The Gunnison River and Riparian Habitat Rehabilitation Project
Local Partnerships at Work

Dan Brauch – CPW Aquatic Biologist
Steve Westbay – City of Gunnison
Background
VanTuyl Ranch & Gunnison River State Wildlife Area
A Project 25 Years in the Making

- Property purchased 1993 by the Trust for Public Lands
- Titles conveyed to Bureau of Reclamation (BOR) & the City
- State Wildlife Area deed transfer from BOR to CPW in 1994
- City took over ranch operations in 2008 after lifetime resident Ray VanTuyl passed away

- Ranch Annexed in 2011
  - Regulated by an Adaptive Resource Management Plan
  - Alluvial Aquifer Recharge – City domestic water source
  - Watershed Protection – Septic system proliferation
  - Prescribed Agricultural Operations & community garden
  - Public Open Space – 5K trail system
  - Flood Control
  - Habitat Protection

Legend
- Agricultural Operations
- City of Gunnison Snow Storage
- Habitat Protection
- Public Facilities
- CPW, Gunnison State Wildlife Area
- VanTuyl Ranch Management Plan
- Preferred Trails Alignment
- Multiple Use - High or Crushed Pine Surface
- Limited Use - Crushed Pine Surface
- Natural Surface
- Ranch Access Points
- 0 300 600 1,200 1,800 2,400 Feet

City Snow Storage
Library Site
Habitat Protection
Agriculture Operations
Rehabilitation Project - It Starts with an IDEA in 2001

- *Fluvial Morphology & River Restoration Assessment*, 2001
- Partners: CWCB, Trout Unlimited, UGRWCD, CPW, City, 2012
- Championing the Cause: CPW & City, 2012
- Funding: 2014 CWCB Grant ($440K); Private Donations ($150K)
- Design Programming 2014 through 2017
- Scope Modification 2016 – Project Cost Overruns
- Permitting: ACOE 404; Fish & Wildlife Service 2017
- Project Bid Award September 2017 & Construction through May 2018

Cosmology for beginners

1. The expanding universe
2. Galaxies, solar systems etc
3. Whatever the universe is expanding into

Hey boss, are you sure you got the directions right?
PROJECT GOALS

• Improve diversions- H2O rights due diligence
• Reconnect floodplains
• Improve channel habitat
• Increase trout biomass
• Improve trout size
• Improve riparian habitat
• Improve public river access
Permitting Overview

- Gunnison Sage-grouse Listing Decision November 12, 2014 - US Fish and Wildlife Service
- ACOE Nationwide Permit 33: Temporary Access Construction and Dewatering – agricultural diversions
- ACOE Regional General Permit 12: Aquatic Habitat Improvement for Stream Channels in Colorado
- Endangered Species Act, Section 7 Consultation, ACOE/FWS
  - Cultural Resource Inventory
  - Wetland Inventory
  - ESA Gunnison Sage-grouse Critical Habitat Biological Assessment
  - Special Conditions for season of operations, equipment access, et AL
- Coordination & Approvals from the Bureau of Reclamation
- County Flood Hazard Application
Project engineering and design was done by the CPW’s engineering staff. These in kind design services, along with permit administration by local agencies added significant project value.
Design Improvements on 7 Channel Segments along a 3.75 mile reach

- Abate historic channelization where practical
- Improve riparian function w/ vegetation treatment
- Reestablish morphological function
- Reconnect floodplains where possible
- Use native vegetation: willow transplants; sod mat
- Improve low profile channel features
- Emphasize low profile channel features

KEY DESIGN CONSIDERATIONS
Hydraulic modeling indicated that the initial designs of one channel feature would cause flood elevation rise & final design alterations were made to ensure no-rise would occur.

Elevation grade change between the head gates and diversion points were critical functions of the final design to ensure adequate water delivery and sediment control.
Frozen soil conditions experienced in early January 2018 finally chased the crew off for the season. Construction began again the past week – estimated completion date May 2018.

A $100,000 grant from the LOR Foundation allowed for constructing a new headworks on the Piloni Ditch & the construction of additional fish habitat structures in all reaches of the river project area.
Piloni Ditch – March 27, 2018
Ongoing Construction

what's wrong with this picture?
Typical Fish Habit Channel Features
CONSTRUCTION NOTES:

1. STRUCTURE SHALL BE FIELD LOCATED BY CPW PROJECT MANAGER OR DESIGNATED REPRESENTATIVE.

2. SURFACE BOULDERS ARE THE TOP COURSE OF BOULDERS. SURFACE BOULDERS SHALL VARY IN DEPTH BETWEEN 1/3 BANK FULL DEPTH AND 2/3 BANK FULL DEPTH.

3. FOOTING BOULDERS ARE PLACED TO PROVIDE A FOUNDATION FOR THE SURFACE BOULDERS. TYPICALLY FASTER BOULDERS SHALL BE BURIED IN THE CHANNEL BOTTOM AND NOT EVIDENT WHEN THE STRUCTURE IS COMPLETED. ALL SURFACE BOULDERS SHALL REQUIRE FOOTERS AND SHALL BE OMITTED ONLY AT THE DISCRETION OF THE PROJECT MANAGER OR DESIGNATED REPRESENTATIVE.

4. BOULDERS SHALL BE PLACED AT AN IRREGULAR SPACING.

5. BOULDERS SHALL BE PLACED APPROXIMATELY 2-4 x BOULDER DIAMETER APART.

6. CONTRACTOR SHALL USE AN EXCAVATOR OF SUITABLE CAPACITY WITH HYDRAULIC THUMB TO CONSTRUCT THE STRUCTURE.

7. CONTRACTOR SHALL ANTICIPATE THAT HANDLING OF INDIVIDUAL BOULDERS, ESPECIALLY BOULDERS AFTER INITIAL PLACEMENT WILL BE NEEDED. CONTRACTOR SHALL ACCOUNT FOR REQUIRED SLEEPER, CHOCKS, ELEVATIONS, AND POSITION.

8. REFER TO PROJECT TECHNICAL SPECIFICATIONS FOR ROCK AND OTHER REQUIREMENTS FOR INSTALLING STRUCTURE.
Fishery habitat improvements include construction boulder gardens and boulder clusters on all project area river reaches.
Low Profile Boulders Clusters at Work
Channelization Challenges
Establishing Thalweg & Sinuosity
Thalweg & Sinuosity- Boulder Gardens in lieu of point bars
Wilson Diversion Pre-Construction Conditions
Low Profile Cross Vanes

**Backfill Retention Fabric Notes:**
1. The purpose of the backfill retention fabric is to inhibit the passage of backfill material (i.e., channel bed material) through or under the structure.
2. Fabric shall be used on the vane of all structures and shall be utilized only at the discretion of CPW project manager or designated representative on a structure-by-structure basis.
3. Fabric manufacturer's roll width shall go from surface boulder along face of boulder and boulder face shall not be cut.
4. Fabric shall start $3$ down surface boulder face. Fabric shall not be visible after backfill.

**Construction Notes:**
1. Structure shall be field located by CPW project manager or designated representative.
2. Surface boulders are the top course of boulders. All surface boulders can be seen protruding from the water surface only during low flows.
3. Footing boulders are placed to provide a foundation for the surface boulders. Typical footing boulder shall be buried in the channel bottom and not seen when the structure is completed. All surface boulders shall be topped only at the discretion of CPW project manager or designated representative on a structure-by-structure basis.
4. The surface of the cross vane shall be finished to a smooth and compact surface in accordance with the lines, grades and cross-sections on elevations shown on the drawings. The elevation of finish for insert elevations shall be within $1/4$ inch of the grade and elevations indicated provided any height does not exceed $1$ inch. All ovals and/or vases along the vane shall be gradual and not abrupt. Mitered boulders shall be $1/4$ inches below the head rock elevation.
5. Contractor shall use an excavator of suitable capacity with hydraulic thumbs to construct the structure.
6. Contractor shall anticipate handling of individual rock (especially boulders) after initial placement may be required to achieve required slopes, grades, elevations, and positions.
7. Refer to project technical specifications for rock and other requirements for installing structures.
Wood Toe and Sod Mat Details
Local contactor Spallone Construction was awarded the Bid in August 2017. CSI Concrete was a subcontractor for the project.

Work on the Wilson diversion began in late October 2017. Favorable weather conditions allowed for completion of all rock structures & concrete work. The majority of vegetation work was also complete during the warm fall season.
Bank stabilization, willow transplanting & other work will improve riparian habitat. Reconnection of the floodplain, where appropriate, was also a project goal.
Floodplain Connection
Terrace & Floodplain Riparian Habitat Treatment
**J-Hook Design Details**

**CONSTRUCTION NOTES:**

1. **Structure shall be field located by CPW Project Manager or designated representative.**

2. **Footing boulders are placed to provide a foundation for the surface boulders.** Typically, footing boulders shall be placed in the channel bottom and not seen when the structure is completed. All surface boulders shall be stacked and shall be limited only at the discretion of CPW Project Manager or designated representative, on a structure by structure basis.

3. **The surface of the J-Hook shall be finished to a smooth and compact surface in accordance with the lines, grades and elevations established by CPW Project Manager or designated representative on a structure by structure basis.** The finished surface shall be a 2-4 inch roughness below the head pool elevation.

4. **Surface boulders are the top course of boulders.** All surface boulders can be seen protruding from the water surface only during extremely low flows.

5. **Top of the bank shall have water flowing over the entire length of the bank at low flows.**

6. **Contractor shall use an excavator of suitable capacity with hydraulic derrick to construct the structure.**

7. **Contractor shall anticipate that handling of individual rock (especially boulders) after initial placement will be required to achieve required slopes, grades, elevations, and position.**

8. **Refer to project technical specifications for tree, willow planting and landscaping, rock, and other requirements for installing structures.**
While equipment was staged at the Wilson Diversion, work to stabilize the Ohio Creek/Gunnison confluence was accomplished.

A J-Hook structure and boulder cluster habitat features were constructed at the confluence.
Observations – Lessons Learned

- Develop partnerships & allies - focus on possible stakeholders
- Be a champion of Great Projects
- Good ideas take time – do not lose focus
- Be a steward of natural resources – it is what sustainability requires

'A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.'
Aldo Leopold
MESA COUNTY
FEMA GRANTS

A how to, or not to, get through the HMGP Grant process

Lessons learned the hard way
**TIMELINE BOSLEY WASH**

- **August 2014 - MC**
  - Applied for HMGF Grant Bosley Wash and Orchard Mesa Detention Basin (Veterans Memorial Park)

- **September 2013**
  - Catastrophic flooding in Colorado State of Emergency Federal Assistance

- **So sorry- your projects suck and your denied letter October 2015**

- **September 2015**
  - Review historical and environmental – RFI before grant would be approved.

