off route travel and parking.

• **Project Offeror:** US Forest Service- Salida Ranger District

• **Point-of-Contact:** Danielle Cook; Janelle Valladares
5575 Cleora Rd
Salida, CO 81201
Danielle.cook@usda.gov
(719)367-4969

• **Point-of-Contact:** Grant Administration
Rick Maestas
2840 Kachina Dr
Pueblo CO
richard.maestas@usda.gov
(719)553-1443

• **Total Project Cost** $121,599.20

• **Amount of NRDA Funding Requested** $79,830

• **Matching Fund Sources, Type, Value and Status:** In kind from USFS and VOC. Potential for grant match from CPW Nonmotorized Trails Grant

• **Signature of the Authorized Offeror**

_____ 8/25/21

Angie Krall- District Ranger
USFS- Salida Ranger District

Date

2. Scope of Work, including maps

a. Target Natural Resource(s):

Watershed restoration is the overall goal of this project, however LLM will also greatly benefit forest health, wildlife habitat, heritage sites, and scenic views while improving safety for public users and extending the recreational user experience.

i. Describe how the proposal will restore, replace or acquire the equivalent of injured natural resources, and how the development, design, implementation and restored site can be made available for public benefit.

The current declining health of the Lost Lake area can be showcased by soil and sediment loss, damaged and decaying vegetation, trampled and withering ground cover, and other effects to the habitat. Trail users are constantly attempting to find new ways through and around the wetlands in order to access the destination of Lost Lake. Due to the original poor placement of the trail, consistent resource damage occurs with nearly every user. The trail is steep in places, located in marshy areas, and not designed for watershed and sediment retention. Though the distance to the lake is roughly 1.2 miles, there is estimated to be about 3 miles of total trail due to braiding and various access points.

With the successful relocation of the trail, the LLM project will restore watershed quality, forest health, and improve wildlife habitat rapidly. The new trail will be primarily located along an old administrative road complete with raised tread and culverts to ensure the trail stays out of the water. The new 1/5 mile of trail construction takes a new route that stays out of the riparian areas and will only cross a creek twice, with overpasses installed to keep users out of the water.
With the new trail relocation will also come a parking area to ensure users are staying off the vegetation. Currently, users park on the side of the highway that allows for roughly 8 vehicles. When no more spaces are available, visitors will pull off on to the forest and create new parking sites along with trail heads. The growing popularity of this trail has its unfortunate effects and without management to this area, we will continue to see negative impacts to the forest and watershed. A new parking area will better accommodate the number of visitors this trail sees which will also lessen the resource damages seen from visitors pulling off the road. This is also a great safety improvement as the parking area will be located off of the main highway.

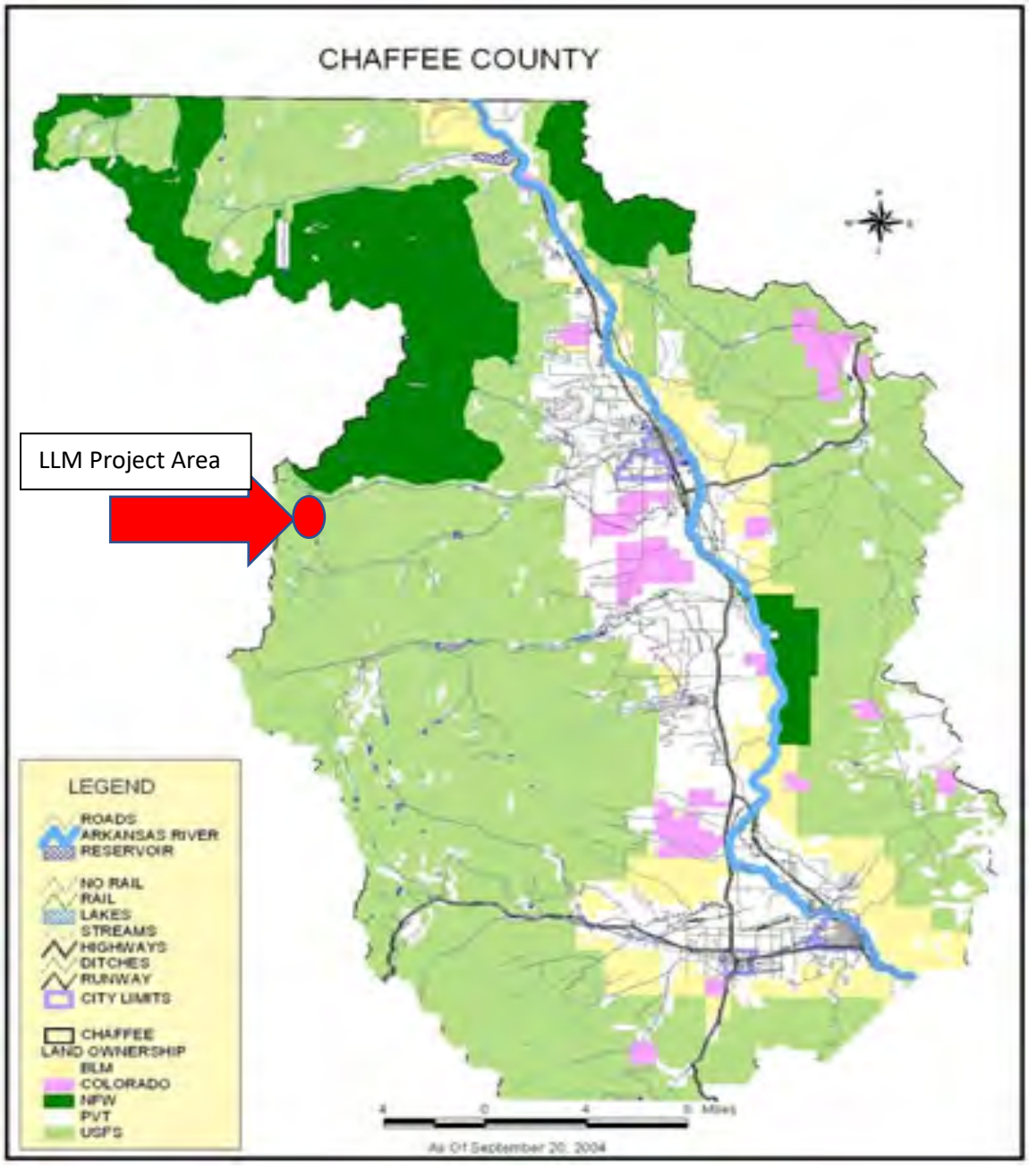
With the installation of the new trail location, the old route will be able to be restored. The approximate 3 miles of illegal routes will be closed and revegetated. Erosion prevention structures such as waddles and coir blankets will be utilized to help retain sediment and soils and work to restore the current ground lost. Due to the relocation of the new trail on an existing administrative road, the bulk of this project will focus on the restoration of the existing route and the resource damages associated with the negative recreation impacts.

ii. Provide a detailed description of the area (acreage, linear footage, etc.) of natural resources addressed by the proposal.

Located 16 miles west of the town of Buena Vista, the Lost Lake Management project will work in the Middle Cottonwood Creek headwaters. Section 26 of T14S, R81W, 6th PM. Elevation from 10,500 to 12,000 ft.
In the area of around 400 acers, the following will be addressed:
Roughly 3 miles of user created trails will be decommissioned and restored. 1.5 miles of new trail will be constructed to a sustainable standard designated by hydrologists, biologists, and recreation specialists. 148 acers of high alpine tundra and riparian areas will be closed off, restored, and

maintained to prevent further sediment and vegetation loss. Miles of watershed will be restored, further strengthening the drainage and downstream runoff.

iii. Provide a map of the area.




PSICC TRAILS -
(1532) - LOST LAKE (planned)
and existing user-created trails
CDNST - 5.5mi
0.4mi
0.3mi
Trailhead parking lot
YELLOW TRAIL is the planned trail
PINK TRAILS are User-Created
GREEN TRAILS are FS System
11/4/2020 - emb
1:10,000
USDA - FSA - FPAC

b. Objectives: Provide clear, measurable, realistic, time-phased, objective(s) for the work proposed.

Upon grant award, the following phases will take place in line with availability of contractors, FS road crews, and volunteer work dates:

- Construct 1.5 miles of new trail, relocating current traffic to sustainable location
- Construct parking area located off of the main highway. Allowance for up to 20 vehicles. Install gate behind lot, allowing for continued admirative use to full size vehicles when necessary
- Decommission and restore user created routes, returning to natural health and conditions
- Manage surrounding area around Lost Lake, restore damaged resources, protect surrounding resources
- Restore forest health, watershed quality, and mitigate erosion damages
- Initial Trail Construction and Lake Management: July 2022- October 2022
- Parking Lot Construction: August 2022-September 2022
- Trail Restoration: October 2022, July 2023
- Continued monitoring and evaluation July 2023- October 2024. Maintain and monitor going forward.

c. Operational Plan: Submit an operational plan that describes the proposal.

