2021 Post Fire Restoration Efforts for Grizzly Creek Fire: Water Quality Monitoring, Rain Gauges and Impacted Downstream Users

Post Grizzly Creek Fire Debris Flows – Glenwood Canyon. Additional photos in reporting package.

Prepared for:
Watershed Restoration Grant for Grizzly Creek Fire Recovery Area - April 2021
Attn: Chris Sturm

June 30, 2022

Middle Colorado Watershed Council
Grant Amount: $223,012
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Middle Colorado Watershed Council

Since early 2021, the Middle Colorado Watershed Council (MCWC) has coordinated post Grizzly Creek Fire water quality (WQ) monitoring activities with affected water user communities along the mainstem of the Colorado River, including downstream municipalities, the agricultural producers and recreationists, along with a series of interested cooperating agencies that include the Colorado River District (CRD or the River District), US Geological Survey (USGS), the Colorado Department of Transportation (CDOT), the Bureau of Land Management (BLM), Colorado Parks and Wildlife (CPW), and the National Weather Service in Grand Junction (NWS).

Together with the River District and USGS, MCWC acquired funding to enhance monitoring of water quality and precipitation activities in response to the Grizzly Creek Fire. Monitoring included enhancement of a 6-parameter data sonde at the Colorado River water quality monitoring station, synoptic sampling of tributaries, and deployment of seven rain gauges throughout Glenwood Canyon.

Initial funding for water quality monitoring was acquired through the River District's Community Partnership Funding for $50,000 with a USGS match of $50,000 to install a new continuous monitoring sensor on the Colorado River (CR) and to establish four synoptic sampling sites. Using additional funding from the USGS Next Generation Water Observing System program (NGWOS), the USGS placed continuous water monitoring equipment at USGS station CR above Glenwood Springs, downstream from the confluence of most of the burned area tributaries (No Name Creek's confluence was downstream from this site) in April 2021. Also, a new sampling site was set up at the Pedestrian Bridge to Two Rivers Park in Glenwood Springs in September 2021. One of the parameters (fluorescent dissolved organic matter, fDOM) at the CR above Glenwood Springs site was discontinued at the end of the year.

Additional funding from the Colorado Water Conservation Board supported placing rain gauges in various locations in Glenwood Canyon to enhance the National Weather Service's monitoring of rain events. MCWC contracted with SGM Engineering to provide technical support and guidance for scoping/planning the water quality monitoring program.

Water Quality Monitoring

Water quality sampling needed to begin prior to the 2021 spring runoff. Using a combination of synoptic sampling and continuous monitoring, the project objective was to discern changes to water quality and in some cases, such as turbidity monitoring, post current conditions to provide warning to downstream users. Four sampling sites were selected for the synoptic measuring: Grizzly Creek, No Name Creek, Colorado River mainstem upstream from the confluence of the Roaring Fork, and Mitchell Creek above the fish hatchery (which served as an unburned tributary reference site). Four time periods were selected for measuring: baseline before snowmelt runoff, during the rising limb of snowmelt runoff, after peak snowmelt runoff, and during low-flow conditions. In addition, during summer monsoon events in July, USGS decided to include an additional sampling because of the unique opportunity to monitor post-debris flow conditions. Synoptic samples were analyzed for nutrients, dissolved organic matter, suspended sediment, trace minerals, major and minor inorganic ions, source-water stable isotopes and polyfluoroalkyl substances (PFAS).

Continuous monitoring activities occurred at the Colorado River above Glenwood Springs and at Colorado River above South Canyon, west of Glenwood Springs. The USGS also has continuous monitoring on the Roaring Fork River at Veltus Park in Glenwood Springs, and this information is pertinent to the Glenwood Springs water department, because the Roaring Fork River is a secondary

source of water for the city. A new station at the Pedestrian Bridge on the Colorado River was established, which includes a 5-parameter sonde that monitors temperature, specific conductance, turbidity, pH, dissolved oxygen (DO), and fDOM every 15 minutes. The information received at the new station overlapped with the CR above Glenwood Springs monitor. The fDOM parameter at CR above Glenwood Springs was removed at the end of 2021.

