

White Paper on Crystal River Restoration Project

The purpose of this white paper is to provide background information on the Crystal River Restoration Project, including project purpose and goals, project description, and construction schedule. The Project is located in and along the Town's Riverfront Park, between Crystal Bridge Drive and the Colorado Parks and Wildlife fish hatchery.

Project Purpose, Background, and Goals

Colorado's riverine and riparian habitats are under constant pressure from over allocation of rivers, the influence of human activity, and climate change. In 2016, a stakeholder-led planning process identified and prioritized the implementation of the Crystal River Restoration Project (Project) to address this severely to unsustainably degraded reach of the lower Crystal River. A collaborative team of experts and local stakeholders has worked hand-in-hand with the Town of Carbondale to develop restoration plans to address the habitat, hydrologic, agricultural, and cultural pressures along this section of the Crystal. The Project will have measurable habitat benefits to the local reach and is intended to serve as a model for other projects in the Crystal Valley, Roaring Fork Watershed, and state of Colorado by demonstrating how a completed Stream Management Plan can be implemented and translate to significant environmental benefits. The collaborative and holistic approach employed by this effort targets multiple objectives and is intent on considerable positive impacts to habitat and wildlife, while enhancing the cultural, educational and passive recreational opportunities on site. Anticipated outcomes include: restoring wetland and riparian areas, preserving healthy habitat, enhancing hydrologic connectivity and fisheries, preventing unnecessary dewatering, and providing wildlife-associated education and recreation opportunities for future generations.

The Project is a result of over 15 years of study and planning and builds upon the follow plans and studies:

- Crystal River Management Plan (CRMP) 2016
- Carbondale Water and Wastewater Master plan 2016
- Carbondale Parks and Recreation Master Plan 2015
- Regional Water Efficiency Plan Roaring Fork Watershed, Colorado 2015
- Municipal Water Efficiency Plan, Town of Carbondale Colorado 2015
- Opportunities for Water Conservation Roaring Fork Conservancy
- Town of Carbondale Source Water Protection Plan 2015
- Wildland Hydrology Crystal River Restoration Scoping 2014
- Roaring Fork Watershed Plan 2012/2019 update
- Crystal River and Coal Basin Aquatic Life Use Assessment 2012
- State of the Roaring Fork Watershed 2008

Early in the planning process, four primary goals were established by Project stakeholders, including the Town of Carbondale, Roaring Fork Conservancy, Aspen Valley Land Trust, and American Rivers. The project goals include:

- 1) Restore the ecological integrity of the riparian zone through streambank improvements, reconnection of the floodplain, and replacement of invasive weed species and aggressive non-

native pasture grasses with healthy and diverse riparian plants, while preserving healthy bird and wildlife habitat.

- 2) Develop a long term, self-sustaining solution to improve river channel stability, fish habitat and spawning areas by promoting conditions that support and enhance instream biotic structure and diversity.
- 3) Create a self-sustaining diversion and head gate structure for the Weaver Ditch to function as part of the river system while maintaining water delivery for the Town of Carbondale in a manner which is compatible with future ditch improvements and efficiencies.
- 4) Enhance passive user experiences of Riverfront Park through interpretive signs, trails, gathering spaces, and educational programs.

The current project team has been working on the project since 2018. Here is a summary of how the design process has progressed:

- Data collection and Site Assessment – Summer 2018
- Conceptual Design and Public Input – Winter – Summer 2019
- Preliminary Design & Permitting – Fall 2019- Spring 2020
- Fundraising – All of 2021-2023
- Final Design – Spring 2022
- Bid and Award – Spring 2023
- Construction – Summer 2023 (earth and rockwork) – Spring 2024 (plants and irrigation)

The preferred alternative selection process included coordination and feedback from Colorado Parks and Wildlife, American Rivers, Roaring Fork Audubon Society, as well as outreach to other groups and members of the public. Feedback received had a heavy influence on the selection of the preferred alternative, which minimizes changes to most of Riverfront Park, focusing on vegetation management and minor trail and boardwalk improvements. See the discussion below for a description of the proposed upland work.

