Mancos Watershed Stream Management Planning Phase I

Final Report

GRANTEE and FISCAL AGENT: Mancos Conservation District, POGG1,PDAA,202000003147

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PROJECT NAME: Mancos Watershed Stream Management Planning Phase I

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INTRODUCTION AND BACKGROUND

The Mancos Watershed Stream Management Plan sought to improve water security for all water uses and values in the Mancos watershed by protecting existing uses, meeting user shortages, and maintaining a healthy riverine ecosystem in the face of future demands and climate uncertainty. The geographic focus of this effort is the entire Mancos River watershed and its main tributaries. This diverse area encompasses Bureau of Reclamation facilities at the top end of the watershed, a productive irrigated valley in the middle, and Tribal and National Park lands towards the bottom end.

The specifics of climate uncertainty, like warmer temperatures, more frequent droughts, and variability of rainfall, paired with the vulnerability of forest and water resources to increased wildlife risk and severity, precipitated the need for a stream management plan. Changes in land use and crop types may change historic surface flow patterns and exacerbate existing concerns about river health and flow shortages. A growing emphasis on recreation and community-wide engagement with the river further demanded forward and collaborative thinking and planning.

The Mancos Watershed Plan was completed in 2011 after a five-year process consisting of extensive stakeholder engagement. The Plan detailed critical issues and goals and provided an implementation schedule. A substantial amount of progress toward these goals was made and in 2016-2018 a group of stakeholders produced an updated report identifying information gaps and data needs. Stakeholders are eager to implement projects that address diverse concerns. The phased approach of this stream management plan allows for implementation of already supported or prioritized projects, alongside the development of strategic monitoring programs, work to fill data gaps around environmental, agricultural, and recreational flow needs, and collaborative development of prioritized projects that are diverse, feasible, and climate smart.

The overarching goals of this first phase were to ensure protection of the current water rights, continued outreach and engagement, and to identify river health, recreational and management opportunities on lands along the Mancos River through modeling, assessments, and monitoring coordination. The second phase will use data and information gathered during Phase I and beyond to assess, identify, and prioritize projects that further the goals of the Stream Management Plan (SMP). The objectives for Phase II are included below and propose building upon Phase I to provide recommendations for increased flows and restoration opportunities, identify potential projects for new and improved infrastructure, and facilitate temporary, voluntary or compensated changes to irrigation uses during below average run-off years. The above opportunities, alongside those not yet anticipated, will incorporate the Bureau of Reclamation Drought Resilience project's decision support framework to identify climate smart opportunities and account for future climate change as a variable in the prioritization and implementation process.

PHASE I OBJECTIVES:

1. Regularly convene the Mancos Watershed Group to direct the stream management plan process and coordinate it with other on-going work that is relevant, such as the USBR funded Prioritized Drought Resilience Framework for the Mancos River: Applied science framework for flows, livelihoods, and fisheries; (Task I)
2. Create an effective way to include irrigation water users' and the Mancos Water Conservancy District's input and ideas into project tasks; (Task I)
3. Improve understanding of Mancos River hydrology through model refinements and running scenarios to prepare to undertake a watershed-wide flow needs assessment in Phase 2 as a means of assessing opportunities to increase storage and in-stream flows; (Task II)
4. Work with a consultant to identify legal opportunities for management options or actions that private landowners or land managers can collectively or individually take to improve river health and flow; (Task II)
5. Assess recreational needs and opportunities throughout the Mancos watershed with an initial focus on the Mancos River in the Town of Mancos and develop project plans to meet those values; (Task III)
6. Expand the collection of data for key variables that have previously been identified as information gaps, including riparian condition, water quality, water temperature, macroinvertebrates, channel morphology, and hydrology; (Task IV)
7. Convene the Mancos Watershed Group to develop a coordinated monitoring strategy and integrate data sharing, which will be integral to future project prioritization and monitoring; (Task V)
8. Review and use existing data and stakeholder input to identify recommendations and management options that will help establish a baseline and the development of a scope of work for Phase II. (Task VI)

TASK I: STAKEHOLDER ENGAGEMENT - OUTCOMES

SUB TASK 1.1: CONVENE MANCOS WATERSHED GROUP

The Mancos Watershed Group (MWG) completed our first meeting to introduce the planning effort, purpose and process. This meeting was held via Zoom toward the start of the COVID-19 pandemic and was not well attended, other than the Stream Management Plan (SMP) technical team and stakeholders that were already a significant part of the process. This made us realize that with COVID-19 challenges we needed to form an alternative strategy to ensure safe participation from the integral stakeholders and decision makers. What we had initially proposed in our application for stakeholder engagement would need to be rethought and an outreach plan developed for mitigating these challenges and making sure our stakeholder process continued with full participation. The MWG developed a tiered approach to

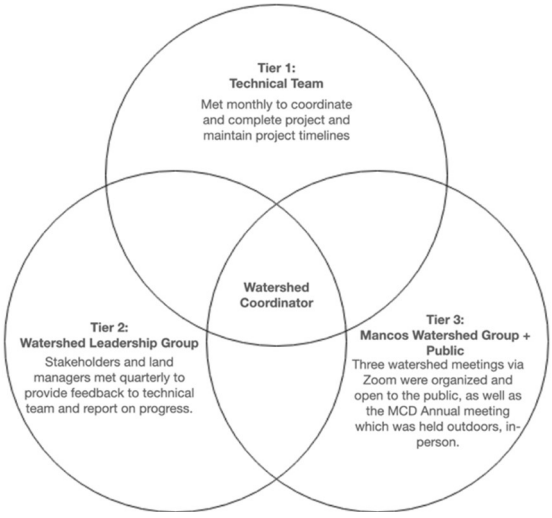

Figure 1: Representation of the Mancos Watershed Group's tiered approach to stakeholder engagement during the COVID-19 pandemic.

stakeholder engagement (Figure 1); instead of seven public workshops to share processes and solicit feedback, we developed three tiers to our Watershed Group and relied heavily on our Agricultural Outreach Coordinator for one-on-one interviews with private landowners. The first tier involved a core technical team of experts that completed the boots on the ground tasks of the SMP. This group convened monthly for one hour throughout the entire project to help mitigate the challenges of the pandemic and keep the project moving forward and on schedule. The second tier was a Watershed Leadership Group, which comprised of all the stakeholders/entities and local land managers within the watershed area. This tier convened quarterly to give valuable feedback to the technical team on progress and overall SMP outcomes. The third tier was the Mancos Watershed Group and the greater public that participated in three Watershed meetings held via Zoom and one Mancos Conservation District (MCD) Annual Meeting held in-person, outdoors. All three tiers' meetings were open to the public but had very specific agendas to create the best overall process and project outcomes, while being respectful of time constraints and participation availability.