After the first major debris flow event, additional separate funding was obtained for an ISCO sampler for sampling during any debris flow above the Roaring Fork confluence. Due to the access and safety considerations during or shortly following a debris flow event, the ISCO sampler will allow USGS to remotely trigger sampling from the Colorado River to capture the effects of any storm events.

Partnerships and Engagement

A Technical Advisory Team (TAT) meets monthly to discuss project progression, compare data with other projects, and advise on additional parameters, impacts and long-term project goals. These meetings of seven to 20 people generally last one hour to one and half hours.

Public Works Directors and City Management and the Downstream Agricultural Community

The changes in water quality, and enhanced risks of flooding and debris flows impact downstream communities. Meetings with public work directors and town managers have ranged from individual meetings to large group meetings to address specific and individual concerns. Particular emphasis has been communication with Glenwood Springs because of the direct impact of the fire on their main water sources of Grizzly and No Name Creeks and the changes to their infrastructure, as well as the towns of Silt and De Beque which are mostly reliant on the Colorado River for their drinking water. Having this network in place facilitated organizing the Colorado River Partner Notification Plan that was set up by CDPHE to warn downstream users of additional post fire events and changes to water quality as we move into the second through fourth years, post-fire.

Other downstream users, the agricultural community, natural resource agencies and recreationists have also been impacted by post fire debris flow events and changes in water quality. CDPHE funding was obtained in the fall/winter of 2021-2022 to help the Silt Water Conservancy District repair their pump facilities at the pump house and set up mitigation measures in preparation for potential high turbidity events in 2022 through 2024.

Rain Gauges

Putting rain gauges in Glenwood Canyon was discussed by stakeholders immediately following the fire in the fall of 2021. The BAER report showed there were a variety of sites to monitor weather changes coming in from different directions, and squalls in certain burn scar drainages had a higher likelihood of flooding and debris flows.

CDOT set up rain gauges in two locations in the canyon in the Grizzly Creek and Cinnamon Creek drainages. Working with the River District, CDOT and the National Weather Service, MCWC used CWCB funding to have USGS place additional gauges at seven other sites: 4 burn-perimeter sites and 3 in drainages. Some of the sites had tipping buckets included with additional sensors, and all had either cell service or GOES [CF1] communication to ensure precipitation information was transmitted as quickly as possible to the National Weather Service in Grand Junction.

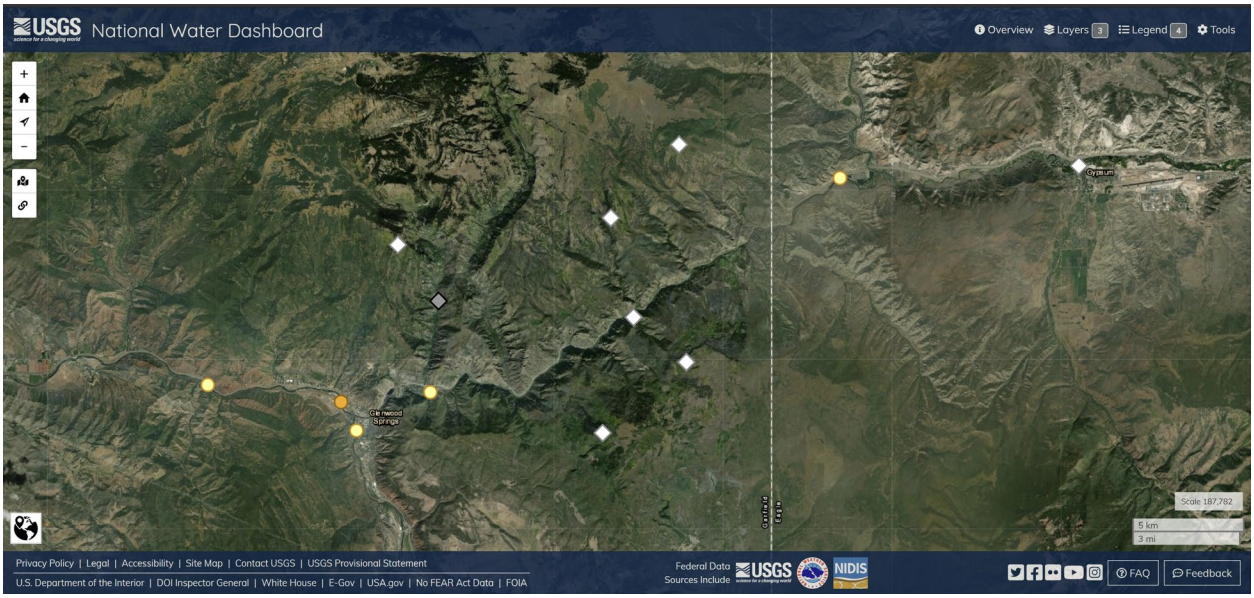
Rain Gauge locations
39°37'4.15"N / 107°18'28.55"W
39°39'28.91"N / 107° 9'42.05"W

