CWCB FINAL REPORT GBRT PEPO Purchase Order 2023-2489 Reporting Period: October 15, 2022 – September 30, 2023



Prepared for:
Public Education, Participation and Outreach (PEPO) Program
Attn: Elizabeth Schoder

September 30, 2023

Applicant: Upper Gunnison River Water Conservancy District (UGRWCD)
Grant Amount: \$25,000

Prepared by: Beverly Richards, UGRWCD Water Resource Specialist and Savannah Nelson, Sunshine Creatives, LLC (GBRT PEPO Coordinator)

Introduction

This PEPO project was initiated to fund a single PEPO Coordinator for the Gunnison Basin, on behalf of the Gunnison Basin Roundtable (GBRT). The PEPO Coordinator's primary task will be to coordinate with the Basin Roundtable in PEPO activities. The predominance of the Basin Coordinators' time will go to the development of the design and implementation of water education activities in the basin that promote education, outreach, and innovation consistent with the mission and goals of the Colorado Water Plan, Basin Implementation Plans and the respective Basin Education Action Plans. Additionally, the PEPO Coordinator supports related roundtable outreach and awareness efforts with regard to grants and open meetings and coordinating with the CWCB around state outreach.

Background

The Gunnison Basin Roundtable (GBRT) received a CWCB PEPO grant for the purpose of efficiently and effectively implementing an education campaign focused on K-12 school children and the general public. This will be accomplished by taking advantage of existing water education opportunities already occurring in the basin and then enhancing those programs with financial and technical support. The end goal is to ensure that constituents understand shared values around water and can communicate effectively thereby ensuring long-term protection of our water resources. The activities directly address the goals articulated in Colorado's Water Plan and the Gunnison Basin Implementation Plan by increasing residents' understanding of complex water issues and challenges in Colorado and the Gunnison Basin. Other administrative activities identified in the proposal support the ongoing work of the Gunnison Basin Roundtable.

Methods

Task 1 – Website Maintenance

This task involves the development and maintenance of basin website and creation of messaging and content for social media. <u>Gunnisonriverbasin.org</u> serves as the hub for water news, information, and resources for the Gunnison River Basin. The website will anchor the educational information promoted in the Community Water Education newspaper campaign and articles in the digital newsletter, as well as GBRT meeting information, water news, events, and resources. This also includes website hosting and maintenance.

WORK COMPLETED:

The website links have been tested and repaired. Events have been posted on a monthly basis, including meeting announcements, agendas, minutes, and other relevant meeting materials.

Articles have been posted to the website that correlate with relevant water news, as designated by our newspaper education campaign, the digital newsletter, and requests made by either the GBRT or CWCB.

Additionally, there has been further optimization of the website, including implementing SEO practices and adding plugins to track statistics and readership.

Task 2 - Administrative Support of PEPO and Gunnison Basin Roundtable Activities

This task involves the PEPO Coordinator posting meeting information for Gunnison Basin Roundtable, including agendas, minutes, locations, and zoom access; monitoring and responding to info@gunnisonbasin.org email messages; attending PEPO CWCB meetings and Gunnison Basin Roundtable meetings to ensure strong communication and current information on coordinated efforts and grant fund balances; and organizing and facilitating Gunnison Basin Roundtable PEPO Committee meetings.

WORK COMPLETED:

There has been attendance at the PEPO CWCB meetings, as well as the Gunnison Basin Roundtable (GBRT) meetings; at each GBRT meeting, PEPO activities were reported to the roundtable. There have been several GBRT PEPO Committee meetings organized and facilitated by the Coordinator, including discussions of the 2023 Water Education Grant, newsletter and social media content, and the basin newspaper campaign.

Additionally, the PEPO Chairs and Coordinator have met once a month, and the PEPO Committee began meeting bi-monthly to discuss ongoing efforts and submit ideas prior to the roundtable meetings, facilitated by the Coordinator.

Events have been posted on a monthly basis, including meeting announcements, agendas, minutes, and other relevant meeting materials. The GBRT email address was recovered and access updated for the current Coordinator to monitor.

