

Watersheds, Streams, & Highways: Resiliency in Disaster Recovery Through Partnerships and Innovation

Chris Sturm

**Colorado Water Conservation Board
Stream Restoration Coordinator**

303 866 3441

chris.sturm@state.co.us



COLORADO

**Colorado Water
Conservation Board**

Department of Natural Resources

ORGANIZATIONAL CHART

GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

**COLORADO WATER
CONSERVATION
BOARD**

Oil & Gas
Conservation
Commission

State
Land
Board

Division of
Minerals &
Geology

Colorado Parks
& Wildlife

Co. State
Forest
Service

Division of
Water
Resources

**Watershed &
Flood Protection**

Interstate, Federal
& Water Information

Stream & Lake
Protection
(In-Stream Flows)

Finance
Section

Water Supply
Planning

- SERVICES**
- Dam Safety
 - Water Commissioners
 - Well Inspections
 - Water Rights
 - Augmentation Plans

<http://cwcb.state.co.us>



COLORADO
Colorado Water
Conservation Board
Department of Natural Resources

5 Things Colorado's Water Plan Will Do

1. Foster collaborative solutions to responsibly address the looming gap between supply and demand (effect of this is to fortify Prior Appropriation Doctrine, not undermine it)
2. Identify and test cost-effective alternatives to the permanent “buy & dry” of irrigated lands
3. Affirm that Colorado will protect its compact entitlements, act affirmatively to avoid compact curtailments where possible, and demonstrate effective state-based policy to prevent federal erosion of state water authority
4. Push federal regulatory processes to move “quicker” by front-loading state activity
5. Align state policies and dollars to support Colorado's water values and policy objectives

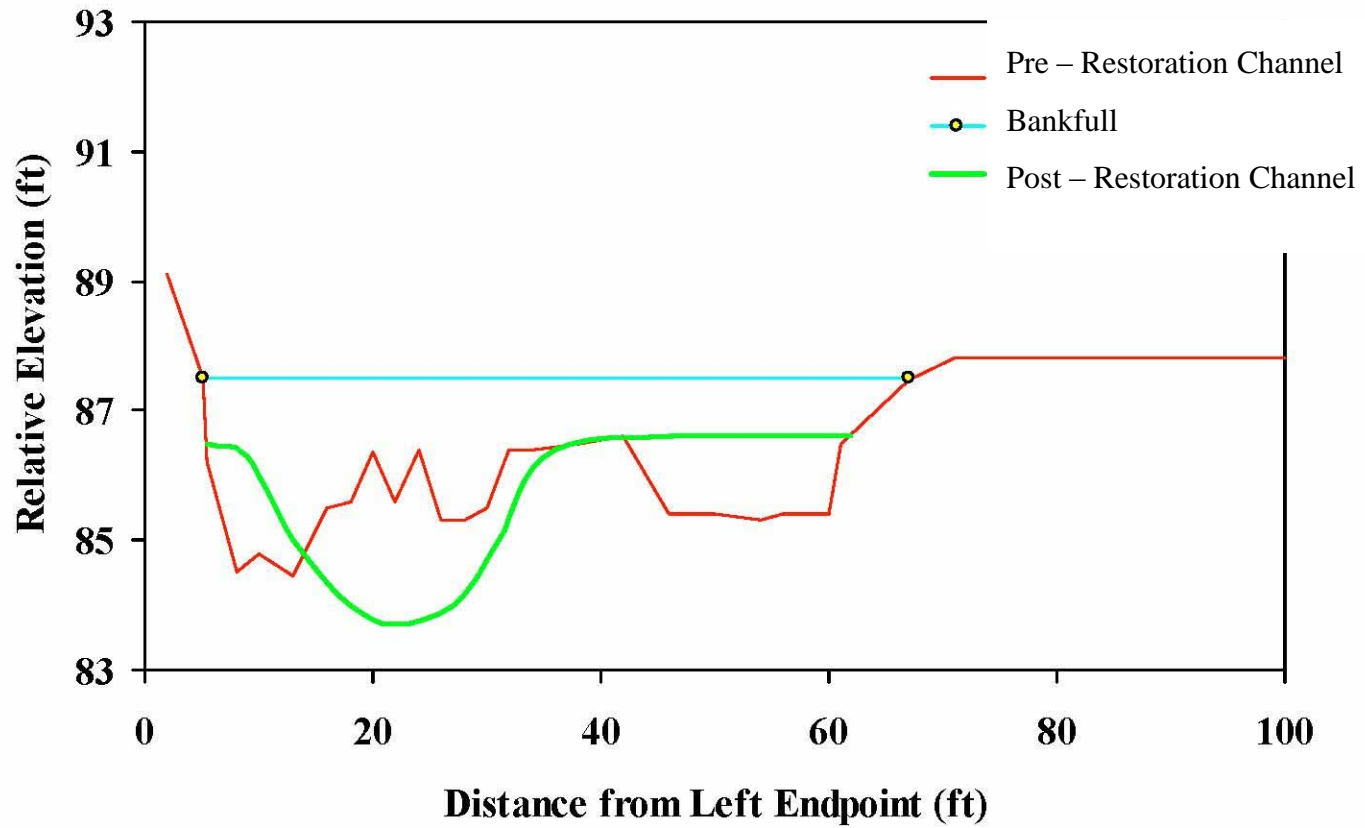
Why Do We Need a Water Plan?