The Lost Lake project aims to directly restore forest and watershed health in sensitive areas by restoration and management work. Users continue to trample sensitive landscapes by continuous off route travel. Along
with excessive user created routes, camping around the lake continues to damage the vegetation and timber
by users scavenging firewood--often cutting down live trees/limbs to build a fire. This project will directly address the current declining health of the Lost Lake area by use of mitigating off route travel, multiple routes, timberline and alpine destruction, and other issues camping brings. The new single-track route to the lake is designed to keep users on the trail while creating a mellow- family friendly grade hiking experience. No wetlands will be traversed, and a seasonal gate will remain closed until the trail is open June 1, both for wildlife and resource concerns. Areas around the lake along with the current user created routes will be decommissioned, restoring health to the overused areas. Finally, a camping ban will be in place for the area further lessening the recreation impacts of firewood cutting, trash and human waste, and impacted vegetation and landscapes. With the camping ban, the decreased opportunity for human caused
wildfires is also a positive outcome of this project.

Improving watershed may be the biggest benefit of this project. With Lost Lake Management, the watershed in the Cottonwood Pass drainage will begin to thrive once again. Current recreation impacts of the area have negatively affected the watershed due to decreasing health of the vegetation including willows and grasses, increasing erosion and sediment movement, and other human caused issues. With the closure and restoration of the user created routes through the wetlands, the watershed will begin to heal and restore to its natural health. Various types of restoration will occur to include the placement of coir logs or blankets that retain the structure and minimize erosion and sediment loss. The new trail will utilize an old administrative route that is currently in place with watershed protection devices already installed. These include elevated tread, large culverts, and side ditches- all of which will keep the trail up and out of any water

crossing and marshy areas. The new section of trail to be constructed has been strategically placed out of flood plains, away from riparian areas, and with minimal water impacts at stream crossings. In addition, the trail will be a interpretive trail that will include information panels throughout the route educating users on the history of the area, the importance of staying on the route, and what wildlife thrives in the area. This trail will be a user-friendly experience to both educate the public but also work to ensure the long term stability of the sensitive high alpine area.

With the successful relocation of the trail, the old non system routes will be able to be decommissioned and restored back to the natural health and stability the area once had. Standing snags/dead trees will be felled to restore important wildlife habitat while also doubling as a restrictor to visitor use. These barriers will be significant near the current parking areas and trail heads as well as through the more heavily wooded areas. The riparian areas will receive erosion prevention devices such as waddles or coir blankets to help mitigate continued sediment loss and begin to restore the natural foundation of the area. The successful restoration of the area will increase the watershed quality due to sediment retention, benefit wildlife habitat with eradicated visitor use through the area and promoted habitat health, and restore forest health allowing vegetation to regrow and stabilize the soils and terrain.
Finally, the addition of a new parking area and trail head will improve public safety and mitigate further resource damages left from the now limited parking areas. Currently, users are parking on the side of the highway and crossing traffic while often creating new pull offs that are trampling the vegetation and forest around the area. New trail heads are constantly being created by users who cannot find parking at the current pull off, so new spots are disturbed in the process. With the installation of the new trail head, visitors and the land will benefit with the off-highway location.

I. **Describe in detail how the work will be implemented.**

a. The area around Lost Lake will receive management by way of area restoration to include fencing off the fragile sites including buck and rail fencing along with educating users by way of signs and markers. A No Camping ban will be in place to ensure the mitigation of resource damage left from campers leaving waste and cutting trees for firewood.
b. New trail construction will be completed by hand crews from the US Forest Service along with Southwest Conservation Corps and Volunteers for Outdoor Colorado. Because 1 mile of the relocated trail follows a gated administrative route, only ½ mile of new trail will need to be constructed. With the location of the trail just below tree line, the terrain is open and can be traversed through with minimal tree clearing or ground disturbance. These circumstances allow for quick hand-built trail construction, making the this is easiest part of the project.
c. Administrative road repairs will include clearing out culverts along with their approaches and lead outs. FS engineers will ensure the road is still accessible for administrative vehicles along with ensuring the long-term stability of the base.
d. FS Hydrologists will work with engineering to provide best practices for culvert and wetland repairs and restoration on the existing admirative route that will become the trail, along with the restoration of the 148 acers of riparian area.
e. Upon completion of the trail relocation and administrative road repairs, a parking lot will be constructed at the trail head location of the new route. Depending on timeframes of availability, either FS road crews or private contractors will be performing the lot construction. The lot will be constructed to hold roughly 20 vehicles.
f. Completion of this project will be marked with the complete restoration of roughly 3 miles of user created routes and campsites. Due to the system of routes braiding through the riparian areas, FS hydrologists and biologists will again be asked for guidance working through the delicate ecosystem. Proper restoration techniques will

be utilized to include coir blankets, waddles, habitat construction, and other various erosion prevention devices.

ii. Describe with whom the Offeror will collaborate to accomplish the scope of work. Provide letters of support from those entities and any other letters of support as an appendix to the proposal.

Southwest Conservation Corps (SCC) will be a leading part of this project for both the trail construction, lake site management, and user trail restoration.
Equally, Volunteers for Outdoor Colorado are interested in the above activities, pending further approval and funding.

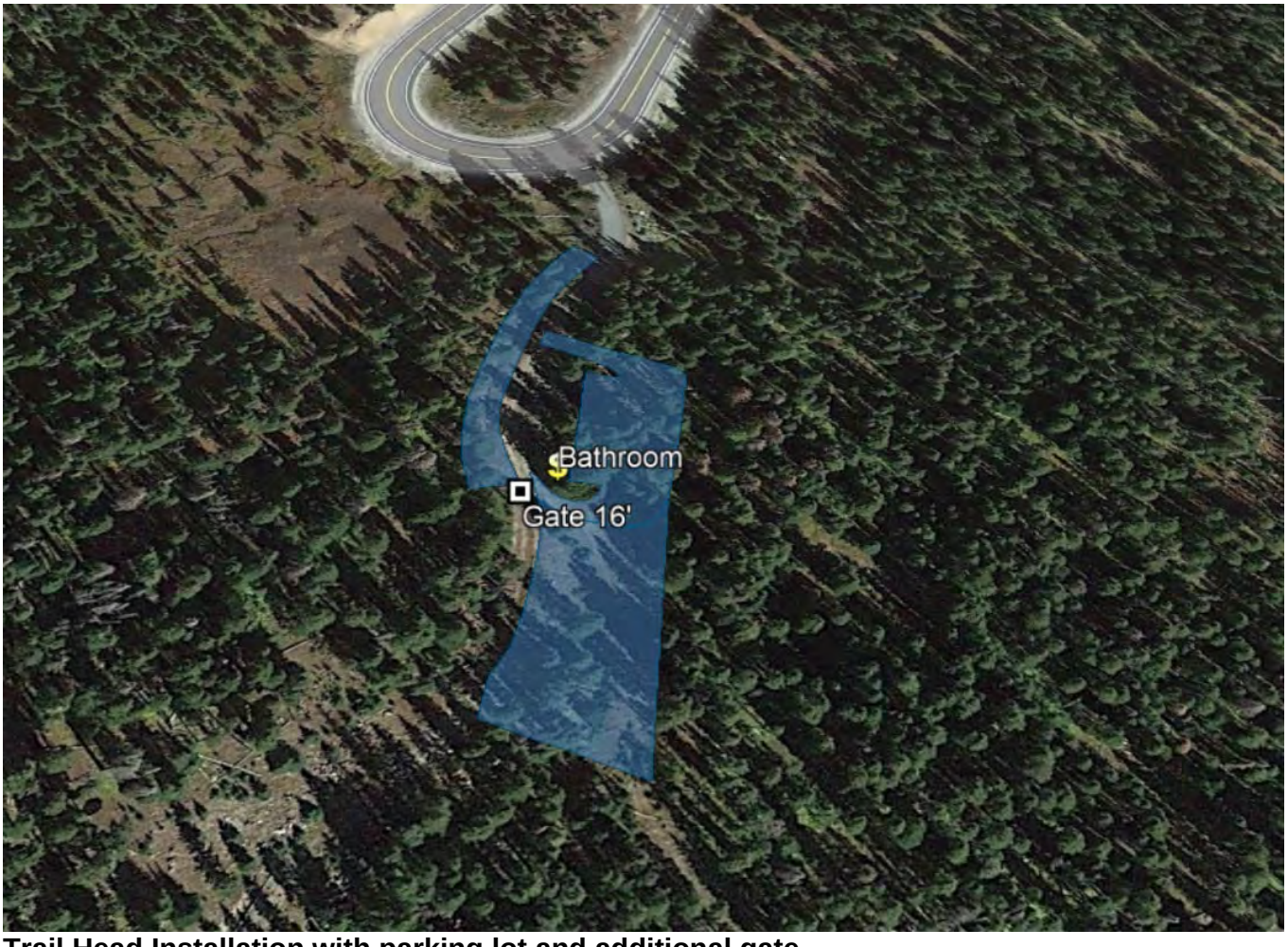
Greater Arkansas River Nature Association (GARNA) will play a large role in the monitoring and assistance with restoration and management activities.

iii. Describe the type and name(s) of donors and what they are contributing in equivalent dollar amount of match if in-kind or actual dollar amount if cash.