As part of the initial planning for the project, a Riparian Restoration Plan and Ecological Integrity Assessment of the project reach completed in 2018 used Ecological Integrity Assessment (EIA) for Colorado Wetlands Field Manual, Version 2.1 (Colorado Natural Heritage Program, 2016) to evaluate conditions. Major ecological factors scored included landscape context, buffer, vegetation condition, hydrological condition, and size, and the ratings are based on deviation from “natural” reference benchmarks. The results of the EIA for Crystal River Project Area show the site has an Overall Ecological Integrity Score of 2.31, which represents a C+ letter grade, or a fair riparian condition. The major factors leading to the score include the lack of hydrological input; i.e., low flows reduce groundwater influence and wetland hydrology; the moderately high cover of understory, non-native plants and invasive noxious weeds, and the adjacent land use activities. In addition, the size was determined to be a negative factor as the natural extent of good quality riparian habitat has been relegated to a narrow band along the Crystal River. The report is available upon request.

Project Description

The goals of this project are a self-sustaining river channel, improved fish habitat and spawning areas, low flow connectivity, enhanced species diversity and ecosystem resiliency, and improved opportunities for recreation including angler access points. These will be realized with implementation of the river restoration improvements and water diversion modifications. Please see the attached diagram of the preferred alternative. Detailed engineering plans are available upon request.

The river restoration component will focus on the 1,600 feet on the northern end of the project reach, where at low flows the wide, shallow riffle impedes passage of fish. The most prominent in-river feature in this reach is the Weaver Ditch diversion and headgate, located approximately 1,000 feet upstream of the Crystal Bridge Drive bridge. The diversion has played a key role in the geomorphology of the project reach. The diversion consists of a boulder and cobble grade control structure (i.e. push up dam) placed in the river to maintain water surface elevations and water delivery to the Weaver Ditch. During low flow periods, such as in the summer of 2018, the alluvium dam is raised and extended upstream. The push up dam is created using borrow material from the channel bed and banks. There are significant cobble deposits in the channel below the diversion point. These alluvial deposits are likely old push up dams washed down during past runoff events. The deposits have widened the channel and created a shallow rocky area the width of the river that does not contain a low-flow channel adequate for fish passage. This condition creates a barrier for fish during low flow and promotes unfavorable warm water conditions. The channel widening has also resulted in downcut banks throughout the lower half of the project reach. Improvements to the diversion will allow the Weaver Ditch diversion structure to function as a stable part of the Crystal River. The increased stability will reduce disturbance causing maintenance activities in aquatic and riparian environments by minimizing the need for annually creating push up dams with heavy equipment to ensure water delivery.

With the primary river disturbance mechanism mitigated, the in-channel portion of the project will focus on improving in-channel connectivity and habitat through this reach of the Crystal River. An engineered riffle will be constructed immediately below the diversion crest. This feature will create a smooth transition off the diversion's boulder grade control, reducing the formation of high velocity water and hydraulics that can impede fish boat passage. The riffle will be constructed of coarse cobble and boulders to provide roughness elements, holding spots, and hydraulic diversity. Below the riffle a low flow channel will be established to provide connectivity through the project reach. The channel will follow the outside bend of the river as it sweeps from river left to river right below the Weaver Ditch diversion. An additional, smaller riffle crest will be constructed partway down the reach to provide additional pool habitat. Material excavated from the channel will be used to build a gravel bar and a low-lying vegetated area on the inside of the bend. Habitat boulders, small rock vanes and other roughness elements will be placed along the outside of the bend to promote faster moving water to maintain the channel and to provide bank stabilization. The engineered riffle, improved channel, additional riffle, and habitat elements will also work together to provide connectivity at a wide range of flow and improve hydraulic diversity, provide resident fish with holding and feeding areas through the project reach.

In addition to the in-channel elements discussed above, riparian bank improvements will address 900 feet of eroding cut banks in the project reach by reducing bank slope, adding toe protection and vegetation.