SUB TASK 1.2: INVOLVE KEY WATER USERS

With Wilson Water Group's (WWG) support, we presented and discussed the 2019 "Mancos Watershed Drought Resilience Planning: Basin Characteristics and Model Development" report to work through questions and concerns raised by the group, clear up misconceptions and build trust in the model. With a combination of feedback from agricultural landowners, hydrology and ecology specialists, the Ute Mountain Ute Tribe (UMUT), Mancos Water Conservancy District (MWCD) and Mesa Verde National Park (MVNP), WWG felt confident in finalizing the model in order to move forward with scenario planning. This helped the process by identifying existing opportunities related to alternative water management and strategies in the Mancos River Watershed through a legal analysis on specific actions and outcomes through work outlined in Task II. We met with MWCD, the Division of Water Resources (DWR), several water rights holders/landowners and WWG. Wilson Water Group compiled a memo for review and it was circulated to the larger technical team for feedback and discussion prior to our scheduled stakeholder meeting in spring of 2021. Wilson Water Group presented the results at our annual meeting to 25 stakeholders, in addition to the Mancos Watershed Leadership Team. The presentation included the model and recommendations to help inform future decisions and planning. It also created the opportunity to identify and develop consensus-based goals/desired conditions for environmental and recreational needs with the SMP. For WWG's specific model refinements and scenarios in Task II, our Agricultural Consultant distributed the report to key water users so they could review the report and suggest modifications to contribute to our understanding of the basin's water use. WWG then addressed their concerns and updated the report and model to reflect the best possible understanding of basin operations. This again took place via Zoom, email chains and individual phone calls to try to incorporate all interested stakeholders, while being cognizant of constraints due to COVID-19.

Watershed engagement for developing a coordinated monitoring plan in Task IV was led by Stephen Monroe and MCD technicians. They have developed a file storage system, developed data logging spreadsheets, and are developing a timeline for continued monitoring coordination with UMUT, MVNP, and the MWCD**.** MCD installed three Sonde Water Quality units to create better engagement opportunities, increase data accessibility and enable more data analysis capabilities. Water quality parameters that we were not previously able to measure regularly, will be measured every 15 minutes using these Sonde units. This data will be available in real time for anyone within the SMP to access. We will receive alerts for set parameters, which will help us to connect directly with Colorado River Watch and grab additional samples to more accurately assess water quality issues. MCD developed a community outreach plan that will enable community members interested in current conditions and projects to be involved and engaged in water quality of the Mancos River Watershed.

Stakeholder engagement also included consensus-based decisions for planning Phase II goals and outcomes to meet set objectives based on the findings outlined above. Phase II was added to the agenda for the monthly technical team meetings and the group discussed strategies to identify Phase II opportunities as Phase I progressed and came to completion in September 2021. We reviewed recommendations for management opportunities, Rapid Stream Riparian Assessment (RSRA) recommendations for private riverfront properties, companion projects and future watershed goals for Phase II.

The District also identified key water users with an interest in environmental and recreational needs and values to help guide the plan development and prioritize actions. We had 100% participation and interest from all of those contacted. The level of involvement is a direct result of riparian corridor concern or ability to positively affect flow through project or management changes. A summary report of feedback and ideas from key water users for all relevant tasks and how that feedback was incorporated into final deliverables is attached.

The District hired an Agricultural Outreach Coordinator to represent the interests of the identified agricultural water users and work as a liaison with the Mancos Water Conservancy District at the meetings of the Mancos Watershed Group. This ensured that key water users, who are generally too busy to participate in meetings of this kind, had a voice at all meetings. The Agricultural Outreach Coordinator regularly visited with area irrigators identified. Our agricultural consultant was actively involved in the SMP technical team meetings and regularly attended MWCD, Ditch and Reservoir meetings to maintain outreach and connections with local irrigators and land managers. He spoke with water users about possible strategies for timing of water calls and a valley wide metering project that would allow access to data in real time during the irrigation season. This hands down was one of the most helpful strategies for our SMP. The Agricultural Outreach Coordinator was integral to development of a specific outreach plan and informational timeline to keep irrigators informed and up to date while combatting the challenges that COVID-19 caused to outreach efforts. Our Agricultural Outreach Coordinator conducted three public meetings to present the final report and incorporate feedback into the final deliverables.

SUB TASK 1.3: INVOLVE TOWN OF MANCOS RESIDENTS IN RECREATION ASSESSMENT

MCD has had great success in connecting Town residents, local businesses, and the Mancos High School chemistry class to our current work on the river. We partnered with the Mancos Watershed Film Festival and over 200 attendees to raise cash match for this project. MCD conducted further outreach to private landowners with riverfront property through Town. As we conducted this outreach, there was some confusion with another group, which necessitated that we do more strategic outreach to clarify that we are not trying to take riverfront property for a trail but want to work individually with landowners on their priorities for their property. Our strategic outreach was highly successful with riverfront property owners through the Town of Mancos. We had most landowners interested in creating recreational access and new conversations were initiated with landowners interested in purchasing property currently for sale to create recreational access and outdoor space for locals and tourism. We met with the Mancos School District Project Based Learning Coordinator and the chemistry teacher to further plan educational opportunities tied to the completed recreational plan.