No other funding sources have been secured at this time. Multiple grants are being pursued to help fund the completion of this project to include additional labor costs, materials, and restoration work post project completion. All additional proposals will serve as additional matching funds if awarded and will be reported to the Upper Arkansas River California Gulch grant committee upon successful award letter.
In-kind work will come from local volunteers, USFS employees, and if awarded- VOC project staff, see budget in figure B for additional matches meeting the 50% match requirement.

iv. Provide construction designs and drawings, if applicable, maps of proposed restoration location(s), and a schedule and/or timeline for the completion of major project components. For proposals that require an engineering design, prior to construction final design documents must be submitted with appropriate professional engineer stamp or certification of design documents. Following construction as-built survey documents will be required. The submittals shall be provided in electronic *.pdf format.

See attached Figure A for restoration needs.



Trail Head Installation with parking lot and additional gate.

v. Describe to what degree the proposal matches the goals of the RP/EA.

vi. Describe how the proposal will be coordinated with complimentary, similar existing, or other proposed projects in the area, if any.

Future projects in the area include protecting wild and scenic views along with a timber management unit of Jones Mtn. Both of these projects have been included in the scoping, and design criteria has been implemented based on comments.
Due to the relocation of the trail to a lower existing route, the wild and scenic views will be restored due to the current trail's restoration work minimizing sights from the CDNST to a minimum.
The only request from the Jones Mtn project included the promise of the administrative route being kept open and sustainable. With this, we will install a gate to keep the route open to administrative full-size use, protect the raised bed tread, and maintain the culverts currently in various states of disrepair.

vii. Describe the operation, maintenance and monitoring (OMM) requirements and the entity(ies) accepting those responsibilities for the duration of the project and a minimum of 10 years thereafter, if applicable. Describe the plans or methods and schedule for how the project will be monitored to evaluate whether it is successful in achieving the restoration objectives. Describe the 6 and 12 month warranty inspections which are required following substantial completion of the proposed project. Detail the funding source, cost, and entity responsible for conducting the long- term operation, maintenance and monitoring. This shall include an Annual Report documenting the OMM.

The USFS will assume all operation, maintenance, and monitoring of the project for generations to come after completion. A dedicated and funded seasonal trail crew will work to maintain the trail of down trees, clogged drains, and off route travel on an annual basis as well as ensuring the seasonal closures are being observed and followed. Current trail counters are assessing numbers on the non-system routes and will help towards monitoring future use when the trail has been successfully relocated. These counters will remain on the non-system route after decommissioning to monitor continued use if any, as well as installed on the new route to monitor relocated and new uses.
The USFS seasonal trail crew receives funding to maintain system routes on the district each year, so this project will be included in the funding going forward. Additionally, the USFS has received new dollars towards a Recreation Ranger program that works similarly to ensure developed and dispersed sites are maintained and managed. This will include the surrounding area around Lost Lake and the allowed use.

viii. Permits/Approvals/Certifications: Describe all permits, licenses, approvals, professional engineers stamps of engineering design and as-built documents that will be required to complete the project and describe current status/progress towards obtaining these permits/approvals.

USFS has completed the required Environmental Assessment and been approved for construction. See attached Figure C.

ix. Project Schedule: Provide a timeline which identifies project phases, milestones, midpoint and pre-final inspections.

See figure D- Lost Lake Management Timeline

All work will be inspected on a regular basis during the ongoing construction by way of on the ground USFS approved Contracting Officers (CORs). Mid-point and final inspections will also be worked into the plan on a continual basis with regular inspections onsite.
Crews will work to follow all grant guidelines along with the associated Decision Memo guidelines from the NEPA document. CORs will ensure all tasks are adherent with the associated documents and policies.

x. Monthly Invoice and Status Report: Describe which activities in the operational plan will be tracked, how they will be counted, and how they will be reported in the monthly invoice.

Reporting will be followed up within the USFS Grants and Agreements specialists who will perform all associated budget and funding invoices. Dani Cook, Trail Manager, will ensure the timely

delivery of invoices and budget reporting to include the salary payments, materials, and associated costs.
Timeline milestones will be reported with documentation of hours and days worked, progress reported in proximity to the timeline provided, and pictures to document.
Our crews have a standard reporting form documenting daily, weekly, and monthly operations which can be consolidated into the overall end of project report. These reports include all deliverables stated, feet of new trail construction, acers of restoration, acers of area reclamation, visitor use, etc.

xi. Project Documentation and Deliverables: Provide a list of documentation and deliverables that will be supplied for the proposed project and throughout the duration of the project including the OMM phase.

With midpoint, final, and post project reporting, we will be able to deliver the following information:

- Feet of new trail constructed
- Feet of user trail decommissioned and restored
- Acers of riparian area restored
- Acers of forest health improved
- Miles of watershed improved
- Number of visitor use before and after project completion

3. Budget Spreadsheet: Describe the total dollar amount requested for the project. Break out the total amount requested by budget categories (personnel, fringe benefits, travel, equipment, supplies, contractual, and operating expenses). Detail those costs that will be claimed as in-kind match, including but not limited to engineering, planning and administration. A budget spreadsheet shall be supplied separately for each substantially different proposal component. (For example, land acquisition costs will be presented separately from habitat restoration costs.)

Within the proposal, describe and justify what will be obtained with the funds. List key staff members that will be assigned to the proposed work, how much time they will work on the project (how many hours per week), and brief descriptions of duties. Describe all private and public (local, state, and federal) funds by budget category that may be expended in the completion of this proposal. Detail the type, donors and dollar equivalent of matching funds obtained to complete or compliment this proposal, if applicable.

See attached Figure B- LLM Budget.

Key staff will include Dani Cook- Trails Manager USFS will be the main staff, working on the administration and overhead of this project. Roughly 20-30 hours a week as construction and restoration work is ongoing. Aaron Lamp- Engineer USFS, Jamie Krezelok- Hydrologist- USFS will be key players, working alongside the restoration and trail head construction while crews are on the ground, roughly 20 hours per week while operations continue. Anna Hendricks- SCC Director along with Kelly Close- VOC project coordinator will play integral roles in the trail construction and restoration work. During this phase, each can be expected to work 10 hours per week with help in the oversight of their crews.
Funds will be used to construct new parking area earth work, aggregate, and gate purchase and installation. These items will be utilized to mitigate further resource damages left from users parking off route. The gate will be used to retain administrative use rights along the roadway while

still allowing for single track use much of the time. Salary funds will be used to employ local conservation corps to work on trail relocation and rehab work.
Materials will include signage to enforce no camping bands and messages such as Leave No Trace and other important land use messages along with directional and interpretive kiosks.
In Kind work will come from the USFS administration and trail crew working alongside volunteers and partners. These matches will be from direct overhead, clearing corridor and tree felling, and fence and sign installations.

4. Public Communication Strategy: Describe the process that will be used to demonstrate inclusiveness, communication, and opportunities for public input over the course of the project.

Through the USFS NEPA process, many public input comments were taken into consideration and included in this project. The project was advertised online, email, and paper to gain public comment. From the initial idea to shovel ready, this project has taken the community needs into consideration. Local wildlife officials from CPW have been included in the design and allowed use and will continue to be involved through the construction, restoration, and future monitoring. Community needs and requests to restore the wetlands to save critical wildlife habitat have been included in the design along with better parking to accommodate a safer recreation experience.

5. Relationship to the Ranking Criteria: Provide a summary of how this project meets each of the objectives indicated by the Screening and Ranking Criteria contained in Section VI.B.1 and VI.B.2 below.

a. Description of the Offeror's Organization:

The Forest Service motto, "Caring for the Land and Serving People," captures the spirit of our mission, which we accomplish through five main activities:

- Protection and management of natural resources on lands we manage.
- Research on all aspects of forestry, rangeland management, and forest resource utilization.
- Community assistance and cooperation with State and local governments, forest industries, and private landowners to help protect and manage non-Federal forest and associated range and watershed lands to improve conditions in rural areas.
- Achievement and support of an effective workforce that reflects the diversity of the American people.
- International assistance to formulate policy and coordinate U.S. support for the protection and sound management of the world's forest resources.

OUR MISSION:

- To sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations.

Specifically, to the Salida Ranger District USFS- we aim to ensure the long-term stability of our public lands in the Arkansas River Valley. Our goal is to manage the forest lands for forest, wildlife, and watershed health all while sharing the recreation experience with our visitors. We recognize

the lasting effects on public health now more than ever during the pandemic and aim to create a symbiotic relationship between our public lands and the public.

