

# Simple Structures for Low Energy Streams

(NRCS Webinar – April 9, 2014)

**Bill Zeedyk**



These are simple structures that can be hand or machine built to modify or stabilize the plan, profile and dimensions of low energy streams.

The structures, and their predictable vegetative response, are a form of bio-engineering and become invisible with time.

Weirs (grade control structures)

Headcut Control Structures

Bank Erosion Control Structures

Induced Meandering Structures

Sheet Flow Spreader Structures

This is not  
about rock  
filled wire  
basket.



# Weirs

(grade control structures)

- One Rock Dam
- Wicker Weir
- Filter Dam (Weir)
- Tree Length Log Mat
- Rock Arch Dam
- Cross-Vane

**What are they used for?**

- Control grade, or
- Raise channel bed

**How do they do it?**

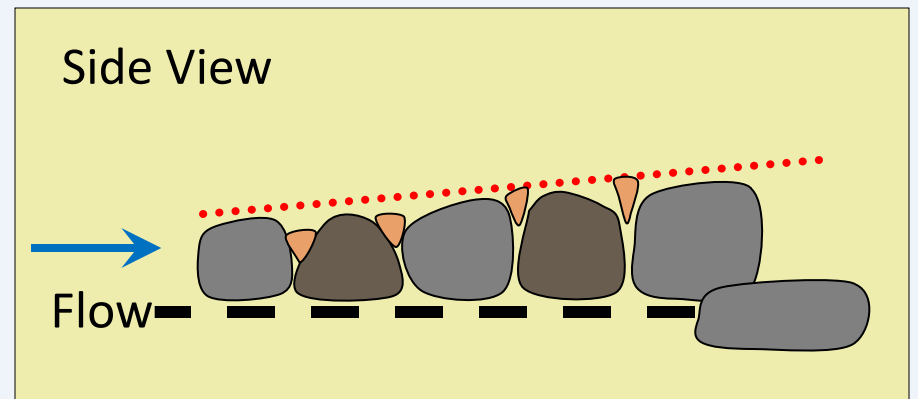
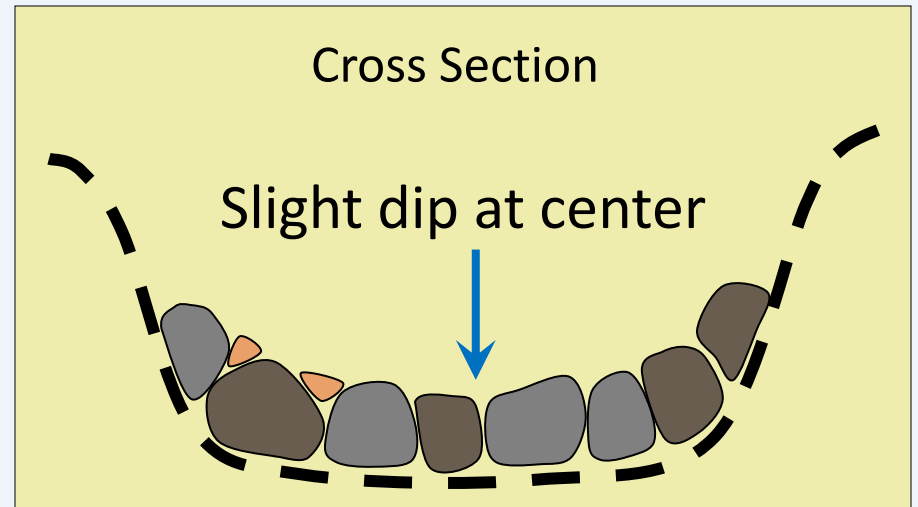
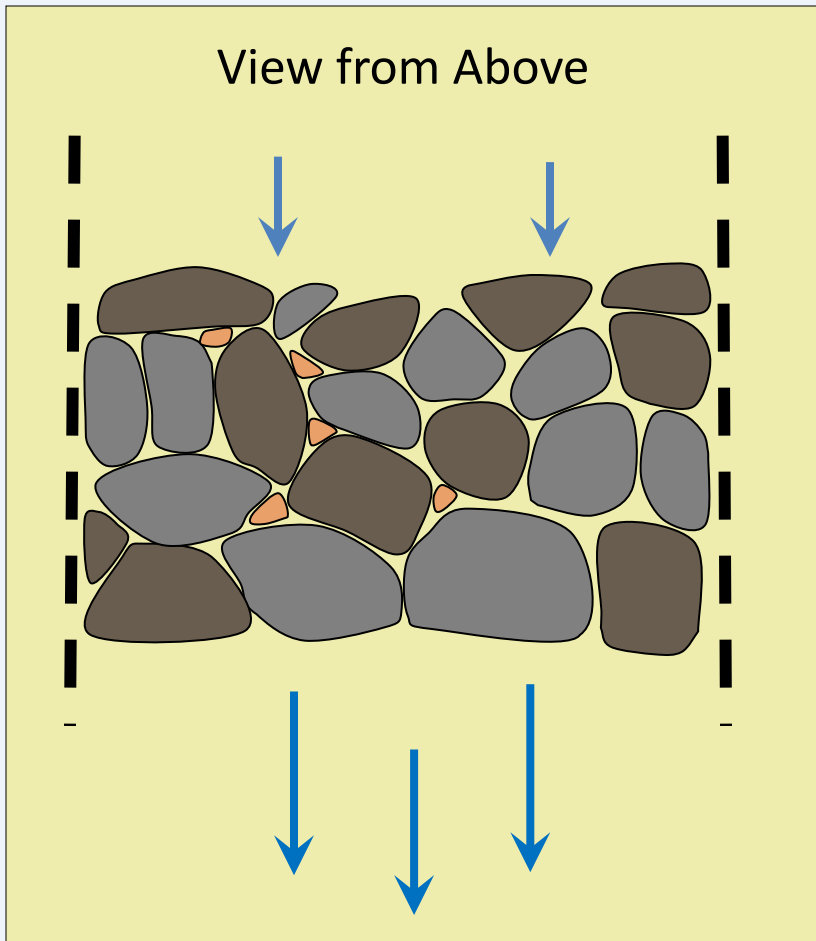
- Slow the flow of water coming off the landscape or down a channel
- Collect sediment to nurture vegetation

**Where can they be used?**

- Moderately to deeply eroded upland gullies or incised channels
- In conjunction with other structures