39°37'42.88"N / 107°11'50.30"W
39°35'43.25"N / 107°17'12.07"W
39°35'20.12"N / 107°11'7.81"W
39°34'15.29"N / 107° 9'28.45"W
39°32'33.59"N / 107°12'4.73"W

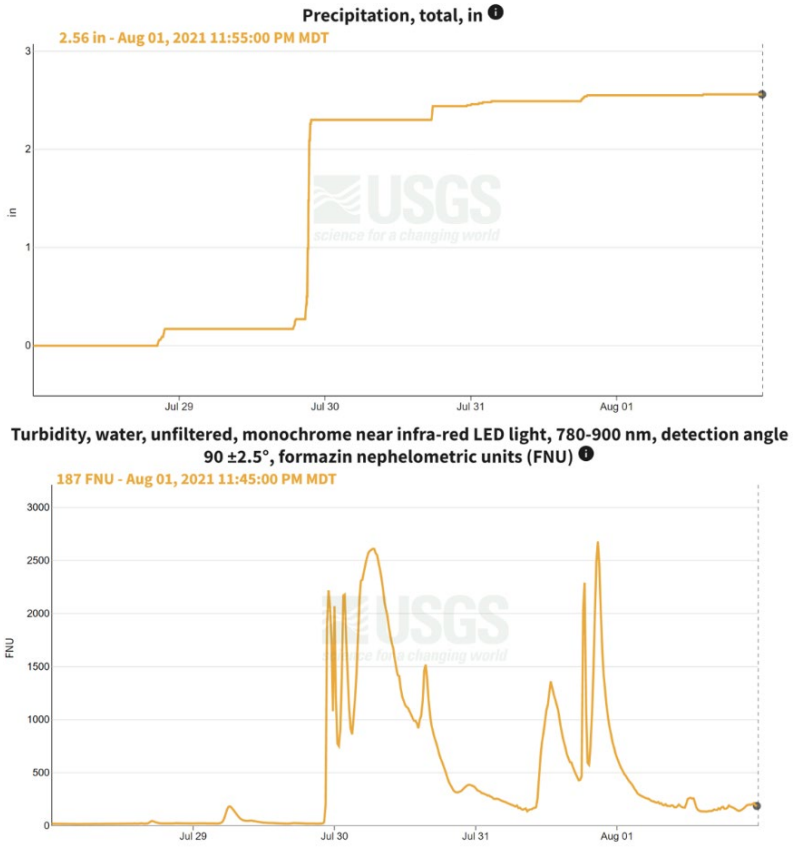
The rain gauges complement the information being perceived on the weather service's doppler radars. The weather service would be able to quickly relay information to CDOT for setting up a warning system for traffic and other users in the canyon.