Additionally, this project is inline with the ranking criteria listed in Section VI.B.1 and VI.B.2 in the following categories:

- Lost Lake Management (LLM) is located within the geographic location listed in the SPP along with all restoration work and watershed improvements requested.
- LLM has been federal scoped for environmental analysis and is approved and ready for construction.
- This project will greatly improve public safety, mitigating the current safety concerns addressed in the ongoing on the ground issues.
- LLM will improve and restore the natural resources in the area including the wetlands, wildlife habitat, forest health, and watershed quality.
- LLM is highly sought after from the local community including recreationalists, biologists, and local residents.
- LLM is very likely to succeed due to the vast improvements that will be implemented quickly. The successful relocation of the trail head and trail will allow for the improved user safety, along with facilitating the ability to properly heal and restore the damaged resources through the riparian areas. Long term monitoring prior, during, and post project completion will allow for measurable deliverables proving the success of this project.
- The technical feasibility of the LLM project is adequate and in line with ongoing USFS projects the district currently manages.
- LLM will benefit watershed quality, forest health, wildlife habitat, and recreation/user safety, making this a multi beneficial project.
- LLM will be a rapid improvement upon the completion of the relocation of the trail system. With this, the area will naturally begin to heal and will greatly improve with the managed restoration work. This work will be witness within the same season of project completion and will continue to thrive and benefit years post completion.
- The duration of benefits for the LLM project will include centuries of restored forest and watershed health. Due to the sensitive nature of the area, this project will thrive once again and remain protected by the outcomes of this project. Generations will be able to witness the improved and restored health to the Lost Lake area.
- A 50% match is guaranteed of non NRD funds by way of in-kind and matching labor hours from the USFS and volunteers. See attached budget for in-kind breakdown.
- The USFS- Salida Ranger District and associated area adopters will ensure the long-term stability and preservation of the area restored within this project. We will assume all management going forward, ensuring the restored areas are protected and the trail and trail head are managed and maintained.
- This project is directly in line with the USFS Recreation Plan, Rocky Mountain Regions trail plan, and Salida Ranger Districts forest plan. LLM will provide management for the long-term stability of the area.
- Though this is not a real estate transaction, this project will benefit the public access to the Lost Lake area, ensuring the long-term recreation experience is managed and maintained.

Describe prior experience with projects of similar scope and complexity. Describe previous experience with regard to each proposed project category or collaboration with organizations that have expertise in those areas. Provide evidence that the Offeror possesses the necessary financial, material, equipment, facility, and personnel resources and expertise, or the ability to obtain them. Provide evidence that the organization meets the eligibility requirements of Section II.C.I.

The US Forest Service – Salida Ranger District is a well-oiled machine in the work that we preform daily. Our objectives match our mission as we traverse through our day-to-day operations, ensuring the long-term health and stability of the public lands we manage.

With this, we have great experience in managing a variety of projects in the natural resource management realm. In line with this project include various trail construction projects, area restorations, and forest health improvements.

Former projects include the closure, decommissioning, restoration, and health improvement of the Mineral Basin Area- a project located one drainage south from the Lost Lake Management (LLM) project. This project included the closure and sustainable relocation of many recreation areas that users had taken over by ways of camping, hiking, and off roading. This area is very unique as it held boreal toad habitat along with other sensitive species and also served as a headwater to the Cottonwood drainage. Visitors travel from all parts of the country to visit this area, similar to Lost Lake, due to the wild and scenic views, wildlife, recreation opportunity, and clean mountain air.

The project included the closure of the over used areas with use of buck and rail, gates, signage, and natural barriers to include boulders-all of which are identical efforts matched in the LLM grant. These engineered designs prove highly effective in educating the public on the reasoning behind the closures, as well as ensuring the areas remain untrampled. Once closed, the areas were restored to their natural health to include the felling of trees to create habitat in the damaged areas, the ripping and loosening of packed soils to facilitate quick regrowth of vegetation, and various erosion prevention measures identical to those listed in the LLM project such as coir blankets and waddles.

Additionally, this project identified proper and legal routes of recreation that allowed for visitors to understand where they can travel along with appropriate ways to camp, fish, and hike. This project was a multi beneficial project in the sense that it aided the forest and watershed health along with improving the recreation experience for users.

This project was funded through internal and external sources, including grants and volunteer efforts- again identical to the LLM project.

Now 5 years post project in the Mineral Basin area, the lasting effects are recognized by way of the improved watershed quality, restored forest health, improved wildlife habitat, and improved recreation experience.

The USFS Salida Ranger District has many decades worth of experience in managing natural resource management projects nearly identical to the LLM project. With this, we are able to give the upmost certainty that if awarded, this project will fall in line with the thousands of other successful projects on our list of accomplishments.

In relation to the eligibility requirements listed in SectionII.C.1, we are a Federal Government agency with the financial and technical capability to successfully complete and manage this restoration project. We deal with multiple grant funded projects each season to include the applications, administrations, reporting, and documentation involved. Additionally, our in-kind match meets the 50% requirement with potential for more once other grant applications are reviewed and awarded.

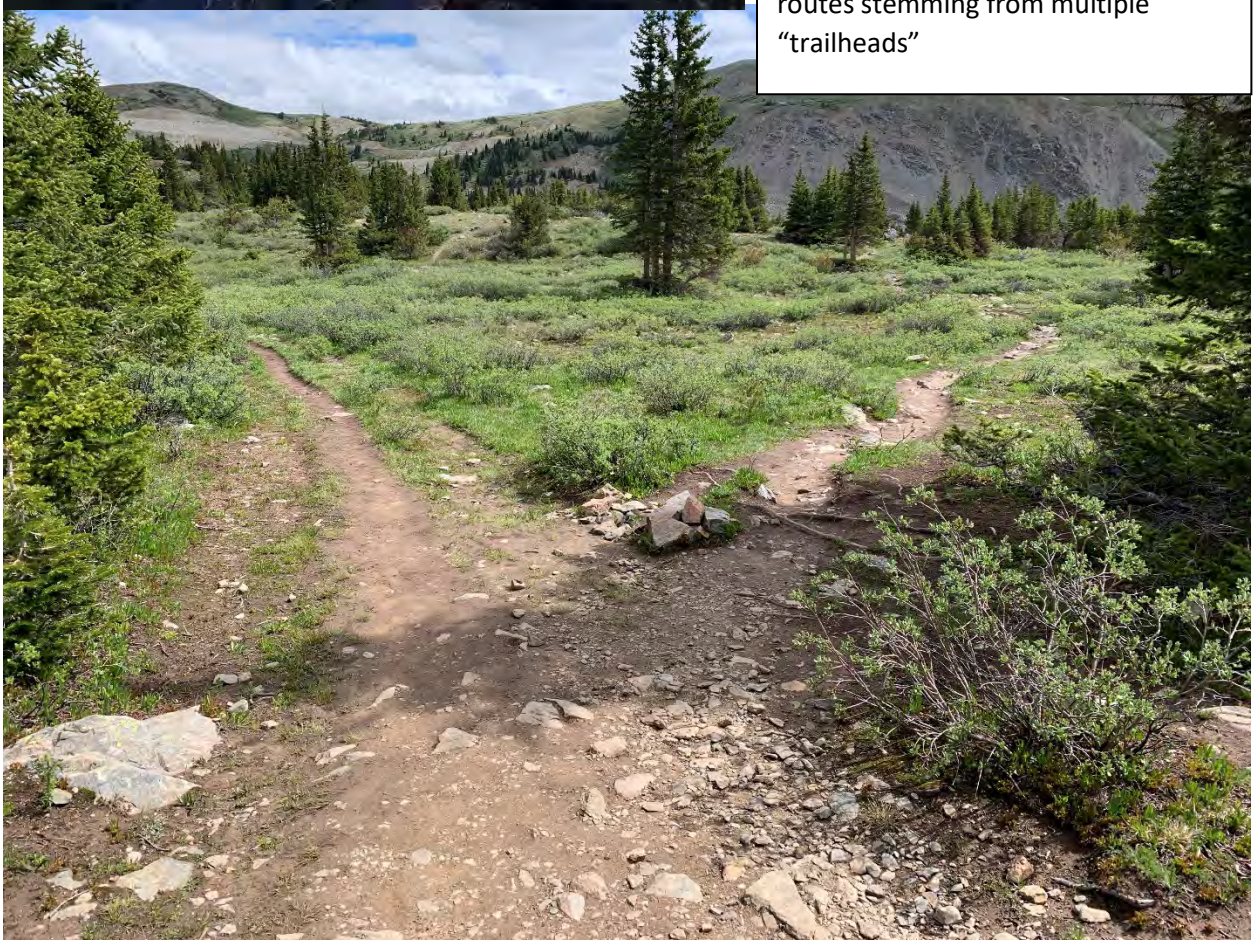
Letters of Support: See Attachment E

Figure A: Lost Lake Management: Current negative impacts requiring restoration work

Current parking along the highway, no official trail head.

Top: Trail braiding as seen from Google Earth.

Bottom: Marshy riparian area in need of closure and restoration. Many routes travel through the wetland wreaking havoc on the watershed and habitat.



Top: Resource damage to the vegetation from users attempting to stay out of the muddy wetland.

Bottom: Convergence of multiple routes stemming from multiple “trailheads”

Top: Multiple routes braiding through vegetation

Bottom: Multiple routes avoiding wet, muddy areas of the trail

Top: Multiple routes left from users taking the less steep, path of least resistance.

Bottom: Multiple routes through the riparian area, leaving resource damage including sediment loss and damaged vegetation.

The final creek crossing after traversing through the riparian area. Extensive restoration will be required to return the area back to its natural health and restore the watershed quality.