MCD attended a public workshop held on April 14th by the Town of Mancos to review the final report for Task III. The Town of Mancos trustees were highly supportive of the proposal and will be adding it to their strategic plan for parks and recreation. The Town will work to fully fund the recommended improvements for recreational access and safety in Cottonwood Park. A second public meeting took place in September with the Mancos School District and private landowners for all three parcels in the proposal. MCD convened this meeting after the completion of the scope of work in Task III to involve the Town, community and landowners in planning and implementing improvements to the three parcels. A summary of feedback and ideas from Town of Mancos residents for all relevant tasks was incorporated into final deliverables. We completed our outreach for the Town of Mancos, the Mancos Public Library, Alpacka Rafts, Mancos School District, and smaller partners. The assessment is completed and attached to this report. A workshop was held with the Town of Mancos and a final public meeting took place in September.

ADDITIONAL TASK: WEBSITE DEVELOPMENT FOR SMP AND WATERSHED

In order to make information and data publicly available to the stakeholders involved and greater community, the Mancos Conservation District created pages on their website dedicated to the Stream Management Plan and Mancos Watershed Group. The SMP page provides information on the Mancos Watershed SMP, outlines the fundamentals of SMPs, and provids stakeholders with additional resources if they'd like to know more or get involved. The Mancos Watershed Group page educated the community about the goals of this diverse group of partners, in addition to providing relevant documents to the public about work being done to advance and achieve economic, cultural and ecological resilience for the Mancos Watershed.

TASK I: STAKEHOLDER ENGAGEMENT – PHASE II FUTURE RECOMMENDATIONS

The current Mancos Watershed Group was highly active throughout the entire project and the group is determined to move forward and tackle recommendations for future projects. The agricultural community would like to see a committee instead of just one Agricultural Outreach Coordinator, and we had several interested individuals with diverse backgrounds, skillsets, and water rights. Creation of an agricultural interest committee would provide an even more representative, watershed-wide outreach effort as we move into Phase II.

The discussion of legal leasing mechanisms and in-stream flow rights was touched on during Phase I, but recommendations for stakeholder engagement and bringing experts to the table to fully explain the options for these mechanisms is needed. We will then use model refinements and legal opportunities for management options from Phase I, Task II paired with USBR report, and stakeholder engagement, to identify specific opportunities and priority reaches for and implementation of management options or actions that private landowners or land managers can collectively take to improve river health and flows.

The project plans developed in Phase I for recreational opportunities were well received and implementation for two of the three town reach improvements was recommended. The third reach, up-stream was recommended for some additional stakeholder feedback and scoping.

Stakeholders would like to see the coordinated monitoring strategy and data collected in Phase I put into a finalized assessment of the Mancos River from the headwaters through the downstream stretch on Ute Mountain Ute tribal lands, primarily focused on riparian habitat, floodplain connectivity, flow timing,

duration and magnitudes, water quality, water temperature, macroinvertebrate populations and native fisheries.

Stakeholders identified concerns specifically on the West Mancos tributary, to the vulnerability of the headwaters and valuable infrastructure to wildfire and climate impacts, recommendations to prioritize work on forested lands was also identified.

We will use the priority list of climate-smart strategies developed in Phase I and funds secured in Phase II to begin implementation on three project demonstration sites identified through Phase I.

The last recommendation is a comprehensive technical report summarizing all available data related to river health, including water quality, water temperature, macroinvertebrates, and results of Rapid Stream Riparian Assessment surveys throughout the watershed. This report then will be used to create an outreach campaign to deliver information on the condition of the watershed to the greater public. The greater community is informed on the SMP and processes but is also greatly interested in receiving info-graphics, presentations and outreach materials with the results.

TASK II: IMPROVE UNDERSTANDING OF RIVER HYDROLOGY AND POLICY, LEGAL FRAMEWORK OPTIONS

Task II implemented several of the recommendations from the 2019 report, including reviewing return flow timing to confirm the currently used general San Juan lagged return flow parameters or refine them. Secondly, Task II extended the modeling period to include 2018 and 2019 so it could include the historical drought of 2018 and high snowpack/low monsoon year of water year 2019. We also utilized the updated decision support tool to run scenarios of river hydrology under current and potential future scenarios. This laid the groundwork for a watershed-wide assessment of flow needs and options for planning Phase II. Mountain Studies Institute recently commissioned a study to investigate future climate conditions for southwest Colorado using available downscaled climate model data. It was Wilson Water Group's (WWG) understanding that the Mountain Studies Institute effort provided a general characterization of what the climate models indicate for the Southwest and the Mancos River basin. Although they used the same available Global Climate Models, they did not generate local natural flow or increased demand datasets as was done by the state of Colorado in their Colorado River Water Availability Study (CRWAS) effort (https://www.colorado.gov/pacific/cdss/colorado-river-water-availability-study).

The state of Colorado selected hydrology representing two future climate scenarios for use in the Technical Update to Colorado's Water Plan. The two scenarios, both representing plausible climate conditions in 2050, were termed "Hot and Dry" and "Inbetween." The associated monthly natural flow and agricultural demand datasets were developed such that they could be incorporated directly into Colorado Decision Support System (CDSS) San Juan basin water rights allocation model (StateMod) and into the detailed Mancos StateMod model that were used to investigate options as part of the Mancos Stream Management Plan. However, the datasets were developed on a monthly timestep only. All selected scenarios were completed and presented to stakeholders. Results from these model scenarios are in the attached memos.

Finally, the District wanted to understand various legal mechanisms for protecting the water rights of water users who may be interested in participating in future streamflow enhancement projects. Options included water transactions, sharing, banking or increased storage in the basin. Division 7 has special considerations for some legal opportunities and WWG investigated and documented current legal

mechanisms available to water users in Division 7. WWG met with water users and stakeholders to determine legal options and confirm current operations of Jackson Gulch Reservoir. Even with the challenges of the Division 7 exception, this presentation by Erin Wilson was highly accepted. While Mancos Valley water users are interested in the legal options to share, bank or increase storage in the basin, there is still a concern around the discussion of in-stream flow rights and what that really means for the future of our river system.

