2013 COLORADO PHASE II EWP

LESSONS LEARNED – VOLUME 1

A summary of lessons learned from the Colorado EWP program; its management, implementation, and the future of monitoring and adaptive management

SUMMARY
2013 COLORADO EWP PROGRAM

The Emergency Watershed Protection (EWP) Program is a reimbursement program, not a grant program.

Post flood photo at Glen Haven on West Creek, an upstream tributary to the Big Thompson River.

- PURPOSE

  Implement emergency recovery measures to protect life and property in watersheds impaired by a natural disaster

- FUNDING

  $63.2 Million in Construction

  ($47.4 Million in Financial Assistance Funding)

  $6.8 Million in Technical Assistance Funding

- LEAD STATE SPONSOR

  Providing 12.5% of the match for the project

  $7.9 Million in match.

- LOCAL SPONSORS/SUB-RECIPIENTS

  Counties, cities/towns, watershed coalitions, and others

  Providing remaining 12.5% of the local match.

PROGRAM CHALLENGES

1. Over 70 identified projects
2. 6 flood affected Counties
3. 9 Watershed Coalitions
4. 30 months to:
    - Identify projects and necessary funding,
    - Find and secure match funding,
    - Convince >500 landowners to participate,
    - Complete field work, designs, permitting, construction procurement, construction, and project closeout

PROGRAM
LESSON 1

Your values and goals are the map that guides every process in the program determining the destination and the desired outcomes.

Before and after pictures on the Big Thompson River at Jasper Lake. Photo shows restoration of flood bench and reconnection of the floodplain on river right.

PROGRAM OBJECTIVES

The EWP Program helps landowners, operators, and individuals implement emergency recovery measures to relieve imminent hazards to **life or property** created by a natural disaster that causes a sudden impairment of a watershed.

COLORADO EWP PROGRAM
2013 FLOOD RECOVERY VISION

To implement watershed recovery projects that reduce risk to life and property, **enhance riparian ecosystems**, and generate long-term stream system **resilience** through a collaborative, watershed-based approach that incorporates the needs of diverse stakeholders.

1

REDUCE HAZARDS AND PROTECT LIFE SAFETY AND PROPERTY

2

USE FEDERAL AND STATE FUNDING EFFECTIVELY

3

ENHANCE THE HEALTH AND RESILIENCE OF WATERSHEDS AND STREAM CORRIDORS

4

BUILD CAPACITY OF WATERSHED COALITIONS

5

ADVANCE A WATERSHED-BASED APPROACH TO FLOOD RECOVERY

GOAL 1: REDUCE HAZARDS AND PROTECT LIFE SAFETY AND PROPERTY

- Improve property owner, community, and stakeholder understanding of hazards, risk, and the limitations of mitigation measures.
- Educate stakeholders on natural flood protection services of healthy ecosystems.
- Reduce hazards created by erosion and channel movement by enhancing stability of stream systems.
- Design and construct projects that prioritize protection of private property, public infrastructure, and critical facilities.

Post flood photo on Big Thompson River at Moodie.

GOAL 2: USE FEDERAL AND STATE FUNDING EFFECTIVELY

- Fund and implement projects that align with vision.
- Leverage partners and other funding sources to increase buy-in and further impacts of investments.
- Provide river restoration opportunities across watersheds and stream reaches.
- Obligate funding throughout program life cycle, i.e. start spending soon.
- Identify and prevent waste and duplication of effort.

Post flood photo on Left Hand Creek.

GOAL 3: ENHANCE THE HEALTH AND RESILIENCE OF WATERSHEDS AND STREAM CORRIDORS

- Design and construct projects to improve geomorphic and ecological structure and function according to the Stream Function Pyramid framework.
- Establish goals and objectives that identify the functional improvements being targeted by each project.
- Design projects to contribute to improvements at individual site, stream corridor, and watershed scales.
- Catalyze natural stream recovery and stabilization processes to minimize need for operations and maintenance.

Post EWP Phase I photo on Big Thompson River at Cedar Cove.

GOAL 4: BUILD CAPACITY OF WATERSHED COALITIONS (AND OTHERS)

- Implement priorities identified in watershed master plans.
- Provide training, resources, and other opportunities for coalition staff and members to improve capabilities.
- Assist coalitions in engaging stakeholders, building relationships, and serving as valued educators.
- Empower coalitions with responsibility for long-term monitoring and oversight of projects.

Post EWP Phase I photo on St. Vrain Creek at Appl
Valley North.

GOAL 5: ADVANCE A WATERSHED-BASED APPROACH TO FLOOD RECOVERY

- Develop and implement projects within a framework through which their long-term successes and failures can be monitored and analyzed.
- Create resources to assist with replication and future implementation of similar programs.
- Document and communicate lessons learned, challenges, and successes in terms of science and policy.

Post flood photo on St. Vrain Creek.

OUTCOMES

As a result of determining the additional values of the goals of the program, multiple benefits were able to be achieved with the available money.