Task 3 – Development of Gunnison Basin Roundtable Newsletter

This task centers on the development of the GBRT seasonal newsletter. This involves developing content, managing mailing lists, designing email newsletter format, and coordinating stories to link with social media.

WORK COMPLETED:

Two digital GBRT seasonal newsletters have been sent via MailChimp.

The process has included brainstorming relevant ideas, outlining and drafting topics, and then meeting with the GBRT PEPO Committee to approve the content and offer any edits or suggestions.

Correlating social media posts have also been published for each newsletter article, directing users to the GBRT website article.

Task 4 – Community Water Education Newspaper Campaign

This task involves the development of an education campaign to educate residents and visitors to Gunnison Basin communities. Water education messages will be developed based on the goals established in Colorado's Water Plan and the Gunnison Basin Implementation Plan, with

attention given to the newest information featured in the 2019 Analysis and Technical Update. Each message will feature a color photograph of Gunnison Basin water and landscapes; a concise, fact-based water education message; a link to more information on <u>gunnisonbasin.org</u>; and a QR code for easy access to the online information.

Ten to twelve messages will be published, and message themes will include supply-demand gap, conservation, land use, agriculture, storage, watershed health, environment, recreation, funding, protection of existing water uses in the Gunnison Basin, municipal water uses, water quality, and drought. These messages will be designed to grab the attention of readers and will run for 10 to 12 months in the major newspapers in the Gunnison Basin, including the Gunnison Country Times, Montrose Daily Press, Delta Independent, Crested Butte News, and the Ouray Plaindealer. These messages will also be featured on the Gunnison Basin's Facebook page.

WORK COMPLETED:

The GBRT PEPO Committee and Coordinator collaborated to create concepts and topics for each of the newspaper campaign ads. Research was conducted for each of the basin newspapers, to learn about newspapers, costs, and ad placement. We reached out to each basin newspaper for quotes and ad restrictions. Because of the delay in receiving PEPO funds, we were only able to cover 7 topics in the newspaper campaign.

Written content and visuals were drafted and approved by the PEPO Committee. The articles were published to the GBRT website, and the visuals were printed in the basin newspapers with a QR code directing readers to the article. This process has been repeated for each of the ad topics.

The topics include:

- What is the GBRT?
- Agriculture in the Gunnison Basin
- Are we in a drought?
- What are water rights?
- What is a watershed?
- Where does western slope water come from and where does it go?
- How can I conserve water and get more involved?

Task 5 - Support for K-12 Water Education throughout the Gunnison Basin

The task involves the development and funding for support of established, hands-on, innovative water education experiences for K-12 students in the Gunnison Basin. Water education programming that addresses issues outlined in Colorado's Water Plan and the Colorado Water Education Plan, as well as the Gunnison Basin Implementation Plan including but not limited to programming offered through school districts, 4-H Clubs, nonprofit community organizations, libraries, scouting, and other organizations. The Gunnison Basin Roundtable PEPO Committee and Coordinator will make every effort to identify and support water education programs in all Basin communities.

WORK COMPLETED:

The GBRT PEPO Committee met and developed the Water Education Grant criteria. From there, the Coordinator researched water education opportunities in the basin to develop the program and award criteria. The grant was then promoted to educators in all basin school districts and organizations on the website and via group and personal emails. The Committee received and reviewed the grant applications, sent any follow-up questions, made final decisions, and sent out award letters to each of the eight applicants. Project awardees contracted with the UGRWCD as the project sponsor and fiscal agent.

The recipients include:

- Gunnison Watershed School District, Outdoor Learning Lab
- Shavano Conservation District, EnviroScape Model and Case
- Gunnison Conservation District, 4th Grade Water Festival
- High Country Conservation Advocates, Slate River Riparian Protection and Youth Education Project
- Friends of Youth and Nature, Watershed Education for Kids
- Lake Fork Valley Conservancy, Lake Fork River Watch Program

Each of the recipients have completed their projects and submitted both their final grant reports and requests for reimbursement.

At the November 20 GBRT meeting, the recipients will give a brief presentation on each of their project results, including visuals and a Q&A session with the roundtable.