Figure B

Proposed Budget
Project Name: Lost Lake Management Applicant name: USFS Salida RD

Project start date: 07/2022

Project end date: 10/2023

CASH	Use of Funds	No. of (Units / Hours / Acres)	Cost Per (Unit / Hour / Acre)	Subtotal *(should match column k)*	Sources of funds: Grant Request	Sources of funds: Applicant Funds	Total Funding ($) - Should match column K
Parking Lot				-			$ -
Materials/ Contractor	Gate Purchase and Installation	1.00	4,700.00	4,700.00	4,700.00		$4,700.00
USFS	Signs, kiosks	5.00	300.00	1,500.00	1,500.00		$ 1,500.00
Contractor /USFS	Earthwork	6.00	950.00	5,700.00	5,700.00		$5,700.00
Contractor/ USFS	Aggregrate Surfacing	302.00	35.00	10,570.00	10,570.00		$10,570.00
Trail Construction				-			$0.00
Southwest Conservation Corps	Felling of trees, clearing cooridor, consturc	2.00	8,000.00	16,000.00	16,000.00		$16,000.00
Volunteers for Outdoor Colorado	Constuction, oversight, restoration	3.00	2,000.00	6,000.00	6,000.00		$6,000.00
Materials	Interpretive and informatonal Signs	3.00	1,900.00	5,700.00	5,700.00		$5,700.00
Admin Route Repairs				-			$0.00
Materials	Culvert Repairs	3.00	2,000.00	6,000.00	6,000.00		$6,000.00
vendor/service provider				-			$ -
Trail Decomission and Restoration				-			$0.00
Southwest Conservation Corps	Restoration Implementation	2.00	8,000.00	16,000.00	16,000.00		$16,000.00
vendor/service provider				-			$ -
Lake Management				-			$0.00
Materials	Informational Signage	4.00	1,915.00	7,660.00	7,660.00		$7,660.00
vendor/service provider				-			$ -
USE OF FUNDS - CASH SUBTOTAL					**$79,830.00**	**$0.00**	**$79,830.00**

IN-KIND	Use of Funds	No. of (Units / Hours / Acres)	Cost Per (Unit / Hour / Acre)	Subtotal *(should match column k)*	Grant Funds	Applicant Funds	Total Inkind ($) - Should match column K
Professional Services				-			
USFS	Administration	30.00	240.00	7,200.00		7,200.00	$7,200.00
USFS	Sign and fence installation, tree fellin	25.00	225.00	3,150.00		3,150.00	$3,150.00
VOC	Volunteer trail work	960.00	26.52	25,459.20		25,459.20	$25,459.20
Materials				-			
USFS	Buck and Rail Fencing	35.00	100.00	3,500.00		3,500.00	$3,500.00
vendor/service provider				-			
Equipment				-			
USFS	Specalized Tools	14.00	150.00	2,100.00		2,100.00	$2,100.00
USFS	Vehicle and Transportation	1.00	360.00	360.00		360.00	$360.00
Land				-			
contributor				-			
				-			
USE OF FUNDS - IN-KIND SUBTOTAL						**$41,769.20**	**$41,769.20**
TOTAL PROJECT COST					**$79,830.00**	**$41,769.20**	**$121,599.20**

Figure C

Decision Memo

Lost Lake Trail

U.S. Forest Service

Salida Ranger District, PSICC

Chaffee County, CO

This decision incorporates all information in this document and included in the project file.

Decision

I have decided to authorize the activities described in the "Proposed Action" section, including any modifications that resulted from environmental analysis and review of regulatory compliance.

Applicable Categorical Exclusion and Findings Required by Other Laws

The "Applicable Categories" section identifies the appropriate category/categories for this action, and provides rationale for categorically excluding this action from documentation in an environmental assessment (EA) or environmental impact statement (EIS) and for using the identified category/categories. The "Environmental Analysis" section documents rationale to support my finding that no extraordinary circumstances exist, along with findings required by other applicable laws and regulations to demonstrate compliance with the regulatory framework for the activities authorized by this decision.

Agencies, Organizations and Persons Contacted

A list of Agencies, Organizations and Persons Contacted regarding this proposal is provided, along with a brief overview of comments/feedback received and how they were considered.

Implementation Date

I intend to implement the decision immediately upon signature.

Administrative Review

Decisions that are categorically excluded from documentation in an environmental assessment or environmental impact statement are not subject to an administrative review process (Agriculture Act of 2014 [Pub. L. No. 113-79], Subtitle A, Sec. 8006).

Contact

Danielle Cook, Trails Manager, Salida Ranger District, 5575 Cleora Rd. Salida, CO 81201; daniellecook@usda.gov; 719-530-3953

March 10, 2021

James Pitts

District Ranger

Categorical Exclusion Review

Project Information

Proposal Name: Lost Lake Trail

Proposal Date: 11/9/2020

Project Contact: Dani Cook, Trails Manager

Responsible Official: Amy Titterington**,** Acting District Ranger

Unit: Pike & San Isabel National Forests, Cimarron & Comanche National Grasslands

Ranger District: Salida Ranger District

Counties: Chaffee County

State: Colorado

Anticipated Implementation: July 2021

Signing Authority: District Ranger

Public web link: https://www.fs.usda.gov/project/?project=59375

General Location: The project area is approximately 16 miles west of Buena Vista, Colorado on Cottonwood Pass near Jones Mountain.

Applicable Management Areas: MA 9B: Emphasis on increasing water yield through vegetation manipulation. Dispersed Rec Management: Semi-primitive nonmotorized, semi-primitive motorized, roaded natural and rural recreation opportunities can be provided (FP III-216 - 223).

Legal Description: Sec. 26 of T14S, R81W, 6th PM

Elevation Range: 10,500-12,000ft

Watersheds: Middle Cottonwood Creek (HUC12: 110200010301)

Applicable Categories

This proposal is categorically excluded from documentation in an environmental assessment or environmental impact statement because it fits the following category or categories, pending extraordinary circumstance determinations:

Applicable Category or Categories:

36 CFR 220.6(e)(1) (DM Required)

This category is applicable for this project because it proposes to construct a new system trail on National Forest System lands.

Proposed Action

There is currently a 1.2-mile, user-created, non-system route to Lost Lake. The route travels along many fall lines through willows and wet, marshy terrain, which is damaging vegetation and increasing erosion. There is no designated parking area so users park along the main highway to access the trail. Though not a legal system route, this trail has been popularized by publicity on local trail, recreation, and county websites. There is a need to design and construct a trail to FS specifications in a sustainable location to mitigate resource damage while maintaining this semi-primitive hiking experience for Forest users. There is also a need to create and designate a parking area and official trail head to allow safe public access.

The new NFS Lost Lake system trail and Lost Lake Trail Head would be designed for resource sustainability and user safety and experience. It would follow an existing gated, administrative use road for approximately 1 mile, then ascend towards the lake approximately 0.5 miles. The new design would facilitate a sustainable grade and tread to ensure long-term resource protection. The route would pass near old historic cabins, have interpretive signs and kiosks, and provide a mild, 3-mile round-trip, hike to Lost Lake accessible by a variety of users. This proposal also includes constructing an official Lost Lake Trailhead with an off-highway parking lot and restroom facility. The restroom facility may not be developed immediately but may be necessary as sanitation needs arise. If future trail reroutes are needed, they will be authorized by this decision if they are less than 1/4 mile in length and follow approval and concurrence by the Salida Ranger District resource specialists such as district botanist, wildlife biologist, or heritage specialist.

Design Elements

The following design elements are incorporated into the proposed action to ensure land management plan compliance:

Table 1. Design elements

Design Element Label	Design Element Description	Plan Component
Silviculture-1	It is preferred to have the spruce trees that are felled for the parking area decked so they can be removed to reduce the potential for spruce beetle.	Silviculture
Silviculture-2	All green Engelmann spruce greater than 8.0” at the large end left on site shall be treated to reduce the buildup of spruce beetle. Treatment shall include running chainsaw the entire bole of the tree, removing the outside bark cambium on 4 sides of the tree. Over 50 percent of the surface area of the cambium shall be treated. If possible, boles should then be bucked into lengths 6 feet or less and placed in open areas to allow solar treatment of the remaining cambium.	Silviculture
Hydro-1	Ensure the stream crossing is on a straight and resilient reach, and as perpendicular to the channel as possible.	Water Resource Improvement and Maintenance
Hydro-2	Install and maintain suitable drainage measures to collect and disperse runoff and avoid or minimize erosion of trail surfaces and adjacent areas.	Erosion Control / Water Quality
Hydro-3	Rehabilitate existing trail to a hydrologically self-maintaining and natural state to the extent feasible. Use barriers and signage to keep users off the closed trail. Use erosion control such as slash, wattles, water bars, re-contouring, or other measures as needed to disperse runoff and reduce soil erosion.	Erosion Control / Water Quality
Hydro-4	If a bridge is constructed at the stream crossing, ensure it does not constrict the natural active flow channel.	Water Resource Improvement and Maintenance