ADDITIONAL OBJECTIVES MET BY THE PROGRAM

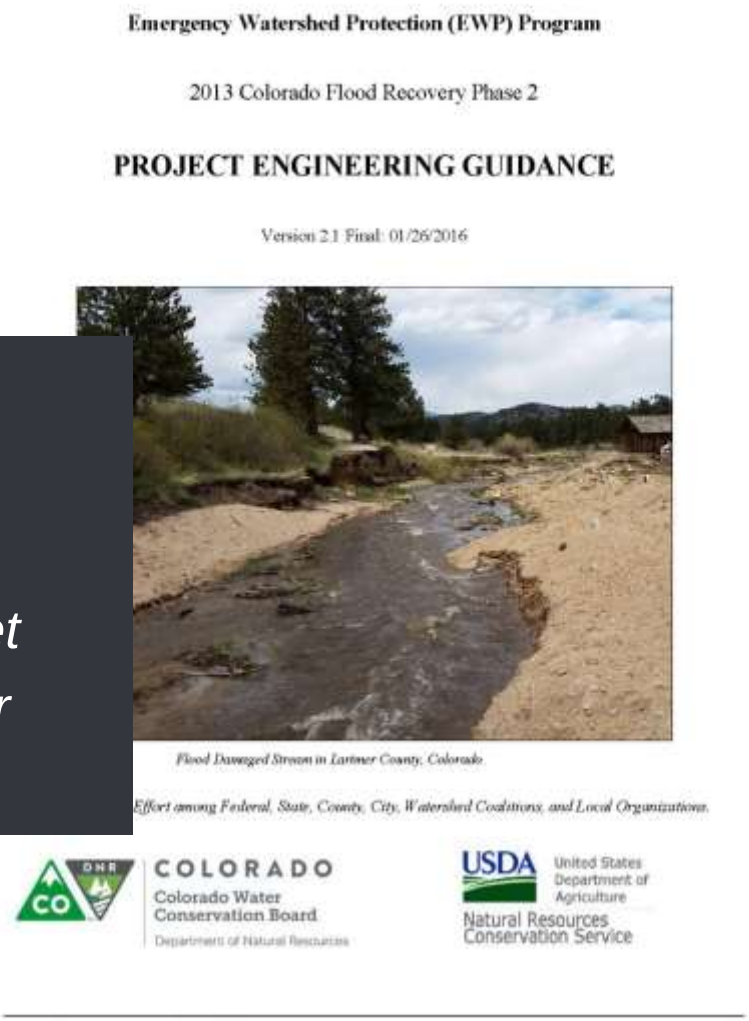
1. Reduce hazards and improve flood conveyance
2. Reconnect floodplains with streams
3. Enhance stream function
4. Manage sediment movements
5. Improve ecological and biological function of the stream
6. Improve recreational potential

Post construction photo on Big Thompson River at Jasper

PROGRAM
LESSON 2

Creating standards for the program, but allowing for designer creativity at the same time results in projects that meet overall goals and also allows for the "art of design"

Project Engineering Guidance document developed by NRCS, CWCB, and DOLA for 2013 Phase II EWP.



Emergency Watershed Protection (EWP) Program

2013 Colorado Flood Recovery Phase 2

PROJECT ENGINEERING GUIDANCE

Version 2.1 Final: 01/26/2016

Flood Damaged Stream in Larimer County, Colorado

Effort among Federal, State, County, City, Watershed Coalitions, and Local Organizations.

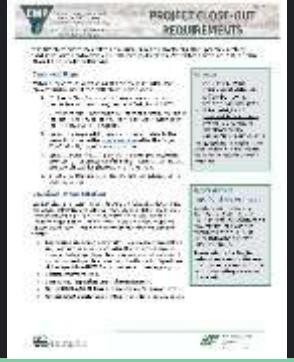
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

USDA United States Department of Agriculture
Natural Resources Conservation Service

PROGRAM GUIDANCE

Information for sponsors including:

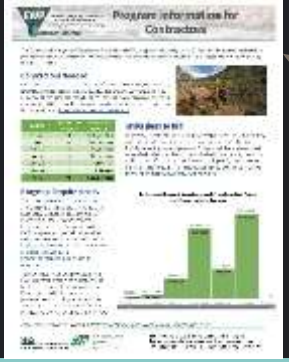
- Fact Sheets
- Templates
- FAQ's



NRCS GUIDANCE

Program information for sponsors, designers, and others including:

- NRCS EWP Manual
- National Practice Standards



DESIGN RESOURCES

Information for designers including:

- Design guidance.
- QA plan and O&M templates.
- Bioengineering Guide

MEETING MATERIALS

Meeting materials for use at public meetings or meetings with landowners including:

- Program overview
- Design specifics
- Watershed maps

CONSTRUCTION RESOURCES

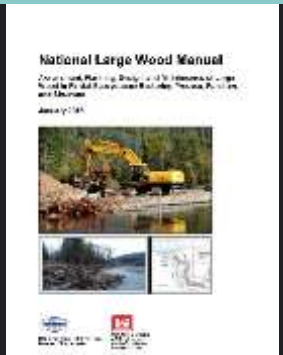
Materials for sponsors, designers, and contractors during construction including:

- Invoice templates
- Observation report templates
- Landowner guide

OUTSIDE REFERENCES

Relevant links and guides for EWP participants including:

- The USBR National Large Wood Manual



OUTCOMES

By developing a comprehensive website with multiple fact sheets, references, guidance, and information the program was able to quickly and effectively deliver program information efficiently and consistently.

