# Final Report

## CCC Ditch Diversion Structure Improvement Project
## San Miguel River near Naturita, Colorado

Submitted To:
Colorado Water Conservation Board
Nov. 14, 2011

COLORADO WATER TRUST

# I. PROJECT INTRODUCTION

The Highline Canal (also referred to as the CCC Ditch) diverts water from the San Miguel River through a concrete diversion structure located on the northeast bank of the river near Naturita, Colorado. A cross-channel dam directs water to the diversion structure. The diversion dam is a five-foot high concrete dam placed perpendicular to the flow of the river. The upstream water diversion facility is a three-foot high by twelve-foot wide orifice controlled by a hand operated steel cylindrical slide gate.

The existing diversion structure for the Highline Canal is an impediment to fish migration and a substantial safety hazard to recreational boating. Collaborative discussions among the ditch company that operates the CCC Ditch and the Bureau of Land Management, The Nature Conservancy, the Colorado Division of Wildlife, and the Colorado Water Trust ("CWT") resulted in an agreed-upon project design that will benefit the water users, boaters, and the local aquatic and riparian environment without impacting a drop of deliveries under the ditch. CWT took the lead on this project, secured nearly all its funding, and hired an engineering firm, FlyWater inc., to design and construct the riffle. FlyWater began harvesting material August 9, and began actual construction on October 6. FlyWater completed construction on October 26.

## II. REPORT CONTENTS



*Appendices*:

A. CCC Ditch Diversion Improvement Project Photo Narrative
B. Design Documents
C. Otter Survey

## III. PROJECT OBJECTIVES

The objectives of this project were to:
(1) Modify existing irrigation diversion structure to allow passage of native and sport fish at nearly all stream flow levels.
(2) Allow for accurate measurement and more regularly-managed diversions to help eliminate the dewatered reach below diversion.
(3) Provide for safe passage over diversion structure for float fishing anglers and other recreationists.
(4) Enhance fish populations and protect "at-risk" species in the San Miguel River.
(5) Contribute to Division of Wildlife goal of increasing angling recreation days by improving the quality of recreational fishing on the San Miguel River.
(6) Demonstrate successful partnership between agricultural water users, private citizens, conservation organizations, and public land management.
(7) Improve and protect river flow while accomplishing conservation, recreation, and economic benefits.

## IV. PROJECT STATISTICS

| | |
|---|---|
| County | San Miguel |
| Water Division | 4 |
| Legal Location | T 46 N., R 13 W., NESW, Section 30, NMPM, |
| Construction Start Date | October 6, 2011 |
| Construction End Date | October 26, 2011 |
| Tons of Rock Installed | 1500 |
| Length of Riffle in Feet | 225 |
| Miles of Public-accessible Coldwater Stream Benefited | 10.5 |

## V. PROJECT FUNDING

| Work Item | Work Activity | Total | FIF | CWCB | SWWCD | Telluride Foundation | CWCB WRP | Walton Family Foundation |
|---|---|---|---|---|---|---|---|---|
| **1A** | Data/Literature Review | $500 | $0 | $0 | $500 | $0 | $0 | $0 |
| **1B** | Hydraulic Survey | $9,150 | $0 | $0 | $9,150 | $0 | $0 | $0 |
| **1C** | Hydrology | $1,400 | $0 | $350 | $0 | $1,050 | $0 | $0 |
| **1D** | Material/Soils Investigation | $300 | $0 | $75 | $225 | $0 | $0 | $0 |
| **1E** | Project Team Meeting | $300 | $0 | $0 | $300 | $0 | $0 | $0 |
| **2A** | Hydraulic Modeling | $5,000 | $0 | $2,000 | $0 | $3,000 | $0 | $0 |
| **2B** | Scour and Erosion Potential | $1,700 | $0 | $1,275 | $425 | $0 | $0 | $0 |
| **2C** | Fish Passage Design | $2,750 | $0 | $1,375 | $1,375 | $0 | $0 | $0 |
| **2D** | Riffle Material Sizing | $4,900 | $0 | $2,450 | $2,450 | $0 | $0 | $0 |
| **2E** | Project Team Meeting | $600 | $0 | $0 | $0 | $600 | $0 | $0 |
| **2F** | Flow Measurement Device Design | $3,500 | $0 | $3,500 | $0 | $0 | $0 | $0 |
| **3A** | Design/Build Plan Set | $2,900 | $2,000 | $900 | $0 | $0 | $0 | $0 |