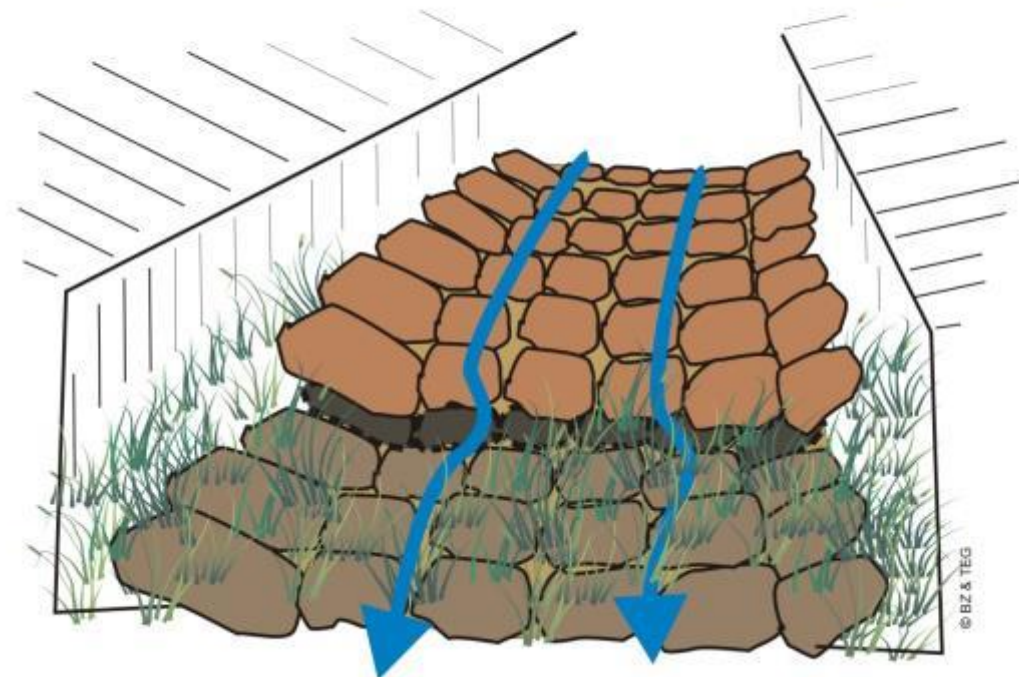
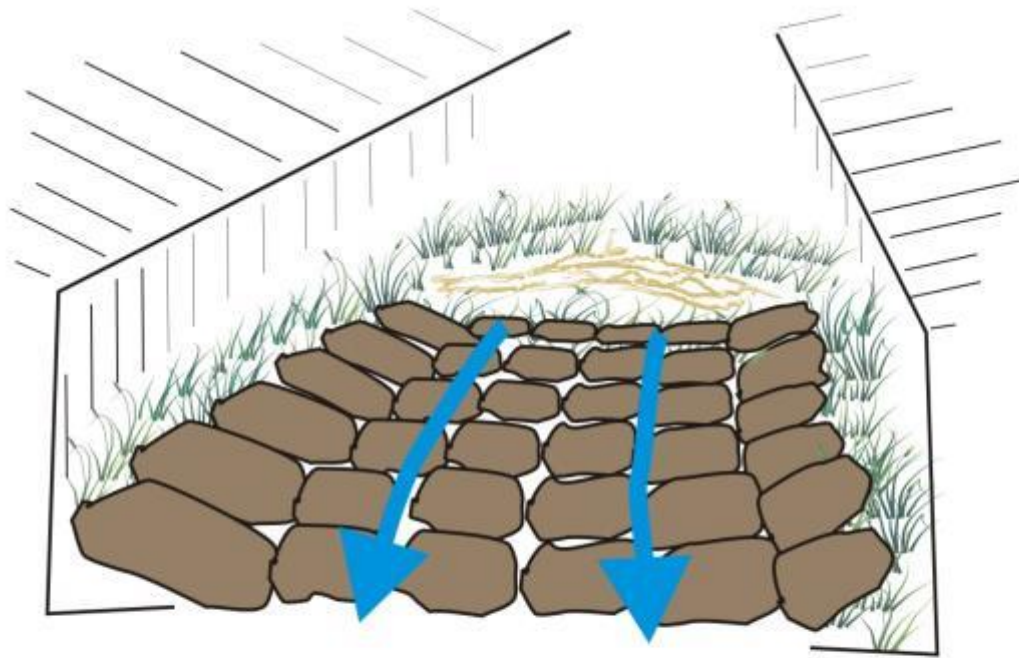
# One Rock Dam in a Gully

1 rock high, several rows wide and uniform surface



# One Rock Dam

Rock Weir



© BZ & TEG



May 2005



October 2005



October 2006 – wet year



October 2012 – drought year



- Slows water flowing over the landscape
- Mulching effect - retains moisture in place
- Captures soil, seeds and nutrients
- Resulting vegetation holds more soil in place, and
- Disperses flow across the landscape

**Hydrology**

**Ecology**

**Geomorphology**



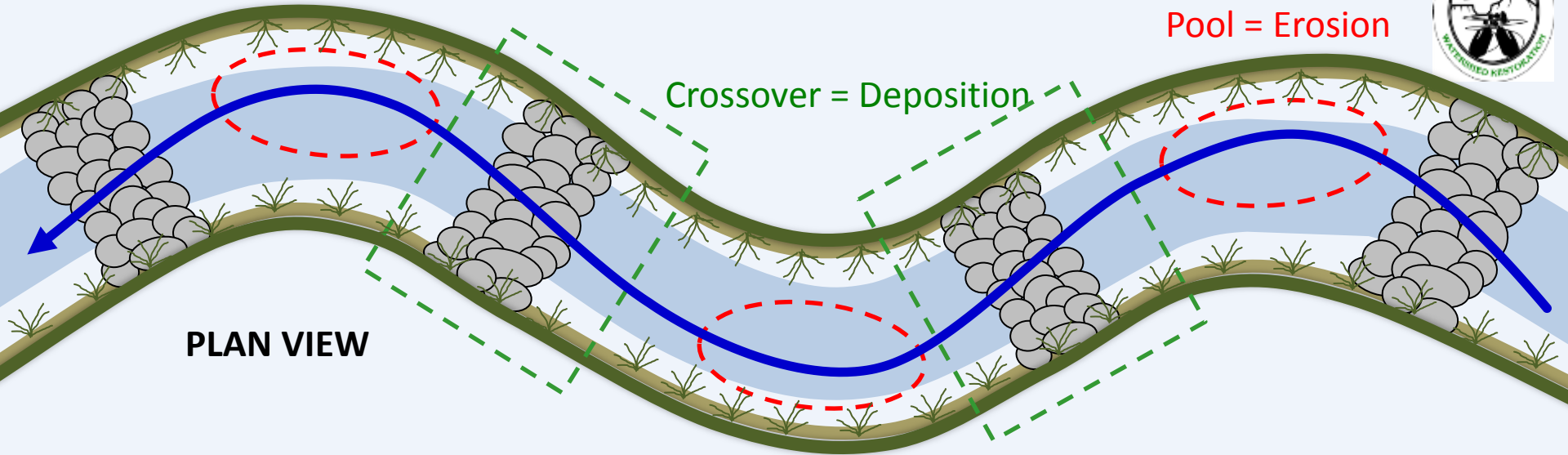
**As built,  
before  
first flood.**



# Raising Streambed Elevation

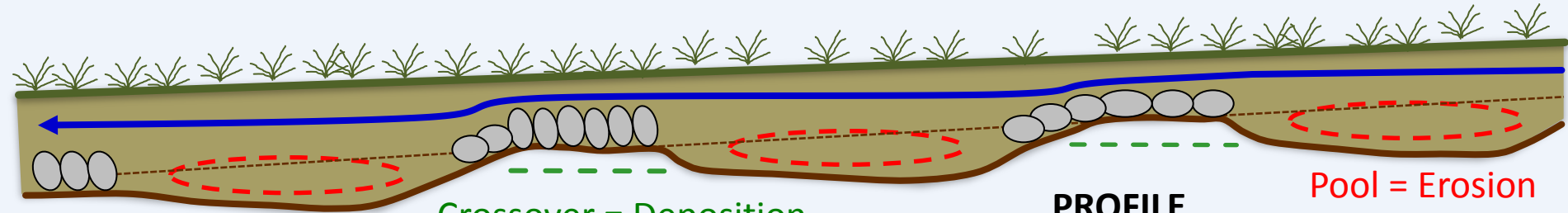


1. Reconnect the floodplain.



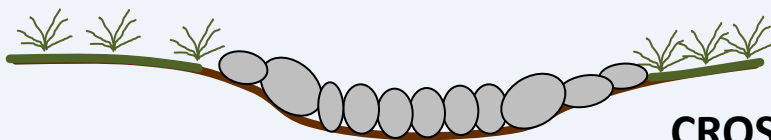
PLAN VIEW

2. Placement at crossovers maintains natural erosion and deposition patterns.

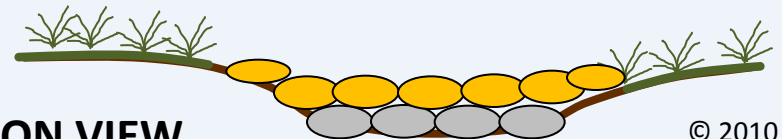


PROFILE VIEW

3. Raising the bed will be achieved in stages.



CROSS SECTION VIEW





**Wicker Weir** – used in sandy, gravel or clay bottom channels, not cobble or small boulders

**What they are used for?**

- To control grade at the crossover in a meandering channel or to raise the bed of a gully