Water Quality Monitoring Data Available in 2021

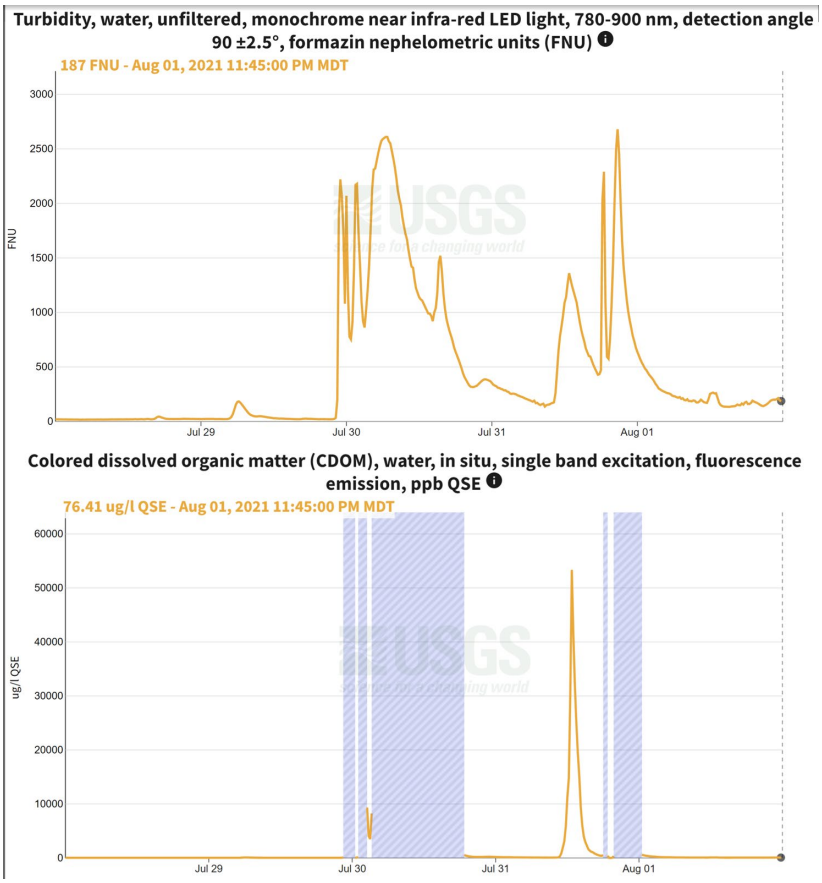
USGS has a National Water Dashboard to allow users to find individual USGS stations that monitor for a variety of parameters (streamflow, water quality parameters, groundwater levels, etc.) as well as various overlays of pertinent data such as weather forecasts and rain gauge data. The interested public or key staff at municipal water supply managers, city governments, water conservancy districts, and other special jurisdictions can sign up for text or email notifications and alerts based on measurements taken at individual USGS station on the National Water Dashboard.



The figure above shows a map view of the USGS stations with water quality and stream flow parameters (circles), as well as the rain gages that were installed in Glenwood Canyon (diamonds).



The figure above is a stacked plot of preliminary precipitation totals (inches) at the Coffee Pot Road rain gage station, located northeast of Glenwood Springs, and preliminary turbidity (FNU) data from USGS station 09071750 covering July 28 to August 1, 2021. During this time, massive debris flows were generated during what hydrologists and meteorologists characterized as a 500-year storm over Glenwood Canyon. The sharp rise in precipitation for the rain gage between the late hours of July 29 and July 30 indicates intense rainfall. Correspondingly, turbidity in the Colorado River peaked several times over the days following major slides in the various drainages of Glenwood Canyon. All data are provisional and subject to revision until they have received final approval.



The figure to the left is similar to the previous figure only showing preliminary turbidity (FNU) data stacked over preliminary fluorescent dissolved organic matter (ug/L, or ppb) data which is analogous to dissolved organic carbon (DOC), which is an important parameter for water treatment plants to monitor as it corresponds to potential increased disinfection byproducts that can be harmful to drinking water customers. Interestingly, organic matter concentrations appear to correlate with turbidity changes and cover a very large range; uncorrected fDOM concentrations spanned from roughly zero to upwards of 50,000 ppb and back down to near zero in a matter of hours. Note: the blue areas in the fDOM plot indicate censored data. All data are provisional and subject to revision until they have received final approval.

Phase II Planning (2022 – 2024)

In the spring of 2022, CWCB funding was approved to continue water quality and rain gauge monitoring for three years (2022-2024).