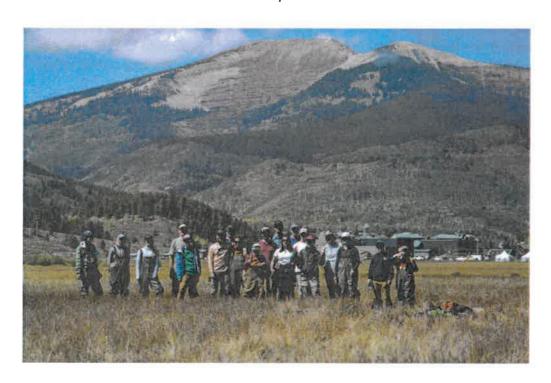
Actual Expense Budget to Date

Please see attached invoice breakdown and match summary.



Slate River Riparian Protection and Youth Education Project

Final Report



Prepared for:
Upper Gunnison River Water Conservancy District on behalf of the Gunnison Basin Roundtable
Attn: Beverly Richards

September 18, 2023

High Country Conservation Advocates Grant Amount: \$1,500.00 Prepared by: Eli Smith

Description of the project

The Slate River Riparian Protection and Youth Education Project, hereinafter (Project) began on March 1, 2023 and was completed on September 16, 2023. High Country Conservation Advocates (HCCA) partnered with the Town of Crested Butte and local restoration practitioner, Arable Earth, LLC). From September 11th through September 15th, staff members from the Town of Crested Butte and Arable Earth, LLC implemented several process-based restoration structures using natural materials to attenuate water across the property. On September 16, HCCA recruited and welcomed 17 volunteers to the site for an educational workday.

Need

The Town of Crested Butte acquired the Eccher Ranch (now Town Ranch) in December of 1994. Immediately following the acquisition, Town contracted Dr David J. Cooper to perform an ecological evaluation of the property. The March 1995 Final Report laid out several priorities for restoration on the land. The main priority from Dr Cooper's evaluation is to fill in the main drainage ditches that were dug during the agricultural tenure on the land. While other restoration work has occurred on the property, this has not.

Methods

17 volunteers harvested and planted approximately 500 local willow stakes along 350 feet of wetland near the newly constructed attenuation structures. The extra slash from willow clippings was utilized as fill material for attenuation structures. "Dressing" the attenuation structures with willow slash will lower the energy and velocity of future high speed runoffs or periods of heavy precipitation. This will recharge the floodplain.

Outcomes

The intended outcome from the volunteer workday is to improve and expand the existing willow complex, stabilize areas where attenuation structures were built, and improve wildlife habitat and forage.

The project will also benefit recreationalists on the heavily utilized river corridor and Deli Trail by improving the resiliency of the river banks and flood plain. It will benefit the citizens of Town and those to the south by offering a zone of relief for flood waters. The improvement of willow cover areas will be beneficial to big game that utilize the property in the spring and fall to migrate up and down valley. This project and associated monitoring will also provide a template for potential restoration projects on adjacent wetlands in the immediate area.

Education

HCCA successfully recruited local youth volunteers and other members of the community to participate in the September 16th workday. Volunteers received instructional flyers once they submitted their RSVP to HCCA (see page 16). On site, volunteers were welcomed to Town Ranch by Eli Smith, HCCA Stewardship Director, and Joey Carpenter, Town of Crested Butte Recreation, Open Space, and Trails Supervisor. Volunteers learned about the history of Town

Ranch, importance of wetlands, and what local organizations are doing to protect our water resources in the Gunnison River headwaters.

After volunteers participated in the introduction to the day, HCCA provided all safety materials and equipment needed. The volunteer group then walked into the wetland area and met Alli Del Gizzi (Arable Earth, LLC) on site to talk about process-based restoration and what structures were built. Eli Smith then led a demonstration on how to select, harvest, and plug local willow. Once the demonstration concluded, volunteers were divided into two groups; 1) willow harvesting and 2) willow planting/structure dressing. Volunteers were on site from 9am to 1:30pm and physically received educational handouts (see page 17).

The event was a success in terms of planting willow, engaging community members in protecting wetland resources, and providing a safe and inclusive environment.

Of the 17 volunteers, 5 were students from Crested Butte Community School, and 6 were students at Western Colorado University.