- **Summer 2015**
  - Bosley Wash RFI - questions and answers

- **December 2015**
  - Bosley Wash
  - Just Kidding- We decided your application was accepted

- **Hiring consultant phase January, February, March, April.... May... Approved and have an agreement in April, 2016**

- **Meeting with Stakeholders**

- **Final #1**
  - February 2017

- **Final #2**
  - Division of Water Resources
  - Revised, final January 2018 - Denied

- **Approved FHWA permit through CDOT, told they don’t issue many of these - February 2018**

- **Just kidding- Final-FINAL, Resubmittal, Resubmittal March 5, 2018**

- **Preliminary Approval From Dam Safety March 20, 2018**

- **Close out paperwork - needs to be completed before March 2019**

- **2016-2017 BLM - ACEC - Visual Resource Right-of-way exclusion area.**

- **Execution Grant January 2016**

- **Thought we had Shovel ready 90% plans.... June 2016**

- **Final #2 Division of Water resources review Submittal September 2017 - Back to the drawing board**

- **Extension for grant applied October 2017- knowing we won’t meet the March 2018 deadline..... Extended to March 2019**

- **Approved FHWA permit through CDOT, told they don’t issue many of these - February 2018**

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TIMES UP
# BOSLEY WASH

## Budget:

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<th>Project Category</th>
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<th>State (12.5%)</th>
<th>Local (12.5%)</th>
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BOSLEY WASH

- Stats:
  - High hazard Dam 10.5 feet
  - Embankment Height 17.5 feet
  - Maximum capacity is 190.14 acre-feet
  - Normal reservoir capacity 62.80 Acre-feet
  - Surface area is 15.75 Acres
  - Maximum discharge capacity is 2,839 cfs
  - Land Swap completed – Mesa County owned property
WOES OF BOSLEY

- Clearance for Historical and environmental before project would be granted
- USACE Permit
- Utilities - High pressure water line
- Agreement with CDOT - FHWA
- Construction cost estimate: $2,870,000 after multiple revisions
  - Original engineers estimate: total project: $2,791,778.00
  - Original engineers estimate for construction: $2,346,030.00
- BLM-
  - Area of Critical environmental Concern ACEC
  - Viewing area from Mt. Garfield
September 2013 Catastrophic flooding in Colorado State of Emergency Federal Assistance

July 2014 - MC Applied for HMGP Grant Bosley Wash and Orchard Mesa Detention Basin (Veterans Memorial Park)

So sorry - your denied letter October 2014

May 2016 - Just Kidding - We decided your application was accepted

Winter 2016 - Orchard Mesa RFI - questions and answers

Executed Grant August 2016

Final Plans August 2017

Construction Start October 2018

Wetlands plantings April 2018

Commissioner approval... FINALLY Design Start Date September 2016

Close out paperwork and waiting for reimbursements Summer 2018

Targeted Completed Construction June 2018

Summer 2018
### Budget:

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<th>Project Category</th>
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ORCHARD MESA

Stats:
- Not a high hazard dam
- Reconstruction of wetlands
- Moving a irrigation pond used at the fairground to a different location
- Worked with the BOR and irrigation company
- Construction estimate at time of grant v.s. actual engineers estimates
- Change order
- Future construction and long term use of the facility. Pre-planning
- USACE Permit
- Multi use facility
TIME-LAPSE PHOTOS
TIME-LAPSE PHOTOS
TIME-LAPSE PHOTOS
TIME-LAPSE PHOTOS
TIME-LAPSE PHOTOS
THE WOES

Top 10 list

- I wish I would have known then what I know now
- Checklist for expenses and submittals for reimbursements
- DHSEM Site visits
- Grant Monitoring
- Design changes and budget for the project. Significant changes. CHANGE ORDERS
- Stakeholders… BLM, Ute Water, BOR, CDOT, Federal Highways….
- No Force Account for Construction but a contingency account
- Affirmative action steps
- Cost reasonableness for contractors
- Paperwork, paperwork and paperwork
  - Schedule of fees
  - Procurement policies
  - Mileage reimbursement
  - Cost reasonableness
  - Historical contract reasonableness
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NOW WHAT

- Continue to wait for the Dam safety to approve Bosley Wash
- Just approved April 2, 2018
- Finish up the Fairgrounds Detention Basin construction
- Apply for another Grant…….

WAIT- WHAT???
“Well, now we know what not to do.”

Questions?
The Aspen Water Equation: Balancing Environmental Health and Community Water Needs

Margaret Medellin, PE – Utilities Portfolio Manager, City of Aspen
April Long, PE – Clean River Program Manager, City of Aspen
PIPE DREAM
One Couple's Ideal Job: Moving Water Under Mountains

Photographs by:
Brent Gardner Smith
Photographs by:
Brent Gardner Smith
RECOGNIZING TRADE OFFS

Allocation of water to one use often comes at a cost to another use.

Snowmelt and rainfall in the mountains above Aspen provide water for human uses and in support of river health.

Patterns of water use are dictated by water rights administration, local policy, and community values and preferences.

Water flowing through many local streams and rivers is allocated in such a way that makes it difficult to provide the entire supply needed to meet all uses, particularly during times of drought. Use of water to meet one need, often results in less water available to meet some other need.

Local Food Production

Ecological Integrity

Parks and Amenities

Drinking Water
FIGURE 2 - DRAFT
CLIMATE SCENARIOS
Maroon Creek Streamflow (USGS Gage 09075700)

- Non-Irrigation Season
- Historical Hydrology
- CMIP3 Run 53 (Warm/Slightly Dry)
- CMIP3 Run 51 (Warm/Slightly Wet)
- CMIP3 Run 4 (Very Hot/Very Dry)
- CMIP3 Run 13 (Warm/Wet)
- CMIP3 Run 12 (Warm/Very Wet)
Proposed Castle Creek Reservoir

Proposed Maroon Creek Reservoir

Pyramid Peak

Maroon Bells

East Maroon Creek

Maroon Lake

Maroon Creek Rd.
“One of the great dreams of man must be to find some place between the extremes of nature and civilization where it is possible to live without regret” – Barry Lopez
Potential Solutions:

- Off-line storage
- In-situ reservoirs
- Conservation
- Reuse
- River Management Plan
- Alternative Transfer Mechanisms
- Cloud Seeding
Roaring Fork River Flows: July 25th, 2012

Description
This map depicts flows in different segments of the Roaring Fork River near Aspen, Colorado. The thickness of the blue line is proportional to the amount of water flowing in that segment of river. Observed stream flows are also indicated in the green callout boxes. Orange circles indicate diversion points on this section of river. Their size is proportional to the decreed diversion rate at these points. Several of the ditch names are indicated for reference.

Flows in the river increase below confluences with tributaries such as Castle Creek. Flows generally decrease at major diversion points. The yellow band proportionally represents the 32-cfs Instream Flow (ISF) right held by the Colorado Water Conservation Board.

Legend
- Streamflow
- ISF Right
- Decreed Diversion Rate (cfs)
  - 0 - 10
  - 10 - 18
  - 18 - 27
  - 27 - 42
  - 42 - 75
- Streams
- Ditches
- City Limits
- Federal Land
- Streets

Created By: Bill Hoblitzell
Created On: 8/1/2012
Data Sources: S.K. Mason Environmental, LLC; CDWR; USDA; NRCS; and Pitkin County.
The Equation:

Supply - Diversions - 

\[
(\text{weighted community value } + \\
\text{weighted community value } + \ldots) = \\
\text{Remaining flow}
\]

(environmental and recreational needs)
The health of our waters is the principle measure of how we live on the land.

- Luna Leopold

margaret.medellin@cityofaspen.com
april.long@cityofaspen.com
Revised Colorado Hydrology and Potential Floodplain Implications

March 6th, 2018
Agenda

• Project Summary and Approach

• Flood Frequency Analysis Approach

• Paleoflood Data Incorporation

• Results Discussion
Project Summary and Approach

Overall Project Goals

- Investigate Colorado River Watershed Hydrology
  - Compile existing documentation
  - Assess impacts of diversions and reservoirs
  - Compare results to effective hydrology
  - Provide report and data for use in subsequent studies
First Steps

Overall Project Goals
Flood Frequency Analysis Approach

Overall Analysis Objectives

Three objectives of this analysis:

1. Simplify analysis by assuming observed records are independent and are one possible scenario in one given year.

2. Evaluate whether all or parts of the basin are inherently different pre-reservoir vs. post-reservoir to a point where the influence is lost due to increasing flows.

3. Develop new flows at current and potential future FIS flow change locations.
Flood Frequency Analysis Approach

Impact of Reservoirs

- Determined Gage Length of Record vs. Reservoir Completion Date
Flood Frequency Analysis Approach

Impact of Reservoirs

• Meeting with Alan Martellaro, Division Engineer
  – Colorado Division of Water Resources District 5
    • Discussed reservoir impacts on large events
    • Non-independent annual flows (e.g. 2016 can depend on 2015)
    • Non-independent diversions (e.g. diversions depend on eastern slope levels)
    • No reservoirs dedicated to flood control within basin
    • Lake Granby outlet capped at 75 cfs unless spillway active
Flood Frequency Analysis Approach

Impact of Reservoirs

• Reservoir Impacts on FFA
  – Many low outliers due to regulation of medium and low flows
    • Same problem as PILFs
Flood Frequency Analysis Approach

FFA Methodology

• Basin is inherently different pre-reservoir vs post-reservoir

  – Focus on post-reservoir conditions at gages within reservoir influence
    • Have the data (+/- 50 years)
    • Matches future conditions

  – Use a statistical approach to simplify a stochastic problem
    • Any condition which has occurred could happen again

  – Rely on 17C MGB test to filter outliers
    • Adjust if needed to ensure expected curve matches data

  – Use gages with most reliable/defensible data

  – Simplify as much as possible
Flood Frequency Analysis Approach

Reservoir Influence

• Cumulative flow plots to track changes post-reservoir
• Granby:

![Cumulative Peak Flow vs Year Graph](image-url)
Flood Frequency Analysis Approach

Reservoir Influence

• Cumulative flow plots to track changes post-reservoir
• Hot Sulphur Springs:
Flood Frequency Analysis Approach

Reservoir Influence

- Cumulative flow plots to track changes post-reservoir
- Glenwood:

![Cumulative Peak Flow Plot](chart.png)

Legend:
- Pre 1968
- Post 1968, with Roaring Fork
- Post 1968, No Roaring Fork
Flood Frequency Analysis Approach

Reservoir Influence

- Cumulative flow plots to track changes post-reservoir
- Cameo:
Flood Frequency Analysis Approach

Reservoir Influence

• Cumulative flow plots to track changes post-reservoir
• Cameo:

![Annual Peak Flow vs. Time](image-url)
Flood Frequency Analysis Approach

Case Study

- Glenwood US vs DS of Roaring Fork

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<th>Percent Chance Exceedance</th>
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<th>Percent Chance Exceedance</th>
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500-year predicted peak: 39,359 cfs  
100-year predicted peak: 34,148 cfs

Downstream includes substantial tributary area from the Roaring Fork...
Case Study

- Glenwood US vs DS of Roaring Fork

<table>
<thead>
<tr>
<th>Percent Chance Exceedance</th>
<th>Computed Curve Flow in cfs</th>
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Pre-Reservoir Gage stopped recording in 1966
Paleoflood Data