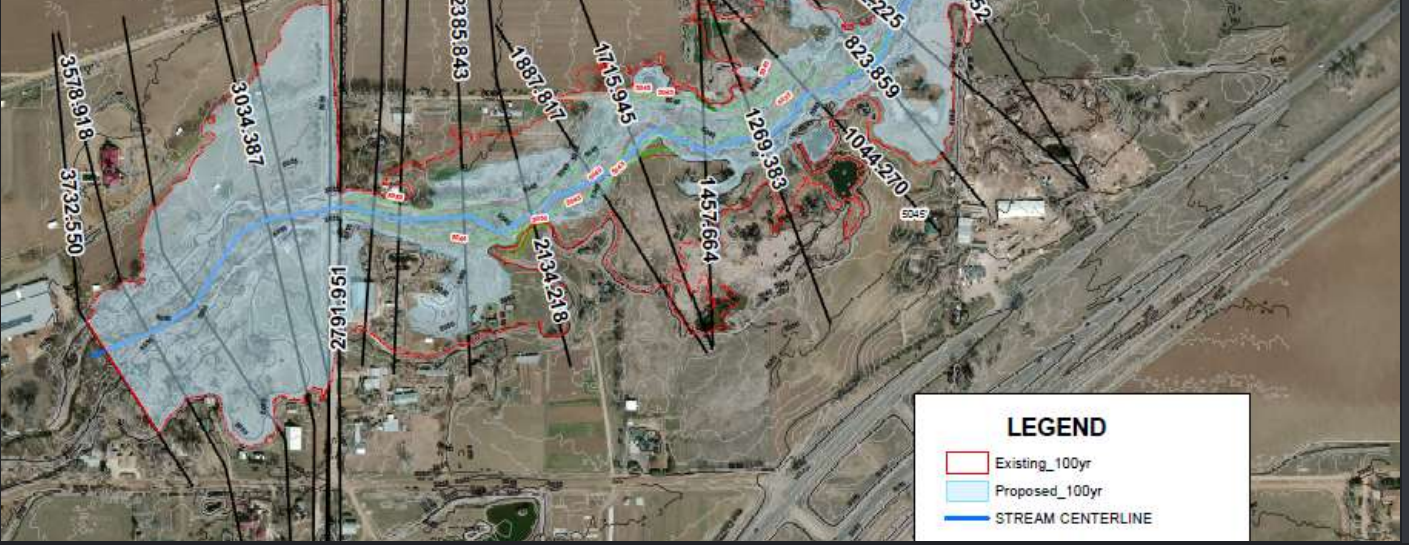
1. One stop website for designers looking for guidance materials.
2. Easy access to meeting handouts and program information for sponsors.
3. Template distribution for program consistency.
4. Easy to reference questions back to the website.
5. Several very good resources developed for use in the future.

Post construction photo on Little Thompson River at North 83rd Street.

PROGRAM
LESSON 3

When asking for funding, it's important to know EXACTLY what you need.

Construction photo of riffle placement on the Little Thompson River at North 83rd Street. Riffle was added to project to protect from downstream degradation.



Floodplain map for Left Hand Creek at North 81st Street

MORE THAN JUST CONSTRUCTION

Technical assistance dollars pay for design, but what about all the other professional tasks related to completing the project?

For a $63.2 million program there was only $6.8 million in TA funding for program management, design, and construction oversight. There was not enough money for professional services. To address this, the program was able to work closely with the Colorado Department of Local Affairs (DOLA) who has been administering CDBG-DR funding for design, construction oversight, and construction implementation.

CONSTRUCTION OVERSIGHT

A budget of 10% of construction was provided for each project either via TA funds, DR funds, or by local sponsor. Oversight budgets did not exceed $150k and were never smaller than $15k.

PERMITTING

Design teams supported permit activities, but for projects with DR implementation money 3% or $20k was provided for permitting activities.

LEGAL

Sponsors were required to get landowner permissions and attorney letters regarding property ownership. $5k was provided on each project with DR implementation money.

PROJECT DELIVERY

Originally, up to $8k per project was provided to cover project management tasks. Ultimately this money was not able to be used due to duplication of benefit.

OUTCOMES

By coordinating between programs money needed for design, construction oversight, permitting, and other activities was provided. Without this, the program would not have succeeded.

1. Ensured that design and construction oversight funding was provided on all projects.
2. Addressed permitting and legal fees.
3. Brought approximately $9 million into the EWP program to fund A&E services.