By the numbers

Date	Student Volunteers	Community Volunteers	Total Volunteer Hours		Riparian Area Treated	Restoration Structures Improved
9/16/23	11	6	76.5	~500	~350 feet	6

Actual Expenses

Task #	Task Description	GBRT Grant Funding
1	Development of educational materials	\$1,000
2	Volunteer coordination, oversight, and community engagement	\$500
Totals		\$1,500

Photos

All photos by Eli Smith unless noted otherwise.



Volunteers and project leaders meeting behind Crested Butte Community School to begin project workday



Volunteers were provided with hand gloves, eye protection, waders, water, and tools needed for the project



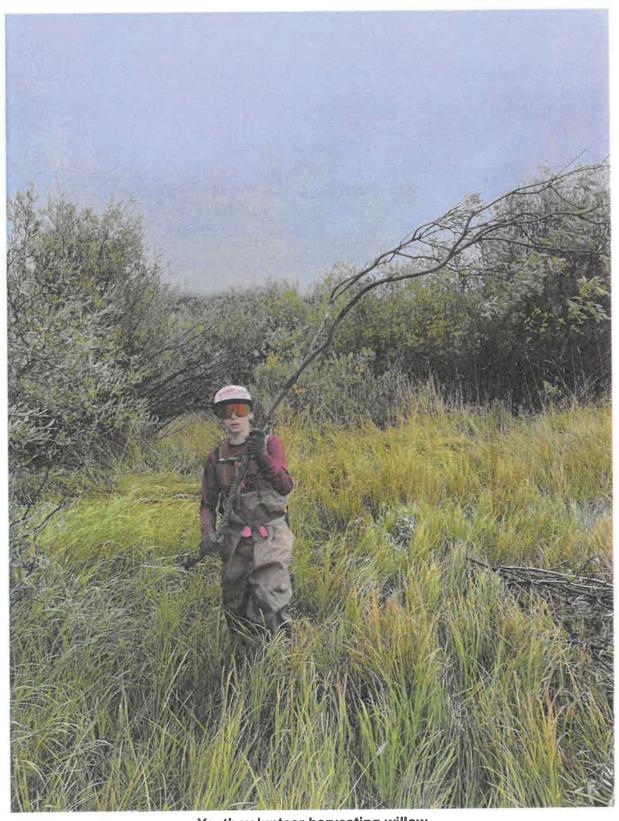
Alli Del Gizzi (Arable Earth, LLC) speaking to volunteers on process-based restoration



Eli Smith leading the willow staking demonstration



Youth volunteer harvesting willow



Youth volunteer harvesting willow



Youth volunteers harvesting willow



Youth volunteers in HCCA waders learning about wetland restoration



Students from Western Colorado University plugging willow stakes



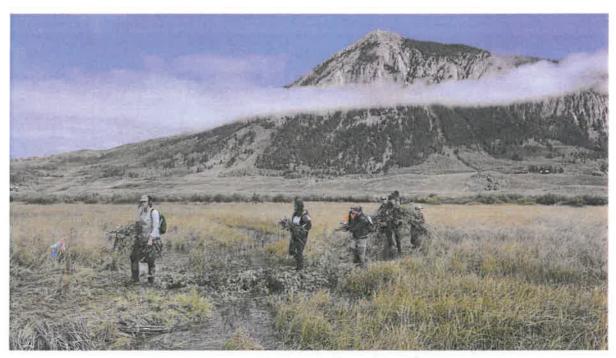
Students from Western Colorado University



Volunteers plugging willow stakes



Volunteers transporting willow stakes and slash



Volunteers transporting harvested willow stakes and slash



Volunteers in the Slate River wetland area with Mt. Emmons (Red Lady) in the background (Photo by Chad Reich)



Town Ranch Restoration project

STEWARDSHIP INFORMATION PACKET



Wetlands are areas where the soils are covered by water, either permanently or seasonally, resulting in unique plants and soils. They can range from areas with a few feet of standing water, to areas with very shallow water, or temporary habitats that only occasionally have standing water. Riparian areas next to streams or rivers that are subject to frequent flooding are also considered wetlands.