- Dr. Bob Jarrett performed paleoflood study in the upper part of the Colorado Basin
  - Non-Inundation Surface (NIS) and Maximum Paleoflood (Qmax) determined by paleoflood study confirmed gage results
  - Unable to perform detailed analysis in middle part of basin due to safety concerns and human development destroying paleoflood evidence
Results

- Focusing on good quality gages like Cameo helps produce quality results.
## Results

<table>
<thead>
<tr>
<th>Gage</th>
<th>Gage Number</th>
<th>Data Set</th>
<th>Drainage Are (mi²)</th>
<th>FIS Analysis</th>
<th>Bulletin 17B Analysis</th>
<th>Bulletin 17C Analysis</th>
<th>Percent Difference</th>
<th>Std. Skew</th>
<th>MSE</th>
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<tr>
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<td>901900</td>
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<tr>
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<td>LOT ** 1000 cfs</td>
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<td>532</td>
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<td>Combo</td>
<td>Combination (65)</td>
<td>825</td>
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<td>905800</td>
<td>Recent Flows</td>
<td>54</td>
<td>9,368</td>
<td>16,617</td>
<td>20,558</td>
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<tr>
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<td>FIS Flows</td>
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<td>9,368</td>
<td>16,617</td>
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<td>9,368</td>
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<td>46,743</td>
<td>50,874</td>
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<td>Entire Record</td>
<td>17</td>
<td>87,532</td>
<td>128,220</td>
<td>147,676</td>
<td>198,578</td>
<td>-54%</td>
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<td>17</td>
<td>87,532</td>
<td>128,220</td>
<td>147,676</td>
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<td>-54%</td>
<td>-17%</td>
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<td>FIS - Near Cisco, Utah</td>
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<td>FIS Flows</td>
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</table>

* Data from preliminary Garfield County FIS and may have changed after creation of this table.

** LOT - Low Outlier Threshold set to
## Results

<table>
<thead>
<tr>
<th>Gage</th>
<th>Gage Number</th>
<th>Data Set (# of Records)</th>
<th>Source</th>
<th>Drainage Area (mi²)</th>
<th>Bulletin 17C Analysis 10%</th>
<th>2%</th>
<th>1%</th>
<th>0.20%</th>
<th>Effective FIS 1%</th>
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<th>1% Change</th>
<th>0.2% Change</th>
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<td>WIR-99 (Kremmling)</td>
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<td>-38%</td>
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<td>Entire Record (83)</td>
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<td>38,800</td>
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<td>WIR-99 (Grand Valley)</td>
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<td>3%</td>
</tr>
</tbody>
</table>

* LOT - Low Outlier Threshold set to

Results

- Results are continuous, consistent and reasonable.
Specific Questions?

HEC-SSP
Version 2.1
July 12 2016

U.S. Army Corps of Engineers
Institute For Water Resources
Hydrologic Engineering Center
Davis, CA 95616
530-756-1104

www.hec.usace.army.mil
Navigating Water Quality Regulations in Colorado

Jane Clary, CPESC, LEED AP
Wright Water Engineers

CASFM Seminar
Glenwood Springs, Colorado
April 2018
Overview

• Clean Water Regulatory Process in Colorado
  – Roles
  – Process

• Relationships among water quality policies, regulations, programs

• 10-year Water Quality Road Map

• Permit-related flexibilities

• Case study
Colorado Water Quality Control

**Commission**

- 9-member citizen commission, appointed by Governor and confirmed by Senate
- Must have at least 2 members from west slope; otherwise must represent various interests in water quality
- 3-year terms; current administration added 2-term limit

**Division**

- ~190 staff across 2 programs – clean water and drinking water
- Commission establishes water quality requirements, and the division implements and enforces them
- Division staff are technical staff to the commission for rulemaking hearings
CDPHE Water Quality Control Division

- WQCD Division Director
- Clean Water Program
  - Permits Section
  - Compliance & Enforcement Units
    - Environmental Data Unit
  - Watershed Section
    - Restoration and Protection Unit
    - Standards Unit
- Safe Drinking Water Program
Colorado Water Quality Forum Work Groups

- Permit Issues
- 303(d) Listing Methodology Policy 10-1
- MS4 - Stormwater
- Nutrients
- Reclaimed Water
- Temperature
- Regulation 82 Workgroup
- Division-Led Workgroups

Work Groups  | Master Calendar  | Workgroup Signup Form  | Workgroup Rationale Form
-------------|-----------------|------------------------|-------------------------
Membership Meetings  | Annual Retreat  | Archives  | Links

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Regulatory Relationships

- Basic Standards (Reg. 31)
- Basin Standards
- 303(d) List (Reg. 93)
- Total Maximum Daily Loads (TMDL)

- Site-specific Standards & Discharger Specific Variance
- Policies & Listing Methodology
- General & Individual Discharge Permits
Rulemaking Process

- Notice approved and published
- Party Status Requests
- Proponent Prehearing Statement
- Responsive Prehearing Statement
- Rebuttals
- Prehearing Conference
- Rulemaking Hearing

Triennial Reviews

- Issues Scoping Hearing (Year 1: Oct)
- Issues Scoping Formulation Hearing (Year 2: Nov.)
- Rulemaking Hearing (Year 3: June)
Suggestions for Effective Rulemaking

Hearing Participation

• Provide an executive summary of the issue(s).
• Maps, photos, tables and graphs are helpful.
• Be concise and organized in writing—Commissioners are processing large volume of information from many parties.
• Take the time to increase the font on graphs and figures used in Powerpoints.
• Work with Division in advance to reach consensus and narrow the issues.
• Stay within the scope of the hearing.
• Include “actionable items”--not just complaints.
• Don’t be deceptive with data and statistics.
• Don’t be a no-show.
Where to Find Commission Regulations and Policies

WQCC regulations and policies, and water quality statutes

Back to Water Quality Control Commission

- Current WQCC regulations.
- Current WQCC policies.
- Colorado Water Quality Control Act.
- On-Site Wastewater Treatment System Act.
- Index of WQCC regulations and policies.
- Superseded WQCC regulations are available in Web Drawer.
WQCC policies

Back to WQCC regulations, policies and water quality statutes

- **Policy 10-1**: Aquatic Life Use Attainment (expires Dec. 31, 2020).
- **Policy 06-1**: Temperature Criteria Methodology (expires Jan. 31, 2023).
- **Policy 96-2**: Human Health-Based Water Quality Criteria and Standards (expires Dec. 31, 2021).
Division—Implementation of Regulations through Permits

Clean water permitting sectors

- Commerce and industry
  - For discharges from commercial and industrial activities - aquatic animal production, commercial washing outdoor structures, coal mining, metal mining, sand and gravel mining, non-extractive industrial, produced water, non-contact cooling water, subterranean dewatering or well development, and water treatment plant wastewater discharges.

- Construction
  - For discharges from construction activities - construction dewatering, ground water remediation, hydrostatic testing, and construction stormwater (erosion control).

- Municipal separate storm sewer systems (MSS)
  - For discharges from municipalities’ storm sewer systems.

- Sewage systems
  - For discharges from wastewater treatment plants/facilities - to surface water and to groundwater

- Biosolids
  - For use and application of biosolids.

- Pesticides
  - For discharges from application of pesticides.

- Reclaimed water
  - For reuse of treated domestic wastewater.

- Pretreatment
  - For nondomestic wastewater to be discharged to a wastewater system.

Water quality permitting policies

- CW1 Clean Water 1 Reasonable Potential
- CW2 Clean Water 2 Applicability of Nutrients Management Control Reg Dilution
- Exception for discharges to waters designated as Critical Habitat for Threatened and Endangered species.
- CW3 Clean Water 3 Permit Compliance Schedules.
- CW5 Discharge from Water-based fire suppression systems.
- Guidance for discharges associated with fire suppression systems.
- CW6 Practical Quantitation Limits.
- CW7 Reporting of surface water discharge associated with residential and landscape irrigation.
- WQP1 Permit Inactivation Policy Where a Discharge Remains.
- WQP2 Significant Digits in Permit Limitations.
- WQP4 401 Certification of 404 After the Fact Permit Application.
- WQP5 Permit Policy for Mining Activities.
- WQP8 Economic Reasonableness.
- WQP19 Policy for Characterizing Ambient Water Quality for use in Determining Water Quality Standards Based Limits.
- WQP20 Baseline Monitoring Frequency.
- WQP21 Guidelines for the Determination of Agronomic Rate for Application of Reclaimed Water Under Reg 84.
- WQP23 Procedures for Conducting Assessments for Implementation of Temperature Standards.
- WQP24 Implementing Narrative Standards in Discharge Permits for Protection of Irrigated Crops.
- WQP25 Monitoring and Reporting Requirements for Reclaimed Water Treatment Facilities.
- WQP26 Methodology for Determining Agronomic Rates for the Beneficial Use of Biosolids.
- WQP27 Low Risk discharge policy.
TMDL Process

### TMDL = $\Sigma WLA + \Sigma LA + MOS$

Where:
- **WLA** = the sum of wasteload allocations (point sources such as permitted wastewater and stormwater discharges)
- **LA** = the sum of load allocations (nonpoint sources and background)
- **MOS** = the margin of safety
## Impairment Decisions

### Category 1
- Attaining water quality standards for all classified uses.

### Category 2
- Attaining water quality standards for some classified uses.

### Category 3
- 3a - Lacking data to determine whether or not classified uses are being attained.
- 3b - Segment placed on the Monitoring and Evaluation List.

### Category 4
- 4 - Not supporting a standard for one or more classified uses, but a TMDL is not needed.
- 4a - TMDL has been completed.
- 4b - Plan for attainment of water quality standards.
- 4c - Impairment not caused by a pollutant.