1. Gap between supply and demand: Declining or flat-lining water supplies and population growth
2. Unacceptable pace of agricultural dry up
3. Environmental stress and recreational opportunities
4. Inefficient and ineffective regulatory processes
5. Fiscal challenges of our water infrastructure systems

CWCB Watershed Protection Program



Channel Cross Section



Hartland Diversion Dam Reconstruction



Swan River Restoration Site



Examples of Colorado Flood Events

- 10's – Cherry Creek in Denver (\$161 million, 2 deaths)
- 20's – Arkansas River at Pueblo (\$1.02 billion, 78 deaths)
- 30's – Monument Creek (\$69 million, 18 deaths)
- 50's – Purgatoire River at Trinidad (\$48 million, 2 deaths)
- 60's – South Platte River in Denver (\$2.95 billion, 8 deaths)
- 70's – Big Thompson Canyon (\$114 million, 144 deaths)
- 80's – Heavy Snowmelt Runoff 1984 (\$63 million, 2 deaths)
- 90's – Fort Collins, Sterling, Lower Arkansas River (\$518 million, 6 deaths)
- **00's – No major disasters, but damages occurred**

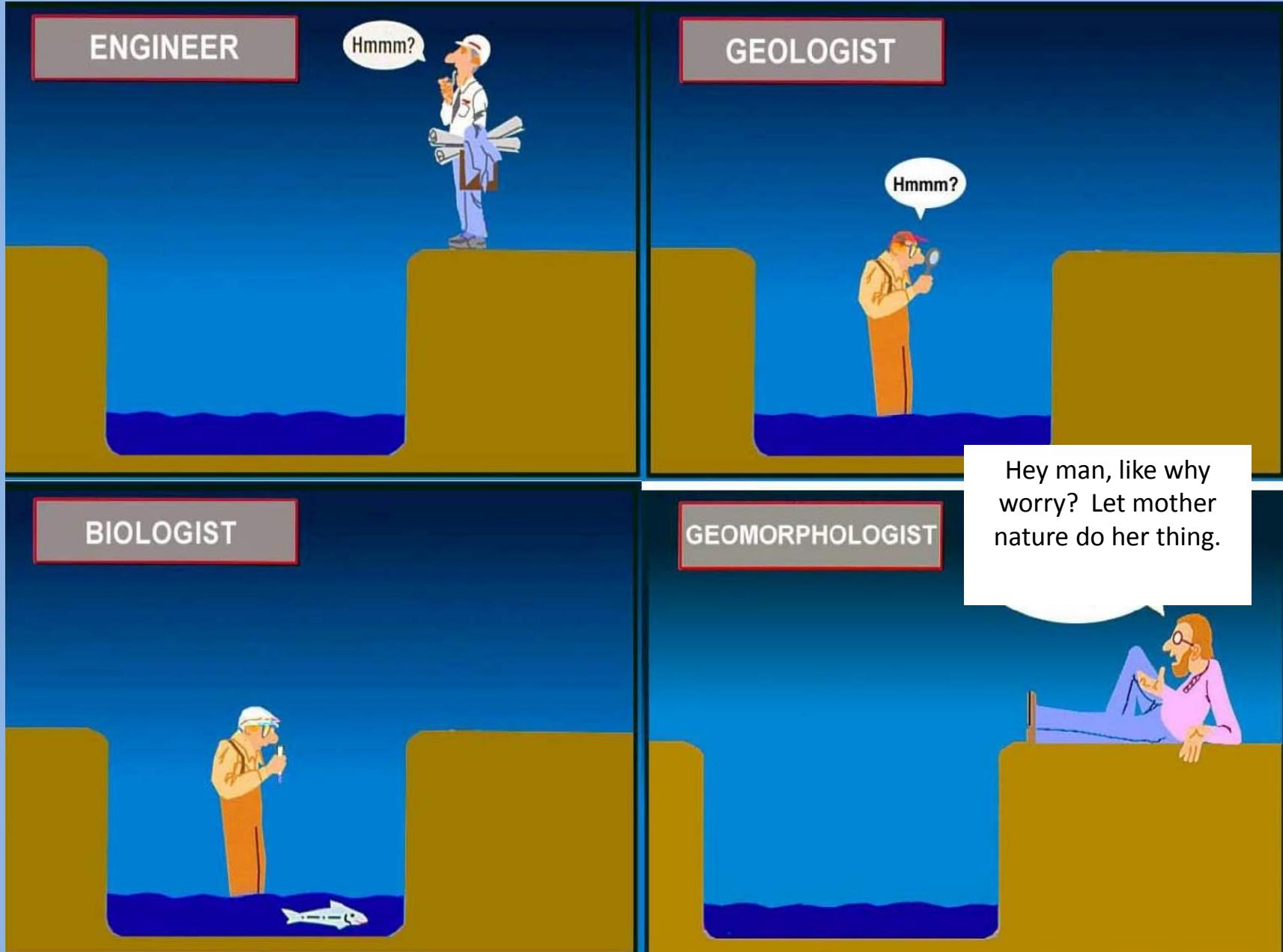
All values are in 2010 dollars

Since 1900, the AVERAGE annual flood losses in Colorado is over \$57 million. Nearly 400 lives have been lost.



