

INGRAM GULCH PROJECT

Fourmile Creek Watershed

2013 Colorado Flood Recovery



COLORADO
Department of Local Affairs
Community Development Block Grant –
Disaster Recovery



COLORADO
Colorado Water
Conservation Board
Department of Natural Resources



United States Department of Agriculture
Natural Resources Conservation Service



Multiple Benefits

- **Protect life, property, and infrastructure**
- **Mitigate flood risk**
- **Improve water quality**
- **Increase floodplain capacity**
- **Protect historical structures**

Located approximately 10 miles west of Boulder, the Fourmile Creek watershed's steep Ingram Gulch was completely burned in the 2010 Fourmile Canyon Fire. Severe debris flows caused by heavy rain on the burn scar followed in 2011, impairing road infrastructure at the bottom of the gulch. The September 2013 flood resulted in additional damage to public infrastructure and private properties and destroyed all of the rehabilitation treatments administered after the fire. Left untreated, erosion and gulying would continue to contribute sediment and debris to the upper reaches of Fourmile Creek and create hazards for the community of Salina.

The Ingram Gulch project aimed to stabilize the gulch to allow for high flows with less infrastructure and ecological damage, and to minimize sediment input to the channel from erosion of steep hillslopes. Goals were accomplished through sediment and debris removal, installation of grade control structures and channel roughness elements, and grading steep slopes to reduce erosion.

The Fourmile Watershed Coalition (FWC) formed in the wake of the flood to lead the community's flood recovery effort. The Ingram Gulch project was highlighted by both Boulder County and the Four Mile Fire Protection District as a high priority project. In 2016, FWC secured state and federal funding to stabilize and vegetate the gulch to increase community safety based on recommendations in the 2014 Master Plan, the post-wildfire Burned Area Emergency Response (BAER) Report, and a Damage Survey Report conducted by the Natural Resources Conservation Service (NRCS) and Colorado Water Conservation Board (CWCB).



Watershed
Fourmile Creek



Locale
Boulder County



Local Sponsor
**Four Mile Fire
Protection District**



Property Ownership
100% private



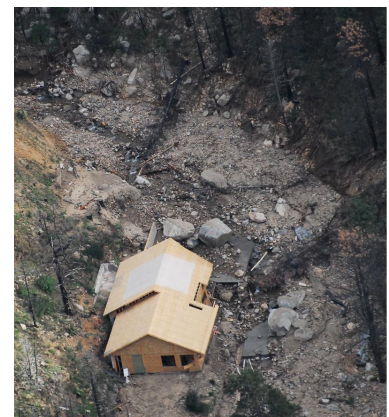
Project Cost
\$1,381,931



Construction Dates
**Sep. 18, 2017 - May 20,
2018 (245 days)**



Left: Upstream portion of the project area before construction, with vertically eroded banks and burn scars on trees in background.

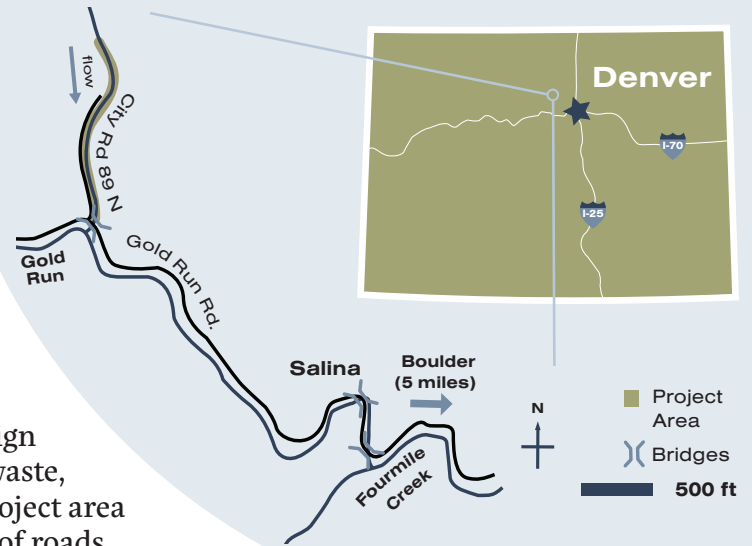


Right: Home in Ingram Gulch engulfed in sediment and other debris after the 2011 debris flow.

River Corridor Rehabilitation

The Ingram Gulch project was completed successfully despite numerous significant constraints that were overcome. Grades in Ingram Gulch hover around 10 percent, making it a very steep and complicated project area, both in terms of design and in terms of the logistics of heavy equipment access. Many of the banks are high and unstable due to erosion processes, so safety was a primary concern during construction. Exposed bedrock is also prevalent, which resulted in numerous field fits and alterations of the project design during implementation. Poor soils, including mine waste, and lack of accessible groundwater in much of the project area made revegetation challenging. Finally, the presence of roads, structures, and historical features restricted the project design. These constraints required creativity, compromise, and commitment to develop the best possible outcome for the project.