Low Tech Process-Based Restoration (LTPBR) is a method that uses simple, cost-effective structures to mimic and initiate natural processes. Sod speed bumps mimic the natural processes of sod root masses, and woody material structures mimic the natural processes of wood accumulation. Planting willows will help stabilize soils and provide habitat for wildlife.

WHY ARE THEY IMPORTANT?

Wetlands Benefit over 75% of the species in the state of Colorado, yet comprise of less than 2% of the landscape. They provide feeding, resting and rearing habitat for wildlife and are among some of the most biologically productive ecosystems in the world. Wetlands help with flood control by acting as "sponges" which can store and slowly release water. Water is filtered after getting slowed in a wetland, by moving around plants, allowing the suspended sediments and pollutants to drop out and settle to the wetland floor or get absorbed by plant roots

WHAT SPECIES ARE BENEFITTED?

In Colorado several species of protected birds such as the Greater Sandhill Crane, Southwestern Willow Flycatcher and Western Yellow-Billed Cuckoo; mammals like Beavers and River Otters; amphibians such as the Northern Leopard Frog and Boreal Toad; fish like the Cutthroat Trout, Bluehead Sucker and many more all call wetlands their home.

HCCA'S STEWARDSHIP PROGRAM

We work collaboratively with land management agencies and community organizations to address climate resiliency through the coordination of on-the-ground stewardship projects. These volunteer-driven projects connect and educate the local community through restoring the health and ecological resiliency of our shared public lands.



Thank you for joining us at the.

TOWN RANCH RESTORATION PROJECT



What?

HCCA, and devoted volunteers (like you!) will help restore the wetland along the Slate River on the Town Ranch property. Volunteers will help stabilize restoration structures built with natural materials by adding sod, removing wire and planting willows.



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Where?

Meet behind Crested Butte Community School at the Tommy V. Ball Field at 9:00am on Saturday, September 16th. Carpooling and riding the bus are highly encouraged. Routes and scheduling for the free Gunnison RTA bus can be found at http://www.gunnisonvalleyrta.com/.

Why?

Adding sod and willows will help provide further stabilization to established structures. This will allow for more wetland vegetation to grow, returning complexity to the riverscape. With the help from volunteers like you, the project will benefit water quality, wildlife habitat, and recreational use of the Slate River!





What to bring?

- · Water bottle
- Sunscreen
- Bug Spray
- Weather appropriate clothes (Hat, layers, rain jacket etc.)
- · Rain boots or close-toed shoes if you are willing to get wet
- Extra snacks

What will be provided?

- · Lunch from Frank's Deli
- Refillable water
- Personal Protective Equipment (PPE)
 - o Gloves, eye and ear protection, water, etc.
- Restoration tools
 - Shovels, loppers, willow stakes, etc.
- Oversight and training



Project Report: Lake Fork of the Gunnison River Watch Program

Submitted to
Gunnison Basin Round Table
Attn: Beverly Richards, UGRWCD
210 West Spenser, Suite B
Gunnison, CO 81230

1. Project Description

The Lake Fork Valley Conservancy (LFVC) partners with the Lake City Community School (LCCS) to conduct water quality sampling through the Colorado Parks and Wildlife River Watch Program. This program teaches important watershed health principals to our local middle and high school students and provides the State of Colorado with high quality data. Approximately 30-35 students participate during the school year (almost all of our middle and high school students).

We currently sample three sites in and near the Town of Lake City that bracket Henson Creek, a tributary of the Lake Fork that has heavy metal contamination from legacy mining. Although this data is useful, it does not help us monitor the impacts of mine remediation that we have conducted in the upper Henson watershed. We wish to expand the program into the summer months to measure water quality during high and low flows at these higher elevation sites. We will identify up to ten students who will work with adult volunteers and LFVC staff. Sampling near these mine sites better educates our youth about the causes of heavy metal contamination and steps to improve stream health. Coordinating this program takes staff time and training. We requested support from the Gunnison Basin Roundtable to fund the River Watch Coordinator position and to send one adult volunteer to River Watch training. This report summarizes our work up through the contract end date of September 15, 2023, although the River Watch Program will continue as part of our ongoing work with the school.