**How do they do it?**

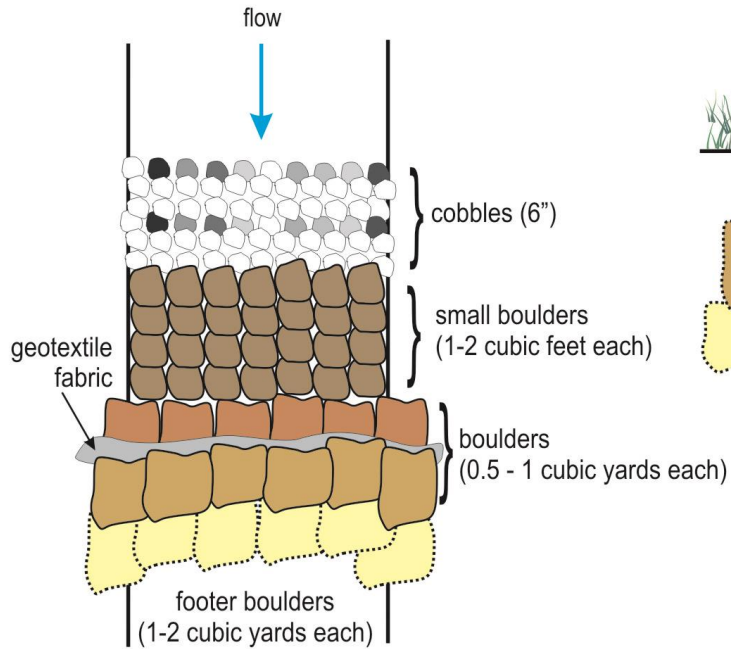
- Slow flow of water and create a riffle/run in the channel bed

**Where can they be used?**

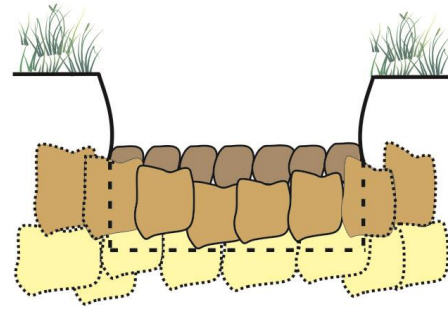
- As part of an induced meandering project

## Filter Weir

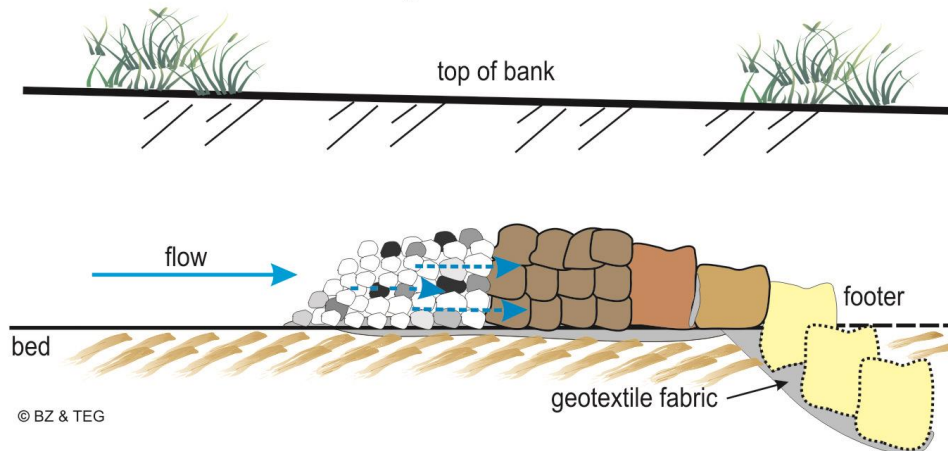
Plan View



Cross Section



Longitudinal Profile



## Filter Dam (Weir)

- Slows the flow
- Captures sediment while impounding water for only a brief period
- Raises the channel bed in an incised channel to improve floodplain access



Machine Built



Hand Built, Book Stacked

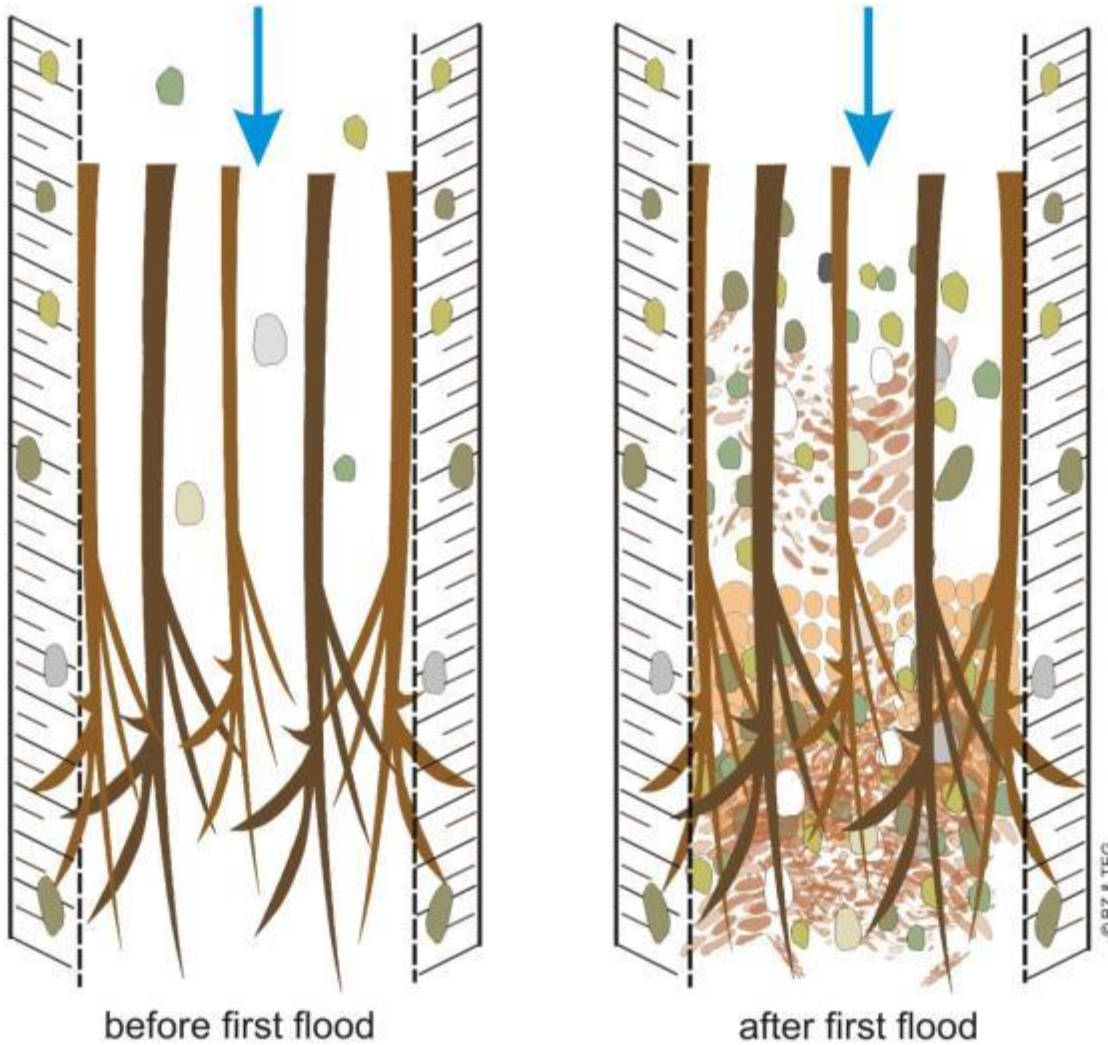


March 2006 after construction.