Fourmile Creek Ingram Gulch



Despite its limitations, several innovative techniques were employed on the Ingram Gulch project. In the upper channel, highly unstable and steep slopes support a potable water system for the landowner. Due to the tenuous nature of this setup, the bank stabilization boulders below it were reinforced by drilling metal rods (dwyidags) into the bedrock upon which they were placed. A seeded “biolog” was installed along the boulder toe to encourage vegetation growth, assist in stabilization, guide the low-flow channel away from the boulders, and cover the dwyidags. Steep, vertically cut slopes were backfilled, seeded, and covered with erosion control blankets. The grade was so steep on these slopes that the erosion matting had to be staked using ladders.

In a location that has historically lacked much floodplain area, a small floodplain bench was graded where possible to reduce scouring energy during moderate runoff events. Embedded “roughness logs” were placed at semi-regular intervals to slow flow velocity along the floodplain bench.

Native plants were installed throughout the project area, and an irrigation system will operate for at least one year to promote vegetation establishment.



Left: Contractor installing steel rods, or “dwyidags,” into bedrock to ensure stabilization of large boulders set in a bedrock cradle.

Bottom Left: Contractor staking erosion blankets on steep slopes.

Bottom Right: Completed vegetated soil wraps as bank protection on the left, a seeded and mulched floodplain bench with floodplain roughness logs incorporated on the right, and a tank with drip lines for watering planted vegetation.



Project Objectives

- Establish vegetative cover on critically eroding land
- Reduce flood risk and increase community safety (particularly the Town of Salina)
- Protect public and private infrastructure
- Improve water quality by reducing sediment loading caused by gulch erosion
- Enrich riparian habitat via addition of topsoil, seeding, and native vegetation
- Protect historical structures
- Improve floodplain function where possible
- Protect and enhance other flood recovery projects located downstream
- Create a model process and innovate techniques that can be applied to other similarly complex areas

Before



Upstream end of the project reach showing extensive erosion and evidence of debris flows and sediment deposition.

After



Stabilized section at the upstream end of the project reach showing grading of a landowner access route, steep erosion control blanket installation, and irrigation lines for watering.



Looking downstream at the lower portion of the project. Note steep banks, lack of floodplain, and extensive deposition.



Lower portion of the project showing graded banks for flood conveyance, stabilized channel bed with in-stream grade control structures, banks protected with toe boulders and willows, and native revegetation throughout the reach.

BY THE NUMBERS

**project length:
1,700 linear feet**



41 in-stream structures



**1,600 linear feet of
bioengineered streambanks**



**798 willow &
cottonwood live stakes**



**1,811
container plants**



**1.8 acres
seeded**



PROJECT TEAM

The Ingram Gulch project was funded by the Natural Resources Conservation Service (NRCS) Emergency Watershed Protection (EWP) Program and the Colorado Water Conservation Board (CWCB). The Department of Local Affairs (DOLA) Community Development Block Grant - Disaster Recovery (CDBG-DR) Watershed Resilience Programs funded design and provided match funding for implementation. CWCB provided technical assistance throughout project planning and execution.

All project partners, including one primary landowner who was very accommodating, built trust early on in the process, leading to a successful rehabilitation project. The Fourmile Watershed Coalition is working with the State on long-term project effectiveness monitoring at the Ingram Gulch project site to assess changes in ecological health and watershed resilience.

Partners

Private landowner
 Four Mile Fire Protection District
 Colorado Water Conservation Board (CWCB)
 Colorado Department of Local Affairs (DOLA)
 Natural Resources Conservation Service (NRCS)

Contractors

Norwest Corporation
 Frontier Environmental Services
 Resilient Watershed Partners (RWP)

FOR MORE INFORMATION

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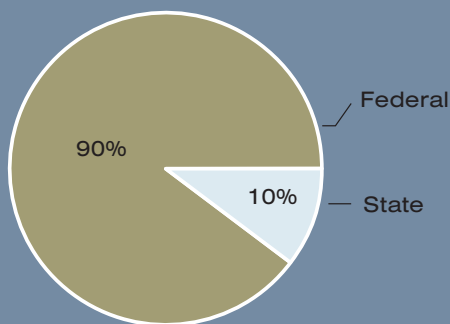
Ingram Gulch civil walkthrough with representatives from the watershed coalition, contractor team, State technical assistance team, and NRCS.



BUDGET

TOTAL: \$1,381,931

Project Funding by Source



Project Cost Breakdown