### Category 5
- Not meeting applicable water quality standards for one or more classified uses by one or more pollutants (303(d) waterbodies). Includes:
- Category 5-alt. - Alternative restoration approaches.
Nutrients

- Adopted by the WQCC in 2012
  - Includes nitrogen, phosphorus, and chlorophyll a criteria for rivers/streams and lakes/reservoirs
  - Direct use water supply (DUWS) and swim beaches
- EPA’s 2016 action letter
- Phased implementation
  - Protect headwaters
  - Allow time for dischargers to optimize treatment/implement enhanced treatment technologies
  - Regulation #85, monitoring

Slide Source: Blake Beyea and Stephanie Baker, WQCD
10-Year Water Quality Roadmap

- **2018**: Roadmap begins
- **2019**: Draft cadmium and arsenic criteria
- **2020**: Draft lakes TN & TP criteria
- **2021**: Reg. #31 RMH clean-up, cadmium, arsenic, temperature standards revisions
- **2022**: Reg. #85: NPS controls, incentive efforts

**Outreach**

Slide Source: Blake Beyea and Stephanie Baker, WQCD
Nutrients Voluntary Incentive Program

- WQCC Policy 17-1 continues tech-based approach to initial nutrient reductions
- Allows facilities to make nutrient reductions in exchange for an extended compliance schedule (up to 10 years) for criteria adopted in 2027
- Creates certainty regarding the year the facility will need to meet water quality based effluent limits

<table>
<thead>
<tr>
<th></th>
<th>≥1</th>
<th>≤0.7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total phosphorus annual median (mg/L)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Months earned</strong></td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total inorganic nitrogen annual median (mg/L)</strong></td>
<td>≥15</td>
<td>≤7</td>
</tr>
<tr>
<td><strong>Months earned</strong></td>
<td>0</td>
<td>12</td>
</tr>
</tbody>
</table>

Slide Source: Blake Beyea and Stephanie Baker, WQCD
## Regulatory Tools for Addressing Difficulty in meeting the WQBEL

<table>
<thead>
<tr>
<th>Regulatory Tool</th>
<th>Situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compliance Schedule</td>
<td>More time is required to achieve the effluent limit</td>
</tr>
<tr>
<td>Grants and Loans</td>
<td>Provide grants and low interest financing to help public entities pay for improvements</td>
</tr>
<tr>
<td>Use Attainability Analyses/Resegmentation</td>
<td>Classified use may not be an actual use (e.g., water supply) or may only be in a portion of a segment.</td>
</tr>
<tr>
<td>Ambient Standards</td>
<td>Water body cannot attain standard due to conditions that are natural/infeasible to correct</td>
</tr>
<tr>
<td>Site-Specific Criteria-Based Standards</td>
<td>An alternative value is protective of the particular uses in the water body.</td>
</tr>
<tr>
<td>Temporary Modifications</td>
<td>Time is needed to evaluate whether the standards are appropriate to protect the uses or source of pollution</td>
</tr>
<tr>
<td>Discharger Specific Variances</td>
<td>Meeting the WQBEL is infeasible</td>
</tr>
</tbody>
</table>

Slide Source: Blake Beyea and Stephanie Baker, WQCD
Discharger Specific Variances

A discharger specific variance (DSV) is a temporary water quality standard that represents the greatest protection of a classified use that is feasible.

• Regulation 31.7(4) and Policy 13-1
  o DSVs are last resort after other regulatory options
  o DSVs are Temporary
  o Best Feasible Water Quality
  o Require an Alternatives Analysis

• Feasibility Tests
  o Limits of Technology Test
  o Economics Test
  o Other Consequences Test
Case Study: Big Dry Creek Watershed Association

- Formed 501(c)(3) in 2004; active since 1997
- Board of Directors
  - City and County of Broomfield
  - City of Westminster
  - City of Northglenn
  - Adams County (no WWTP)
  - Weld County (no WWTP)
Big Dry Creek Watershed
• 110 square miles
• 42 mile length
• Rocky Flats to Fort Lupton
Highlights of Annual Water Quality Analysis (for 2016 data)

• Data summary and comparison to stream standards
• Key constituents of interest
  – a. *E. coli*
  – b. Iron
  – c. Nutrients
• Biological Overview (MMI)
• Flow conditions
• Quality assurance/quality control
## Regulation 38 Standards

### REGULATION #38 STREAM CLASSIFICATIONS and WATER QUALITY STANDARDS

**Big Dry Creek Basin**

1. Mainstem of Big Dry Creek, including all tributaries and wetlands, from the source to the confluence with the South Platte River, except for specific listing in Segments 4a, 4b, 5 and 6.

<table>
<thead>
<tr>
<th>Designation</th>
<th>Classifications</th>
<th>Physical and Biological</th>
<th>Metals (ug/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COSPBD01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UP</td>
<td>Agriculture</td>
<td>DM</td>
<td>Metals</td>
</tr>
<tr>
<td></td>
<td>Aq Life Warm 2</td>
<td>MWAT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Recreation P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qualifiers:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Other:**

- Chlorophyll a (mg/m³)(chronic) = applies only above the facilities listed at 38.5(4).
- Phosphorus(chronic) = applies only above the facilities listed at 38.5(4).
- Selenium(acute) = 19.1 ug/L from 11/1 - 3/31 TVS from 4/1 - 10/31.
- Selenium(chronic) = 15 ug/L from 11/1 - 3/31 7.4 ug/L from 4/1 - 10/31.
- Refer to Section 38.6(4)(d).

<table>
<thead>
<tr>
<th></th>
<th>Physical and Biological</th>
<th>Metals (ug/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DM</td>
<td>MWAT</td>
</tr>
<tr>
<td>Temperature °C</td>
<td>WS-I</td>
<td>WS-I</td>
</tr>
<tr>
<td>D.O. (mg/L)</td>
<td>---</td>
<td>5.0</td>
</tr>
<tr>
<td>pH</td>
<td>6.5 - 9.0</td>
<td></td>
</tr>
<tr>
<td>Chlorophyll a (mg/m³)</td>
<td>---</td>
<td>150*</td>
</tr>
<tr>
<td>E. Coli (per 100 mL)</td>
<td>---</td>
<td>205</td>
</tr>
<tr>
<td>Inorganic (mg/L)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammonia</td>
<td>TVS</td>
<td>TVS</td>
</tr>
<tr>
<td>Boron</td>
<td>---</td>
<td>0.75</td>
</tr>
<tr>
<td>Chloride</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Chlorine</td>
<td>0.019</td>
<td>0.011</td>
</tr>
<tr>
<td>Cyanide</td>
<td>0.005</td>
<td>---</td>
</tr>
<tr>
<td>Nitrate</td>
<td>100</td>
<td>---</td>
</tr>
<tr>
<td>Nitrite</td>
<td>---</td>
<td>4.5</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>---</td>
<td>0.17*</td>
</tr>
<tr>
<td>Sulfate</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Sulfide</td>
<td>---</td>
<td>0.002</td>
</tr>
<tr>
<td>Selenium</td>
<td>---</td>
<td>varies*</td>
</tr>
<tr>
<td>Arsenic</td>
<td>---</td>
<td>340</td>
</tr>
<tr>
<td>Arsenic(T)</td>
<td>---</td>
<td>100</td>
</tr>
<tr>
<td>Beryllium</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Beryllium(T)</td>
<td>---</td>
<td>100</td>
</tr>
<tr>
<td>Cadmium</td>
<td>TVS</td>
<td>TVS</td>
</tr>
<tr>
<td>Chromium III</td>
<td>TVS</td>
<td>TVS</td>
</tr>
<tr>
<td>Chromium III(T)</td>
<td>---</td>
<td>100</td>
</tr>
<tr>
<td>Chromium VI</td>
<td>TVS</td>
<td>TVS</td>
</tr>
<tr>
<td>Copper</td>
<td>TVS</td>
<td></td>
</tr>
<tr>
<td>Iron(T)</td>
<td>---</td>
<td>1000</td>
</tr>
<tr>
<td>Lead</td>
<td>TVS</td>
<td></td>
</tr>
<tr>
<td>Manganese</td>
<td>TVS</td>
<td>TVS</td>
</tr>
<tr>
<td>Mercury</td>
<td>---</td>
<td>0.01(t)</td>
</tr>
<tr>
<td>Molybdenum(T)</td>
<td>---</td>
<td>150</td>
</tr>
<tr>
<td>Nickel</td>
<td>TVS</td>
<td>TVS</td>
</tr>
<tr>
<td>Selenium</td>
<td>---</td>
<td>varies*</td>
</tr>
<tr>
<td>Silver</td>
<td>TVS</td>
<td>TVS</td>
</tr>
<tr>
<td>Uranium</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Zinc</td>
<td>TVS</td>
<td>TVS</td>
</tr>
</tbody>
</table>
## Overall Comparison to Designated Uses and Standards (same as 2015)

<table>
<thead>
<tr>
<th>Designated Uses</th>
<th>Use Attained?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquatic Life Life Warm 2</td>
<td>Partial*</td>
</tr>
<tr>
<td>Recreation P</td>
<td>no</td>
</tr>
<tr>
<td>(Potential Primary Contact)</td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td>yes</td>
</tr>
<tr>
<td>Parameter Groups</td>
<td>Standards Attained?</td>
</tr>
<tr>
<td>Physical (e.g., DO, pH)</td>
<td>yes</td>
</tr>
<tr>
<td>Biological (E. coli)</td>
<td>no</td>
</tr>
<tr>
<td>Inorganics (e.g., CN, NH3)</td>
<td>yes</td>
</tr>
<tr>
<td>Metals (e.g., Cu, Cd, Zn, Se)</td>
<td>Partial (*Fe below WCR 8)</td>
</tr>
<tr>
<td>Other</td>
<td>Comments</td>
</tr>
<tr>
<td>Interim Nutrient Values (e.g., TP, TN)</td>
<td>Future Issue</td>
</tr>
<tr>
<td>Aquatic Life Policy 10-1 (e.g., MMI)</td>
<td>Attains</td>
</tr>
</tbody>
</table>
### Example 303(d) List Excerpt

<table>
<thead>
<tr>
<th>Listed portion:</th>
<th>COSJSJ10_A</th>
<th>Mainstem of the Rito Blanco River from Echo Ditch to the confluence with the Rio Blanco River.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affected Use</td>
<td>Analyte</td>
<td>Category / List</td>
</tr>
<tr>
<td>Aquatic Life Use</td>
<td>Temperature</td>
<td>3b - M&amp;E list</td>
</tr>
<tr>
<td>Recreational Use</td>
<td>E. coli</td>
<td>3b - M&amp;E list</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Listed portion:</th>
<th>COSPB0D1</th>
<th>Mainstem of Big Dry Creek, including all tributaries and wetlands, from the source to the confluence with the South Platte River, except for specific listing in Segments 4a, 4b, 5 and 6.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affected Use</td>
<td>Analyte</td>
<td>Category / List</td>
</tr>
<tr>
<td>Aquatic Life Use</td>
<td>Iron (Total)</td>
<td>5 - 303(d)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Listed portion:</th>
<th>COSPB0D1</th>
<th>Mainstem of Big Dry Creek From Weld County road 8 to the confluence with the South Platte River</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affected Use</td>
<td>Analyte</td>
<td>Category / List</td>
</tr>
<tr>
<td>Aquatic Life Use</td>
<td>Temperature</td>
<td>5 - 303(d)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Listed portion:</th>
<th>COSPB0E1a</th>
<th>Mainstem of Bear Creek from the boundary of the Mt. Evans Wilderness area to the inlet of Evergreen Lake.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affected Use</td>
<td>Analyte</td>
<td>Category / List</td>
</tr>
<tr>
<td>Aquatic Life Use</td>
<td>Temperature</td>
<td>5 - 303(d)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Listed portion:</th>
<th>COSPB0E1b</th>
<th>Mainstem of Bear Creek from Harriman Ditch to the inlet of Bear Creek Reservoir.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affected Use</td>
<td>Analyte</td>
<td>Category / List</td>
</tr>
<tr>
<td>Aquatic Life Use</td>
<td>Temperature</td>
<td>5 - 303(d)</td>
</tr>
</tbody>
</table>
Recent Changes to 2018 303(d) Listing Methodology for E. coli

- Rolling 61-day geometric mean
  - No more fixed bi-monthly evaluations
  - No more combining multiple years of data for bimonthly period
- Sample size requirements for listing
  - 5 or more for normal 303(d) listing
  - 4 or more for “overwhelming evidence”
  - 2&3 M&E List
- Delisting
  - Attain standard (based on geometric mean of 5 samples/61 days) for same time period during which impairment was identified for most recent 2 years.