June 2008

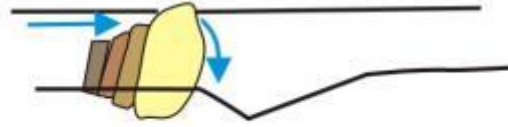
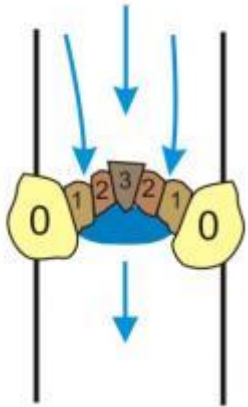
## Tree Length Log Mat



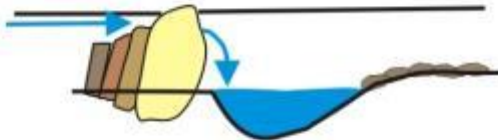
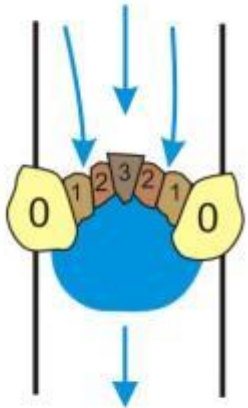
- **Grade control**
- **Slows the flow of water coming down the channel**
- **Increases bank storage**
- **Sediment deposited between stems and branches, anchors logs in place**
- **Stored moisture nurtures colonizing vegetation**
- **Ideal for stabilizing burned areas**

# Rock Arch Dam

at treatment



3-5 years after treatment



plan view

cross section

profile

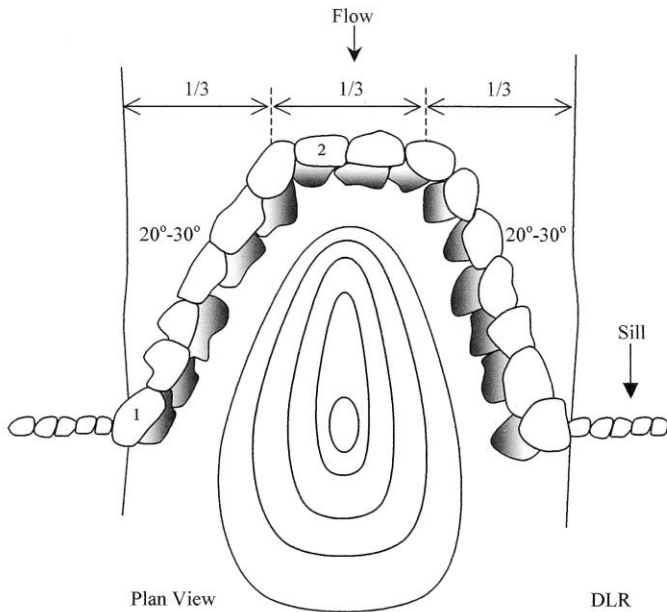
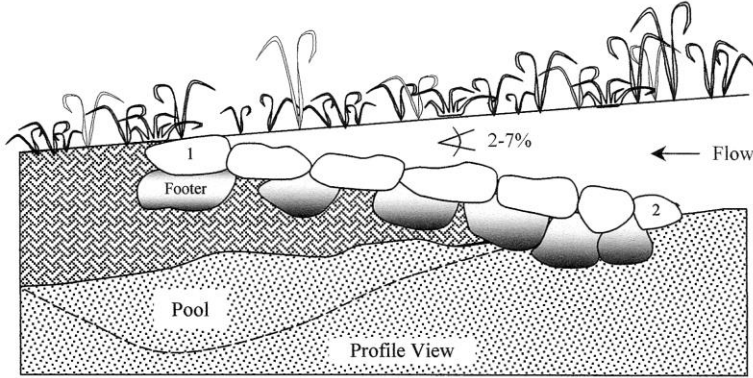
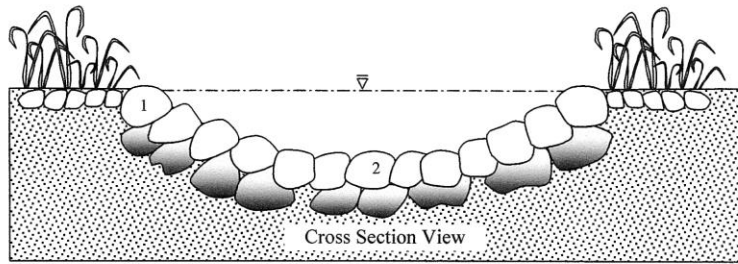
© BZ & TEG



- Captures sediment and stores water
- Creates a scour pool on the downstream side providing a water source for wildlife or livestock
- Saturates the bed and banks



# Cross-Vane for low standard road stream crossings - Grade Control



# Headcut Control Structures

- Rock Rundown
- Step Falls
  - Zuni Bowl
  - Log and Fabric

**What are they used for?**

- Stop headward progression of a headcut (bedscarp)

**How do they do it?**

- Prevent scour pool formation and stimulate vegetation growth

**Where can they be used?**

- Gully fans
- Stabilized bedscarps within established channels
- Moderately to deeply eroded upland gullies or incised channel

# Rock Rundowns

(are longer than wide)



November 2006



March 2007



June 2007

Sandia Prep Reach of Cedro Creek Restoration Project, Tijeras, New Mexico

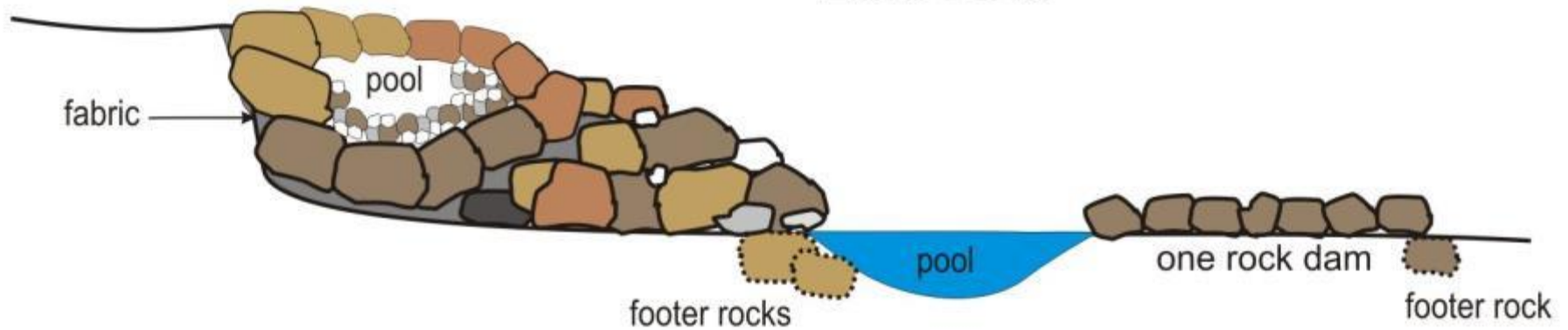


# ROCK RUNDOWN

(With one rock dam )

- **What they used for?**  
To slow water coming over a low energy headcut
- **How do they do it?**  
Rocks create rough surface to slow the water, cracks where seeds germinate and vegetation grows
- **Where can they be used?:** **Used only in low energy headcuts (NOT in-channel headcuts!)**

## Zuni Bowl



© BZ & TEG



*... is composed of rock lined step falls and plunge pool that prevent the headcut from continuing to migrate upstream or upslope.*