MCWC will expand data collection and analysis by adding soil moisture sensors and additional in-channel water quality monitors and support continued operations of the rain gauge network. Phase II will improve spatial resolution of water quality monitoring in the watershed by adding an additional 2-P monitoring station above the town of Silt's water intake and a 5-P water quality monitoring station at the Rulison bridge above Parachute, Battlement Mesa Metro District, and De Beque's water intake. By also co-locating a new soil-moisture network within the existing rain gauge network in the canyon, MCWC hopes to improve flooding and debris flow forecasting as part of the early warning system.

An integrated and customizable web-based system (a new Data Dashboard) is being created to display real-time information on water quality and precipitation conditions to inform downstream users and the general public of changes exceeding thresholds, along with alerts and flood warnings. Each town on the river corridor in the Middle Colorado will have a customized version of the Data Dashboard for their water plant.

SGM Engineering Technical Advice

SGM Engineering began advising Middle Colorado Watershed Council in the summer of 2021 providing technical and project management services for the first year of the water quality monitoring project. Project management included managing execution and advice to the Technical Advisory Team (TAT), grant research and reporting support. Biweekly advisory meetings and monthly stakeholder and TAT meetings included meeting summaries and coordination planning for outcomes, schedules and project details. SGM also provided support for long-term water quality monitoring strategy that integrated goals and metrics for the project into the next three years of planning.

Technical Advisory Team (TAT):
Dave Kanzer, Don Meyer, Brendon Langenhuizen, Colorado River District
Chip Fisher, Angie Fowler, Christina Pearson, SGM
Paula Stepp, George Wear and Doug Winter, MCWC
Justin Anderson, USFS
Cory Williams, John "Ryan" Banta, Nancy Bauch, and Rodney Roderick, USGS
Chad Rudow, Roaring Fork Conservancy
Kevin Hyatt, BLM
Dr. Kenneth Hurst Williams, Berkeley Labs
Nathan Bell, Silt Water Conservancy District
Paul Hempel, Marshall Caine and William Clauss, Colorado Rural Water Association
Warren Hays, City of Glenwood Springs
Dr. Belize Lane, University of Utah

Municipal Outreach:
City of Glenwood: City Manager Debra Figueroa, Public Works Director Matt Langhorst, Water/ Waste Water Plant Operations Superintendent Warren Hays
Town of New Castle: Town Manager David Reynolds, Public Works Director John Wenzel
Town of Silt: Town Manager Jeff Layman, Public Works Director Trey Fonner
City of Rifle: City Manager Tommy Klein, Utilities Director Robert Burns, Wastewater Supervisor Jared Emmert
Town of Parachute: Town Manager Stuart McArthur, Public Works Director Mark King
Battlement Mesa Metro District: District Manager Steve Rippy, Water Plant Operator Greg Jacobs
Town of De Beque: Town Manager Care McInnis, Utilities Director Tim Melovek and Mark King in 2022
Garfield County: County Manager Kevin Batchelder, Construction Contracts Administrator Scott Henricksen, Emergency Manager Chris Bornholdt
Mesa County: Andy Martsoff

Rain Gauge Communication Network
Dave "DK" Kanzer, Brendon Langenhuizen, Don Meyer, Colorado River District
Andrew Knapp, Jamie Yount, Nicholas Barlow, Todd Blake, CDOT
Aldis Strautin, Jeff Colton, National Weather Service Grand Junction
Cory Williams, John "Ryan" Banta, John Fulton, Ken Leib, Mark Henneberg, Rodney Richards, Nancy Bausch, USGS
Marshall Caine, Paul Hempel, William Clauss, Rural Colorado Water Association

Agriculture Community Outreach:

Nathan Bell, Silt Water Conservancy District
Emily VanBuskirk Schwaller, GarPit CD, District Manager
South Side, Sopris and Book Cliffs Conservation Districts
Jeff Houpt, Blue Stone Conservancy District
Ryan Jarvis, legally represents variety of conservancy districts

Power Point of USGS final report Water Quality Monitoring attached.
Photos from site visits attached.

