

A scenic view of a reservoir surrounded by mountains and a forested hillside under a cloudy sky. The water is calm and reflects the sky. The foreground shows rocky terrain with some sparse vegetation.

Rio Grande Reservoir Cooperative Project

Building consensus and trust for a
multi-use storage project

RiverWare User Group Meeting

August 28th, 2013

Arista Hickman and Kelly DiNatale
DiNatale Water Consultants
Boulder, CO

General Project Location Rio Grande Basin Colorado

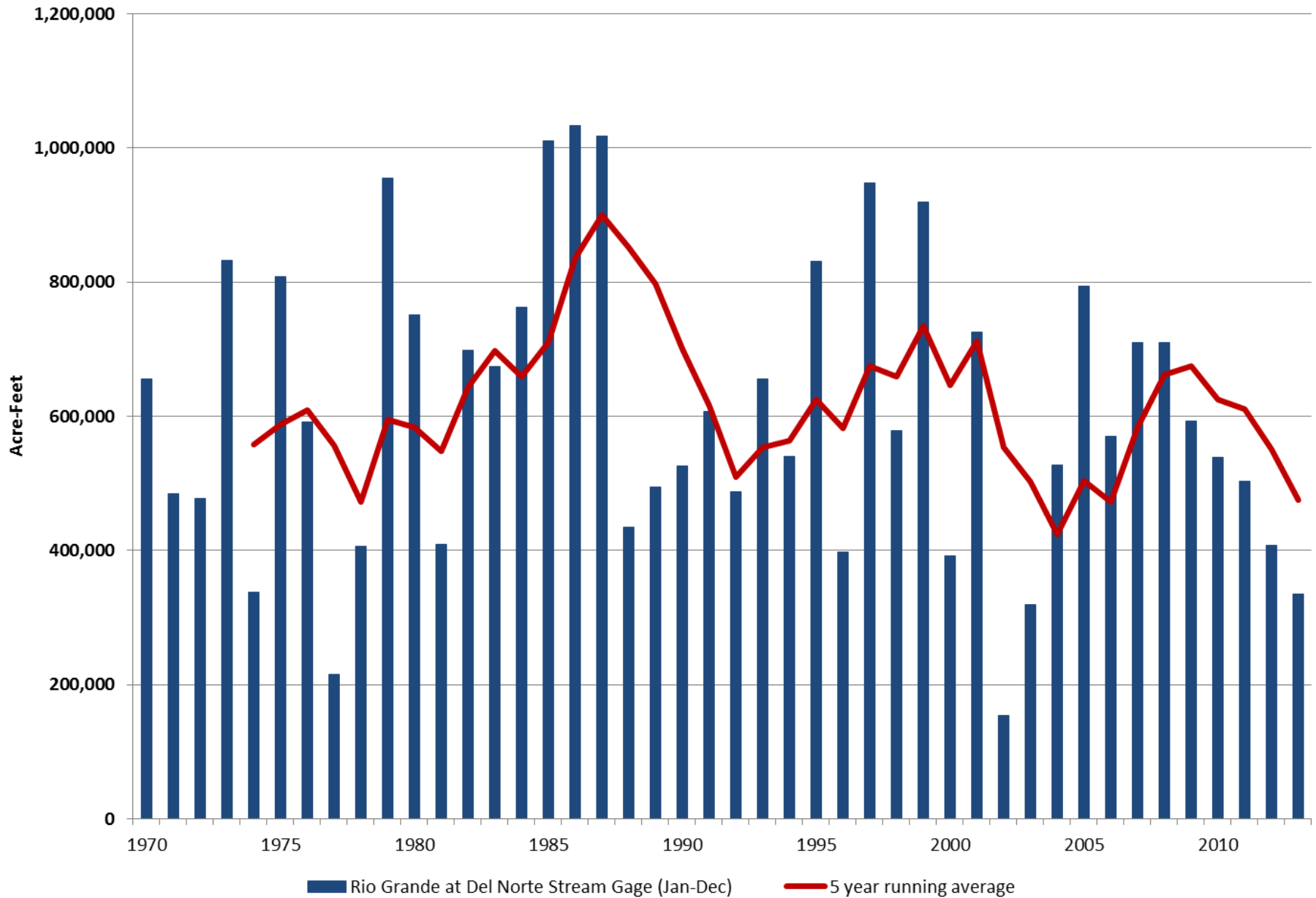


Rio Grande Basin Water Supply Challenges

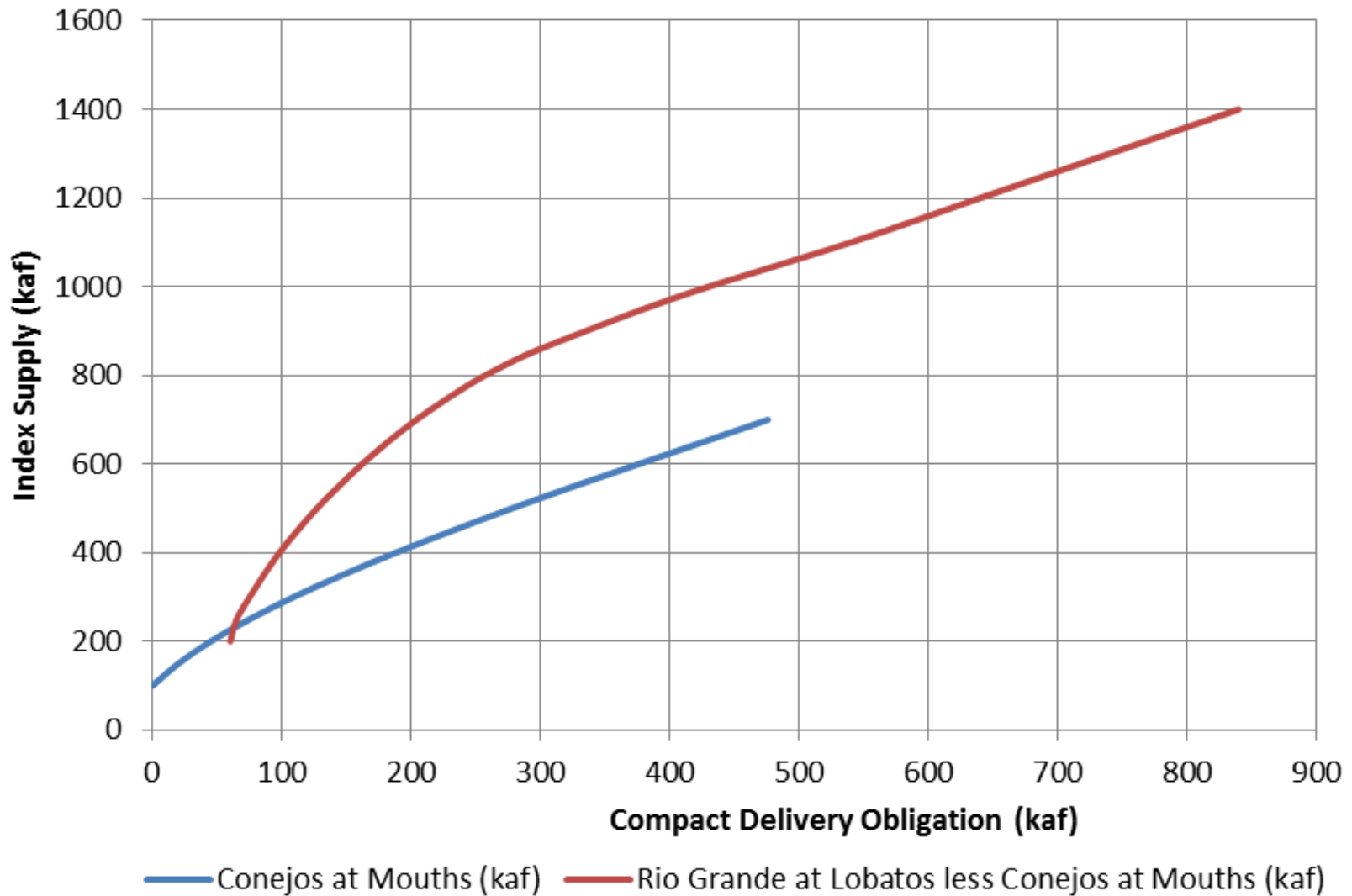
- Sustained Drought and climate change
- Beetle kill and fires
- Rio Grande Compact deliveries
- Limited pre-compact storage
- Two of four mainstem pre-compact reservoirs in need of major rehab (\$35M+)
- Overdraft of unconfined aquifer
- Well augmentation requirements