Design Element Label	Design Element Description	Plan Component
Hydro-5	Avoid soil disturbing actions (such as trailhead building) during periods of heavy rain or wet soil. Do not operate equipment when conditions will result in rutting of soils	Soil Compaction / Water Quality
Hydro-6	Locate vehicle service and fuel areas, chemical storage and use areas, and waste dumps on gentle upland sites. Mix, load and clean on gentle upland sites. Dispose of chemicals and containers in State-certified disposal areas.	Water Quality
Wildlife-1	Keep equipment and campsites at least 100 feet from all live streams, wet depressional areas, springs or other riparian and wetland habitats unless approved by the Forest Service.	Threatened, Endangered and Sensitive Species
Wildlife-2	Trail building/rehab activities within primary lynx habitat will not occur from April 15 – June 1 to minimize potential disturbance to lynx kittens when most vulnerable. Exceptions to these activities and timeframe may occur depending upon site conditions, and after discussions and approval from the District Ranger and District Biologist. This Design Feature will also protect wolverine, boreal owl, ptarmigan, and big game young when most vulnerable (i.e., mule deer, elk, bighorn sheep).	Threatened, Endangered and Sensitive Species
Wildlife-3	Retain seedlings and saplings trees whenever possible across the project area.	Threatened, Endangered and Sensitive Species
Wildlife-4	Retain trees and snags which are currently providing wildlife habitat such as cavities and nests.	Threatened, Endangered and Sensitive Species
Wildlife-5	If threatened, endangered, or sensitive species are discovered during project implementation, they will be protected and consultation with the U. S. Fish and Wildlife Service will occur when necessary.	Threatened, Endangered and Sensitive Species
Wildlife-6	Recommended Raptor Buffer Guidelines (Colorado Parks and Wildlife) will be reviewed for guidance in the instance an occupied raptor nest is discovered during implementation. Active nests will be avoided.	Threatened, Endangered and Sensitive Species
Wildlife-7	Areas of snow willow (*Salix nivalis*) would be avoided to the maximum extent possible from any ground/vegetation disturbance to limit or avoid impacts to suitable butterfly habitat.	Threatened, Endangered and Sensitive Species
Botany-1	If threatened, endangered, or sensitive species are discovered during project implementation, they will be protected, and an FS Botanist will be contacted.	Threatened, Endangered and Sensitive Species

Design Element Label	Design Element Description	Plan Component
Botany-2	If noxious weeds are encountered during trail construction or rehabilitation, an FS Botanist or Rangeland Management Specialist will be notified of the species and location of the occurrence for follow-up treatment or monitoring. Refer to the CO Dept. of Agriculture Noxious Weed Species List: https://ag.colorado.gov/conservation/noxious-weeds/species-id	Noxious Weeds/Invasive Species Management

Project Maps

Environmental Analysis

National Forest Management Act (NFMA) - Land Management Plan Consistency

The pertinent specialists have reviewed the proposal, incorporating specific Design Elements listed above to ensure consistency with applicable land management plan direction. The following summarizes the analysis and conclusions supporting plan consistency.

Botany: Following review of the Colorado Natural Heritage Program Database (2020) and available Forest information, we have determined that there are no documented occurrences of any federally endangered, threatened or proposed species, or any Regional Forester Sensitive Species (RFSS) within the proposed project area. While there is no habitat for any federally listed species, habitat may be present in the project area for two RFSS. Design criteria for Botany, Hydrology and Wildlife will decrease potential effects to these habitats from project activities. Because there are no records or habitat for any federally listed species, the proposed project will have no effect on these species. Since there are no records of any RFSS occurrences and most of the trail already exists on the ground (not new construction, already disturbed), the proposed project will have negligible impacts on RFSS. Additionally, closing and rehabilitating the numerous social trails in the project area, and, rerouting the trail to upland areas and out of the alpine ecosystem will have a beneficial effect on botanical resources.

Cultural/Heritage: The Area of potential affects (APE) was surveyed. Results recorded 3 cabin foundations outside the APE. Therefore the, cabins will not be impacted by the trail re-alignment. The foundations fall within the PSICC Definitions of Isolated Finds. No other cultural resources were observed within the project area. Therefore, as this survey falls within the PA for Limited results submission, no consultation prior to implementation is required. Limited results survey form will be submitted to Office of Archaeology and Historic Preservation.

Engineering: New parking will necessitate opening of existing gate closure and amendment of MVUM. Construction of parking would include previously undisturbed areas and the requirement for a new closure gate. Option for a toilet would necessitate excavation and site leveling

Fisheries: There are no threatened, endangered, or sensitive fish species within or immediately downstream of the project area. Project design criteria to protect hydrology will also protect fish habitat. Closing and decommissioning the existing trail through wetlands and replacing it with the proposed trail in the uplands will have a positive net effect for the watershed.

Fuels: This project poses no concerns or effects to fuels management.

Hydrology: The trail parallels an unnamed tributary to Middle Cottonwood Creek for a short distance. The trail is out of the floodplain and in an upland location throughout its' length. There is one stream crossing, which will likely be designed as a low water crossing with steppingstones placed to allow for crossing. This would minimize any potential impacts to streamflow constriction due to a bridge. If a bridge is necessary, it will be installed to allow for bankfull flows and will not change the streambank dimensions. The proposed trail will follow an old NFS road for approximately 1 mile. There are multiple culverts along this road. Drainage along this road will be improved where necessary to ensure the trail remains stable. The trailhead is in an upland location out of any riparian or wetland area. There may be a short-term increase in sediment to the stream during trail construction, but this will not impact stream health. The current trail location crosses a large willow complex with many braided trails through the area as trail users attempt to cross this wet area. Reducing trail use through this wetland complex will allow for the wetland vegetation to recover through this area. Design elements have been included to ensure that water quality is protected. There would be a beneficial impact to floodplain and wetland condition through the implementation of this proposed action. The project is consistent with Forest Plan direction for water resources.

Lands and Special Uses: This project will have no effect on lands and realty resources.

Minerals: This project will have no effect on geologic or mineral resources.

Range: This project will have no effect on range management attributes or activities.

Recreation: Lost Lake has become a very popular destination for hikers. This popularity has resulted in various non-system trails leading to the lake. This trail falls within an appropriate management area 2B which provides for opportunity for outdoor recreation in a roaded natural and rural setting including developed recreation facilities and year-round motorized and nonmotorized recreation. In addition, the Recreation Opportunity Spectrum (ROS), identified as Semi Primitive-Motorized, allows for the development of nonmotorized trails and parking areas. By designing a sustainable system trail and identified parking area this project will improve access to an already popular and beautiful high alpine lake.

Scenic Resources: The adopted Visual Quality Objective (VQO) for management area 9B is "Modification." Management activities in foreground and middle ground dominate but harmonize and blend the natural setting. Management activities may also dominate but appear natural when seen as background. Although the Continental Divide National Scenic Trail (CDNST) is not considered a Management Area, consideration to the scenic values surrounding the trail should be taken into consideration. The Lost Lake trail will be constructed using native material and structures designed and built to blend with existing form, line, color, texture. Additionally, users of the CDNST in this location will not be able to see the new Lost Lake Trail because the trail location is on the west side of the Continental Divide and there are no vantage points of the new trail in this area.

Soils: This project includes ground disturbing actions, which will impact soil resources on a small scale. Erosion rates are generally highest during road construction and decrease over time as disturbed areas are stabilized by revegetation or development of an armored surface (MacDonald and Stednick 2003). Erosion will be minimized through proper drainage design and erosion control (design elements Hydro-2 and Hydro-3).

Silviculture: Need to ensure access to the administrative road is maintained. Road will be used for future vegetation management project. In addition, it is preferred to have the trees that are felled for the parking area decked so they can be removed to reduce the potential for spruce beetle. Decked trees would be utilized for various forest products. If spruce is left on site, the following design criteria will need to be followed: All green Engelmann spruce greater than 8.0" at the large end left on site shall be treated to reduce the buildup of spruce beetle. Treatment shall include running chainsaw the entire bole of the tree, removing the outside bark cambium on 4 sides of the tree. Over 50 percent of the surface area of the cambium shall be treated. If possible, boles should then be bucked into lengths 6 feet or less and placed in open areas to allow solar treatment of the remaining cambium.

Special Management Areas: This trail does not connect or intersect any special management areas.

Wildlife: The project is located within the habitat of the listed species, Canada lynx and Uncompahgre fritillary butterfly and the habitat of ten Sensitive species. Details are described in the Biological Evaluation/Assessment.

Other Resources: N/A

Table 2. Applicable project file documentation to support land management plan compliance

Supporting Documentation	File Name(s) / Link
BE for CE-Level Decision Template, Lost Lake Trail	BE_LostLakeTrail_Dec2020.docx
BE for CE-Level Decision Template, Lost Lake Trail (plants)	Project Record

Other Law, Regulation and Policy Consistency

The following laws, regulations, or policies pertinent to this project include:

Clean Water Act

The Clean Water Act requires maintenance and restoration of the physical, biological, and chemical integrities of waters of the United States. Design elements (Hydro-1 and Hydro-2) require sustainable trail construction to reduce erosion. The trail and trailhead were designed to stay in upland areas, outside of the floodplain and riparian area. Therefore, there will be no impact to water quality from the proposed action.