Construction photo on North Fork of the Big Thompson River at Drake.

PROGRAM
LESSON 4

Design costs don’t always follow a rule of thumb, i.e. Construction Cost x % to determine fee.

Revegetation on the North Fork of the Big Thompson River at Drake. Project recreated flood benches, reconnecting the river to the floodplain.

DESIGN COSTS

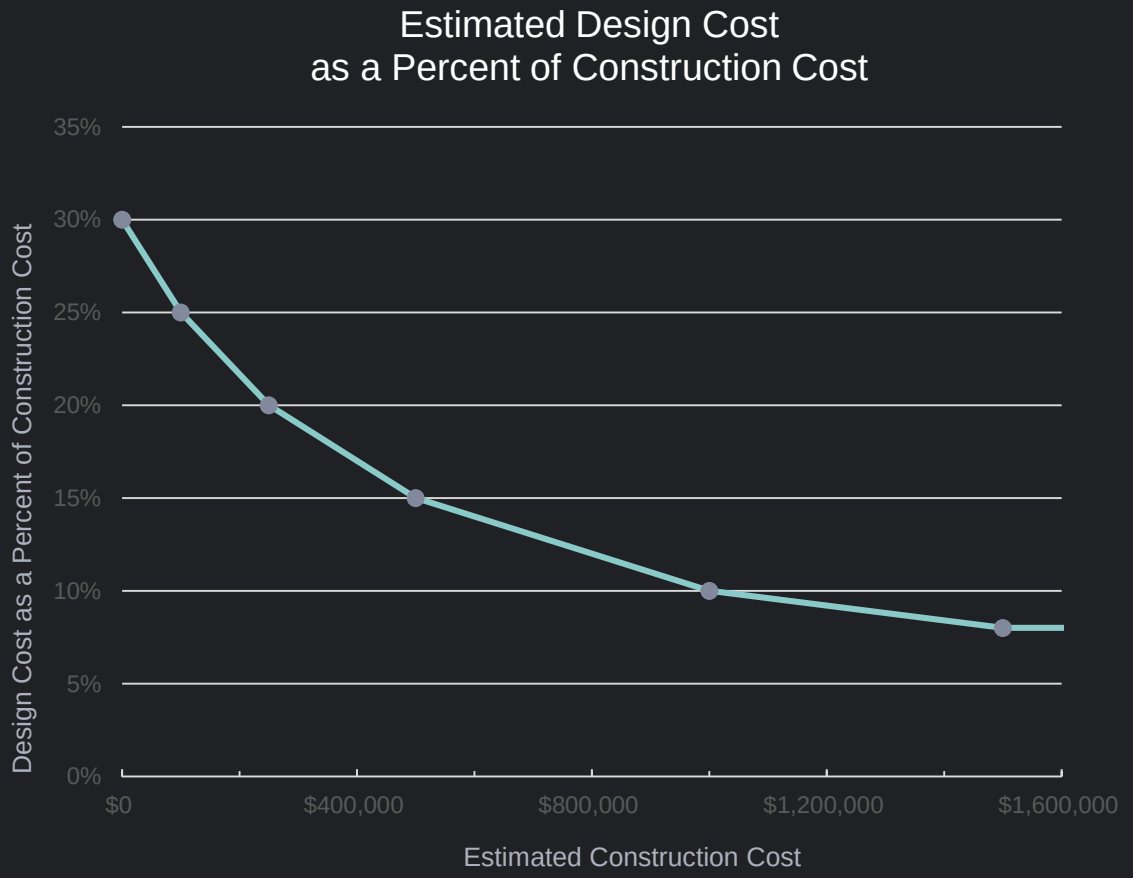
LIMITED FUNDING

MANDATE TO HOLD COSTS TO 10% OF CONSTRUCTION

- Project ranged in size from $26k to $6 million
- Creating a design cost curve allowed the program to meet the 10% objective, but with major caveat…

DESIGN TO 60%-80% LEVEL RATHER THAN 100%

- Required project partners process for bidding
- Required extensive construction oversight



OUTCOMES

With a sliding design cost curve, reduced design requirements, a flexible bidding process, and increased construction oversight the EWP program was able to maximize Technical Assistance dollars.

1. Maximize design dollars throughout the program
2. Decrease design times by reducing design requirements
3. Reduce design costs by implementing a project partners bidding process for maximum flexibility
4. Provide funding for extensive construction oversight on projects to make field adjustments on the fly.

Post project photo on South Platte River at State Highway 60.

PLANNING AND OUTREACH
LESSON 1

Master planning is necessary to determine your risk and to set your program priorities.

Post project photo of Left Hand Creek at North 81st Street.