Standard Components
- Magnitude: 126 cfu/100 mL
- Duration: 61-day rolling average
- Frequency: Geometric mean cannot exceed standard
# Historical Annual E. coli Summary (2000-2016)

<table>
<thead>
<tr>
<th>Year</th>
<th>bdc0.5</th>
<th>bdc1.0</th>
<th>bdc1.5</th>
<th>bdc10.0 (Broom. WWTP)</th>
<th>bdc2.0</th>
<th>bdc11.0 (West. WWTP)</th>
<th>bdc3.0</th>
<th>bdc4.5</th>
<th>bdc5.0</th>
<th>bdc6.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>212</td>
<td>151</td>
<td>389</td>
<td>--</td>
<td>574</td>
<td>--</td>
<td>294</td>
<td>500</td>
<td>212</td>
<td>323</td>
</tr>
<tr>
<td>2001</td>
<td>477</td>
<td>118</td>
<td>332</td>
<td>215</td>
<td>649</td>
<td>68</td>
<td>387</td>
<td>634</td>
<td>442</td>
<td>510</td>
</tr>
<tr>
<td>2002</td>
<td>858</td>
<td>230</td>
<td>363</td>
<td>364</td>
<td>934</td>
<td>16</td>
<td>536</td>
<td>441</td>
<td>451</td>
<td>572</td>
</tr>
<tr>
<td>2003</td>
<td>191</td>
<td>210</td>
<td>293</td>
<td>27</td>
<td>615</td>
<td>24</td>
<td>382</td>
<td>225</td>
<td>249</td>
<td>339</td>
</tr>
<tr>
<td>2004</td>
<td>279</td>
<td>181</td>
<td>217</td>
<td>18</td>
<td>346</td>
<td>28</td>
<td>205</td>
<td>187</td>
<td>156</td>
<td>377</td>
</tr>
<tr>
<td>2005</td>
<td>152</td>
<td>122</td>
<td>281</td>
<td>26</td>
<td>328</td>
<td>35</td>
<td>204</td>
<td>113</td>
<td>182</td>
<td>301</td>
</tr>
<tr>
<td>2006</td>
<td>76</td>
<td>241</td>
<td>316</td>
<td>20</td>
<td>309</td>
<td>48</td>
<td>214</td>
<td>163</td>
<td>179</td>
<td>333</td>
</tr>
<tr>
<td>2007</td>
<td>196</td>
<td>177</td>
<td>257</td>
<td>14</td>
<td>324</td>
<td>66</td>
<td>230</td>
<td>231</td>
<td>198</td>
<td>364</td>
</tr>
<tr>
<td>2008</td>
<td>266</td>
<td>197</td>
<td>267</td>
<td>10</td>
<td>461</td>
<td>6</td>
<td>439</td>
<td>376</td>
<td>290</td>
<td>380</td>
</tr>
<tr>
<td>2009</td>
<td>61</td>
<td>78</td>
<td>147</td>
<td>5</td>
<td>207</td>
<td>14</td>
<td>251</td>
<td>137</td>
<td>149</td>
<td>197</td>
</tr>
<tr>
<td>2010</td>
<td>111</td>
<td>191</td>
<td>193</td>
<td>12</td>
<td>483</td>
<td>16</td>
<td>376</td>
<td>280</td>
<td>235</td>
<td>368</td>
</tr>
<tr>
<td>2011</td>
<td>64</td>
<td>228</td>
<td>323</td>
<td>6</td>
<td>622</td>
<td>8</td>
<td>518</td>
<td>537</td>
<td>380</td>
<td>730</td>
</tr>
<tr>
<td>2012</td>
<td>267</td>
<td>397</td>
<td>260</td>
<td>7</td>
<td>555</td>
<td>8</td>
<td>544</td>
<td>497</td>
<td>390</td>
<td>545</td>
</tr>
<tr>
<td>2013</td>
<td>239</td>
<td>214</td>
<td>292</td>
<td>3</td>
<td>398</td>
<td>10</td>
<td>424</td>
<td>342</td>
<td>272</td>
<td>505</td>
</tr>
<tr>
<td>2014</td>
<td>119</td>
<td>269</td>
<td>254</td>
<td>5</td>
<td>323</td>
<td>9</td>
<td>371</td>
<td>410</td>
<td>287</td>
<td>1085</td>
</tr>
<tr>
<td>2015</td>
<td>257</td>
<td>251</td>
<td>230</td>
<td>4</td>
<td>311</td>
<td>9</td>
<td>528</td>
<td>415</td>
<td>266</td>
<td>490</td>
</tr>
<tr>
<td>2016</td>
<td>207</td>
<td>254</td>
<td>221</td>
<td>5</td>
<td>312</td>
<td>18</td>
<td>358</td>
<td>315</td>
<td>300</td>
<td>536</td>
</tr>
</tbody>
</table>
Big Dry Creek: Upstream to Downstream

E. coli (MPN/100 mL)
**E. coli TMDL**

- Load duration curve approach
- 10% MOS + Reserve Capacity
- Reductions not targeted to WWTPs
- Public notice and final notice completed summer 2016
- Prepared by Division with input from BDCWA
- Hydrology was a major complicating factor
Figure 6.2-1 E. coli data (2003-2014) for bdc2.0 plotted on load duration curve based on Westminster flow gage.
Middle Reach Allocations

Table 3. Middle Reach *E. coli* TMDL: allowable loading and pollutant reductions necessary to meet the recreation based *E. coli* standard in Big Dry Creek.

<table>
<thead>
<tr>
<th>Loading Calculations (Giga-cfu/day)</th>
<th>High Flow</th>
<th>Moist Conditions</th>
<th>Mid-Range Flows</th>
<th>Dry Conditions</th>
<th>Low Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMDL</td>
<td>423.34</td>
<td>198.56</td>
<td>129.18</td>
<td>73.58</td>
<td>27.94</td>
</tr>
<tr>
<td>MOS (10%)</td>
<td>42.33</td>
<td>19.86</td>
<td>12.92</td>
<td>7.36</td>
<td>2.79</td>
</tr>
<tr>
<td>Allowable Load</td>
<td>381.01</td>
<td>178.71</td>
<td>116.26</td>
<td>66.22</td>
<td>25.14</td>
</tr>
<tr>
<td>Existing Load</td>
<td>1119.13</td>
<td>425.48</td>
<td>244.05</td>
<td>114.49</td>
<td>94.98</td>
</tr>
<tr>
<td>Required Reductions</td>
<td>66%</td>
<td>58%</td>
<td>52%</td>
<td>42%</td>
<td>74%</td>
</tr>
</tbody>
</table>

**WLA**

<table>
<thead>
<tr>
<th></th>
<th>Westminster WWTF</th>
<th>Broomfield WWTF</th>
<th>MS4s</th>
<th>Reserve Capacity</th>
<th>Non-point Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Flow</td>
<td>58.24</td>
<td>74.20</td>
<td>149.14</td>
<td>7.46</td>
<td>91.97</td>
</tr>
<tr>
<td>Moist Conditions</td>
<td>54.32</td>
<td>64.00</td>
<td>36.23</td>
<td>1.81</td>
<td>22.34</td>
</tr>
<tr>
<td>Mid-Range Flows</td>
<td>51.49</td>
<td>57.63</td>
<td>4.29</td>
<td>0.21</td>
<td>2.64</td>
</tr>
<tr>
<td>Dry Conditions</td>
<td>31.97</td>
<td>31.58</td>
<td>1.60</td>
<td>0.08</td>
<td>0.99</td>
</tr>
<tr>
<td>Low Flow</td>
<td>16.99</td>
<td>4.92</td>
<td>1.94</td>
<td>0.10</td>
<td>1.19</td>
</tr>
</tbody>
</table>
Dry Weather Outfall Sampling
One Illicit Discharge Identified and Corrected

Four years later—E. coli still well above standards downstream...
Controllable E. coli Source?
Colorado E. coli Toolbox: A Practical Guide for Colorado MS4s

- Introduction
  - Colorado regulations
  - Extent of problem
  - TMDLs
- Finding the sources
- Developing a control strategy
  - Progression of controls
  - Modeling
- Source controls
- Structural BMPs
- Regulatory considerations/site-specific standards

Accessible at www.udfcd.org
Developing an E. coli Control Strategy

General Themes:
• Address human source first, then other sources
• Address dry weather first, then wet weather
• Implement nonstructural/source controls, then structural
Site Specific Standard: Selenium

<table>
<thead>
<tr>
<th>Selenium (µg/L)</th>
<th>Irrigation Season</th>
<th>Non-irrigation Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Sites (85th %)</td>
<td>5.0</td>
<td>N/A</td>
</tr>
<tr>
<td>bdc1.5, 2.0, 4.5 (85th %)</td>
<td>5.1</td>
<td>7.4 (ch)</td>
</tr>
<tr>
<td>bdc1.5, 2.0, 4.5 (Max)</td>
<td>11.0</td>
<td>18.4 (ac)</td>
</tr>
</tbody>
</table>

- 5-year analysis meets stream standards.
- Sampling frequency switched to quarterly in 2013, consistent with other metals.
- Removed from 303(d) List in 2016.
- Also new statistical methodology for site-specific standards for 2016 303(d) Listing Methodology.
New Colorado Nutrient Interim “Values” (Regulation 31)

(b) Interim Phosphorus Values

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lakes and Reservoirs, cold, &gt;25 acres</td>
<td>25 ug/L</td>
</tr>
<tr>
<td>Lakes and Reservoirs, warm &gt; 25 acres</td>
<td>83 ug/L</td>
</tr>
<tr>
<td>Lakes and Reservoirs, &lt;=25 acres</td>
<td>RESERVED</td>
</tr>
<tr>
<td>Rivers and Streams – cold</td>
<td>110 ug/L</td>
</tr>
<tr>
<td><strong>Rivers and Streams - warm</strong></td>
<td>170 ug/L</td>
</tr>
</tbody>
</table>

1. summer (July 1-September 30) average Total Phosphorus (ug/L) in the mixed layer of lakes (median of multiple depths), allowable exceedance frequency 1-in-5 years.
2. annual median Total Phosphorus (ug/L), allowable exceedance frequency 1-in-5 years.