**Before**



# Zuni Bowl

Save the floodplain

**During**



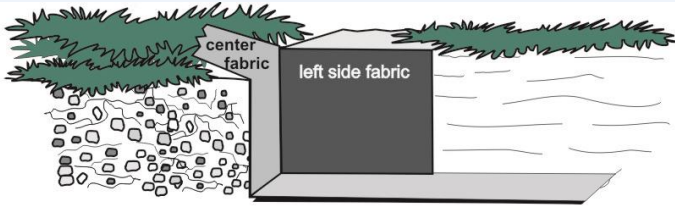
**After**



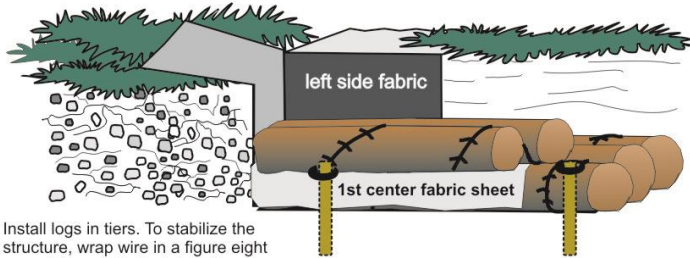




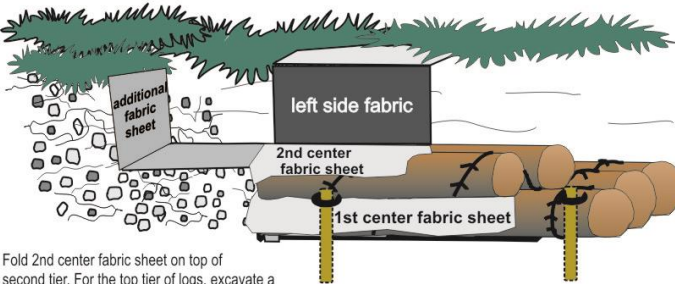
# Log and Fabric Structure



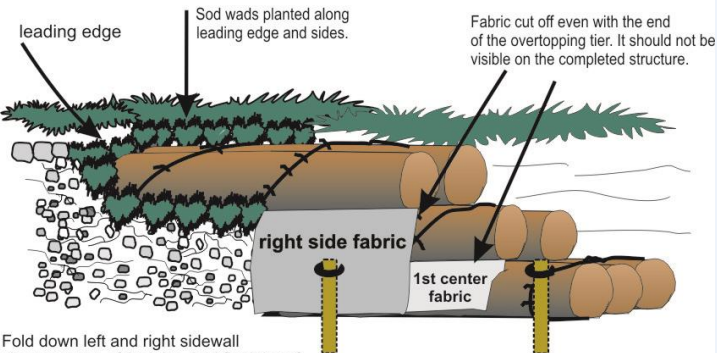
Square off headwall, sidewalls and bottom of channel. Drape 2 or more sheets of geotextile across the headwall and 1 layer on each sidewall.



Install logs in tiers. To stabilize the structure, wrap wire in a figure eight around logs and attach to "T" post. How the logs are wired and fastened will depend on expected flood effects.



Fold 2nd center fabric sheet on top of second tier. For the top tier of logs, excavate a platform upstream of the structure. Lay an additional piece of fabric on headwall and new platform.



Fold down left and right sidewall sheets on top of 2nd tier. Add final tier of logs slightly lower than the top edge and wire down. Tuck in center fabric along the upper tier. Install sod clumps along the leading edge and sides.







**September 2005**



**July 2010**

# Bank Erosion Control Structures

- Post Vane
- Boulder Vane
- Log Vane

(analogous to a spur)

**What are they used for?**

- **Prevent bank erosion in incised channels**

**How do they do it?**

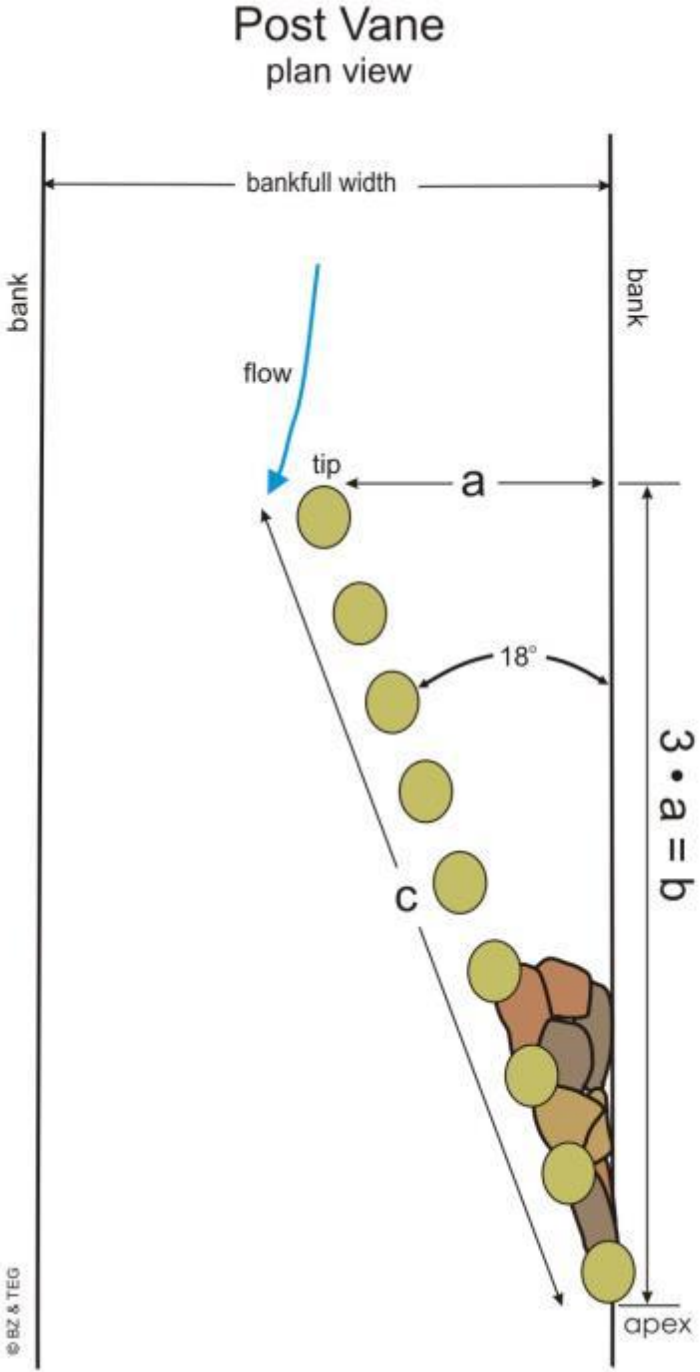
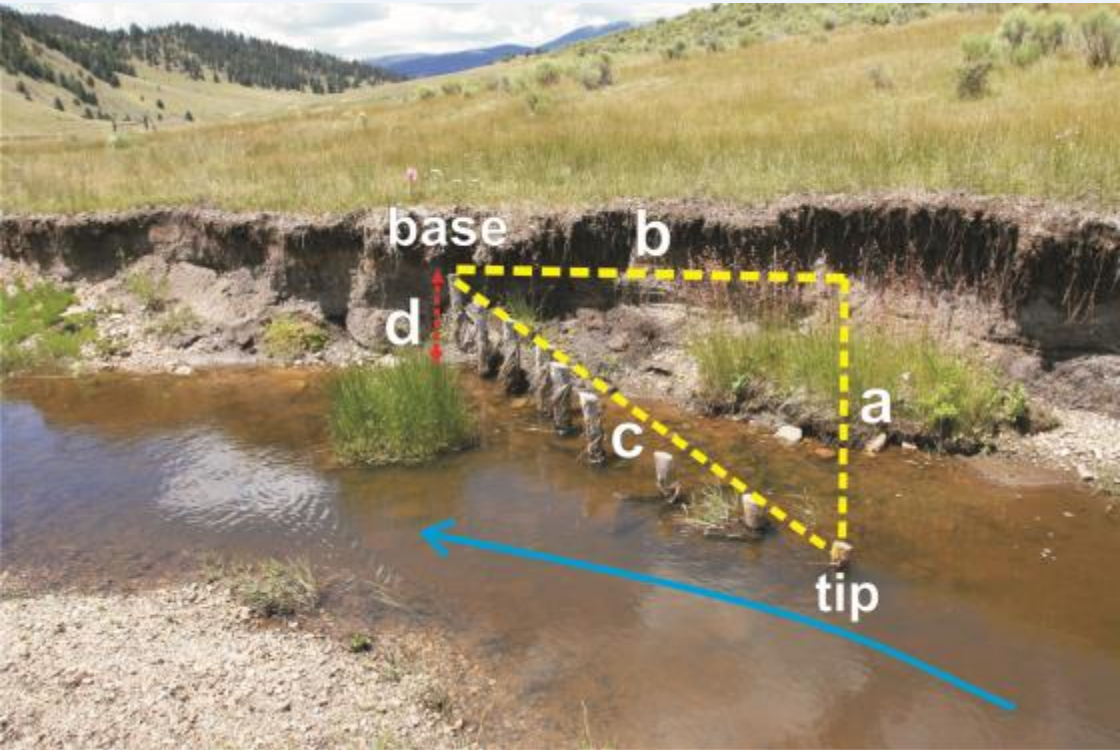
- **Move the thalweg away from the base of the bank**