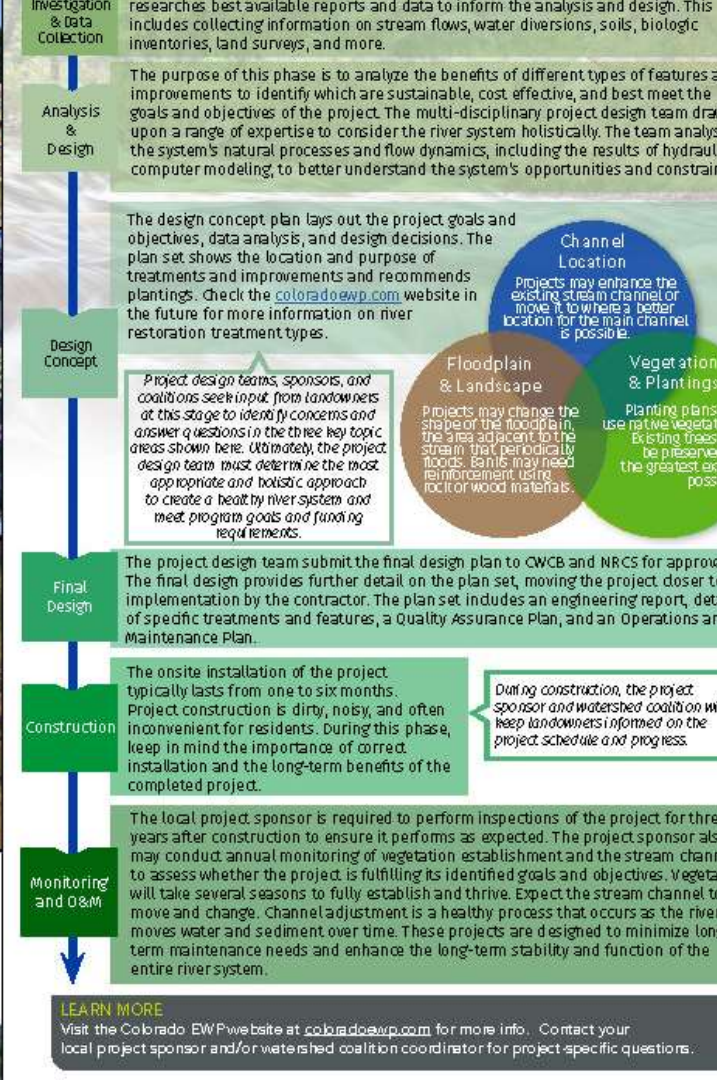
PLANNING AND OUTREACH
LESSON 2

Communicating risk to landowners continues to be one of the most challenging issues we face in the river/floodplain management community.

Map of two-dimensional modeling of flood risk for Left Hand Creek.

PLANNING AND OUTREACH
LESSON 3

Landowners need to understand the process and what they should expect from start to finish.



Fact sheet created for landowners adjacent to EWP projects explaining what to expect from design through construction and ultimately monitoring and O&M.

DESIGN AND CONSTRUCTION
LESSON 1

Good design considers all the functions of the river.

Post project photo of Left Hand Creek at North 81st Street.

STREAM FUNCTIONS PYRAMID

BIOLOGICAL

Biodiversity and the life histories of aquatic and riparian life.

PHYSIOCHEMICAL

Temperature and oxygen regulation; processing of organic matter and nutrients.

GEOMORPHOLOGY

Transport of wood and sediment to create diverse bed forms and dynamic equilibrium.

HYDRAULICS

Transport of water in the channel, on the floodplain, and through sediments.

HYDROLOGY

Transport of water from the watershed to the channel.

OUTCOMES

Designing a project to address all of the stream functions means you need diverse expertise. The CWCB anticipated this and ensured that the program and design teams had the necessary expertise to deliver.

1. All design teams consisted of:
    - H&H Engineer
    - Geomorphologist
    - Ecologist
    - Biologist
2. Program teams also included diverse experts for design reviews and construction quality assurance.

Post construction photo on Fall River at Elkhorn. Riffle pool sequence can be seen in the background.

DESIGN AND CONSTRUCTION
LESSON 2

Allowing river systems to move is a good thing, but sometimes we have to set boundaries on how far.

Post project photo on Left Hand Creek at North 63rd Street. Photos is looking downstream. Far bank on river left is buried soil riprap with willow toe and container stock.

HOLDING THE LINE: “SOFT” BANK STABILITY

LIVE CRIB WALLS

Composed of stacked rows of rootwads and boulders for ballast. Soil backfill is placed between the trees and the structure is planted with willow stakes to create a stable bank. Photo is on Left Hand Creek at North 81st Street.

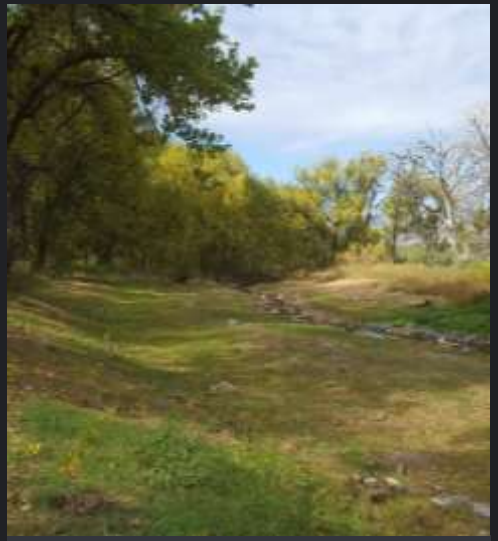
WOOD STRUCTURES

Wood structures are composed of rootwads and boulders for ballast and are placed in various configurations to lock the structure in place, creating an entangled structure that works against the force of the river to stabilize the bank and to create aquatic habitat. Photo is on South St. Vrain Creek at Hall Ranch.