2. Description of Tasks and Outcomes

Task 1: Water Quality Sampling Coordination

<u>Project Coordination</u>. LFVC hired a contractor, Camille Richard, to coordinate water quality sampling activities for this grant, who discounted her hourly rate for the River Watch program. The coordinator identified seven new River Watch locations: two that are above and below the Hough Mine clean up in upper Palmetto Gulch, three that bracket Palmetto Gulch creek at its confluence with Henson, and two that are above and below the Ute Ulay clean up on lower Henson. These are in addition to the three sites that LFVC regularly monitors with students in and near the Town of Lake City that bracket Henson Creek. The Coordinator worked with River Watch to add these new sites to the River Watch database and arranged for new sampling supplies to be sent, once a complete supply and equipment inventory was done. In addition to

River Watch sites, we also involved student and adult volunteers in sampling sites around the Slumgullion Earthflow as part of a project to assess chemical impacts of the earthflow and associated legacy mining on Slumgullion Creek, Malter Creek, and the Lake Fork. Table 1 lists the sample sites, sampling parameters, and dates and Figure 1 shows sample locations. Sampling protocols for River Watch sites follow the CPW River Watch Manual (2020 version). Sampling protocols for Slumgullion sampling followed LFVC water quality sampling manual.

Student Participation and Learning. In April of 2023, all middle and high school science students (35) participated in watershed science and water quality training at school. In May 2023, they participated in the first River Watch sampling event under this contract. This involved field sampling at the three Town sites and then titrations in the science laboratory to quantify DO, hardness, and alkalinity. Science students will continue to monitor these three sites for the remainder of the academic year, through May of 2024.

For summer sampling, eight students were recruited, along with five adults, to conduct sampling at the ten River Watch sites and at the ten sites surrounding the Slumgullion Earthflow. During these events, they not only learned sampling techniques, but also why we were sampling these sites, highlighting the impacts of legacy mines, how mine clean up improves water quality, and the geology of the Earthflow and its chemical makeup. Students enjoyed the opportunity to gain field experience and see how their efforts assist the LFVC to acquire usable data for project monitoring and decision making. We plan to annually continue summer high and low flow sampling for the ten River Watch sites, provided that River Watch continues to support our program and we have the available volunteers.

We were unable to conduct high flow River Watch sampling in June because of delays getting needed supplies from River Watch. Therefore, we decided to involve students in sampling of our Slumgullion sites so that they could get the field experience during high flow season. They also participated in low flow sampling at these sites. We also had planned to conduct macro-invertebrate sampling in late summer for the three Town sites (Station Numbers 246, 761, and 765), but River Watch did not have the funding to cover our sites this year. We plan on sampling these sites next year, contingent on funding. Despite these setbacks, students still gained valuable field experience and knowledge regarding how water quality serves as an important indicator of watershed health.

Task 2: River Watch Training

We planned to send one adult volunteer to the official River Watch training in Cedaredge, CO (Oct 18-21, 2023), but by the time we were able to find a person committed to attending (the STEM teacher at LCCS), the training was already full. We will see if a seat opens this year, but if not, we will plan to send a participant in 2024. The Coordinator went through the official training in 2019 so was able to effectively train all volunteers. However, it is our goal to find a long-term volunteer (e.g. the STEM or science teacher at LCCS) who can take over the coordination role. Investing in a formally trained volunteer will ensure greater sustainability of the program by helping LFVC supervise and train students and other volunteers in River Watch purpose and methods, as well as other sampling projects we initiate.

3. Project Timeline

There was a disconnect between the project timeline in the Scope of Work and the completion date indicated in the contract. Initially we proposed a project completion date of December 31, 2023, and this date is what is in the Scope of Work. However, the contract specifies a project end date of September 15, 2023. We apologize for missing this in the contract when first initiated. Despite this, we are committed to continuing the River Watch program beyond the contract date through May of 2024. Our committed match will cover Coordinator time for sampling for the 2023-2024 LCCS academic year and pay for a volunteer to attend the River Watch training next year.