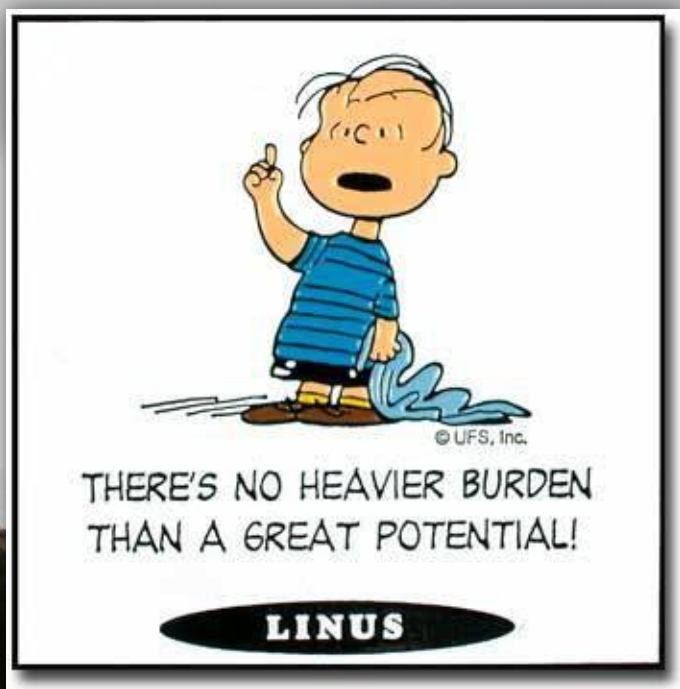
Who is responsible for R'ing the stream?

Different Views of the River - CWCB Flood Recovery Team



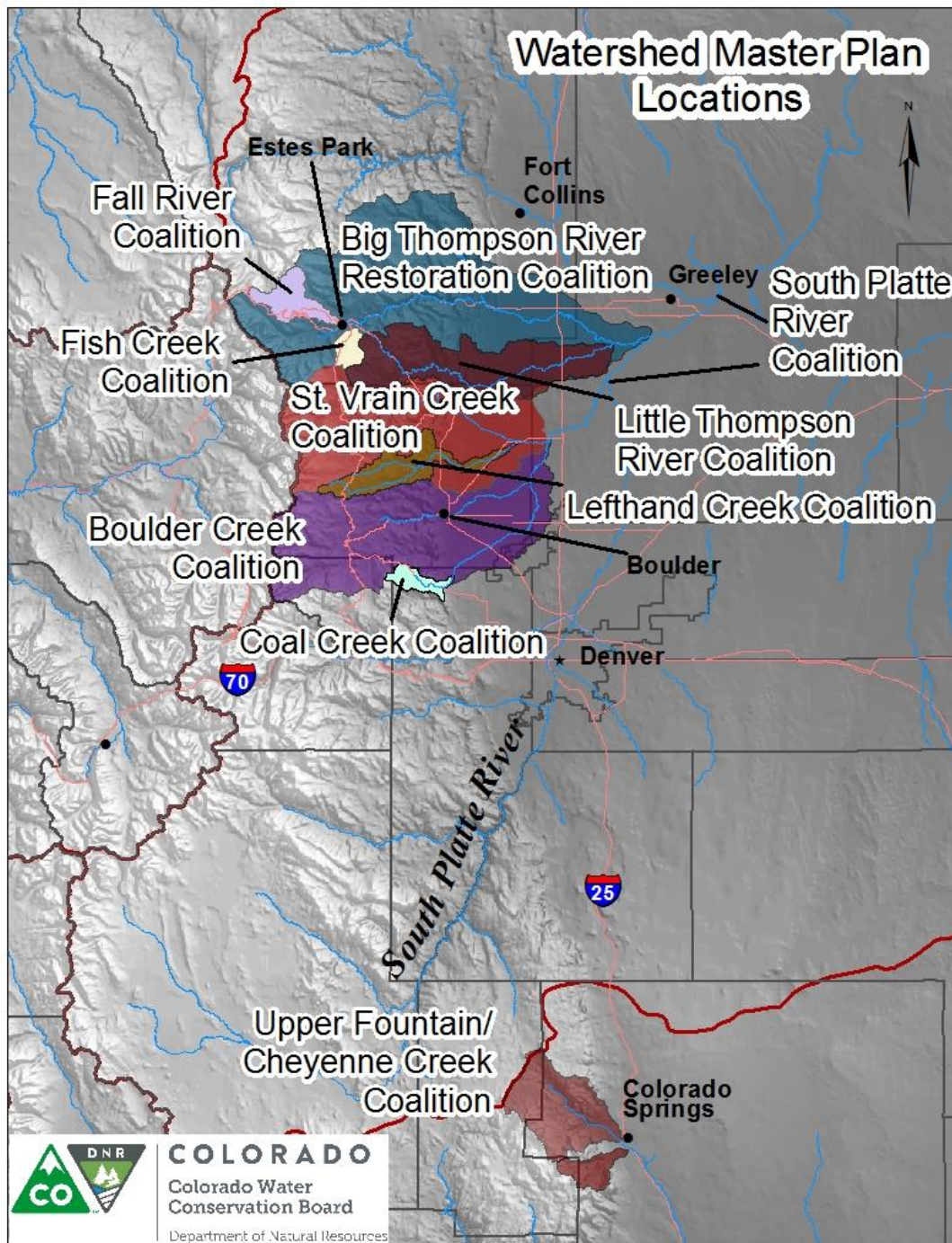
CWCB Flood Recovery Team

- **Local Stream Coalition Development and Coordination**
- **Watershed and Stream Master Planning**
- **Technical Support for exigent stabilization projects**
- **Develop Strategy for Multi-Objective Diversion Design/Construction**
- **Technical Support - Stream Restoration Design/Implementation**