(c) Interim Nitrogen Values (Effective May 31, 2017)

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lakes and Reservoirs, cold, &gt;25 acres</td>
<td>426 ug/L</td>
</tr>
<tr>
<td>Lakes and Reservoirs, warm, &gt; 25 acres</td>
<td>910 ug/L</td>
</tr>
<tr>
<td>Lakes and Reservoirs, &lt;=25 acres</td>
<td>RESERVED</td>
</tr>
<tr>
<td>Rivers and Streams – cold</td>
<td>1,250 ug/L</td>
</tr>
<tr>
<td><strong>Rivers and Streams - warm</strong></td>
<td>2,010 ug/L</td>
</tr>
</tbody>
</table>

1. summer (July 1–September 30) average Total Nitrogen (ug/L) in the mixed layer of lakes (median of multiple depths), allowable exceedance frequency 1-in-5 years.
2. annual median Total Nitrogen (ug/L), allowable exceedance frequency 1-in-5 years.
Big Dry Creek Total Nitrogen (2016)

• Third year of TN data (due to adding TKN to monitoring program)
• Does not meet interim values below WWTPs to South Platte.
2016 Total Phosphorus

Big Dry Creek: Upstream to Downstream

Interim TP "value" = 0.17 mg/L
# Regulation 85 Effluent Limits for Existing and New Facilities
(not yet in BDC permits)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>PARAMETER LIMITATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Existing Facility</strong></td>
<td><strong>Annual Median</strong>&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>(a) Total Phosphorus</td>
<td>1.0 mg/L</td>
</tr>
<tr>
<td>(b) Total Inorganic Nitrogen as N&lt;sup&gt;3&lt;/sup&gt;</td>
<td>15 mg/L</td>
</tr>
<tr>
<td><strong>New Facility</strong></td>
<td><strong>95&lt;sup&gt;th&lt;/sup&gt; Percentile</strong>&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>(a) Total Phosphorus</td>
<td>2.5 mg/L</td>
</tr>
<tr>
<td>(b) Total Inorganic Nitrogen as N&lt;sup&gt;3&lt;/sup&gt;</td>
<td>20 mg/L</td>
</tr>
</tbody>
</table>

---

1. Running Annual Median: The median of all samples taken in the most recent 12 calendar months.
2. The 95<sup>th</sup> percentile of all samples taken in the most recent 12 calendar months.
3. Determined as the sum of nitrate as N, nitrite as N, and ammonia as N.
Decreases in TP @ Broomfield and Westminster WWTPs

- Biological nutrient removal at Broomfield and Westminster WWTPs.
- No sooner than July 1, 2013, Reg 85 Limits for WWTPs > 2 MGD = 1 mg/L TP as annual median.
- New permits expected in 2018.
TP Load Reductions at bdc6.0

- Barr-Milton TMDL Target 20% load reduction relative to 2004.
- Flow variations affect load.
- Missing data affect reliability of estimate during 2016.
Biennial Biological Monitoring

• 2016 Sampling
• Fish
• “Bugs”
• Habitat
• Overall trends in aquatic life health
  – Over time
  – By location
Big Dry Creek MMI Scores

- Higher scores are better.
- Aquatic life Policy 10-1 attained for all years, all sites except 2016 bdc5.0 is “below attainment & above impairment.”
- Note site-to-site and annual variability.
Big Dry Creek Case Study: CLEAN Center Research Project 4: Fluvial instability and riparian degradation

Roderick Lammers
Co-PI: Dr. Brian P. Bledsoe, Ph.D., P.E.
Co-PI: Dr. Daniel Baker, Ph.D., P.E.
Preliminary results

- Eroded area (satellite imagery)
- Bank heights (field)
- Soil bulk density (US Soil Survey)
- Bank P concentrations (field)
Preliminary results (cont.)

- Historically average of ~10% of total watershed P load
- Recently, contribution percentage may be higher
- Future of channel erosion uncertain
Conclusions

• Know the regulations and the regulatory process.
• Good data are important—helps objective decision-making and common ground.
• Watershed approach can provide holistic view of stream issues and leverage funding.
• If you have a water quality problem, chances are there are groups engaging on your issue and/or resources available to help you.
Questions?

Jane Clary
Wright Water Engineers
303-480-1700
clary@wrightwater.com

Thank you and acknowledgements for selected slides:
• Blake Beyea and Stephanie Baker, Water Quality Control Division Standards Unit
• Trisha Oeth, Esq., Administrator, Water Quality Control Commission
COLORADO WATER CONSERVATION BOARD

Operations/Programs:
- Water Project Loan Program
- Water Conservation and Drought Planning
- Interstate Compact Protection
- Stream and Lake Protection
- Watershed & Flood Protection
- Decision Support Systems
- Water Supply Planning
1960s and 70s - Increasing public concern about the impact of human activities on the environment

Toxic Chemicals
- Silent Spring by Rachel Carson

1st Earth Day
- 1970 National Environmental Policy Act
- 1972 Clean Water Act, Costal Zone Mgt. Act, Marine Mammal Protection Act
- 1973 Endangered Species Act
- 1974 Safe Drinking Water Act

1960’s
- 1964 Wilderness Preservation Act
- 1968 Wild and Scenic Rivers Act

1970’s
- Keep America Beautiful Campaign

Abuse of Nation’s Natural Resources

Creation of New Federal Agencies

Keep America Beautiful Campaign

1964 Wilderness Preservation Act

1968 Wild and Scenic Rivers Act

The Quiet Crisis

ISF PROGRAM HISTORY
COLORADO IN THE 1970s

• Public concern over dry stream reaches
• No mechanism within the water rights system to keep water within a stream for environmental preservation
• Federal imposition of bypass flows on Fry-Ark project
• Threats of ballot initiative to allow private ISFs
SENATE BILL 73-97
Established Colorado’s Instream Flow Program

- Recognized “the need to correlate the activities of mankind with some reasonable preservation of the natural environment”
- Vested the CWCB with the authority “on behalf of the people of the state of Colorado, to appropriate or acquire... such waters of natural streams and lakes as may be required to preserve the natural environment to a reasonable degree.”
SENATE BILL 73-97

Instream Flow & Natural Lake Level water rights:

- In-channel or in-lake appropriations of water
- For minimum flows between specific points on a stream, or levels on natural lakes
- To preserve the natural environment to a reasonable degree
- Administered within the State’s water right priority system
- Entitled to stream conditions existing at time of appropriation
- Made exclusively by CWCB
WHAT DOES THE PROGRAM ACCOMPLISH?

Maintains flows in streams to ensure preservation of the natural environment and achieves a balance with other beneficial uses of water in the state.

Provides regulatory certainty for water users by preserving the doctrine of prior appropriation and operating within the priority system.
ISF PROGRAM AREAS

New Appropriations
Appropriate and adjudicate a new (junior) ISF water right for the minimum required to preserve the natural environment to a reasonable degree.

Water Acquisitions
Acquire existing water rights and change to ISF use in amounts CWCB determines appropriate to preserve or improve the natural environment to a reasonable degree.

Monitoring and Request for Administration
Actively monitor conditions at stream gages and initiate administrative calls as necessary to ensure ISF rights are met.

Legal Protection
Initiating legal action through Colorado’s water courts when necessary to provide 100% protection of the state’s decreed ISF rights.

Inter-Section Issues –
DSS, Wild and Scenic, State Water Plan, River Restoration, Stream Management Plans, etc.
ROLE OF ISF PROGRAM IN WATER COMMUNITY

• Coordinate with federal agencies to address their resource protection goals through state-held water rights

• Collaborate with CO Parks and Wildlife, Colorado Water Trust, conservation groups, local governments and others on protecting Colorado’s rivers and streams

• Work in partnership with water suppliers to enable water projects to move forward while ensuring protection of the natural environment

• Work with stakeholder groups on Wild and Scenic alternative processes and other projects

• Assist with Water Plan implementation
TWO WAYS CWCB OBTAINS ISF WATER RIGHTS

New Appropriations

• Appropriate and adjudicate a new (junior) ISF water right for the **minimum required to preserve** the natural environment to a reasonable degree.

Water Acquisitions

• Acquire existing water rights for ISF use **in amounts CWCB determines appropriate to preserve or improve** the natural environment to a reasonable degree.
ISF APPROPRIATION PROCESS

• Any person or entity may recommend streams or lakes to be considered for appropriation to preserve the natural environment.

Recommendation Development (Year 1)

• Collect data and quantify flow requirements using standard methodology
• Submit recommendations “in writing and with specificity” at ISF workshop.

Recommendation Processing and Outreach Activities by Staff (Year 2)

• Public Notice in March and November
• Reviews submitted data and performs a detailed water availability analysis
• Perform site visits and collects additional data
• Holds public meetings to get input on recommendations

Board Appropriation Administrative Process (Year 3)

• Staff recommends Board form its intent to appropriate – typically at the Board’s January Meeting.
• If recommendation contested, staff negotiates settlement or Board holds hearing (ISF Rule 5 notice and comment procedures)
• File application for ISF water right in water court
STATUTORY REQUIREMENTS

The Board must make 3 determinations before applying to water court for an ISF water right:

(1) A natural environment exists
Typically identified by the presence of a coldwater fishery, but other indicators can be used (warm water fishery, riparian vegetation)

(2) Water is available for appropriation
- Determined by water right and hydrologic investigations
- Daily Median hydrology when available – water available 50% of time

(3) No material injury to other water rights will occur
- New appropriations are junior water rights and have no effect on existing senior appropriations
- 37-92-102(3)(b) - Recognition of existing undecreed uses and exchanges
NATURAL ENVIRONMENT

flannelmouth sucker

Colorado cutthroat trout

brook trout
## 2018 ISF Appropriations

<table>
<thead>
<tr>
<th>Div</th>
<th>Stream</th>
<th>Watershed</th>
<th>County</th>
<th>Length (miles)</th>
<th>Upper Terminus</th>
<th>Lower Terminus</th>
<th>Flow (CFS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Coyote Wash</td>
<td>Upper Dolores</td>
<td>Montrose</td>
<td>10.5</td>
<td>Colorado/Utah Stateline</td>
<td>Confl. Dolores River</td>
<td>0.8 (09/01 - 02/29) 2.2 (03/01 - 08/31)</td>
</tr>
<tr>
<td>4</td>
<td>Dutchman Creek</td>
<td>Tomichi</td>
<td>Saguache</td>
<td>6.78</td>
<td>Headwaters</td>
<td>Confl. Owens Creek</td>
<td>0.94 (04/01 - 08/31) 0.84 (09/01 - 03/31)</td>
</tr>
<tr>
<td>5</td>
<td>Abrams Creek</td>
<td>Eagle</td>
<td>Eagle</td>
<td>3.95</td>
<td>Headwaters</td>
<td>Mrs. Paye Ditch hdgt</td>
<td>0.75 (05/01 - 09/30)</td>
</tr>
<tr>
<td>6</td>
<td>Douglas Creek</td>
<td>Lower White</td>
<td>Rio Blanco</td>
<td>26.3</td>
<td>Confl. E &amp; W Douglas Creeks</td>
<td>Confl. White River</td>
<td>2.7 (03/16 - 06/15) 1.7 (06/16 - 06/30)</td>
</tr>
<tr>
<td>6</td>
<td>Lost Creek</td>
<td>Upper White</td>
<td>Rio Blanco</td>
<td>3.64</td>
<td>Confl. Hahn Creek</td>
<td>Confl. Long Park Creek</td>
<td>1.3 (10/01 - 03/31) 2.3 (04/01 - 08/15) 1.8 (08/16 - 09/30)</td>
</tr>
<tr>
<td>6</td>
<td>Hahn Creek</td>
<td>Upper White</td>
<td>Rio Blanco</td>
<td>4.71</td>
<td>Headwaters</td>
<td>Confl. Lost Creek</td>
<td>0.75 (11/01 - 04/30) 2.6 (05/01 - 08/31) 1.6 (09/01 - 10/31)</td>
</tr>
</tbody>
</table>
CWCB’S WATER ACQUISITION PROGRAM

**CWCB can acquire water:**

- in amounts it determines appropriate to preserve or improve the natural environment to a reasonable degree
- by donation, purchase, lease, or other contract
- on a permanent or temporary basis
- from **willing** water rights owners.