**Construction materials can vary with the nature of bed and bank soils.**

**Manage streambank vegetation to compliment the function of the vanes.**

**Usually used in sets of 3 or more.**

# Streambank Erosion Mitigation using Post Vanes











**July 2007**



**September 2010**

2001

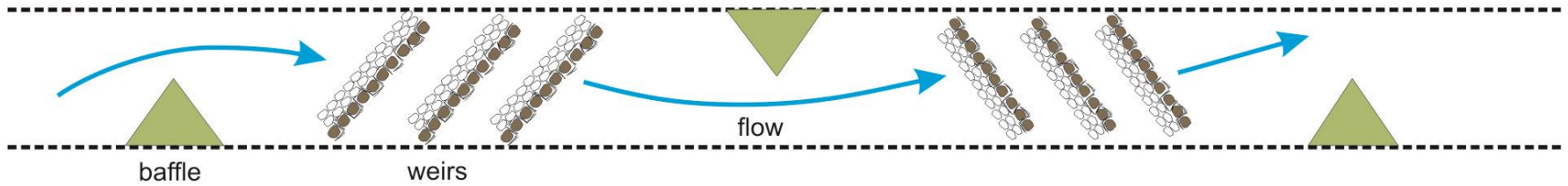


2009

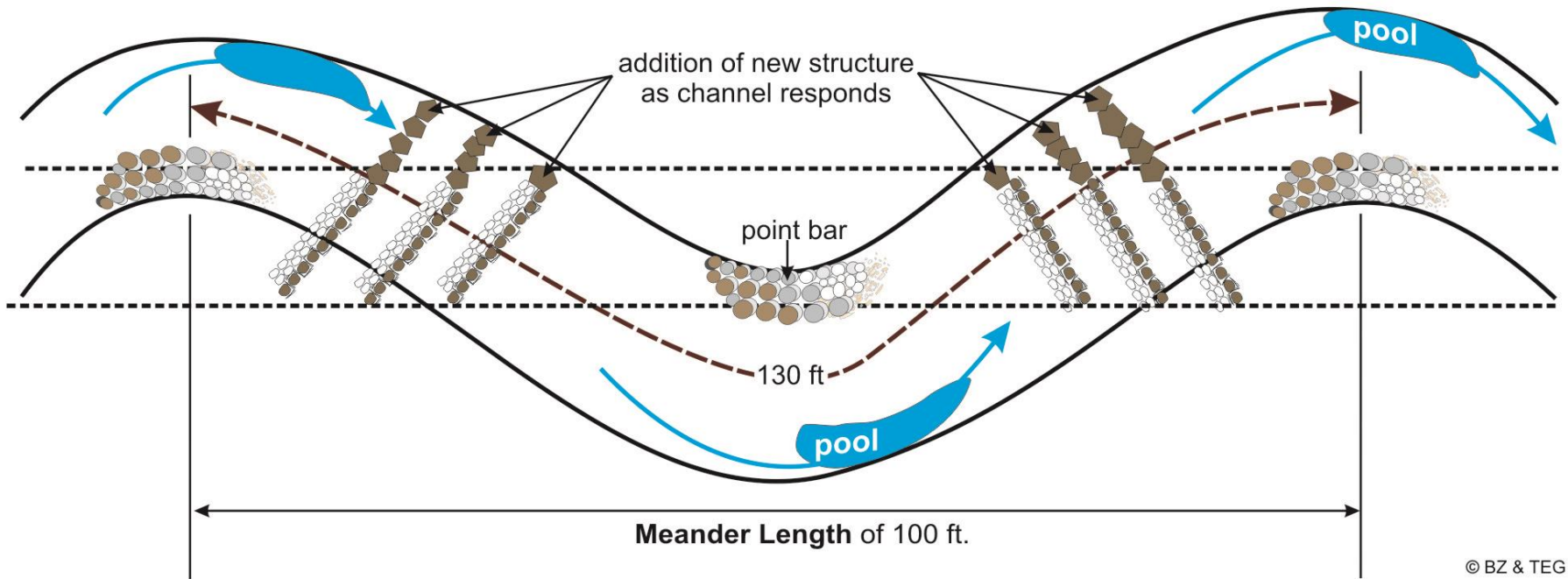


# The Meandering Process

**Before:** Incised channel with a **Bankfull Width** of 10 ft., a **Channel Length** of 100 ft., and a **Sinuosity** of 1.00.



**After:** Meandering channel with a **Bankfull Width** of 13 ft, a **Channel Length** of 130 ft., and **Sinuosity** of 1.3.