Watershed Coalitions

- Estes Valley Watershed Coalition
- Big Thompson River Restoration Coalition
 - Little Thompson Watershed Restoration Coalition
 - St. Vrain Creek Coalition
- Fourmile Watershed Coalition
- Left Hand Watershed Oversight Group
 - Coal Creek Canyon Watershed Partnership
- Middle South Platte River Alliance
- El Paso County Regional Watershed Collaborative



Watershed Coalitions

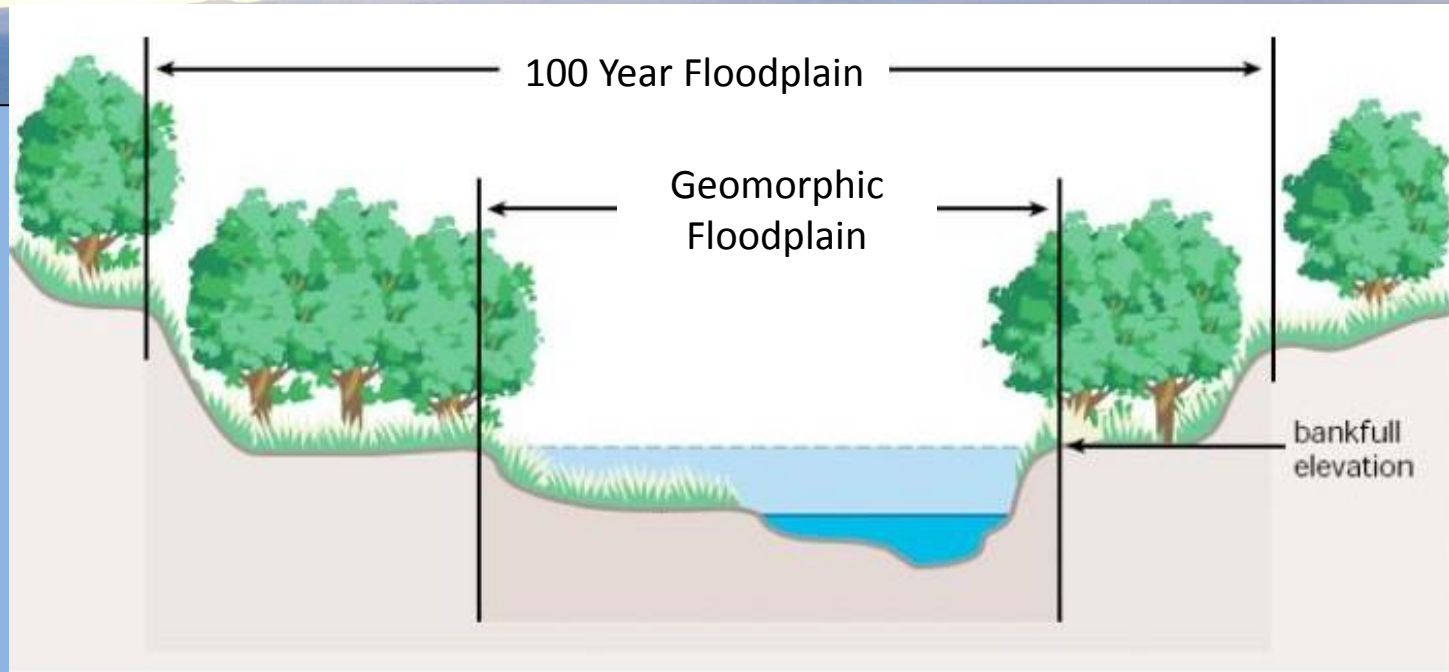


Post-Flood Watershed Master Planning

Delineation of 100 year, bankfull, and low flow channel/floodplain

Conceptual channel design

Project prioritization and cost estimates



Elements to include:

Channel Stabilization

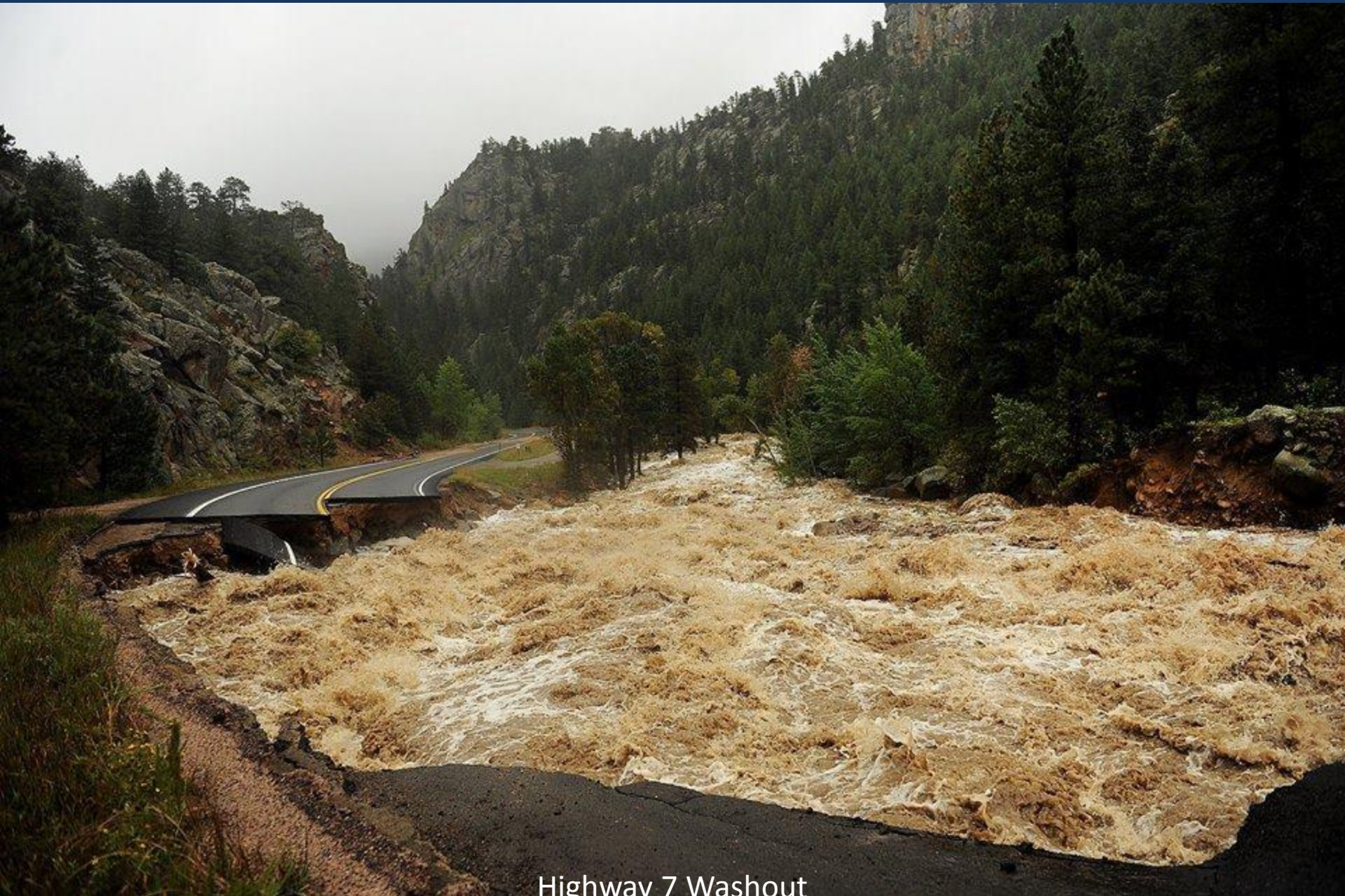
Channel Location

Flood Control

Floodplain Preservation/Restoration

Aquatic and Terrestrial Habitat Restoration

Water Supply Diversion Reconstruction with Multi-Objective Function



Highway 7 Washout
Photo by Estes Park News



Lyons Flooding
Photo by, Blanca Blanco



Highway Washouts in Estes Park
Photo from Twitter by @KDVR