TASK III – RECREATIONAL OPPORTUNITIES IN THE TOWN OF MANCOS

A review of the Mancos River hydrology and geomorphic data in the Town of Mancos reach was conducted using available aerial imagery (e.g., Google Earth, etc.) and by performing a visual geomorphic assessment of each parcel. This review included some representative bank full channel width and depth measurements, bed and bank stability assessments, calculations of composition and cover of riparian area, and assessing the presence of anthropogenic factors adversely affecting each parcel. We identified desirable stable or reference sites and problem areas within each parcel and feasible geomorphic and/or riparian stabilization, restoration and/or enhancement opportunities and potential recreational opportunities within each parcel. We prepared a brief summary report that describes the present-day site, hydrology & geomorphic characteristics, and any identified "improvement" opportunities as well as important limitations, and general recommendations. We also prepared conceptual plans and cost estimates for each parcel. An assessment was completed of on-the-ground and aerial photographic data of each of the three parcels: Town of Mancos Reach, Private Reach, and Mancos School District Reach, as well as a review of previously collected hydrologic and Mancos River geomorphic data. The completed assessment is attached to this report.

TASK IV - RIVER HEALTH/WATER QUALITY ASSESSMENTS

The objective of Mancos Stream Management Plan Phase I - Task IV was to collect data addressing information gaps and data needs identified by a group of Mancos Watershed stakeholders in 20I8. The group identified riparian ecosystems, water quality, and water quantity as priority values and indicators of watershed health and resilience. Consistent repeatable, science-based data collection methods were used at sites throughout the watershed to collect data at sites selected based on guidance from land managers and experts. The geographic scope of assessments was informed by watershed attributes, existing studies, and stakeholder concerns. This report provides summaries of the Mancos Conservation Districts riparian, water quality, and water temperature survey and data collection activities during 2020 and 2021.

Streams and riparian areas support biological diversity and are beneficial to human uses including agriculture and recreation. Additionally, healthy riparian areas help improve water quality and aid in flood control and erosion prevention. Rapid Stream Riparian Assessment (RSRA) is a semi-quantitative method used to evaluate the functional condition and ecological health of wadable streams (Stacey, 2007). Surveys of seventeen sites in the Mancos watershed were completed in 2006 (Stacey, 2007) and additional surveys were completed by others in 2012-2014. RSRA surveys include observations of five functional components of the stream-riparian ecosystem that provide important benefits to humans and to aquatic and terrestrial wildlife. The RSRA uses a five-point scoring system, with scores ranging 1, defined as *completely non-functional or poor* to a score of 5, defined as *fully functional or excellent.*

FUNCTIONAL RIPARIAN ASSESSMENTS

In 2018-2021 the Mancos Conservation District completed seven RSRA surveys at sites in the Mancos watershed. Surveys were completed on reaches of the river owned by private landowners, the Town of Mancos, and the Ute Mountain Ute Tribe. Overall mean scores for RSRA surveys completed on the Mancos River and tributaries from 2020 and 2021 ranged from 2.0 to 3.6. Summaries of surveys and all data and will be included in a report that will be completed in late 2021. RSRA surveys provide valuable information describing riparian ecosystem health, and a valuable foundation for development of recommendations for stream restoration projects and river management alternatives. The final report was completed and our outreach has been so successful that we have a backlog of private landowners interested in these assessments. Conducting RSRA surveys has been the best way to make an on-site visit and have in-depth discussions with individual landowners about the goals and concerns for each reach. We are seeing an increased interest in in-stream and riparian improvements, including the support of current populations of beaver and interest in providing habitat for beaver population expansion at certain locations.

WATER QUALITY

The availability of clean water is essential for agricultural and domestic water users, as well as to river health. The Mancos River and its tributaries provide water for agriculture, domestic water supply, aquatic and riparian ecosystems, and recreation. Known water quality issues in the Mancos watershed include high levels of salinity associated with the Mancos Shale, and high concentrations of metals sourced from historic mining activities and local geology.

In 2018 the Mancos Conservation District initiated a River Watch water quality monitoring program, collecting monthly samples at six sites in the Mancos Valley. In 2021, through a partnership with Colorado Department of Public Health and Environment (CDPHE), we were able to install three Sonde Water Quality Units at current or past stream gauge locations. One unit is on private land, one is at a Montezuma County Bridge, and the third is next to a Division of Water Resources (DWR) managed gauging station. Though turn-around times from the River Watch water quality laboratory time can be as long as six months, the Sonde Units collect real-time data for six core water quality parameters every 15 minutes. Data from River Watch samples collected in 2018 through 2021 will be included in a report that will be completed in by MCD staff in 2022. Information about water quality conditions in the river will be useful to multiple agencies in support of planning and management decisions.

The outreach involved in determining sites for the installation of Sonde Units has generated amazing community interest in our water quality work, the Stream Management Plan and future options for the Mancos River. We are piloting the Sonde Unit project in partnership with CDPHE, River Watch and River Science to help align River Watch citizen science programs with real time data. The Sondes will send us alerts when parameters are breached and we can quickly respond and take physical samples. The hope is to better understand how high concentrations of metals, salinity and nutrients align with these spikes or drops in water quality. We continue to collect water quality samples at 10 locations and have been able to increase the frequency this spring in addition to add *E. coli* testing to the sampling protocols.

WATER TEMPERATURE

Water temperature plays a key role in chemical and biological reactions, influencing water quality and the health of aquatic ecosystems. The Mancos River and its headwater tributaries are designated Cold Water

fisheries, and reaches at lower elevations are identified as Warm Water fisheries. Recent models predict that the thermal regime in the Mancos River is likely to experience significant changes in the future due to climate change, with the cold/warm water transition zone moving upwards in elevation.