**March 1998**

**Eroding Bank, source for  
downstream point bar formation**

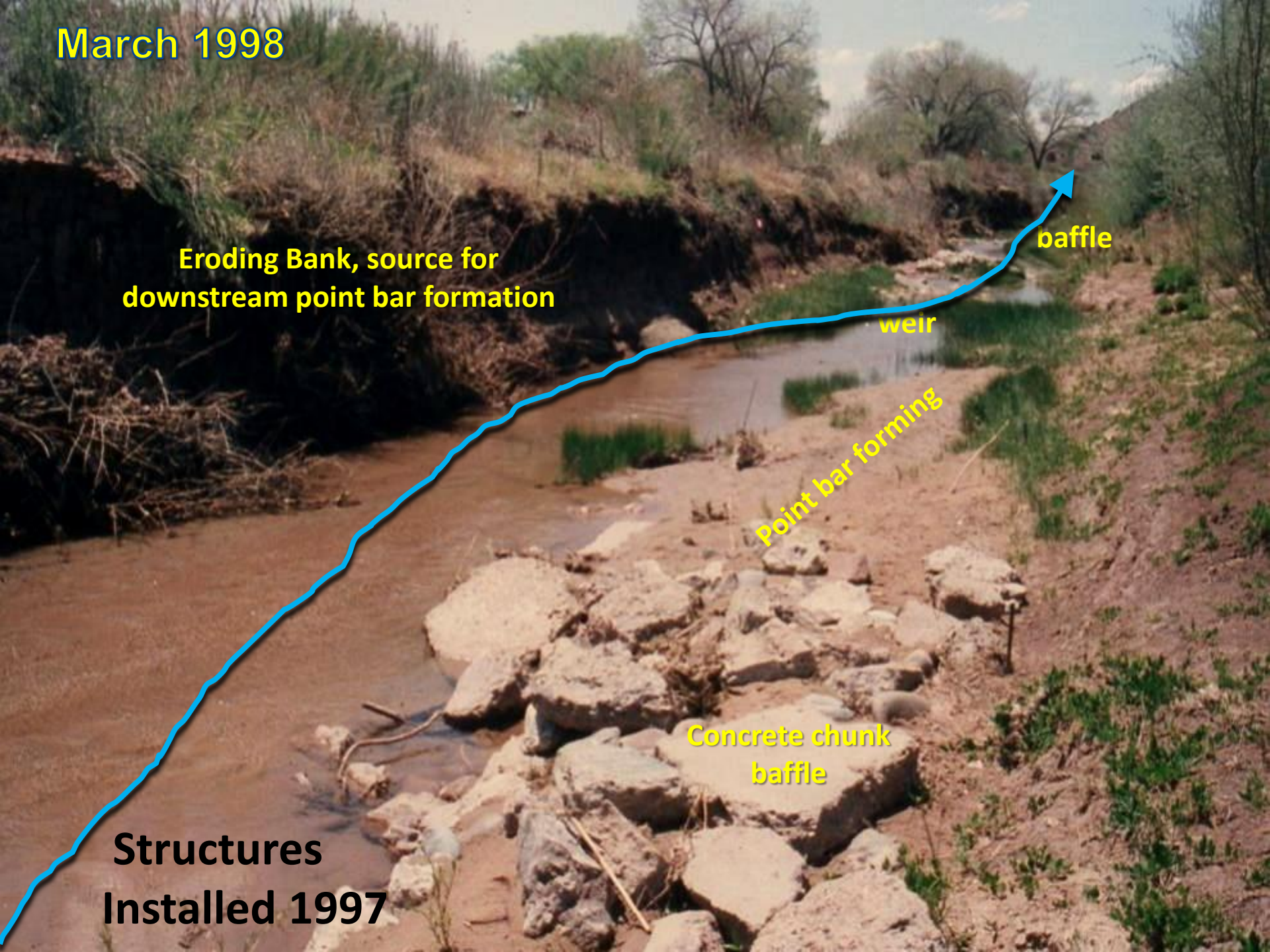
**baffle**

**weir**

**Point bar forming**

**Concrete chunk  
baffle**

**Structures  
Installed 1997**



**May 2004**

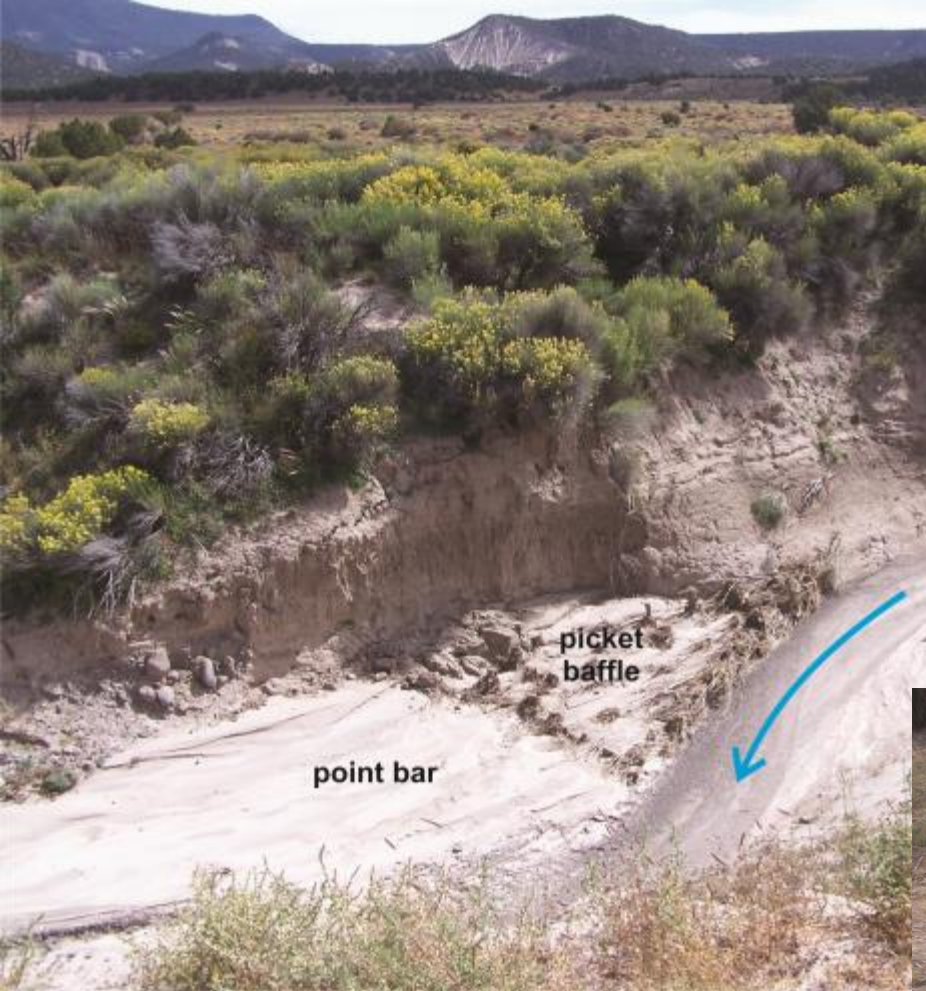


**The water did the work!  
Getting Better!**

**May 2010**



**Higher Stream Bed... Lower Banks... Wetland Plants...Hydric Soils...  
Meandering Channel...Perennial Pool... New Floodplain**



# Baffles





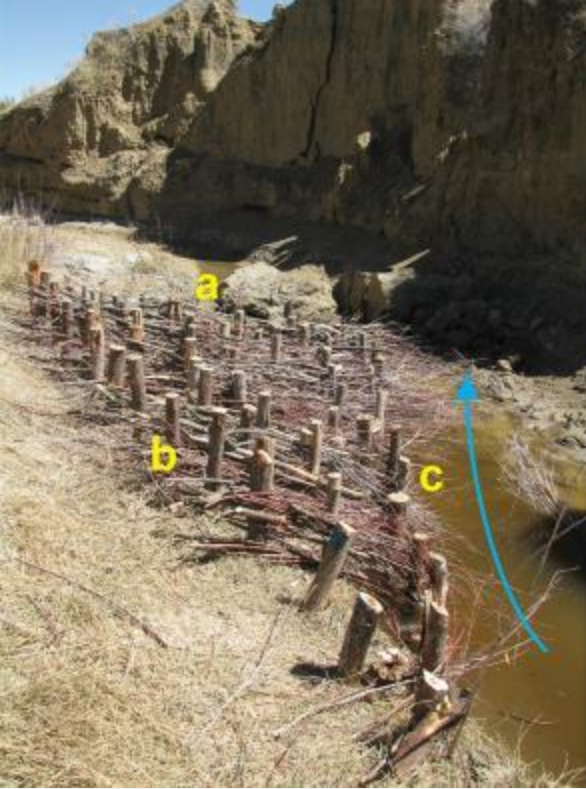
- Ultimately, structures do not control erosion, stabilize banks or build soil, **plants do!**
- Structures are a means to an end, not an end unto themselves.
- Structures can provide a place and time to enable vegetation growth, capture soil-building sediment and debris, and increase the supply of moisture and nutrients available to sustain locally-adapted plant life, thus protecting the stream bank.
- Over the long run, any structure that is incompatible with morphological processes will retard, not advance, channel stability.



**September  
2007**



## Cebolla Canyon, El Malpías National Conservation Area (BLM )



- Old road captured the creek caused gully.
- 40 ft. deep, 80 years old,
- Top of gully – crop field, 1935.
- Hand built structures