Press articles:
https://www.vailmag.com/news-and-profiles/2022/06/eb00812f-aa06-46d9-92c7-a148dc93fdac
https://www.postindependent.com/news/grizzly-creek-burn-scar-just-the-half-of-it-in-causing-devastating-glenwood-canyon-flooding-last-summer/

https://www.postindependent.com/news/glenwood-canyon-monitoring-project-gets-funding-for-second-phase/

https://www.latimes.com/environment/story/2021-09-27/burn-scars-of-wildfires-threaten-drinking-water-across-much-of-the-west

https://www.coloradoan.com/story/news/local/colorado/2021/09/29/burn-scars-wildfires-threaten-wests-drinking-water/5906945001/

https://soprissun.com/2022/05/04/dismal-water-flows-inspire-expansive-collaboration/

Glenwood Canyon Restoration Alliance
Glenwood Canyon Sign Replacement Project
The Glenwood Canyon Sign Project benefitted from a variety of local, state and federal partners' year-long engagement to determine the inventory, assessment and priority of which signs needed replacement in the canyon due to impacts from the 2020 Grizzly Creek Fire and post-fire events and weathering. Under the guidance of the US Forest Service and in conjunction with the Glenwood Canyon Restoration Alliance, these stakeholders devised a plan to use the signage to incorporate the fire and post-fire story and to communicate the Canyon's unique history and importance in this region both as a natural asset and an important economic driver in the region.

Education and Outreach
In Autumn, 2021 RFOV, MCWC and partners hosted two in-person events related to Glenwood Canyon restoration: the first, a townhall open to the public with speakers from various government and non-profit agencies; the second, a tour through the damaged Grizzly Creek Trail for city and county officials. These events helped define expectations for upcoming on-the-ground work in the current Project Season 2022.

MCWC worked with the State Emergency Management Team to set up a warning system to be managed by CDOT and MCWC to provide notification to downstream users flooding and debris flows in the canyon and extreme changes to water quality that might impact water treatment plants and the agriculture community.

In the winter and spring of 2022, MCWC provided post-fire restoration presentations during the Rivers Edge West February 2022 Riparian Restoration Conference; Club 20's April 2022 Water Summit; and the Colorado River District May 2022 State of the Middle Colorado River in Glenwood Springs, Colorado.

In June of 2022, MCWC organized an educational community hike in the Grizzly Creek drainage to share impacts for the August 2022 fire. Guest speakers included representatives from CDOT to tell about the fire and post fire debris impacts to highway infrastructure; USFS forest hydrologist; City of Glenwood Springs to discuss the fire and post fire impacts on the town's water plant infrastructure; and SGM Engineering to explain the USGS's post fire water quality monitoring efforts to track changes to water quality. Guests were also sent a link to a YouTube presentation by a local CPW representative that shared information on the impacts of the fire and post fire debris flows to local native fish species and macroinvertebrates.

GCRA Educational Materials

2022 Factsheet

This front-back onesheet was developed by RFOV with partners for distribution to local guide services and companies to provide an instructive, but brief, reference for disaster related restoration activities within Glenwood Canyon, and how to best evacuate if need be. Factsheets have been distributed widely during guide service trainings and other public hikes within the canyon.

2022 Reference Guide

This 23-page document was developed by RFOV with specific contextual details for agencies and companies to have on-hand should residents or visitors have questions regarding geography, hydrology, fire science, or biology in Glenwood Canyon. Reference guides have been distributed more narrowly than factsheets, because whereas the latter may accompany a guide on a rafting trip the former will likely be kept at their office.

GCRA Data Visualization

RFOV has developed an online map with data and photos collected from a variety of government partners to aid residents and visitors in their exploration of the canyon pre-2020-fire and post-2021-landslides. This has required a significant amount of time and effort to collate and recode data as well as to make the map for user-friendly for persons without prior technical knowledge. In future years, more datapoints can be added to make this an ever-expanding resource for public education.

GCRA Guide Service Training

Because the guides will see far more persons through the burn area than any non-profit will this season, these trainings are a valuable tool to leverage the educational capacity of RFOV and the public outreach abilities of guiding companies.