The Mancos Conservation District (MCD) initiated a water temperature monitoring program to determine status and trends in water temperature in the Mancos River and its tributaries. In March 2020 MCD installed water temperature loggers at six sites on the Mancos River and its tributaries, ranging in elevation from 6,535 upwards to 7,530 feet above sea level. In 2021 MCD installed additional temperature loggers at higher elevation sites on the San Juan National Forest.

Temperature loggers will be downloaded during Fall 2021 and data will be included in a report completed in late 2021. Information about current water temperature conditions in the river will be useful to multiple agencies and SMP partners in support of planning and management decisions.

CHANNEL MORPHOLOGY

Drought impacts over the last 20 years have affected river flows, and in recent years the lower reaches of the Mancos River have been impacted by extremely low flows, and some sections of the river dry completely. The frequency, intensity, and duration of droughts are expected to increase across the region, with potentially dire consequences for fisheries, riparian ecosystems, forests, and the human communities in the watershed. Summer flows are important for the survival of cold and warm water fish species, and years with low summer flows (e.g., 2002, 2012, and 2018, 2020, 2021) were particularly detrimental to warm water fish. During these periods, riffles dry and isolated pools are all that remain in the river, thus reducing in-channel connectivity necessary for fish to access food sources. Hydrologic connectivity between the channel and floodplain is also reduced, limiting availability of water required to support riparian vegetation.

In 2021 the Mancos Conservation District completed surveys at seven sites in the Mancos Valley. Selection of survey methods was refined through consultation with Colorado Parks and Wildlife staff and data will be used to model minimum flow requirements for fish habitat, and high-flow floodplain connectivity. Summaries of surveys and all data and will be included in a report that will be completed in late 2021. Channel morphology surveys provide valuable information describing hydrologic processes necessary to maintain and restore healthy fisheries and riparian ecosystems, and are a valuable foundation for development of recommendations for stream restoration projects and river management alternatives.

HYDROLOGY

The Ute Mountain Ute Tribe (UMUT) completed the installation of three recording stage gauges along the Mancos River during 2020. These were near the boundary of the Ute Mountain Ute Tribal land and Mesa Verde National Park, close to the confluence with the San Juan River and at one location in between. Work at each location included a survey of the longitudinal profile of the stream channel and several cross sections. Additionally, a staff gauge, pressure transducer, temperature/conductivity probe and camera were installed at each location.

TASK V – DEVELOPMENT OF A COORDINATED MONITORING STRATEGY

The Stream Management Plan is intended to serve as a roadmap defining a coordinated monitoring strategy for the Mancos Watershed. This strategy emphasizes collection of scientifically credible data that will meet critical information needs addressing stakeholder identified river health concerns including: effects of low flow on stream ecosystems; water quality impairments; riparian habitat degradation; how climate impacts may influence water availability; and recreational water needs. The Mancos Watershed

Group (MWG) is a diverse group of partners who work collaboratively at the watershed-scale to advance and achieve economic, cultural, and ecological resilience for the watershed. The MWG includes representation from: private landowners; federal agencies including the U.S. Forest Service, National Park Service, and Bureau of Land Management; local municipalities and entities including the Town of Mancos and the Mancos Water Conservancy District; the Ute Mountain Ute Tribe; and the Mountain Studies Institute, an independent not-for-profit mountain research and education center based in Durango, CO.

In 2011 the Mancos Valley Watershed Group completed the Mancos Watershed Plan, defining a set of goals intended to improve river health, and identifying critical water related issues within the watershed. The Watershed Plan pointed towards necessary information needed to address the goals and resolve the issues, and has provided a foundation that has guided subsequent projects and studies. Progress has been made on many of the studies and management measures recommended in the Mancos Watershed Plan; numerous projects addressing irrigation efficiency in the Mancos Valley have been completed and more are planned. However, many of the goals identified in the Watershed Plan have been achieved only partially, and some not at all.

At the time the Mancos Watershed Plan was completed climate change was on the distant horizon and was not directly addressed. Since that time the western United States, including southwest Colorado has been experiencing a long-term megadrought which has reduced the amount of water in streams and rivers, and has significantly impacted the agricultural community. In 2018 a group of stakeholders led by Mountain Studies Institute completed the Mancos River Resilience Report. The group identified a set of core values including agriculture, water quantity, water quality, fish, macroinvertebrates, and riparian ecosystems. Existing data were gathered for each of these values and information needs were identified. In 2021 Mountain Studies Institute completed the report *Prioritized Drought Resilience for the Mancos Watershed,* a multi-stakeholder effort identifying and prioritizing locally relevant, climate-informed drought resilience strategies across multiple values.

The Mancos River is a perennial stream that flows from its headwaters at 13,000 feet in the La Plata Mountains, through irrigated ranch and farmlands in the Mancos Valley, and eventually reaches the San Juan River after passing through Mesa Verde National Park and Ute Mountain Ute Tribal lands. Flows in the Mancos River are highly variable and come from winter snowpack and occasional high flows occurring during periods of heavy summer rains. Numerous diversions withdraw water from the river for municipal and agricultural uses. Future climate scenarios project seasonal temperatures to get hotter and flow in the river to decrease.

The Mancos watershed consists of four sub-reaches "nested" within the larger watershed. These reaches are defined by topography, and both natural conditions and human-activities within the watershed are reflected in the health of the river.

- The Mancos Headwater sub-reach is mostly forested lands above 7500 feet, managed by the San Juan National Forest and at lower elevations also includes numerous privately owned parcels. The forests are high fire-risk, and key infrastructure providing water to municipal and agricultural water users is located in the upper West Mancos watershed.
- The Mancos Valley sub-reach (6500-7500 feet) is mostly irrigated ranch and farmlands.
- Downstream from the Mancos Valley is the Ute Mtn Ute, BLM, and NPS Canyons and Mesas sub-reach. The National Park Service, Bureau of Land Management and Ute Mountain Ute Tribe all manage portions of this remote and rugged sub-reach. Grazing by cattle is excluded from the reach of the Mancos River flowing through Mesa Verde National Park, but cattle and feral horses roam freely on Ute Mountain Ute Tribal lands.