SOIL WRAPPED LIFTS

Where some long-term bank adjustment is allowable and hard structures are not required, planted soil wrapped lifts provided a good solution for bank stabilization. Lifts include willow staking and container planning. Photo is on Left Hand Creek at Bielins-Hock.

HOLDING THE LINE: “HARD” BANK STABILITY



SOIL RIPRAP/SETBACK RIPRAP

In locations where protection of structures or infrastructure is critical, buried soil riprap or setback riprap can be placed as a more traditional method of stabilizing the bank. Photo is on Left Hand Creek at North 73rd Street. The photo is looking upstream and the river right bank is composed of buried soil riprap vegetated with willow stakes and container stock.

COBBLE/BOULDER TOE

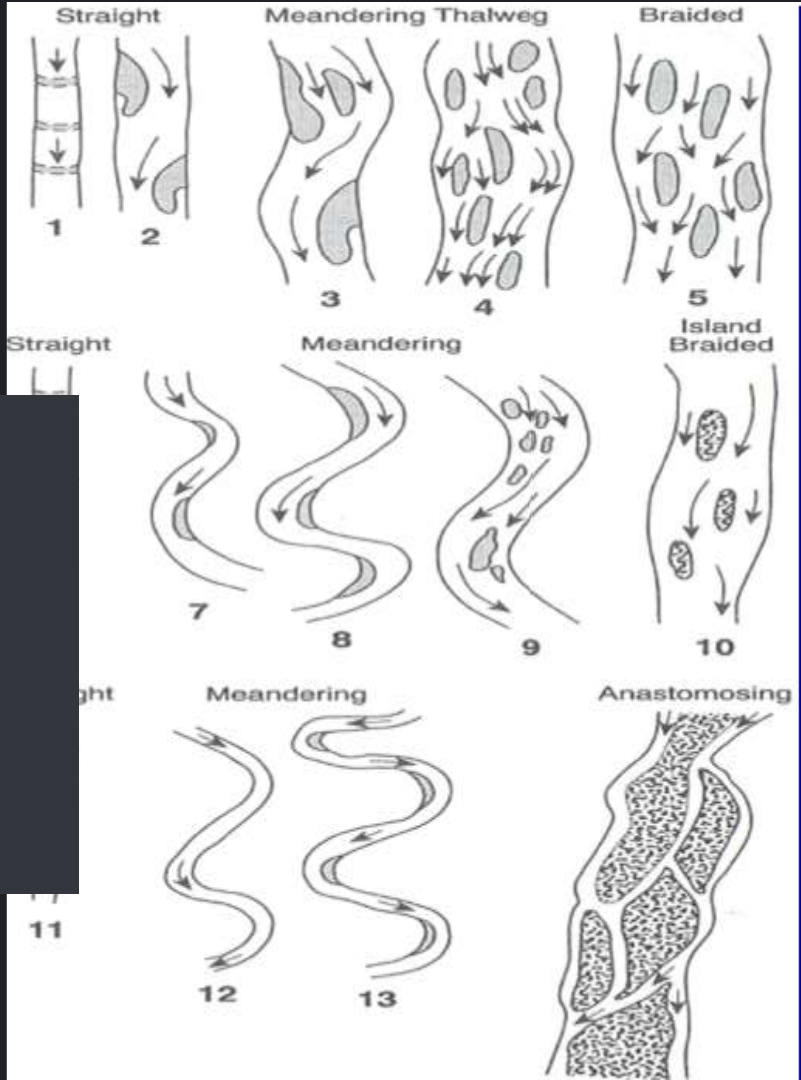
Using the larger natural material in the channel, channel edges can be hardened for protection against erosion during bankfull flows. To add stability, willow stakes and container stock are integrated into the toe. Photo is on Left Hand Creek at Streamcrest.

BOULDER TOES

For speed of installation and in areas where minimal bank disturbance was desirable boulder toes were used with coir blanket on the upper bank. Willow stakes are planted into the toes for revegetation and to further stabilize the bank. Photo is on Left Hand Creek at North 41st Street.

DESIGN AND CONSTRUCTION
LESSON 3

Understanding where you are in the basin gives you knowledge regarding what you are designing



THE RIGHT MORPHOLOGY FOR THE RIGHT TOPOGRAPHY

STEP POOLS

In mountainous locations with steep grades. Used to dissipate energy. Post construction photo on the Fall River at River's Edge in Estes Park.