Water temperatures in the Crystal River during the extremely low flow periods of August and September are a concern highlighted in the CRMP. While the project cannot influence the natural and seasonal characteristics of flows of the Crystal River, the project will benefit water temperatures in two ways: (1) by creating a low flow channel downstream of the Weaver Ditch diversion, a deeper channel will aid in reduced temperatures during dry years, where currently water is dispersed throughout an over-widened and shallow reach; and (2) by restoring riparian vegetation and canopy to increase stream shading and help to mitigate stream temperature.

A final in-channel component will be a maintenance access ramp on the east bank adjacent to the headgate. This access point will provide a dedicated and durable access point to service and maintain the Weaver Ditch diversion without the need for tracking up the river from Crystal Bridge Drive, which is the current practice.

From Riverfront Park's perspective and in line with the "keep it wild" directive, the Project will focus on riparian improvements, removing invasive species while retaining vegetation in functional habitat areas. The contractor will not be performing any vegetation removal or grading in any nesting vegetation. Temporary irrigation will also be installed to help with the establishment of the plants. The only recreation related improvements in the upstream 90% (2,285 out of 2,600 feet) of the project will include rehabilitation of the existing dirt trail in its current alignment, replacing the aging boardwalk in its current alignment, and providing four angler access points using native materials to reduce the creation of social trails which could damage riparian vegetation and disturb nesting sites. Riverfront Park's current "no-dog" policy will remain in effect and the park's Bald Eagle Closure from December through March will also remain unchanged. An added gate and fence at the north entrance to the park will help restrict access during these closure periods. It is also worth noting that no heavy equipment will be used in the upstream portion of the park. All of the channel and bank work described in the previous paragraph will be performed from the river, with access from the Weaver Ditch Headgate.

The educational and recreational elements of the park improvements will focus on the 200 feet upstream and downstream of Crystal Bridge Drive. North of the bridge, the project will add a ramp for accessibility to Riverfront Park, allowing visitors of every ability to access the Crystal River. The improvement will make Riverfront Park the only fully accessible Crystal River frontage within the Town of Carbondale. The accessible ramp off Crystal Bridge Drive will lead to a rustic gathering area just south of the bridge with direct access to the Crystal River. This area is intended to also serve as an outdoor classroom for the five nearby schools, helping to create the community's future river stewards.

In summary, the project will provide additional ecosystem services in a number of ways:

- 1) In-channel component of the project will reduce fine sediment input in to the Crystal River by stabilizing river banks and the Weaver Ditch diversion in the project reach.
- 2) The modified diversion will allow the Town of Carbondale to be more precise with its diversion to the Weaver Ditch, increasing the efficiency of irrigation water withdraws from the Crystal River.
- 3) The channel bed modifications will provide connectivity for aquatic species through the project reach during low flow periods in late summer and early fall, removing an existing barrier during critical spawning periods.

- 4) The in-channel improvements will add physical structure to the project reach, providing habitat and reducing the impacts of disturbance for aquatic species in a reach identified as severely impaired for lack of physical structure.
- 5) The riparian improvements along the river banks will provide additional shade for the Crystal River, reducing water temperatures during low flow periods in late summer.
- 6) The installation of riparian plants will improve vertical habitat complexity particularly providing a missing mid-layer of riparian shrubs and trees, enhancing vital habitat for the many species of native birds that reside or visit the riparian corridor throughout the project reach.

Construction schedule and timing

The project has been through the full regulatory review process and has received permits from the US Army Corps of Engineers and the Town of Carbondale. Because the federal government has provided funding through the US Bureau of Reclamation's Water SMART grant, the project has also gone through the National Environmental Policy Act (NEPA) process and received a categorical exclusion.

Initially the project construction was proposed for a fall and early winter time period. In the fall of 2021 however, Colorado Parks and Wildlife became more concerned about mountain whitefish in the Crystal River, whose populations are rapidly declining. As a result, the available in-water work window was shifted to a summer time period with a mandate to be complete with in-channel work by September 30.

The project team is working through selecting an appropriate start date to meet the compressed construction timeline and avoid impacts to bird and animal species in Riverfront Part and will share this information when available.

Exhibit 1

PREFERRED ALTERNATIVE
RESTORATION AND PROGRAMMING
CONCEPTUAL MASTER PLAN