- The Ute Mountain Ute Range sub-reach of the watershed is entirely on Tribal lands and is between the mouth of Mancos Canyon and the confluence with the San Juan River. The lower reaches of the river regularly run dry, thereby putting fish, riparian habitat, economic, and cultural values at risk.

MONITORING GOALS

Development of a coordinated monitoring strategy is guided by more than twenty years of engagement from Mancos watershed stakeholders. A series of reports identify and prioritize goals and concerns initially defined, and then refined over time with input from stakeholders. Mancos Conservation District completed a community survey in 2019, with respondents identifying climate change and drought, lack of current storage and sound infrastructure, and water education as the highest priorities. The drought in 2018 caused prolonged drying of the river in many locations, reiterating the importance of addressing this issue.

Goals identified in the 2011 Mancos Watershed Plan were:

- Improve fishing, primarily from the confluence of the East Mancos River with the West Mancos River downstream.
- Reduce the loading of dissolved copper from the East Mancos River either through reductions at the source, increasing assimilative capacity, or through dilution.
- Work with irrigators/irrigation companies and landowners along the Mancos River to restore the functioning capacities of the river system.
- Work with irrigators to rebuild diversion systems that are in need of constant maintenance and that have major impacts on river functions.
- Improve the riparian ecosystem and thus the functioning capacity of the river.
- Improve in-stream flows throughout the summer months through the town of Mancos and downstream when irrigation tends to dewater the river.

The Mancos Watershed Plan also identified specific needs and issues:

- Upgrade aging, 19th century-vintage irrigation infrastructure.
- Address the historical levees from just above the town of Mancos and extending approximately six miles downstream.
- Water quality impairments in the East Mancos River.
- Low flows during late summer irrigation season.

Core river and watershed health values identified by stakeholders in the in 2018 *Mancos River Resilience Report* are shown below. Also shown are a summary of recommendations included in the report. These recommendations are based on gaps or needs identified through synthesis of available data.

- Agriculture
    - Assess and monitor soil conditions in the Mancos Valley.
- Water Quantity
    - Establish and maintain streamflow gaging stations at key points on the Mancos River.
    - Implement a flow monitoring network on the major diversions in the watershed.
- Water Quality

- Address identified water quality impairments for the Mancos River.

- Fish
  - What is the estimated abundance, distribution, and age structure of each fish species in the Mancos River and how have these been changing over time?
  - What are the most productive reaches in the Mancos Watershed for native fish? For game trout?
- Macroinvertebrates
  - Data documenting benthic macroinvertebrate communities and habitat in the Mancos River is sparse and much of it is outdated. Reaches where multi-metric index impairments have been identified should be priorities for future monitoring efforts.
- Riparian ecosystems
  - Are cottonwoods and other native tree species regenerating along the river?
  - What flows in the Mancos River support establishment of cottonwood seedlings?
  - What conditions are needed for woody shrub and tree species recruitment?
  - How widespread are tamarisk, Russian olive, Siberian elm, and other invasive species in the watershed?

Table 1. Correspondence between goals identified in the Mancos Watershed Plan, river health concerns identified in Mancos Watershed Stream Management Plan Phase I - Task V, and river health values presented in Mancos River Resilience Report (Bueno et. al. 2018)

2011 Watershed Plan - Goals	**SMP Phase I - Task V**	**Mancos River Resilience Report - Values**				
		Water Quality	**Water Quantity**	**Macro-invertebrates**	**Riparian Ecosystem**	**Channel Morphology**
Improve in-stream flows throughout the summer months through the town of Mancos and downstream when irrigation tends to dewater the river.	Effects of low flow on stream ecosystems	**X**	**X**	**X**		**X**
Reduce the loading of dissolved copper from the East Mancos River either through reductions at the source, increasing assimilative capacity, or through dilution.	Water quality impairments	**X**		**X**	**X**	
Improve the riparian ecosystem and thus the functioning capacity of the river.	Riparian habitat degradation		**X**	**X**	**X**	**X**
Not Included	How climate impacts may influence water availability	**X**	**X**	**X**	**X**	**X**
Improve fishing, primarily from the confluence of the East Mancos River with the West Mancos River downstream.	Recreational water needs	**X**	**X**	**X**	**X**	

The 2021 *Prioritized Drought Resilience for the Mancos Watershed* report expanded the watershed health values to include Pinyon-Juniper woodlands and Ponderosa pine forests. The report identified value specific and cross-cutting drought resilience strategies.

- Promote research, education, and monitoring
- Identify and protect climate refugia for fish and riparian plant species
- Promote landscape connectivity
- Maintain and enhance hydrologic processes
- Maintain and restore riparian vegetation
- Reduce the risk and long-term impacts of severe disturbances
- Sustain fundamental functions of soil and water
- Facilitate adjustments through community species transition

CURRENT MONITORING AND ASSESSMENTS

In the Mancos watershed the Mancos Conservation District, the National Park Service, and the Ute Mountain Ute Tribe each administer water related monitoring programs (Table 2). Each of these programs are funded and staffed independently, use program specific protocols, and are implemented to support each organizations goals and objectives.

Table 2: Active monitoring programs in the Mancos Watershed.

Organization	Water Quality	Water Quantity	Macroinvertebrates	Riparian ecosystems	Channel Morphology
Mancos Conservation District	X		X	X	X
Mesa Verde National Park	X		X	X	X
Ute Mountain Ute Tribe	X		X		X

In 2018 the Mancos Conservation District (MCD) initiated several projects on the Mancos River for the purpose of addressing the Watershed Plan's goals. These include Rapid Stream-Riparian Assessments, River Watch water quality sampling, and macroinvertebrate sampling. More recently MCD implemented a water temperature monitoring program, and has completed a series of channel morphology surveys.

Downstream from the Mancos Valley, the National Park Service (NPS) monitors water quality, macroinvertebrates, and surface and ground water hydrology at two sites on the Mancos River in Mesa Verde National Park. From 2016 to 2018, the NPS also completed surveys of current and historic channel morphology and riparian vegetation along the Mancos River in the park boundaries.