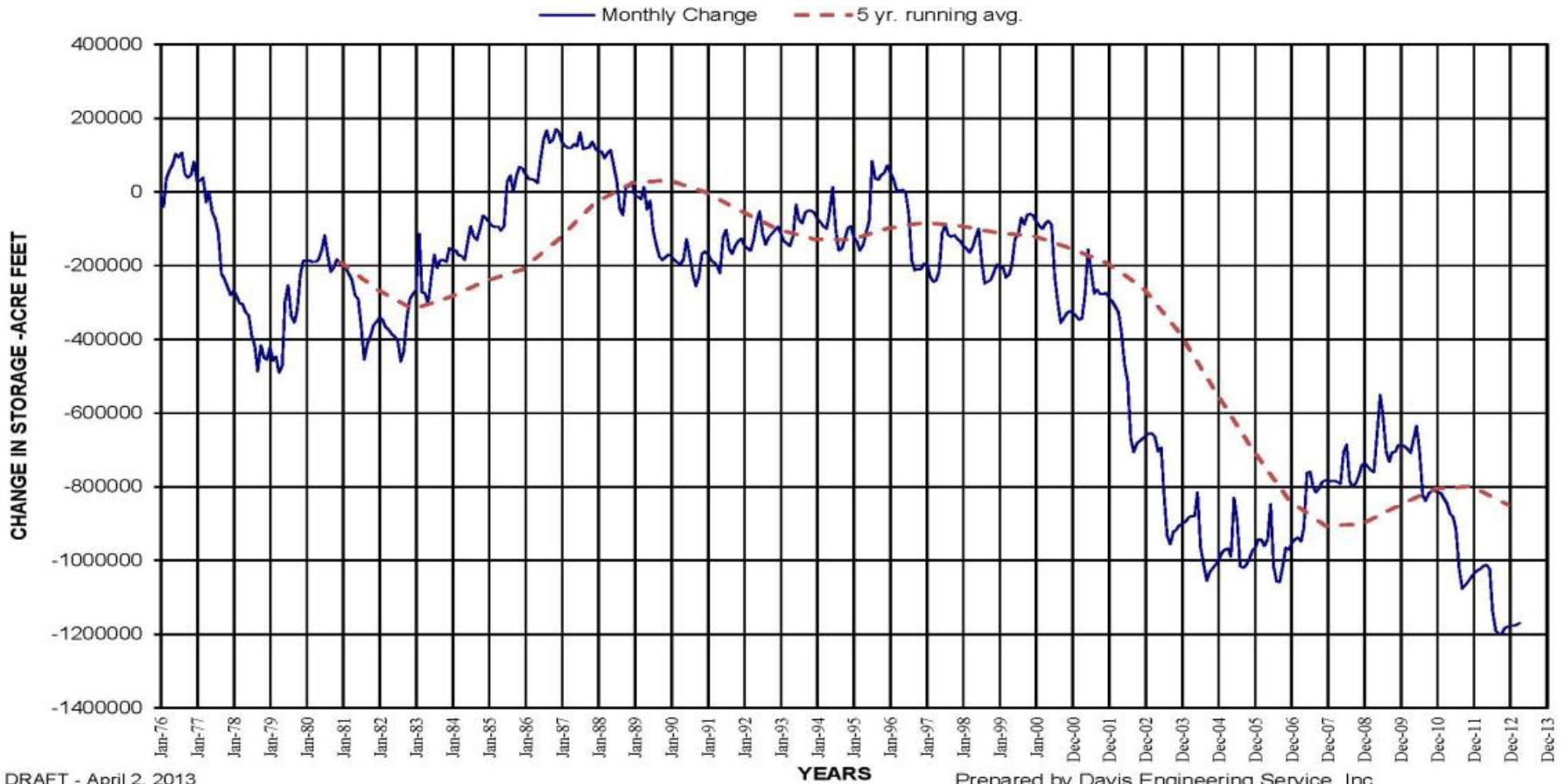
Rio Grande at Del Norte, CO Annual Flow



Rio Grande Compact Delivery Obligations



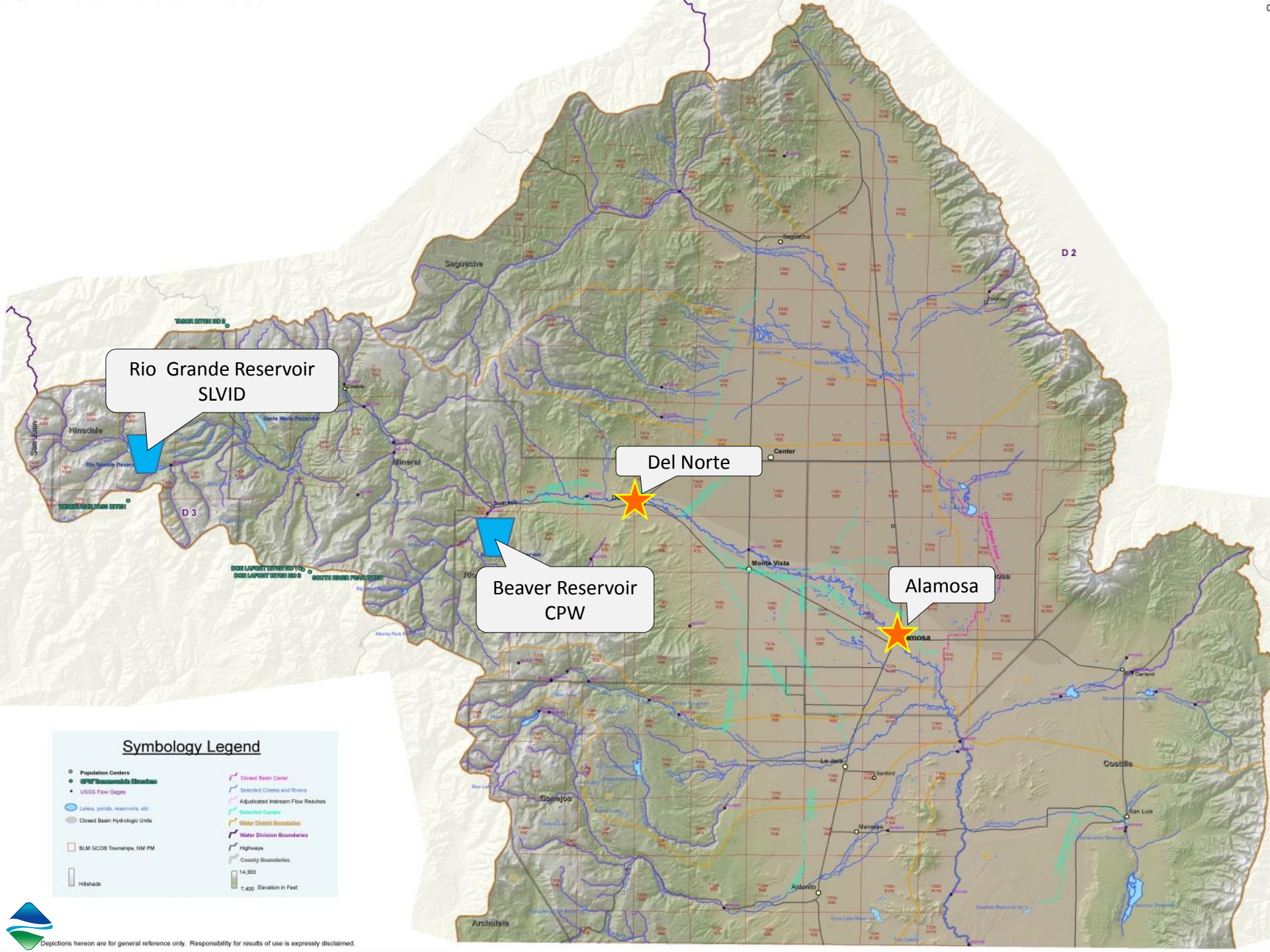
CHANGE IN UNCONFINED AQUIFER STORAGE WEST CENTRAL SAN LUIS VALLEY



DRAFT - April 2, 2013
Data through April 1, 2013

Prepared by Davis Engineering Service, Inc.
For Rio Grande Water Conservation Dist.





Rio Grande Reservoir
SLVID

Del Norte

Beaver Reservoir
CPW

Alamosa

Symbology Legend

○ Population Centers	🌊 Closed Basin Hydrologic Units	🚰 Selected Creeks and Rivers
● USGS Flow Gages	📏 Adjusted Instream Flow Reaches	🛞 Twinned Canals
🌊 Lakes, ponds, reservoirs, etc.	🗺️ Water District Boundaries	🚰 Closed Basin Canals
🗺️ Closed Basin Hydrologic Units	🚰 Water Division Boundaries	🛞 Highways
🗺️ BLM GCDR Townships, NM PM	🚰 County Boundaries	📏 14,300
🗺️ Hatched	📏 7,600 Elevation in Feet	