Endangered Species Act - Threatened, Endangered, Proposed and Candidate Species and Critical Habitat

Table 3. Threatened, endangered, proposed or candidate species and critical habitat effect determinations

Species/ Habitat	Status	Proposed or Designated Critical Habitat Present?	Determination	Brief Rationale (or refer to other project documentation)
Uncompahgre fritillary butterfly	Endangered	No	NE	Closure and rehabilitation of the non-system trail will allow for alpine vegetation recovery, potentially benefitting the snow willow. Species is not known to occur in the area.
Canada lynx	Threatened	No	NLAA	Some understory vegetation important to snowshoe hares could be lost from trail building, but the amount of acreage is less than 2 acres for a .7 mile stretch of new trail approximately 3 ft. in width (estimated .25-acre loss in lynx habitat). The impacts to lynx habitat will be minimal along stretches of light maintenance. In addition, rehabilitation, and vegetation recovery of the current 1.6 miles of trail will allow for conifer and aspen regeneration to eventually recover the old trail and potentially replace lynx habitat that is lost along the new trail.

NE – no effect; **NLAA** – may affect, not likely to adversely affect; **LAA** – may affect, likely to adversely affect; **No Jeopardy** - not likely to jeopardize the continued existence or adversely modify critical habitat

Supporting Project Documentation

Table 4. Applicable project file documentation to support Endangered Species Act compliance

Supporting Documentation	File Name(s) / Link
BE for CE-Level Decision Template, Lost Lake Trail	BE_LostLakeTrail_Dec2020.docx
BE for CE-Level Decision Template, Lost Lake Trail (plants)	Project Record

Sensitive Species (FSM 2670)

Table 5. Sensitive species impact determinations

Species	Determination*	Rationale (or refer to project documentation)
Hoary bat	MIIH	Snags will be retained during project implementation.
Pacific marten	MIIH	Avoidance of the area after the trail is constructed.
North American wolverine	NI	Extremely rare in Colorado, wide-ranging species, and avoidance of the area after trail construction.
Pygmy shrew	MIIH	Amount of ground disturbance is less than two acres, so risk is very low.
Boreal owl	MIIH	Habitat loss along the trail, avoidance after trail is constructed.
Olive-sided flycatcher	MIIH	The amount of use along the trail will likely increase, further displacing songbird species such as the Olive-sided flycatcher.
White-tailed ptarmigan	NI	The closure and rehabilitation of the trail in the alpine could benefit this species over time.
Boreal toad	NI	Boreal toad habitat is present along the portions of the trail set for rehabilitation. Closure of this trail route could benefit this species. The new trail route avoids wetland habitat and will not impact this species.
Northern leopard frog	NI	These are like the impacts of the boreal toad.
Western bumblebee	MIIH	Alpine and grass meadows along the trail will be impacted.
Braya glabella	MIIH	Gravelly alpine slopes near the new or user-created routes may be disturbed during trail construction/rehabilitation. However, rerouting the trail to upland out of alpine habitat has a beneficial effect on smooth northern-rockcress.
Carex diandra	NI	Habitat is outside elevation range.
Cypripedium parviflorum	NI	Habitat is outside of elevation range.
Eriophorum gracile	NI	No peat bogs or fens in the project area.
Ranunculus grayi	NI	Habitat outside elevation range.
Xanthisma coloradoense	MIIH	Habitat may be disturbed during trail construction/rehabilitation. However, rerouting the trail to upland out of alpine habitat has a beneficial effect on Colorado tansy-aster.

NI – no impact; **MIIH**- may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species; **WIFV** - will impact individuals or habitat with a consequence that the action may contribute to a trend towards federal listing or cause a loss of viability to the population or species

Supporting Project Documentation

Table 6. Applicable project file documentation to support agency sensitive species compliance

Supporting Documentation	File Name(s) / Link
BE for CE-Level Decision Template, Lost Lake Trail	BE_LostLakeTrail_Dec2020.docx
BE for CE-Level Decision Template, Lost Lake Trail (plants)	Project Record

Special Management Areas (for example, Wilderness, Roadless, Wild and Scenic Rivers, etc.)

Table 7. Special management area compliance determinations

Management Area Type	Applicable Law / Regulation to Demonstrate Compliance With	Rationale for Compliance
N/A		

National Historic Preservation Act – Section 106 Review

No historic properties affected - 36 CFR 800.4(d)(1). Section 106 Review has been completed for the project area and no National Register eligible cultural sites were found.

Comments

The survey results were less than 4 isolated finds. The trail length falls within the mileage that allows for a Limited results form to be used. Under the Colorado PA for Limited results surveys No further consultation is needed.

Government to Government Consultation (EO 13175)

The responsible official identified the following regarding Government to Government consultation:

No Tribal Governments to consult

Relevant Executive Orders

The responsible official determined the proposal complies with the following Executive Orders, which were deemed relevant based on the nature of the proposal.

Below is a list of Executive Orders that typically apply to Forest Service proposals. Links to all Executive Orders can be found in the Federal Register (https://www.archives.gov/federal-register/executive-orders/disposition).

EO 11988, Floodplain Management – requires determination of action occurring in a floodplain, using HUD floodplain map or more detailed map if available.

The project does not impeded flow within the floodplain. There will be no impacts to floodplain processes from the proposed action.

EO 11990, Protection of Wetlands – avoid actions within wetlands unless there are no practical alternatives, and the action includes all practicable means to minimize harm to wetlands.

The proposed trail and trailhead are in upland locations outside of wetland areas. The restoration of the existing user created trail through the willow complex will improve wetland function in this area through reduced use.

EO 12898, Environmental Justice – identify and address disproportionately high and adverse effects on minority and low-income populations.

This project will not have a disproportionately high or adverse effects on minority or low-income populations. No fees were proposed for the trail or associated facilities, and, this area is and will remain open to all members of the public.

EO 13007, Indian Sacred Sites – avoid adversely affecting the physical integrity of these sites.

No Indian sacred sites were identified in the project area, therefore, there will be no adverse effects.

EO 13175, Consultation and Coordination with Indian Tribal Governments - agencies consult with Indian tribes and respect tribal sovereignty as they develop policy on issues that impact Indian communities.

No Tribal consultation was not necessary for this project.

EO 13112, Invasive Species – prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.

A GIS search of known occurrences of Colorado state-listed invasive plants was conducted. There is a record of Canada thistle occurring near the trailhead. Weed monitoring will occur during trail construction and rehabilitation.

EO 13186, Migratory Birds – identify actions that may have a measurable negative effect on migratory bird populations.

Extraordinary Circumstance Determinations

Pertinent specialists have reviewed the proposal and made the following determinations with regards to degree of effects for the resource conditions considered:

Table 8. Resource conditions considered for extraordinary circumstance determinations

Resource Conditions Considered for Extraordinary Circumstances	Is there a degree of potential effect that raises uncertainty over its significance? Briefly explain.
Federally listed threatened or endangered species, designated critical habitat, and Forest Service sensitive species	Botany: NO, there is no uncertainty Rationale for yes/no: There are no Threatened, Endangered, Proposed or RFSS within the project area.
	Fisheries: N/A, not present Rationale for yes/no: There are no Threatened, Endangered or Sensitive fish within or immediately downstream of the project.
	Wildlife: NO, there is no uncertainty Rationale for yes/no: See BE/BA
Floodplains, wetlands, or municipal watersheds	NO, there is no uncertainty Rationale for yes/no: The proposed action is not within any floodplain or wetland area. This is not a designated municipal watershed.
Congressionally designated areas, such as wilderness, wilderness study areas, or national recreation areas	N/A, not present Rationale for yes/no: N/A
Inventoried roadless areas	NO, there is no uncertainty Rationale for yes/no: An analysis of the effects to CRAs was conducted and evaluated by the RO. The project will, overall, help maintain roadless characteristics within the project area.
Research natural areas	N/A, not present Rationale for yes/no: N/A
American Indians and Alaska Native religious or cultural sites	N/A, not present Rationale for yes/no: N/A
Archaeological sites, or historic properties or areas	N/A, not present Rationale for yes/no: N/A

Supporting Project Documentation

Table 9. Applicable project file documentation to support NEPA compliance

Supporting Documentation	File Name(s) / Link

Supporting Documentation	File Name(s) / Link
BE for CE-Level Decision Template, Lost Lake Trail	BE_LostLakeTrail_Dec2020.docx
BE for CE-Level Decision Template, Lost Lake Trail (plants)	Project Record

Agencies, Organizations and Persons Contacted

The responsible official contacted the following interested and affected agencies, organizations, and persons about this project.

Scoping letters were sent to sixteen individuals and groups, including Colorado State Forest Service and Colorado Parks and Wildlife. A total of 5 comment letters were received. Comments focused on trail design, rehabilitation of user-created trails, opportunities for interpretation/education, and effects to wildlife and rare plants. Many of these suggestions were already part of or were integrated into the decision. All comments were considered as part of this analysis and decision. Comment letters received, consideration of comments, and names of contacted parties are in the project record.