The Ute Mountain Ute Tribe (UMUT) published *Mancos River Water Quality and Trends Assessment: 2011 – 2012* (Ute Mountain Ute Tribe 2013) presenting water quality and other data collected from waters throughout the Mancos watershed and continues their water quality and macroinvertebrate

monitoring programs in the Mancos River. In 2020 UMUT expanded their hydrologic monitoring program to include surface and ground water hydrology, and channel morphology as well.

Additionally, state and federal agencies monitor streamflow and periodically conduct condition assessments and sample biological components. The Colorado Division of Water Resources and the United States Geological Survey maintain a network of streamflow gages on the Mancos River and tributaries. Current and historic streamflow gages are shown in Table 3. In upper elevations of the Mancos watershed the San Juan National Forest periodically assesses and classifies watershed condition and Colorado Parks and Wildlife samples fish at various reaches of the Mancos River most years as well.

Table 3. Streamflow gages in the Mancos Watershed.

Stream Gage Name	Station ID	Status	Period of Record
West Mancos River Near Mancos	09368500	Inactive	1939 - 1953
West Mancos River Below Jackson Gulch Reservoir Inlet Canal	MANJACCO	Active/ DWR	2005 - Present
East Mancos River Near Mancos	09369000	Inactive	1937 - 1951
Middle Mancos River Near Mancos	09369500	Inactive	1938 - 1951
Mancos River Near Mancos	MANMANCO (09370000)	Active/ DWR	1932 - 1938, 1954 - 1957, 1971 - Present
Mancos River at CJ's Bridge near Mancos	MANCHICO	Active/ DWR	2016 - 2018
Mancos River at Anitas Flat Below Mancos	09370600	Inactive	2004 - 2015
Mancos River Near Cortez	09370800	Inactive	1976 - 1979
Mancos River Below Johnson Canyon Near Cortez	09370820	Inactive	1979 - 1982
Mancos River Near Towaoc	09371000	Active/ USGS	1921 - 1943, 1951 - Present
Navajo Wash Near Towaoc	09371002	Inactive	1986 - 1993

Projects focused on specific issues in the Mancos watershed have collected large amounts of data. These include studies to assess salinity contributions from the Mancos River to the Lower Colorado River Basin (Yochum 2004) and multiple studies of water quality in the East Mancos River, most recently *East Mancos River Watershed Montezuma County, Colorado: Aqueous Metal Sources, Concentrations, and Mass Loading* (Wright and Roberts 2020).

GAPS

Drought has persisted in southwest Colorado during the ensuing years since the Mancos Watershed Plan was completed and the effects of climate change have become increasing clear. Reaches of the river in the Mancos Valley and further downstream have dried up in many recent years, and water has been limited or unavailable for the agricultural community. Improving management of limited water supplies is imperative. Recent studies (Buono et. al. 2018, Wilson Water Group 2020, Buono et. al. 2021) have

pointed out the need for additional streamflow gages and installation of additional measurement devices at Jackson Gulch Reservoir and at diversions throughout the water infrastructure.

Reduced stream flows due to climate change have negative impacts on aquatic and riparian ecosystems, altering or limiting habitat for many species. The need to identify and protect climate refugia for fish, and riparian ecosystems was identified as a top cross-cutting strategy in *Prioritized Drought Resilience for the Mancos Watershed* (Buono et. al. 2021).

In addition to water, healthy soil is essential for functional and sustainable agriculture. Relatively little is known about soil condition and health in the Mancos watershed (Buono et. al. 2018).

MANCOS WATERSHED'S COORDINATED MONITORING STRATEGY

The Mancos watershed's coordinated monitoring strategy, as seen in Figure 2, is the intersection of stated goals and evolving objectives with current data collection efforts. The strategy focuses on goals identified the 2011 Mancos Watershed Plan, and additional objectives addressing climate driven changes in streamflow and water availability. Monitoring of values identified in *Mancos River Resilience Report* (Buono et. al. 2018) addresses objectives identified in the Mancos Watershed Plan.

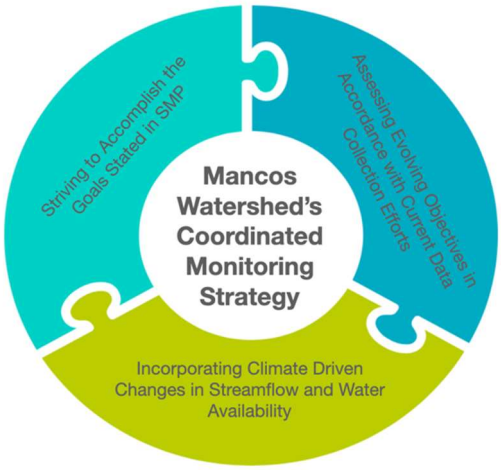

Figure 2: Key components of Mancos Watershed's Coordinated Monitoring Strategy

Monitoring is regular, long-term observations of current and changing conditions, and can include biological, physical, or chemical measurements. Assessments are the use of data to evaluate or appraise conditions to support decision-making and planning processes. There are many types of monitoring and the most appropriate approach for addressing a specific goal is dependent on resources and data needs. A multi-scale approach to monitoring in the Mancos watershed includes:

- Surveillance - detect change in target variables over space and time
- Targeted - focused on a specific question, and over a defined area. This is the best approach for determining cause.
- Effectiveness - most commonly used to effectiveness monitoring in restoration project to ascertain if restoration techniques are successful or not.
- Landscape - conducted over large areas, commonly in the form of spatial data.

Importance is placed on coordinating data collection efforts across jurisdictions, using compatible protocols whenever possible, and communicating monitoring efforts and data with other stakeholders and with the public. Specifically, monitoring objectives will focus on collection of data supporting identified goals and gaps, characterizing and quantifying the status and health of riparian ecosystems; hydrologic connectivity between stream channels and floodplains; flow timing, duration and magnitudes; water quality; water temperature, macroinvertebrate populations and native fisheries. The coordinated monitoring strategy will be a basis for guiding selection of monitoring sites and parameters, and informs development of plans for water management or restoration projects designed to mitigate drought-related impacts to river health and agricultural water users.