Rio Grande Cooperative Project Background

Beaver Reservoir

- CPW owns and uses a number of native and transmountain water rights in the Rio Grande Basin, including Beaver Reservoir
- Pre-compact reservoir
- Storage capacity of approximately 4,500 acre-feet
- Under a storage restriction due to dam safety issues
- Cost of repairing Beaver Reservoir is \$16 million

Rio Grande Reservoir

- Only mainstem on-channel pre-compact reservoir in the basin
- Storage capacity of 54,000 acre-feet
- 100 year-old dam has dam safety issues related to seepage, spillway capacity and outlet works
- Repair of the dam is estimated to cost \$20 - \$25 million
- CPW stores and regulates many of its transmountain water rights in Rio Grande Reservoir



Background Issues

- CPW owns an extensive water rights portfolio in the basin
 - How to best meet its multiple objectives?
- Colorado Parks and Wildlife cash strapped
 - Is the rehab of Beaver a priority for limited funds?
 - Can a case be made for grants for rehab?
- Storage in Rio Grande Reservoir was under a temporary year to year basis
 - Is this vital to management of CPW's water rights?
- SLVID needed financial assistance to fund the Rio Grande Reservoir rehabilitation
- SLVID was the client, CPW a potential customer for storage in Rio Grande Reservoir

Beaver Reservoir



Colorado Parks and Wildlife

- Evaluate the yield of its water rights portfolio
- Catalog its water needs – current and potential
- Evaluate the yield of Beaver Reservoir:
 - with and without the rehabilitation
 - maintaining various conservation pool levels
 - meeting the junior CWCB in stream flow right with voluntary releases
- Determine optimal storage accounts in Rio Grande Reservoir
 - Spill-proof vs. space available
 - Conservation and operating pools
- Understand how to manage and coordinate operations to maximize yield and provide for streamflow benefits

Operations Modeling Goals

- Optimizing the yield and operations of CPW native and transmountain water using Beaver Creek Reservoir and Rio Grande Reservoir
- Ability to incorporate future water obligations when amounts and locations are determined, e.g.; well pumping depletion obligations
- Evaluate opportunities for use of CPW's water rights , e.g.; increase reliability during extended droughts, maintain minimum pool in Rio Grande, deliveries to other CPW uses
- Quantify Beaver Reservoir yield
 - Conservation pool
 - Voluntary minimum streamflows
 - With and without rehab
- Evaluate CPW target storage account in Rio Grande Reservoir based on goals and operations criteria



Rio Grande Reservoir



Components of Operations Model (CPW components)

- Four water user accounts
- Storage accounts in Rio Grande and Beaver Creek reservoirs
- Downstream delivery locations
- CWCB instream flow below Beaver Reservoir
- Synthetic and historical inflows
- Target conservation pool levels in Beaver and Rio Grande Reservoirs



Model Selection

- Previous modeling performed in Excel
- Conversion to daily timestep – file size
- Flexibility in rules, deliveries and storage accounts
- Water rights operations not critical – performed externally
- User interface – export results for run comparison
- Accounting and physical



Model Inputs

- CPW Daily and Annual Obligations
- Minimum Streamflow Target

Storage Account	Initial Storage	Target Storage (Minimum)
Source A	0	0
Source C	0	100
Source D	0	100
Source B	2,000	2,200
All Accounts Combined	2,000	2,400
Maximum Storage	4,434	

Storage Account	Initial Storage	Target Storage (Minimum)
Source A	3,000	3,000
Source B	0	100
Source C	0	100
Source D	0	100
All Accounts Combined	3,000	3,300
Maximum Storage	6,000	



Operations Model

- Historical analysis
 - January 1, 1980 - December 31, 2008 (period for which daily data are available)
 - Daily timestep
 - Simulated daily obligations (based on information from CPW and Water Commissioner)
 - Account inflows
 - Reservoir exchanges, substitutions, and outflows
- Ability to modify flows and obligations
 - Use synthetic instead of historical inflows
 - Add additional delivery obligations
 - CWCB instream flow rights