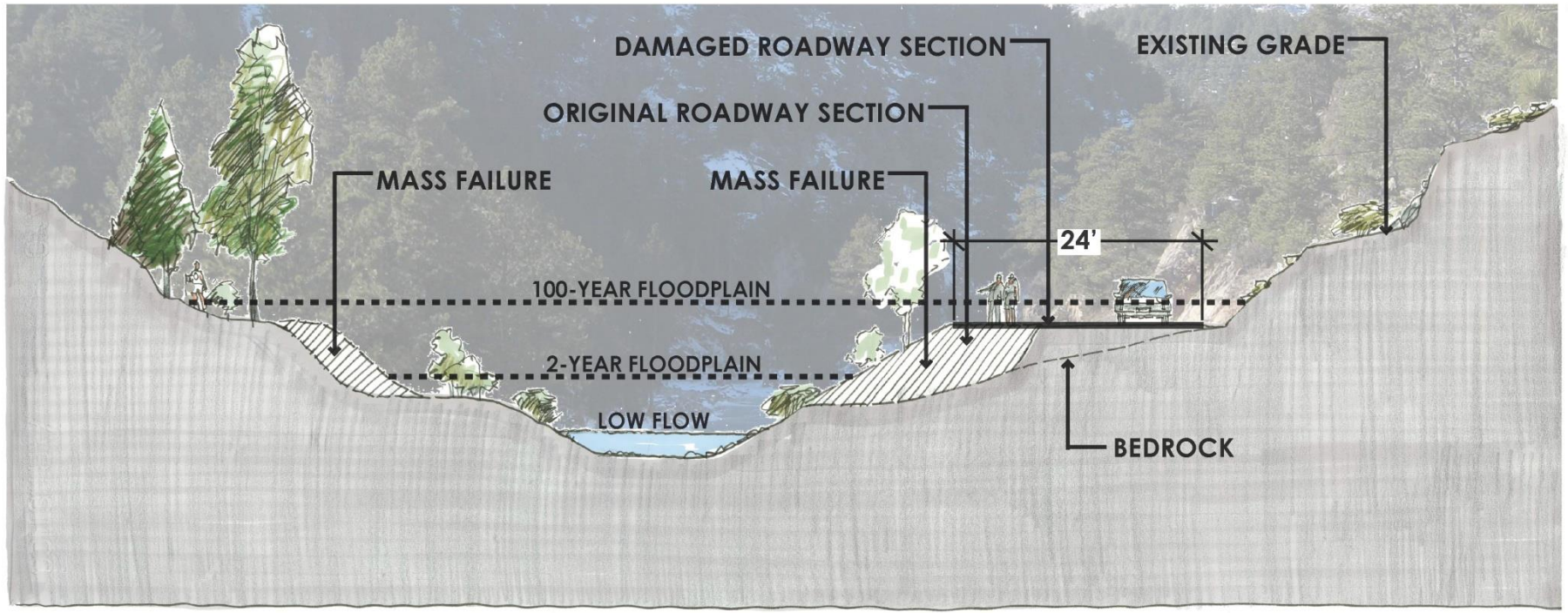


Moving road on to bedrock



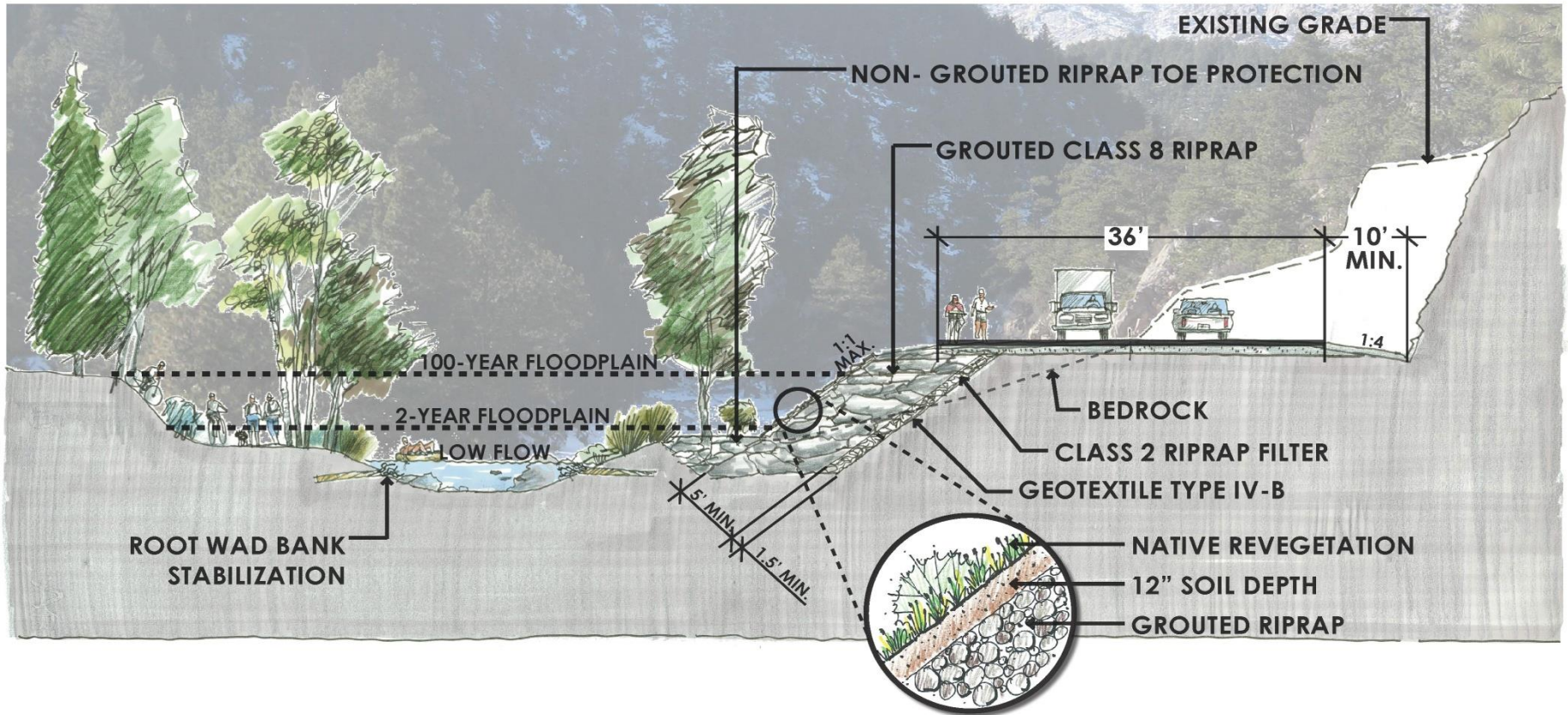
CASE STUDY: CDOT River Restoration

ORIGINAL & DAMAGED TYPICAL SECTION



CDOT River Restoration

PROPOSED REPAIR TYPICAL SECTION





Working the River and Road Together HWY 36

- Moved road over
- Moved river back
- Room for river to spread out
- Reinforced banks
- Root wads