April 2010

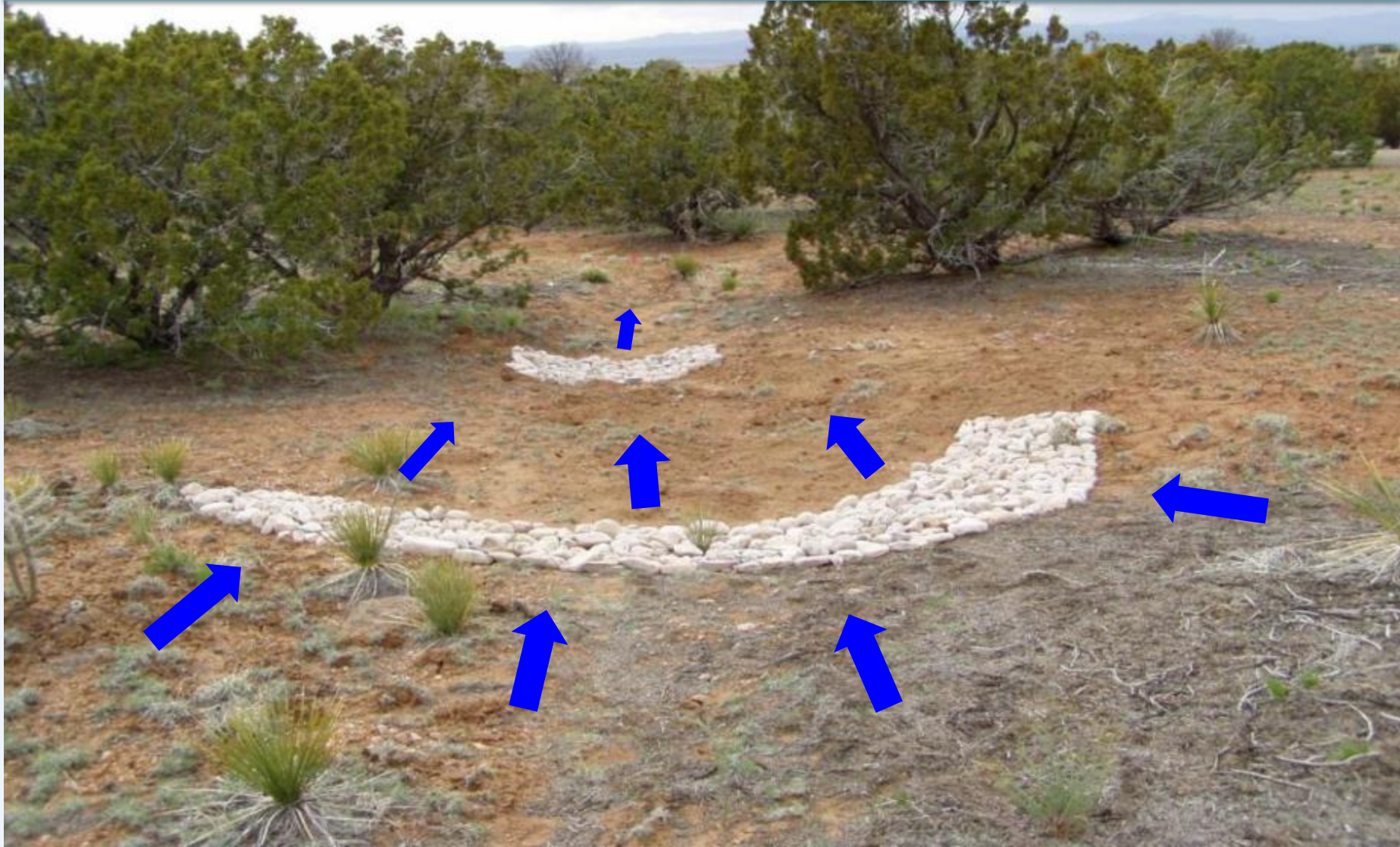


**Expanding floodplain**

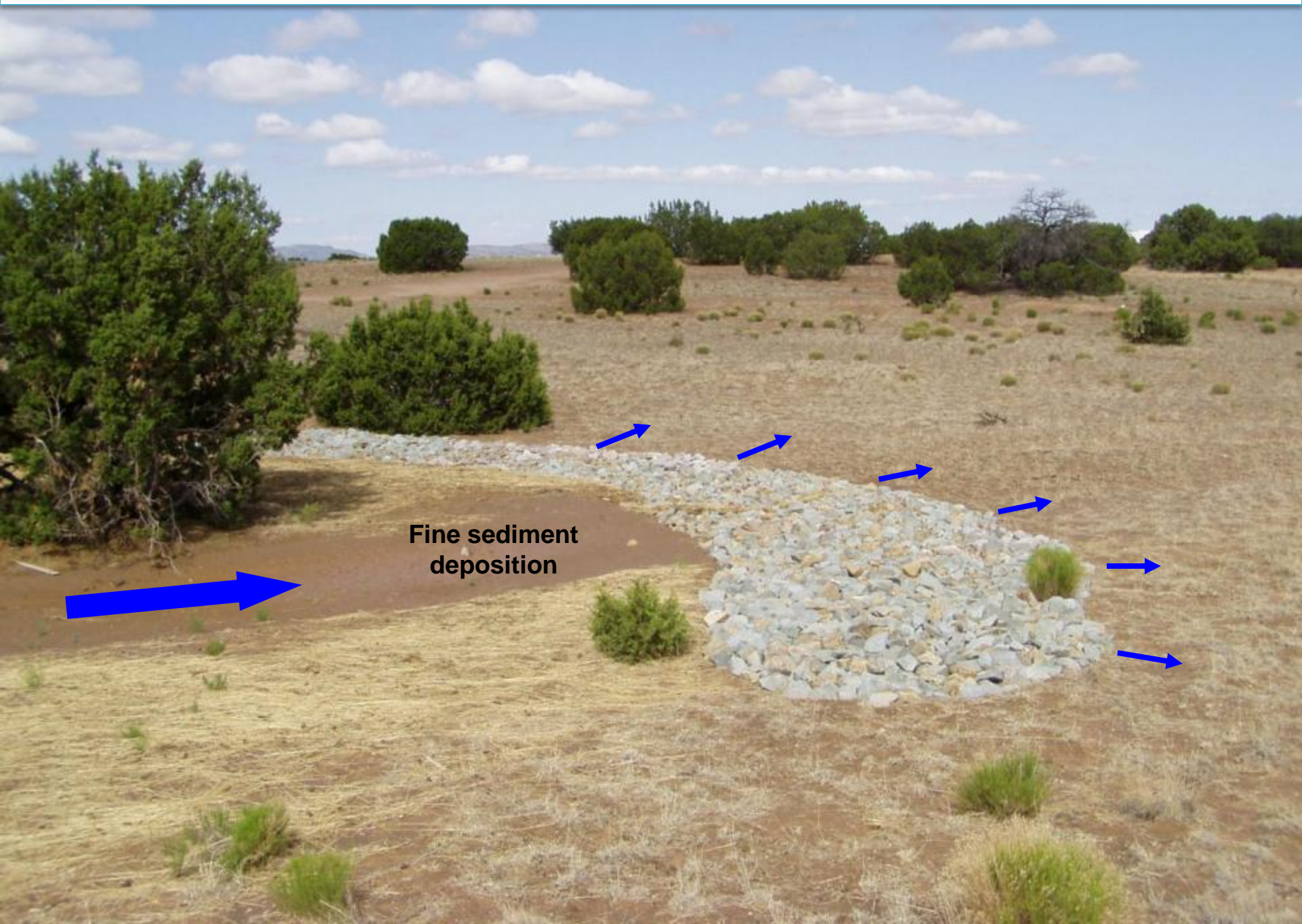
# Media Luna

Purpose is to preserve or establish dispersed flow (sheet flow) as appropriate to the land form.

**Tips Down – prevents an eroding gully from moving up valley**



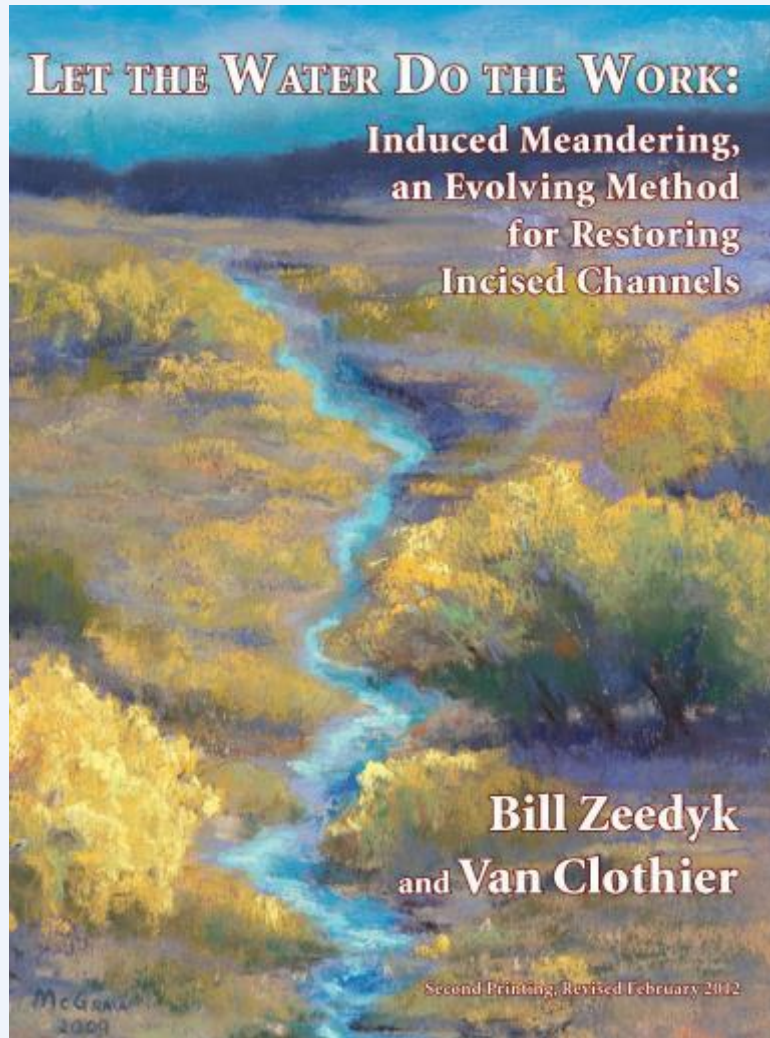
# Tips Up – spreads surface runoff from channels and initiates sheet flow



Fine sediment  
deposition



This has been brief overview for the use of simple structures to stabilize, modify or restore low energy stream channels. Structures are fully described in ***Let the Water Do the Work*** by Zeedyk and Clothier, available from Chelsea Green.



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