| Work Item | Work Activity | Total | FIF | CWCB | SWWCD | Telluride Foundation | CWCB WRP | Walton Family Foundation |
|---|---|---|---|---|---|---|---|---|
| **3B** | Permit Documents | $900 | $0 | $900 | $0 | $0 | $0 | $0 |
| **3C** | Purchase Construction Easement | $15,000 | $6,000 | $2,000 | $0 | $0 | $0 | $7000 |
| **4A** | Mobilization | $3,600 | $2,600 | $1,000 | $0 | $0 | $0 | $0 |
| **4B** | Materials Harvest | $71,500 | $40,000 | $31,500 | $0 | $0 | $0 | $0 |
| **4C** | Construction | $101,000 | $60,500 | $11,175 | $0 | $0 | $29,325 | $0 |
| **4D** | Reclamation | $10,000 | $5,000 | $5,000 | $0 | $0 | $0 | $0 |
| **5** | Maintenance Account | $8,000 | $0 | $0 | $0 | $0 | $0 | $8,000 |
| **6** | Legal | $3,000 | $1,500 | $1,500 | $0 | $0 | $0 | $0 |
| **7** | Project Management | $10,000 | $0 | $0 | $0 | $0 | $10,000 | $0 |
| **Totals** | | $256,000 | $117,600 | $65,000 | $14,425 | $4,650 | $39,325 | $15,000 |

The project also received in-kind contributions from the Bennett River Ranch, consisting of the donation of rock, clay and gravel, and appraised at a total donation value of $44,213.

## VI. PROJECT DESCRIPTION

The CCC Ditch project improved the existing diversion dam with the installation of a modified Newbury Riffle. This is a riffle, essentially a fish ladder, that connects the top of the downstream side of the diversion dam with the riverbed below. The hydraulics over this structure will facilitate fish migration over the dam and will create a safer structure for boat passage. Even with the addition of the riffle, the

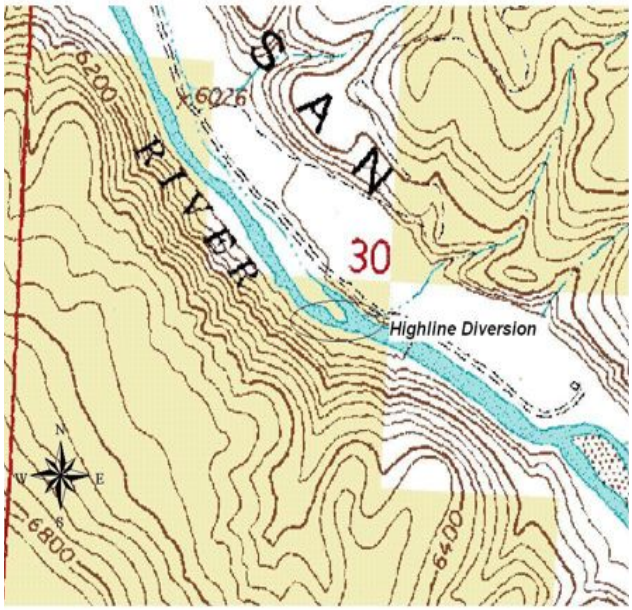


Figure 1: Map of Project Location, showing land ownership (yellow shading is BLM-managed lands and white is private lands.

existing diversion will retain its full functionality. Figures 1 – 4 are maps and photos of the existing structure.