Working the River and
Road Together – Post
Construction
May 2015



**Probable Cost of Stand Alone
River Project - \$1,300,000**

Actual Cost - \$192,000

10,755 Linear Feet of Restoration
on two rivers: North St. Vrain and
Little Thompson



CWCB Flood Recovery Team



Compound Channel



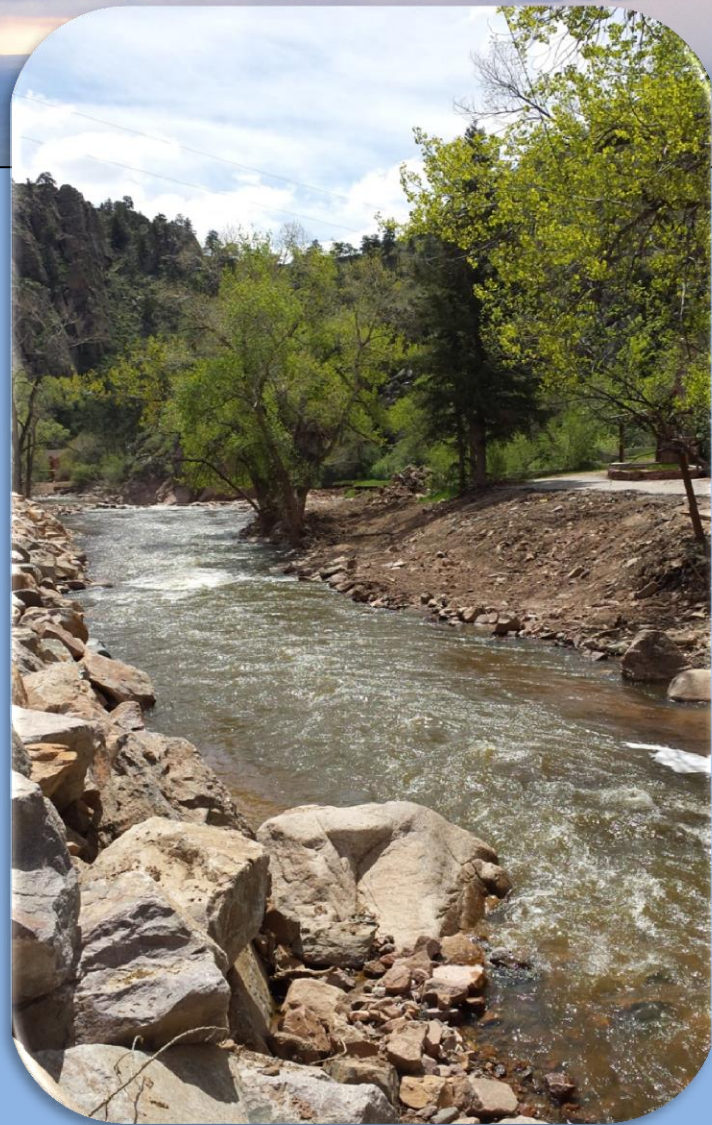
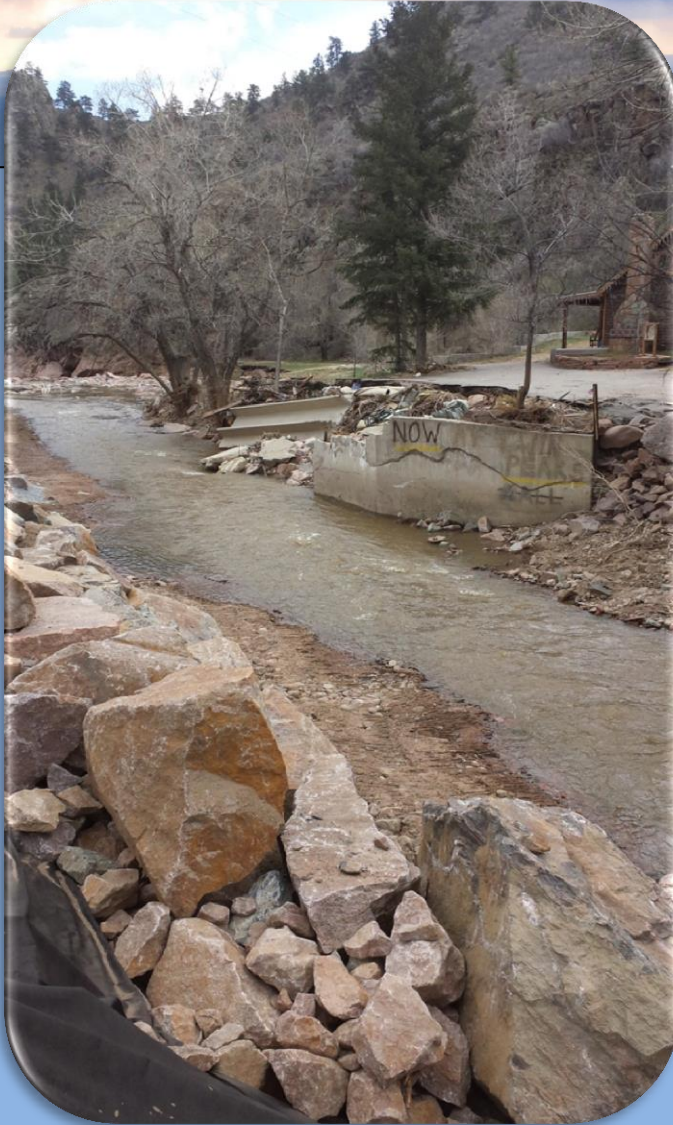
Typical Cross Section