Co Dept of Public Health and Environment
Lost Lake Management Budget Timeline Template

Figure D

Beginning Date	Ending Date	Activity	Reponsible Person	Comments/Milestones
6/1/2022	10/31/2022	Parking Lot Construction*	Aaron Lamp USFS	Timeline depnt, internal vs contractor
6/1/2022	10/31/2022	Admin Road Maintenance*	Aaron Lamp USFS	Culvert removal, drainage efforts
Post Lot and Admin Maint.		Post Engineering inspection	Aaron Lamp USFS	Evaluate work and future needs
6/2/2022	8/31/2022	Trail Construction	Dani Cook USFS/SCC/VOC	Via availability for SCC and VOC work
6/3/2022	10/31/2022	Lost Lake Management	Dani CookvUSFS/ SCC/VOC	Close trails around lake, instal signage for no camping and Leave no Trace
Post Trail Const		Post Trail Inspection	Dani Cook USFS	Evaluate work and future needs
8/31/2022	11/1/2022	Restoration and Closure	Dani Cook USFS/ SCC/VOC	Close and restore exsisting routes
6/1/2023	6/1/2023	Final Inspection post winter- evaluate future needs for restoration work.	USFS	Ensure restoration work is holding up along with any additonal follow up on the trail construction.
				*dependent on availabiilty of FS crews vs contractors at time of funding award

CHAFFEE COUNTY
Public Health

Chaffee County Public Health

448 East 1st Street · Suite 137 · Salida, CO · Phone 719-539-4510 ·Fax 719-539-7197

August 11, 2021

To Whom It May Concern,

My name is Andrea Carlstrom, Director of Chaffee County Public Health, and I am writing in support of the Lost Lake Management Grant application put forth by the USFS Salida Ranger District.
Lost Lake is an ecologically diverse and unique area found in the high alpine tundra and located just below the Continental Divide near Cottonwood Pass. This area is popular to many species of wildlife including moose, elk, deer, lynx, various birds, and fish as well as increasingly popular to recreationalists for hiking, fishing, hunting, camping, and wildlife viewing. Due to advertisements of the current non system route on well-known trail and county websites, this area has become trampled and damaged by users hoping to access the lake by any means possible. Multiple user-created routes can be witnessed braiding through wetlands and wildlife habitat causing visual and physical scars on the land due to the lack of a sustainable Forest Service approved route.

The Lost Lake Management grant aims to restore forest health, improve watershed quality, and strengthen wildlife habitat all while improving and managing for recreational opportunities. With the approved relocation of the trail to a more sustainable and ecological friendly location, the damaged riparian area will be restored to its natural condition and thrive once again. Restoration of the old user created routes will ensure the long-term stability of the area is withheld all while improving forest health and watershed quality. The area around the lake will also be managed to ensure off route travel is mitigated, forest health is upheld, and important heritage sites are protected.

The relocation of the trail will also support a safer and more sustainable recreation experience for the ever-increasing influx of public land visitors. Currently, visitors park on the side of the busy highway and create new parking spaces along with additional trail heads. The new trail location along with the installation of a designated parking area and trail head will ensure the safe recreation opportunity for the thousands of users this area currently hosts each season.

Without funding for this project, the current visitor impacts will continue to damage a critical area for our community. Chaffee County Public Health, which also oversees our local Environmental Health program, feels the Lost Lake Management project will benefit forest health, wildlife habitat, watershed quality, and recreation opportunities, and we are greatly in support of the requested funding opportunity.

Thank You for your consideration,

Andrea Carlstrom

Andrea Carlstrom, MBA
Director, Chaffee County Public Health

Greater Arkansas River Nature

Susan Newton
Upper Arkansas River Watershed NRDA Manager
Colorado Dept of Public Health and Environment
4300 Cherry Creek Drive South
Denver, CO 80246-1530

PO Box 1522
Salida, Colorado 81201
719.539.5106
info@garna.org
www.garna.org

Re: Lost Lake Management Grant Proposal

Dear Upper Arkansas River Watershed NRDA Project Grant Committee,

The Greater Arkansas River Nature Association (GARNA) is pleased to support the Lost Lake Management Grant application put forth by the USFS Salida Ranger District. GARNA, through community collaboration, inspires a conservation ethic by providing educational opportunities and experiences so that those who live, work and play in the Upper Arkansas Valley are motivated to take care of the natural resources and leave a legacy of responsible use of the natural environment. We've accomplished our mission for 25 years through formal partnerships with public land management agencies. GARNA enjoys partnership with the USFS Salida Ranger District.

Lost Lake is an ecologically diverse and unique area found in the high alpine tundra and located just below the Continental Divide near Cottonwood Pass. This area is popular to many species of wildlife including moose, elk, deer, lynx, various birds, and fish as well as increasingly popular to recreationalists for hiking, fishing, hunting, camping, and wildlife viewing. Due to advertisements of the current non system route on well-known trail and county websites, this area has become trampled and damaged by users hoping to access the lake by any means possible. Multiple user- created routes can be witnessed braiding through wetlands and wildlife habitat causing visual and physical scars on the land due to the lack of a sustainable Forest Service approved route.

The Lost Lake Management grant aims to restore forest health, improve watershed quality, and strengthen wildlife habitat all while improving and managing for recreational opportunities. With the approved relocation of the trail to a more sustainable and ecological friendly location, the damaged riparian area will be restored to its natural condition and thrive once again. Restoration of the old user created routes will ensure the long-term stability of the area is withheld all while improving forest health and watershed quality. The area around the lake will also be managed to ensure off route travel is mitigated, forest health is upheld, and important heritage sites are protected.

The relocation of the trail will also support a safer and more sustainable recreation experience for the ever-increasing influx of public land visitors. Currently, visitors park on the side of the busy highway and create new parking spaces along with additional trail heads. The new trail location along with the installation of a designated parking area and trail head will ensure the safe recreation opportunity for the thousands of users this area currently hosts each season.

Without funding for this project, the current visitor impacts will continue to damage a critical area for our community. GARNA feels the Lost Lake Management project will benefit forest health, wildlife habitat, watershed quality, and recreation opportunities and are greatly in support of the requested funding opportunity.

Please feel free to contact me with any questions, concerns or for more information.

Sincerely,

Dominique Naccarato

Dominique Naccarato
GARNA Executive Director Dominique@garna.org

VOLUNTEERS FOR OUTDOOR COLORADO
600 South Marion Parkway
Denver, CO 80209
303.715.1010
voc.org

8/25/21

To whom it may concern,

I am writing to express Volunteers for Outdoor Colorado's (VOC) support of the Lost Lake Management Grant application put forth by the USFS Salida Ranger District.

Lost Lake is an ecologically diverse and unique area found in the high alpine tundra and located just below the Continental Divide near Cottonwood Pass. This area is popular to many species of wildlife including moose, elk, deer, lynx, various birds, and fish as well as increasingly popular to recreationalists for hiking, fishing, hunting, camping, and wildlife viewing. Due to advertisements of the current non system route on well-known trail and county websites, this area has become trampled and damaged by users hoping to access the lake by any means possible. Multiple user-created routes can be witnessed braiding through wetlands and wildlife habitat causing visual and physical scars on the land due to the lack of a sustainable Forest Service approved route.

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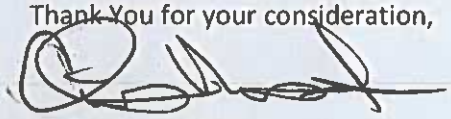
Without funding for this project, the current visitor impacts will continue to damage a critical area for our community. VOC feels the Lost Lake Management project will benefit forest health, wildlife habitat, watershed quality, and recreation opportunities and are greatly in support of the requested funding opportunity. We also look forward to supporting this effort through the engagement of our volunteer pool or even with an established VOC project.

Thank You for your consideration,



Chris Nesset, CEO
chris@voc.org
303-715-1010 ext 121

SOUTHWEST
CONSERVATION CORPS
A program of Conservation Legacy

August 26, 2021

To whom it may concern,

I am pleased to submit this letter of support on behalf of the Southwest Conservation Corps for the Lost Lake Management Grant application put forth by the USFS Salida Ranger District.

Lost Lake is an ecologically diverse and unique area found in the high alpine tundra and located just below the Continental Divide near Cottonwood Pass. This area is popular to many species of wildlife including moose, elk, deer, lynx, various birds, and fish as well as increasingly popular to recreationalists for hiking, fishing, hunting, camping, and wildlife viewing. Due to advertisements of the current non system route on well-known trail and county websites, this area has become trampled and damaged by users hoping to access the lake by any means possible. Multiple user-created routes can be witnessed braiding through wetlands and wildlife habitat causing visual and physical scars on the land due to the lack of a sustainable Forest Service approved route.

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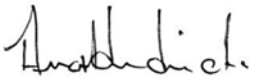
Without funding for this project, the current visitor impacts will continue to damage a critical area for our community. Southwest Conservation Corps feels the Lost Lake Management project will benefit forest health, wildlife habitat, watershed quality, and recreation opportunities and are greatly in support of the requested funding opportunity.

Thank You for your consideration,



Anna Hendricks
Los Valles Director
Southwest Conservation Corps, Salida