CWCB may use any funds available to it for water acquisitions (Construction Fund, Species Conservation Trust Fund)
TYPES OF ISF ACQUISITIONS

Permanent:
- Donation or purchase
- Water right conveyed to CWCB
- Change water right to ISF use (water court)

Contractual Interest:
- Can be for any time period
- Can be flexible to meet water right owner’s needs
- CWCB typically applies to water court to obtain a decreed right to use the water for ISF purposes
  - Add ISF as a decreed use
  - Ensure no injury to other water rights on stream
WATER ACQUISITION REVIEW & APPROVAL PROCESS

Using two-board meeting process, CWCB considers these factors:

- Reach of stream where acquired water will be used
- Historical use and return flows
- Location of other water rights on reach
- Potential for material injury to existing decreed water rights
- Effect of proposed acquisition on
  - Interstate compact issues
  - Maximum utilization of waters of state
- Whether water will be available for subsequent use downstream
- Water administration issues, if any
Every transaction requires a written agreement.

- Developed cooperatively with water right owner.

- Outlines the terms and conditions of the conveyance.

- Can address water court responsibilities, streamflow monitoring, protection and enforcement of the conveyed right, and other issues.

- Enforceable by either party as a water matter in water court.

CWCB must obtain a decreed right to use that water for ISF purposes – often a change of water right.

NO INJURY TO OTHER WATER RIGHTS!
LONG-TERM LOAN OR LEASE EXAMPLES

Pitkin County

• Long-term loan of up to 3.83 cfs for Maroon Creek and the Roaring Fork River

• Trust Agreement with option to add more water rights in future

Rocky Mountain National Laboratory

• 99 - year lease for $10 per year to protect unique glacial ponds and habitat for neotenic salamanders
PERMANENT ACQUISITION EXAMPLES

Hat Creek Ditch
• Vail Associates donated water right to CWT, who donated it to CWCB

• Changed to ISF use on Hat Creek and East Brush Creek (.9 – 2 cfs)

• CWT sold HCU to Town of Eagle for use d/s of ISF reach

Peabody No. 1 Ditch
• Retiring rancher sold land to USFS and later sold water right to CWT.

• CWT donated water right to CWCB for ISF use to preserve and improve 14 miles of the Blue River above Green Mountain Reservoir.

• After ISF use, HCU credits remarkeeted to Colorado River District for downstream augmentation uses.
TEMPORARY LOANS & LEASES OF WATER FOR ISF USE

• Limited to
  • ISF use for a period of 120 days
  • 3 years of use over a 10 year period

• Can be used on any stream where CWCB currently holds an ISF right, up to decreed amount

• **No water court change case** – State and Division Engineer can approve ISF use if no injury to other water rights

• Expedited approval process
TEMPORARY LOAN EXAMPLE

Coats Bros Ditch, Tomichi Creek (Gunnison Basin)

- Maintain agricultural use (165 acres of irrigated hay and pasture) while providing water to restore flow to Tomichi Creek
- Water Trust, CWCB identify annual need for water – owner decides annual and seasonal implementation
- Temporary split-season lease - Irrigation through July 1 or August 1, followed by ISF use.
- CWCB, CO Water Trust, and Trout Unlimited
ISF PROGRAM STATISTICS

39,479 miles of perennial streams

With ISF Protection 23%
Without ISF Protection 77%

Appropriated
Instream flow water rights on
- over 1,600 stream segments,
- covering 9,352 miles of stream,
- and 480 natural lakes

Acquired
Over 26 water right donations or long-term contracts for water totaling
420 cfs and 9,340 AF

High Creek Fen – Park County
ISF water rights are adjudicated and administered within Colorado’s priority system, like all other water rights in the state.

All decreed water rights are entitled to stream conditions as they existed at the time of appropriation.

CWCB has standing in Water Court to ensure changes to senior rights do not alter stream conditions in a way that injures decreed ISF water rights.
CWCB staff:

- reviews water court resumes each month for applications that could injure ISF water rights
- files statements of opposition to such applications
- works with the AG’s Office to negotiate terms and conditions to include in water court decree that protect the ISF

Injury can result from:

- Plans for augmentation
- Changes of water rights
- Inundation
CWCB installs new stream gages and cooperates with USGS and DWR on existing stream gages.

Real time monitoring by over 150 gages via the DWR / CWCB flow alert system—sends email alerts to staff.

Staff gages and interested stakeholders also alert staff to observed or suspected low flow conditions.

Staff coordinates with the DWR on low flow conditions and places administrative calls for ISF water rights when warranted.
UPPER COLORADO WILD & SCENIC STAKEHOLDER GROUP

- **Goal**: Create a river management plan alternative for BLM and USFS to consider as part of planning process – would be an alternative to a finding of suitability for W&S

- **Participants**: local governments, water users, environmental and recreation interests, landowners, state agencies

- Focus on two flow-related ORVs: recreational fishing and recreational boating

- Stakeholder group developed ISF recommendations for base flows on three reaches of Colorado River:
  - Blue River to Piney River
  - Piney River to Cabin Creek
  - Cabin Creek to just u/s of Eagle River

- CWCB appropriated three ISFs in 2011; decreed in 2013. Flow rates range from 500 – 900 cfs.

Request for Water Acquisitions Pilot Process

• CWCB partnering with Colorado Water Trust on process
• To invite voluntary water offers from willing water rights owners to benefit streamflows
• To provide a user-friendly mechanism for water rights owners to explore working with CWCB and the Colorado Water Trust on water transactions
• To streamline transaction processes and utilization of resources
• To facilitate implementation of Colorado’s Water Plan objectives
• To add flows to river segments in need while coordinating with agricultural and other uses
REQUEST FOR WATER ACQUISITIONS
PILOT PROCESS

INITIAL SCREENING

CONFIDENTIAL PROCESS

TRANSACTION DEVELOPMENT

- Water Conservation Programs
- Short Term Leases
- Long Term Leases
- Water Right Donation or Purchase

August 2018 – 2019 +

Submitting an inquiry or preliminary offer of water DOES NOT commit you to completing a project with the Water Trust or Water Conservation Board.
Vail’s Approach to Restoring an Impaired Waterway

Pete Wadden
Watershed Education Coordinator
pwadden@vailgov.com
Status of Gore Creek

Gore Creek—the clear, rocky mountain stream that runs through the heart of Vail—offers a peaceful respite for residents and visitors, important wildlife habitat, and a water supply for downstream communities. But despite its beauty, the river’s health is threatened. Here’s a run-down of the challenges and the many ways we can all play a part in the solution.

**THE CHALLENGE**

1. **Improper Use of Chemicals**
   - When pesticides are applied on windy days or immediately prior to rain, they can make their way into the creek at harmful loads.
2. **Winter Maintenance**
   - Traction sand, de-icers and accelerants used to treat icy roads increase dissolved solids, chlorides, and conductivity in streams.
3. **Paved Surfaces**
   - Parking lots, driveways, sidewalks, and other “impervious surfaces” speed the flow of water, and pollutants...to streams.
4. **Treated Grass Clippings**
   - When residents or businesses near their lawns and areas or grass clippings onto paved areas, rainfall carries fertilizer and pesticides directly to Gore Creek.

**ECOSYSTEM DISRUPTION**

As the populations of macroinvertebrates suffer, treat are affected, which has an impact on Vail’s Gold Medal fishing and the predators that rely on these species.

**THE SOLUTION**

1. **Proper Use of Fertilizer**
   - Avoid the use of fertilizers if the forecast calls for rain in the next two days.
2. **Spot-Treating Weeds**
   - Spot-treat critical areas for weeds or remove unwanted plants by hand, to reduce the use of chemicals.
3. **More Native Plants**
   - Add trees and shrubs to your yard to capture and hold sediment before it can reach the creek.
4. **Proper Disposal**
   - Dispose of garden chemicals correctly by taking unused products to your local household hazardous waste site.

**How is Water Quality Determined?**

Macroinvertebrates are used to assess water quality because they have limited movement, high reproductive rates, and varying sensitivity to pollution. Data shows that macroinvertebrate populations in Gore Creek are below healthy levels, paralleling the beauty of urban development.

Has been on Clean Water Act 303d list for low aquatic life since 2012
Three sources of contamination

Landscaping practices
- Bright green turf requires a lot of water and chemicals at 8,150 ft
What is causing impairment in Gore Creek?

Landscaping practices
• Pesticide use

Town of Vail set the example and promoted its successes.
• Reduced foliar pesticide use by 92% from 2014 to 2016
• Has held workshops to encourage homeowners and landscapers to do the same
Foliar pesticide application

- That might be too much...
Three sources of contamination

- Rapid development over 50 year period
- An impaired creek almost seems inevitable when considered through that lens (in retrospect)
Three sources of contamination

- Increased impervious surfaces
  - Speeds runoff, eliminates filtration
  - Faster water carries more pollutants

- Rapid development over 50 year period
- An impaired creek almost seems inevitable when considered through that lens (in retrospect)
Impacts of Impervious Surfaces

As impervious surfaces in a watershed increase, stormwater has less opportunity to infiltrate.

Only 3% of Gore Creek watershed is developed, but urbanization is concentrated along the creek, increasing impact.
Most people don’t know

If it has an open grate, it doesn’t get filtered (storm sewers and sanitary sewers are different).
In 2016 people dumped:
- Cement

People don’t know where the water goes.
Education is needed in Vail

In 2016 people dumped:
- Cement
- Cooking grease

People don’t know where the water goes.
Education is needed in Vail

In 2016 people dumped:

- Cement
- Cooking grease
- Paint

People don’t know where the water goes.
Education is needed in Vail

In 2016 people dumped:
- Cement
- Cooking grease
- Paint
- Window Cleaner

People don’t know where the water goes.
Education is needed in Vail

In 2016 people dumped:
• Cement
• Cooking grease
• Paint
• Window Cleaner
• 120 hot dogs

Down storm drains in Vail

People don’t know where the water goes.
Three sources of contamination

- Untreated stormwater
- Stormwater dumping
Raise awareness

Newspaper ads and articles

Vail is quite possibly the perfect mountain resort, but all that perfection comes with a cost. We treat our roads with chemicals and use pesticides and fertilizers to keep everything green.

As a result, Gore Creek is feeling the impact that comes with turning a mountain into the premier international resort. Thankfully, a little wild can go a long way.

To keep Gore Creek healthy, don’t mow right to the edge of the creek, use weed killers and fertilizers sparingly, and plant native species on your property. That way, the creek will remain a healthy place for moose, trout, and all the other wild things.

Find out more at www.lovewithvail.org/gorecreek
Outreach and events

- Nothing works like face-to-face
Gave people the tools and motivation to contribute to your community-wide effort.

This certificate recognizes that

Kreston Rohrig

of Four Seasons Landscaping and Irrigation

is a certified Restore The Gore Leadership Partner who received training to enhance their expertise in the areas of sustainable native landscaping, proper use of landscaping chemicals and creek-friendly landscaping practices.