BEAVER DAM ANALOGS

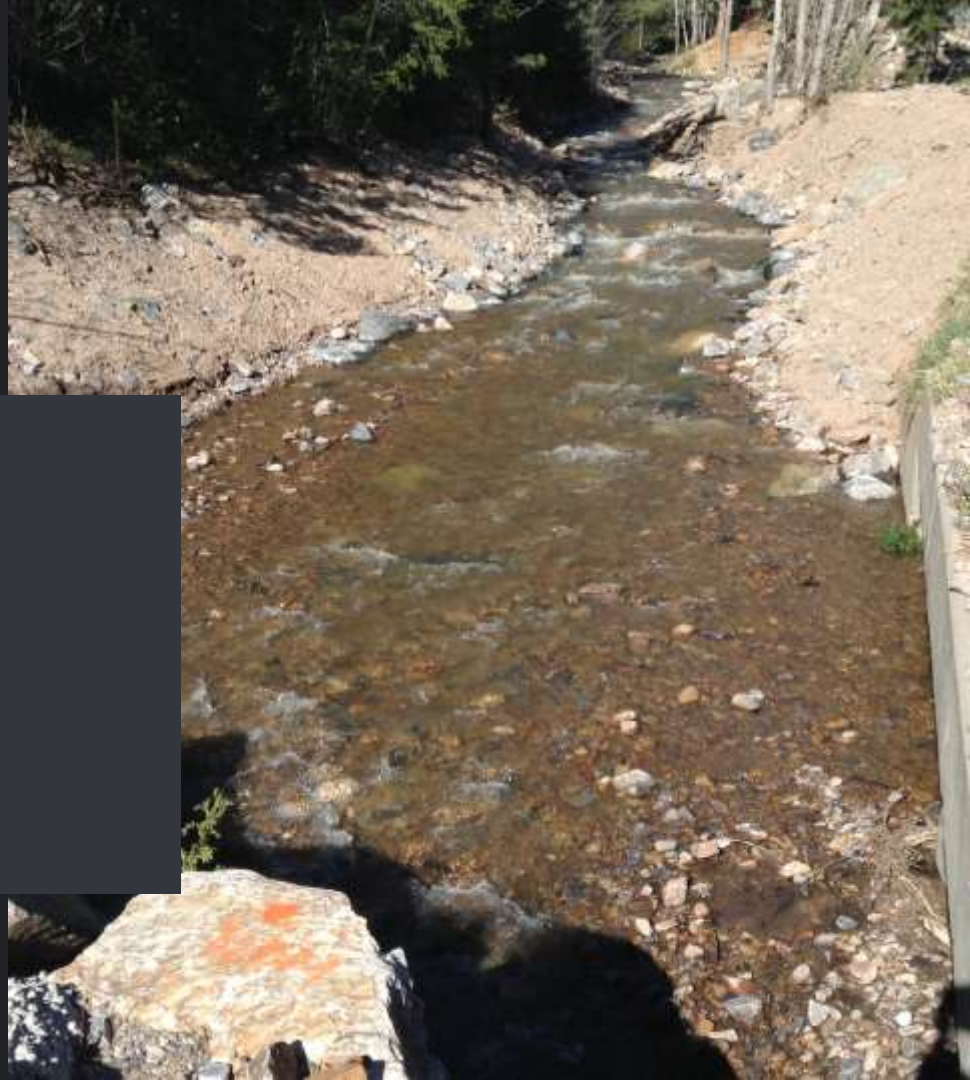
Used in flatter valleys for simulated natural grade control. Post construction photo is on Fish Creek in Estes Park.

RIFFLE/POOL

Used on mildly steep slopes from 1% - 3% to dissipate energy and create habitat pools. Photo is on Left Hand Creek at North 41st Street.

DESIGN AND CONSTRUCTION
LESSON 4

Reach scale resiliency cannot be achieved by working in-between the culverts.



Post construction photo on Coal Creek Canyon at Highway 72. Poorly aligned existing culvert that could not be reconstructed with EWP funds.

DESIGN AND CONSTRUCTION
LESSON 5

Many lessons come from experience; seeing things constructed and how they react and adjust to high flows.

Post construction photo during spring runoff on Left Hand Creek at North 63rd Street. Here water is returning to the main channel via an adjacent overflow channel.

THE “SIMPLE” STUFF (THEY DIDN’T TEACH YOU IN SCHOOL)

ROOTWADS

Rootwads require a good foundation, many times another rootwad set transverse to the primary log. They need to be placed at the right location, i.e. on the outside of bends and at pools so they stay wet and create habitat. Photo is on Left Hand Creek at North 81srd Street.

RIFFLES AND RIFFLE CRESTS

It’s important to increase the D50 of the riffle face to address increased shear stress. Too small and the face rock will move and create a vertical drop at the reinforced crest. Photo is on South St. Vrain Creek at Hall Ranch.