The riffle was constructed with a designed gradation consisting of silts and fines, river rock and cobble, and large boulder material. A combination of the relatively flat riffle slope (approximately 20:1) and the strategically placed larger rock stabilized the riffle material in place. Use of fine material mixed with river rock and cobble to create the riffle minimizes the riffle porosity and interstitial flow, keeping virtually all of the river flow on the surface of the riffle. The riffle construction includes areas to concentrate flows and provides instream structure to reduce velocities.

*Figure 2: Oblique aerial picture of project area.*

*Figure 3: Highline Diversion, slide gate (submerged orifice)*

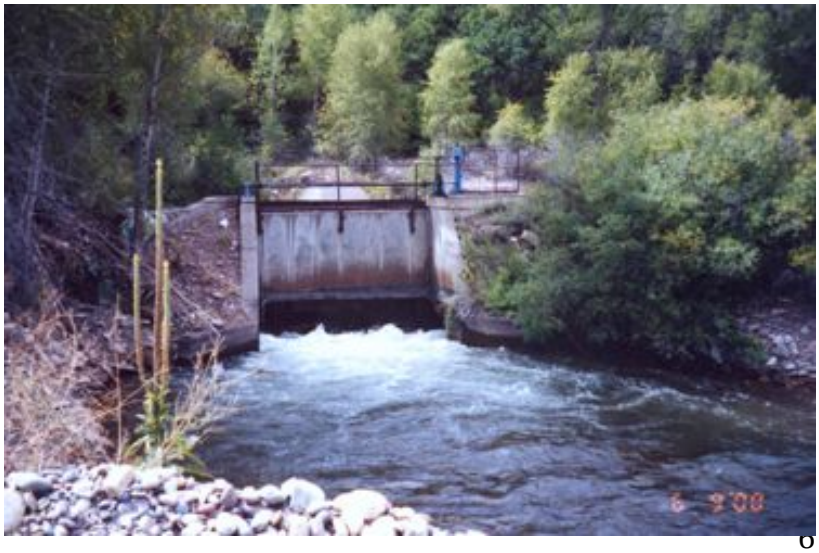

*Figure 4: Highline Diversion Dam across the San Miguel River.*

### *a. Pre-Construction Efforts*

The project's stakeholders selected FlyWater, inc. to conduct the design and construction. The following tasks occurred in anticipation of design and construction:

- Task 1A – Data/Literature Review
- Task 1B – Hydraulic Survey
- Task 1C – Hydrology
- Task 1D – Materials/Soils Investigation
- Task 1E – Project Team Meeting

### *b. Preliminary Design*

The preliminary design effort was completed in 2010 in several tasks:

- Task 2A – Hydraulic Modeling
- Task 2B – Scour and Erosion Potential
- Task 2C – Fish Passage Design
- Task 2D – Riffle Material Sizing
- Task 2E – Flow Measurement Device Design
- Task 2F – Project Team Meeting

### *c. Design*

Comments and direction from the Preliminary Design Project Team meeting were incorporated into the design for preparation of permit and design/build documents.

- Task 3A – Design/Build Plan Set

- Task 3B – Permit Documents
- Task 3C – Purchase Construction Easement

Appendix B provides these project plans.

### *d. Construction*

FlyWater broke ground on August 9. CWT gathered stakeholders (local property owners, the CCC Ditch President, local elected officials, anglers, Colorado Parks and Wildlife biologists, and Bureau of Land Management hydrologists) on October 21 to see the nearly completed work. The following tasks were completed by the dates indicated in the parentheticals:

- Task 4A – Mobilization (August-October, 2011)
- Task 4B – Materials Staging (August-October, 2011)
- Task 4C – Construction (October, 2011)
- Task 4D – Reclamation (October-November, 2011)

## VII. OBJECTIVES REVISITED

The objectives of this project were to:

(1) Modify existing irrigation diversion structure to allow passage of native and sport fish at nearly all stream flow levels.