TASK VI – MANAGEMENT OPPORTUNITIES, SUMMARY AND PRIORITIZATION

Phase I of the Mancos Stream Management Planning efforts included a task to use the daily water rights allocation model developed for the Mancos River basin to improve the understanding of river hydrology under current and potential future operational scenarios. Types of questions that the model could analyze were identified in the Wilson Water Group work plan as follows:

- The instream flow right on the East Mancos is met, on average, less than 25% of the time in August-April. The instream right downstream of the Phase I reach in Mesa Verde National Park is also regularly short. Are there structural or operational changes within the Phase I reach that could increase the amount of time these instream flow rights are met?
- How will the planned installation of piped ditches, gated pipe and sprinkler irrigation change surface and groundwater patterns at key locations?
- How will changes in crop type or parcel size (for example, hay meadows to hemp) impact water use and hydrology patterns?
- Future climate scenarios point towards increased variability in the natural flow of the Mancos River, resulting in decreased flows in some years and water surplus in others. What is the role of expanded storage in meeting future consumptive or environmental flow needs?
- Where are the locations of consistent dry-up points on the Mancos River? Are there structural or operational changes that could decrease the amount of time these points are dry?

A subgroup of water users and providers in the basin convened to explore potential opportunities to change Jackson Gulch Reservoir operations to allow agricultural water users more opportunities during drought conditions. Note that the group is not advocating for reservoir operation changes, only considering model scenarios that may shed light on future opportunities. The subgroup received information on constraints and opportunities associated with reservoir operations and outlined some scenario options for the greater water user community to consider.

Even though model scenarios are only intended to shed light on future opportunities, it is important to understand the process that would need to be undertaken to change reservoir operations and/or allow storage of non-project water rights. The following summarizes the general process:

1. Obtain Congressional Authorization for Bureau of Reclamation to perform a Feasibility Study
2. Bureau of Reclamation Completes Feasibility Study
3. Based on the Feasibility study, Congress authorized the project
4. Bureau of Reclamation implements the new project, subject to appropriation and other funding requirements. One of the first public activities to implement the project is NEPA compliance.

POTENTIAL JACKSON GULCH RESERVOIR OPERATION SCENARIOS

Potential Jackson Gulch Reservoir operation scenarios were divided into two broad categories:

1. Scenarios that help understanding how reservoir storage and releases could be impacted by changes in annual hydrology, runoff patterns, and demands based on current reservoir operations; and

2. Scenarios that investigate revising current reservoir operations to mitigate impacts of changes in annual hydrology, runoff patterns, and/or demands.

Scenarios Based on Current Reservoir Operations

Scenarios to understand potential future impacts to reservoir storage and releases could answer the following types of questions:

- How long could storage releases continue if average runoff is 15 to 30 days earlier than current average and increased temperatures cause longer irrigation season demands? This investigation would reflect senior users calling out junior direct flow water rights earlier, resulting in earlier need for reservoir releases.
- What happens to storage if there is increased municipal and domestic demands on the reservoir and decreased irrigation demands? This investigation would reflect some "urbanization" where municipal or industrial uses occur on currently irrigated land.
- How would warmer temperatures and earlier growing season impact the ability for the reservoir to store to capacity during the runoff?

Scenarios Investigating Potential Changes to Reservoir Operations

Once impacts based on current reservoir operations are understood, it was possible to investigate changes to reservoir operations to provide increased drought resiliency and mitigate the potential impacts to annual hydrology, runoff patterns, and demands. As discussed above, any changes to reservoir operations would likely require congressional authorization. Mitigation scenarios could include the following:

- Would it be beneficial to reduce irrigation from stored water in dryer years and allow individual users to carry-over that water for protection against back-to-back dry years? This scenario could answer questions including risk associated with the reservoir filling the next year that would result in individual water users losing their carry-over water.
- What happens if certain uses (for example municipal and agricultural) or specific users were given priority when the reservoir does not achieve a full fill? This scenario could include different user classifications and corresponding rate structures.
- What options exist to use the reservoir for direct-flow storage without impacting yield for Project water users? Could this option provide water users with a more secure supply? This scenario could include fallowing or deficit irrigation, allowing direct flow water rights to be stored temporarily and released later in the season either for irrigation or other uses.
- How would varying coordination of storage deliveries assist with water use, for example, scheduled releases by reach in lieu of on-demand releases?
- How would more user-to-user lease assist with dry years (for example, a plan in place for more marginal operators to sell their water during dryer times, or flexibility for spot market leases)?

On August 3rd of this year, the Mancos Valley Irrigators, MWCD, DWR and MCD convened a meeting to discuss all of these options and questions. They also discussed the 2021 agricultural season and the river flows and water availability with a 0 allocation of ag water from Jackson Gulch Reservoir. A draft action plan was developed from this public meeting and is attached. This plan of action will help to inform Phase II and the creation of a final SMP report.

TASK VII – PROJECT COORDINATION AND ADMINISTRATION

REPORTING

MCD provided the CWCB a progress report every 6 months, beginning from the date of the executed contract. The progress reports described the completion or partial completion of the tasks identified in the statement of work including a description of any major issues that occurred and any corrective action taken to address these issues.

FINAL DELIVERABLE

At completion of the project, MCD is providing, through this report, the CWCB a final report that summarizes the project and documents how the project was completed. This report contains photographs, summaries of meetings and engineering reports/designs.

ATTACHED REPORTS

Wilson Water Group Final Report and Memos
Chris Pitcher Final Town Report
Rapid Stream Riparian Assessment Summary
Mountain Studies Institute BOR Drought/Climate Report
SMP Action Plan from Agriculture and SMP Workshop
Agricultural Outreach Coordinator Final Report

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