4. Project Expenditures

Description	Initial	Expenditures as of 9/15		Future Match
	Budget	GBRT	LFVC	LFVC
RW Coordinator Time: 50 hours @ \$30/hour	\$2160	\$1500	\$0	\$600 (4 school sampling events)
Slumgullion Coordinator Time @ \$50/hour	\$0	\$0	\$1250	\$0
River Watch Training (\$275 fee plus travel)	\$340	\$0	\$0	\$340
TOTAL	\$2500	\$1500	\$1250	\$940

Table 1. 2023 LFVC water quality sampling sites, parameters, and dates.

Site Number	Description	Parameters	Dates	
RW-246	Lake Fork River - San Juan Bridge Drive	pH, EC, temperature, total and dissolved metals, hardness, alkalinity, DO, flow, macro-invertebrates	5/3/23, 9/11/23, 11/1/23, 1/4/24, 3/6/24, 5/1/24	
RW-761	Lake Fork Above Henson Creek	pH, EC, temperature, total and dissolved metals, hardness, alkalinity, DO, flow, macro-invertebrates	5/3/23, 9/11/23, 11/1/23, 1/4/24, 3/6/24, 5/1/24	
RW-765	Henson Creek above Lake Fork	pH, EC, temperature, total and dissolved metals, hardness, alkalinity, DO, flow, macro-invertebrates	5/3/23, 9/11/23, 11/1/23, 1/4/24, 3/6/24, 5/1/24	
RW-1009	Henson Creek above Ute Ulay	pH, EC, temperature, total and dissolved metals, hardness, alkalinity, DO, flow	9/11/23	
RW-1010	Henson Creek below Ute Ulay	pH, EC, temperature, total and dissolved metals, hardness, alkalinity, DO, flow	9/11/23	
RW-1011	Palmetto Gulch at Confluence	pH, EC, temperature, total and dissolved metals, hardness, alkalinity, DO, flow	9/9/23	
RW-1012	Henson Creek above Palmetto	pH, EC, temperature, total and dissolved metals, hardness, alkalinity, DO, flow	9/9/23	
RW-1013	Palmetto Cr below Hough Mine	pH, EC, temperature, total and dissolved metals, hardness, alkalinity, DO, flow	9/9/23	
RW-1014	Henson Creek below Palmetto Creek	pH, EC, temperature, total and dissolved metals, hardness, alkalinity, DO, flow	9/9/23	
RW-1015	Palmetto Creek above Hough Mine	pH, EC, temperature, total and dissolved metals, hardness, alkalinity, DO, flow	Not sampled. Creek dried up.	
MC-1	Malter Creek above confluence with Earthflow	pH, EC, temperature, total and dissolved metals, anions, flow	6/5/23, 9/7/23	
MC-2	Malter Creek above Highway 149	pH, EC, temperature, total and dissolved metals, anions, flow	6/5/23, 9/7/23	
MC-3	Malter Creek on LFVC property	pH, EC, temperature, total and dissolved metals, anions, flow	6/5/23, 9/7/23	
SC-1	Slumgullion Creek above Peniston Park	pH, EC, temperature, total and dissolved metals, anions, flow	6/5/23, 9/7/23	
SC-2	Slumgullion Creek below Peniston Park upstream of Hwy 149	pH, EC, temperature, total and dissolved metals, anions, flow	6/5/23, 9/7/23	
SC-3	Slumgullion Creek above Highway 149 below active slide	pH, EC, temperature, total and dissolved metals, anions, flow	6/5/23, 9/7/23	
SC-4	Slumgullion Creek on County Road 33 at outlet	pH, EC, temperature, total and dissolved metals, anions, flow	6/5/23, 9/7/23	
LF-1	Lake Fork at LSC outlet	pH, EC, temperature, total and dissolved metals, anions, flow	6/6/23, 9/8/23	
LF-2	Lake Fork at commons area - Weems Malter Placer Sub-division	pH, EC, temperature, total and dissolved metals, anions, flow	6/6/23, 9/8/23	
LF-3	Lake Fork below Highway 149 Dawn of Hope Bridge	pH, EC, temperature, total and dissolved metals, anions, flow	6/6/23, 9/8/23	