*The constructed riffle was designed specifically to accommodate both native and sport fish passage at nearly all but extreme low flow levels.*

(2) Allow for accurate measurement and more regularly-managed diversions to help eliminate the dewatered reach below diversion.

*FlyWater moved the ditch staff gage closer to the ditch's headgate, allowing for more real-time measurement of flows. This permits the ditch company to more accurately divert the amount of water to which they are entitled under their decree, leaving more water in the river. The success of the riffle construction has also prompted the ditch company to consider allowing CWT to install a telemetry system at the headgate. This technology would enable the ditch company to read water flows and open and shut the ditch headgate remotely. FlyWater is working with Aqua Engineering on the design for this technology for the project.*

(3) Provide for safe passage over diversion structure for float fishing anglers and other recreationists.

*The constructed riffle was designed specifically to remove the 'keeper' hydraulic that proved dangerous to recreationalists.*

(4) Enhance fish populations and protect “at-risk” species in the San Miguel River.

*Colorado Parks and Wildlife believes the construction project will enhance fish passage and protect "at-risk" species in the river.*

(5) Contribute to Division of Wildlife goal of increasing angling recreation days by improving the quality of recreational fishing on the San Miguel River.

*Colorado Parks and Wildlife believes the construction project will improve the quality of fishing by enhancing fish migration past the CCC Ditch Diversion Structure.*

(6) Demonstrate successful partnership between agricultural water users, private citizens, conservation organizations, and public land management.

*On October 21, agricultural water users, private citizens, conservation organizations, local elected officials, and public land managers met at the CCC Ditch. While the group observed the ongoing construction, each person spoke about why the project was important to them. Among the comments, the local ranching landowner shared his hope that his grandchildren could fish this stretch as he had as a boy. And notably, the CCC Ditch president commented that although it took a long time to align the interests of so many parties, patience prevailed and the structure benefits every group involved. The collaboration was successful in the eyes of everyone that attended.*

(7) Improve and protect river flow while accomplishing conservation, recreation, and economic benefits.

*By bringing together so many seemingly divergent interests, the benefits of the project are broad: improved diversion efficiency, more fishing days, improved aquatic habitat, and safer boating.*

## VIII. LESSONS LEARNED

The project was a tremendous learning experience for CWT staff, from construction management to the importance of stakeholder buy-in.

One important outcome of this project was witnessing ranchers, environmentalists, biologists and recreationalists come together and agree that rivers are important. But beyond that, the attendees at our unveiling in October saw that river health need not always come at the expense of the traditional Colorado economy. Our hope is that this successful partnership can be translated across the state - the stakeholders here proved it works.

Even more, we saw that patience is a key asset. This project was originally envisioned 10 years ago, yet only took 20 days of construction to complete. Without continuous outreach, problem solving, and negotiation, the project might still be in its conceptual stages. But with local support and a patient attitude, these projects can be realized.

On an organizational level, this was our first physical solutions project. We had to develop, on-the-fly, methods of managing several grants and a contractor. This took new levels of expertise to manage, among other efforts. Next time, all systems will already be in place.

# Appendix A:
# CCC Ditch Diversion Structure Project Photo Narrative

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After ten years of planning, fundraising, and wrangling, it has taken just under three months to complete the construction phase of the CCC Diversion Structure Project.

Beginning in August 6, Colorado Water Trust's contractor, FlyWater, inc., began harvesting fill materials from outcrops near the structure: 1500 tons of large rocks and smaller cobbles.

After harvest, FlyWater began the actual riffle construction on October 6.

Working through October, FlyWater's machines hauled the fill rock into the San Miguel's riverbed, building up the riffle's skeleton.

On October 21, CWT's staff visited the project site on one of the last days of construction.

FlyWater turned water over the new riffles, reconnecting two segments of stream that have been separated for more than 50 years.

Below the ditch looking back upstream, the diversion structure just peeks above the multitude of riffles that now allow fish migration up and down the San Miguel.