Protecting the stream and the road

BEFORE **AFTER**





Reshaping the Channel

BEFORE





Connecting the Channel with the Floodplain

AFTER



Coming Soon – HWY 34!

Floodplain at work



➤ **Technical Support
for exigent
stabilization projects**



CDOT & CWCB Partnership

- Started meeting in November 2013.
- Recognized an unmet need for design hydrology for the permanent repair projects.
- Identified seven Flood Affected Watersheds that are critical to CDOT's re-construction efforts.
- Watersheds
 - Big Thompson River
 - Little Thompson River
 - St. Vrain Creek
 - Lefthand Creek
 - Boulder Creek
 - Coal Creek
 - South Platte River

Key Messages

- CWCB/CDOT Partnership
- What kind of event did we experience in September 2013?
 - Collected numerous Peak Flow Estimates from the event
 - Comparing these flow estimates to the revised Hydrology
- The flood served as a catalyst for large scale updates
- Updated and consistent Hydrology is already helping local communities
- Higher level of risk than the existing Flood Insurance Studies indicate
- Resiliency through improved floodplain maps and better information for the Local Communities to use

Scope of the Hydrologic Evaluations



1. Estimate peak discharges from September 2013 flood and compare to current regulatory discharges.
2. Prepare rainfall-runoff model and calibrate to 2013 event.
3. Update flood frequency analyses.
4. Use rainfall-runoff model to estimate predictive peak discharges based on NOAA/NRCS design storms.

CWCB Flood Recovery Team

Technical Support – Stream Restoration

Design/Implementation



CWCB Flood Recovery Team

➤ Technical Support - Stream Restoration Design/Implementation



CWCB Flood Recovery Team

➤ Technical Support - Stream Restoration Design/Implementation



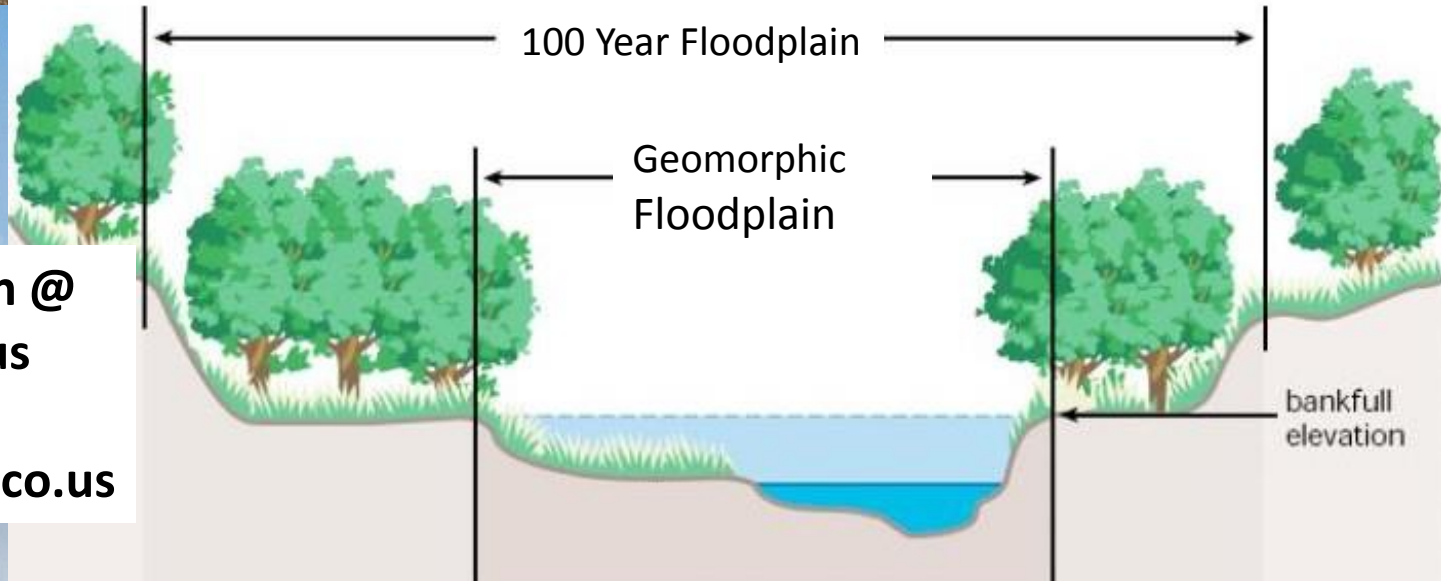
CWCB Flood Recovery Team



CWCB Flood Recovery Team







More Information @
cwcb.state.co.us
or email
chris.sturm@state.co.us