CROSS VANES

Foundation rock are critically important to successful cross vanes. Without the foundation, the rocks will roll. Well placed boulders of appropriate size, gradually sloped arm, and geotextile are all part of getting construction right. Photo is on Fourmile Canyon Creek at Wagon Wheel Gap Road.

ADDITIONAL INSIGHTS AND ON THE GROUND LESSONS

OVERFLOWS AND HABITAT AREAS

Where there is space, creating overflow channels for large flood events provides additional conveyance, reduces shear stress in the main channel, and creates additional habitat areas. Photo is on Left Hand Creek at North 63rd Street.

COIR (IT WORKS!)

Coir is of great benefit to hold banks and soil while vegetation develops. Many EWP projects experienced high water after or during construction and those areas with coir held the soil in most cases and no or little repair was necessary. Photo is on Left Hand Creek at North 63rd Street.

MEANDERING THOUGHTS

Low flow channels meander. Evaluating upstream and downstream reaches, estimating and incorporating sinuosity into the designs increases interest and complexity and lengthens the stream. In combination with riffles, pools and bars are created. Photo is on Little Thompson River at North 83rd Street.

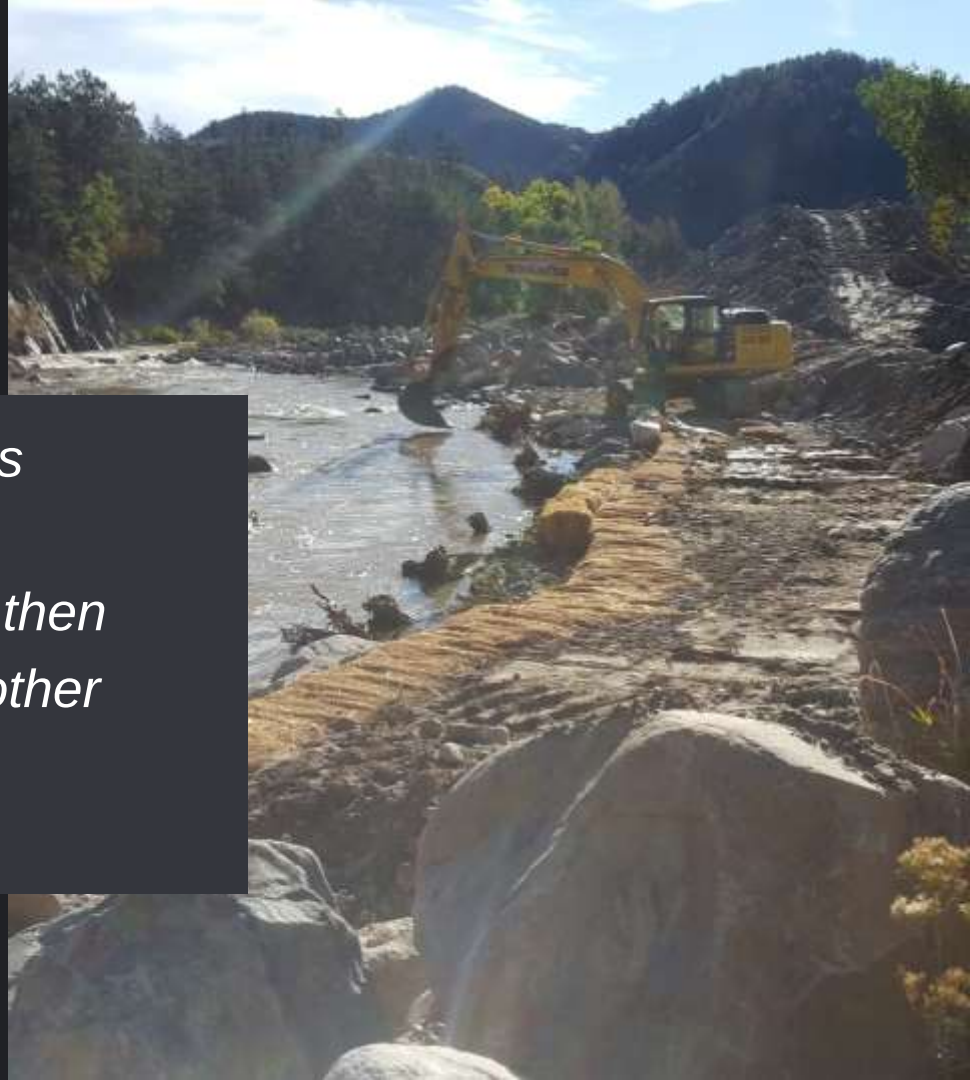
DESIGN AND CONSTRUCTION
LESSON 6

When you are going to build this many projects this fast, you need to grow your own plants

Willow stakes on Left Hand Creek. Designers worked directly with ecologists after site grading to better determine location and density of staking.

ADAPTIVE MANAGEMENT
LESSON 1

Part of the process involves designing a solution, implementing the solution, then adapting the solution . In other words, “stuff moves.”



Construction of woody toe with soil wrapped lifts on the Big Thompson River at Cedar Cove.

THAT'S ALL

THANKS

FOR YOUR TIME