Vail offers a free, annual workshop for landscape contractors.
Volunteer events
- Get people involved
- Raise awareness
- Make them feel empowered
- Create community ambassadors
- Create sense of ownership, accomplishment and community
- You may get some actual work done
Social media

- Restore the Gore is active on Instagram and Facebook
- Town of Vail also has a Twitter account
Social media

Restore the Gore is active on Instagram and Facebook, Town of Vail also has a Twitter account
Specific Programs

- Stormwater art installation
- Restore the Gore stickers
- Gore Creek Spill Hotline
Specific Programs

Project Re-Wild
Lunch with the Locals

A Complimentary Ecology Presentation
WEDNESDAY, JULY 12  |  12 PM
Lionshead Welcome Center

FREE LUNCH
for attendees

Come enjoy a complimentary lunch and listen to a presentation on the history of the Clean Water Act and how the designation of Gore Creek as an impaired waterway impacts our community. Experts from the Town of Vail, Walking Mountains Science Center, and Eagle River Watershed Council will be on hand to answer questions about what residents can do to help Restore the Gore. There will also be native seed mixes, stickers and informational brochures given away to attendees.
Specific Programs

FREE MOVIE
FRIDAY, SEPTEMBER 2 | 7:30 PM | FORD AMPHITHEATER

Rated G
Time 77 min

DisneyNature BEARS

This Labor Day weekend, you are invited to join us for a FREE evening of adventure, strength, love and family. Disneynature’s BEARS will take us into the wonderful and unpredictable world of a mother grizzly bear, Sky, and her two newborn cubs as they face the challenges and triumphs of surviving and thriving in the Alaskan wilderness. The show will begin with a short film about the life cycle of the bear in the Yukon.

Lovevail.org
BIG RIVER DROUGHT CONTINGENCY PLANNING
Disparity of People and Water

West Slope
80% of water

Front Range
80% of people
Transmountain diversions (to east) and downstream demands (to west)

6,000,000 to 8,000,000 af/yr

450,000 to 600,000 af/yr
Colorado River Basin Today

- Seven Basin States
- Almost 300,000 square miles
- 35 Million People and growing
- Up to 5.5 Million Irrigated Acres
- 10 Autonomous / Sovereign Tribes
- 2 Countries
90% of the people

90% of the water
1922 Colorado River Compact

- Divides Colorado River (incl tributaries), into Upper & Lower Basins and defines Divisions
- Boundary between the two basins is Lee Ferry, Arizona
- Lower Division: Nevada, California & Arizona
- Upper Division: Wyoming, Colorado, New Mexico & Utah
- Arizona, Utah and New Mexico have lands within both basins
Law of the River Allocations

- 7.5 MAF to Upper Basin (by %’s to CO, UT, WY, NM)¹
- 7.5 MAF to Lower Basin (4.4 CA; 2.8 AZ; 0.3 NV)²
- 1.0 MAF additional to Lower Basin³
  - (i.e., tributary development, e.g., Little Colorado and Gila Rivers in AZ)
- 1.5 MAF to Mexico⁴

17.5 MAF Total Allocated ‘on paper’

¹ 1922 Colorado River Compact, 1948 Upper Colorado River Compact
² Colorado River Compact, 1929 Boulder Canyon Project Act, 1964 AZ v. CA
³ 1922 Colorado River Compact
⁴ Treaty of 1944

Colorado River District
Protecting Western Colorado Water Since 1937
Colorado River Compact of 1922

Colorado, like all Upper Division states, shares obligations to the Lower Division

III (d) the Upper Division shall “not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any ten consecutive years.”

III (c) regarding Mexico...the Upper Division must “deliver at Lee Ferry water to supply one-half of the deficiency so recognized in addition to that provided in paragraph (d).”

Colorado River District
Protecting Western Colorado Water Since 1937
## Current Use Estimates

<table>
<thead>
<tr>
<th>Description</th>
<th>MAF/ year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Basin uses incl. reservoir evap.</td>
<td>4.0 - 4.5</td>
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<tr>
<td>Lower Basin State Allocations</td>
<td>7.5 - 7.5</td>
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<tr>
<td>Lower Basin reservoir evap. (and other losses)</td>
<td>1.0 - 1.5</td>
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<tr>
<td>Lower Basin tributaries</td>
<td>2.0 - 2.5</td>
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<td><strong>Total Lower Basin</strong></td>
<td>10.5 - 11.5</td>
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<tr>
<td><strong>Subtotal</strong></td>
<td>14.5 - 16.0</td>
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<tr>
<td><strong>Add Mexico</strong></td>
<td>1.5 1.5</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>16.0 - 17.5</td>
</tr>
</tbody>
</table>

**Colorado River District**

*Protecting Western Colorado Water Since 1937*
Hydrology comparison
average natural inflows at Lee Ferry

- 2000-2015: 12.4 MAF/year
- 2000-2004: 9.4 MAF/year
- 2005-2015: 13.8 MAF/year
- 1930-2015: 13.9 MAF/year
- Basin Study \(^{cc}\): 13.7 MAF/year

\(^{cc}\) = climate change

Data from Reclamation’s Naturalized Flows database
Water Budget at Lake Mead

- **Inflow**
  (release from Powell + side inflows) = 9.0 maf

- **Outflow**
  (AZ, CA, NV, and Mexico delivery + downstream regulation and gains/losses) = -9.6 maf

- **Mead evaporation losses** = -0.6 maf

- **Balance** = -1.2 maf

Given basic apportionments in the Lower Basin, the allotment to Mexico, and an 8.23 maf release from Lake Powell, Lake Mead storage declines about 12 feet each year.
Colorado River at Lees Ferry, AZ
Natural Flow
SAME GRAPH STARTING IN 1878

- ten year moving average
- running average to date

ANNUAL FLOW IN MILLIONS OF ACRE-FEET PER YEAR

YEAR

- 1878
- 1881
- 1884
- 1887
- 1890
- 1893
- 1896
- 1899
- 1902
- 1905
- 1908
- 1911
- 1914
- 1917
- 1920
- 1923
- 1926
- 1929
- 1932
- 1935
- 1938
- 1941
- 1944
- 1947
- 1950
- 1953
- 1956
- 1959
- 1962
- 1965
- 1968
- 1971
- 1974
- 1977
- 1980
- 1983
- 1986
- 1989
- 1992
- 1995
- 1998
- 2001
- 2004
- 2007
- 2010
- 2013

YEAR
Lake Powell Releases

- Controlled by the 2007 Interim Guidelines
- Based on storage levels in both Powell & Mead
- What happens in the LB impacts Powell and what happens in the UB impacts Mead
- As long as Powell has storage - NO compact problems for UB
Contingency Planning

Challenge from US Department of Interior:
What if the current drought were to continue?
Have a plan in place by 2015 (MOA or similar)

The Goal:
Identify actions to reduce risk of losing power production or being unable to deliver water

Possible Solutions:
Extended Operation of CRSP reservoirs
Demand Management
Cloud seeding / other augmentation approaches
What if drought periods of past 25 years repeated?

- Current conditions at Powell: about 60% full Jan 1 2018
- Three recent droughts superimposed on current conditions (drawdowns based on historical record)
- No contingency planning actions in place; no water banking in place

Elevation 3525: Threshold for Lower Operating Tier; Reclamation is concerned about Hydropower efficiency and hydraulics/cavitation below this level

Elevation 3490: Ability to make releases per 2007 Interim Guidelines (and hence Compact Compliance) is jeopardized
Contingency Planning

Why do we need one?
The Colorado River Basin has been in a prolonged drought since 2000

Who is taking the lead?
The 7 Colorado River basin states & US Bureau of Reclamation

Who in Colorado is actively involved?
The Colorado River District, Southwestern Water Conservation District, Colorado Water Conservation Board, The Nature Conservancy and Front Range Water Council are jointly investigating the feasibility of a water bank.
Basics of Contingency Planning

1. Extended operations
Federal reservoirs upstream of Lake Powell – Flaming Gorge, Aspinall and Navajo Reservoirs – would release additional water for storage and use in Lake Powell.

2. System augmentation
Enhanced cloud seeding and accelerated removal of non-native vegetation such as tamarisk.

3. Demand management
Additional conservation by municipal and irrigation users and deficit irrigation or falling by agricultural users.
Colorado River Storage Project Units (CRSP)


**Source:** USBR Upper Colorado Region

**Levels as of 3/25/2018**

- **Flaming Gorge**
  - 3.7 MAF active capacity
  - 85% full

- **Blue Mesa**
  - 0.84 MAF active capacity
  - 65% full

- **Navajo**
  - 1.7 MAF active capacity
  - 73% full

- **Lake Powell**
  - 26 MAF active capacity
  - 54% full
Augmentation (weather modification)

HOW CLOUD SEEDING WORKS...

1. A minute amount of silver iodide is sprayed across a propane flame

2. The silver iodide particles rise into the clouds

3. The silver iodide causes cloud moisture to freeze and create ice crystals

4. Ice crystals grow big enough to fall as snow
Cooperative Demand Management

• Creating an arsenal of flexible approaches ~
  • to reduce risk of shortages
  • to protect historical water uses
Cooperative Demand Management

Lower Basin:
• Increasingly reduced deliveries from Lake Mead as water level drops.

Upper Basin
• Reducing Consumptive Use
  • Agriculture
  • Municipal & Industrial
  • Trans-mountain Diversions
## Lower basin DCP Conservation schedule

<table>
<thead>
<tr>
<th>Lake Mead Elevation</th>
<th>AZ (2007)</th>
<th>AZ (Plan)</th>
<th>AZ Total</th>
<th>NV (2007)</th>
<th>NV (Plan)</th>
<th>NV Total</th>
<th>CA (2007)</th>
<th>CA (Plan)</th>
<th>CA Total</th>
<th>USBR</th>
<th>Mexico Minute 319*</th>
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DCP Outcomes

- Powell and Mead are operationally coupled through the ‘07 Guidelines
- Neither Basin can completely mitigate its own risk: The best solutions require participation by both Upper and Lower Basins.
Colorado Basin River Forecast Center
Lake Powell 17 Group

Percent Median To Date: 78% (15.5 / 19.8)
Percent Seasonal Median: 70% (15.5 / 22.0)

Accumulation rate 0.2 in/day
averaged over last 3 days.

Median 1981-2010
Average 1981-2010
2018
2017
2002
2015

Created 03/27.20:43 G MT
NOAA/CBRFC, 2018

Colorado River District
Protecting Western Colorado Water Since 1937
Water Supply Forecast

Colorado - Lake Powell, Glen Cyn Dam, At (GLDA3)
Period: Apr-Jul, Official 50% Forecast (2018-03-15): 3100 kaf (43% Average, 48% Median)
ESP is Unregulated and No Precipitation Forecast Included

- Max 1984
- Min 2002
- Average
- Median
- Observed Accumulation
- Observed Total
- Normal Accumulation
- ESP
- ESP (wo Obs)
- Official 10
- Official 30
- Official 50
- Official 70
- Official 90

Volume (kaf)