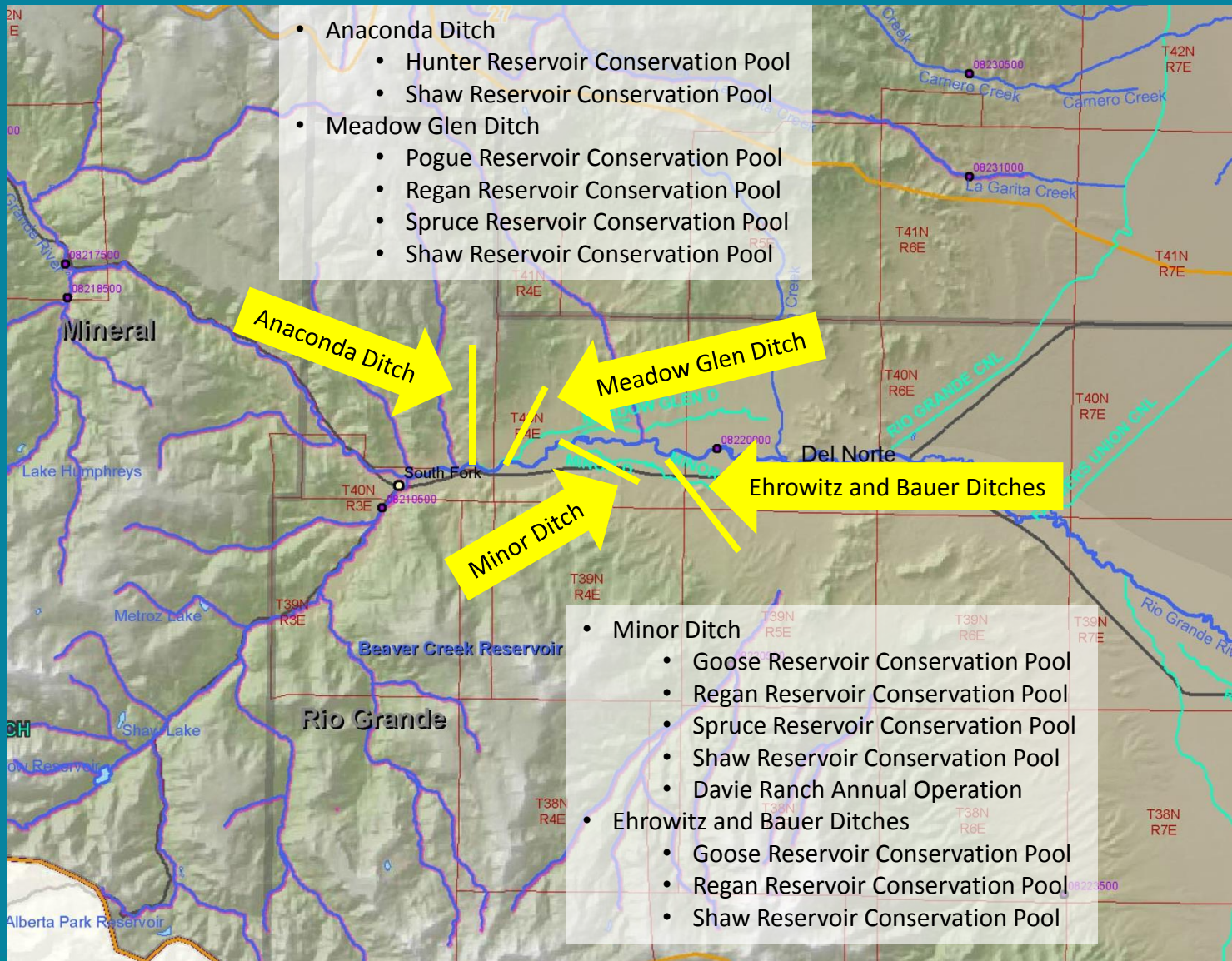


Example: Annual Operations and Transit Loss

Annual Operation	Water Source for Use	Water Source for Transit Loss	Alternative Water Source	Headgate Delivery, AF	Transit Loss Percent	Transit Loss, AF	Total Release Requirement, AF
Davie Ranch	Source B	Source B	Source A, C, or D	200.0	5%	10.0	210.0
BLM Well Augmentation	Source C	Source B		79.0	20%	15.8	94.8
Red Mtn Ranch Evaporation	Source C			8.0	0%	-	8.0
Trujillo Meadow Evaporation	Source B			50.0	20%	10.0	60.0
Wagon Wheel Gap Augmentation	Source B			0.3	0%	-	0.0
Fuchs (Future)	Source C/ Seepage out of Rio Grande Reservoir			130.0	0%	-	130.0
Home Lake	Source C Out of Beaver	Source B		190.5	5%	9.5	200.0
Blanca Wetlands	Source C	Source B		200.0	20%	40.0	240.0
Future Augmentation	Source B	Source B		400.0	20%	80.0	480.0
Subtotal				1,257.8		165.3	



CPW Obligations above Del Norte Gage

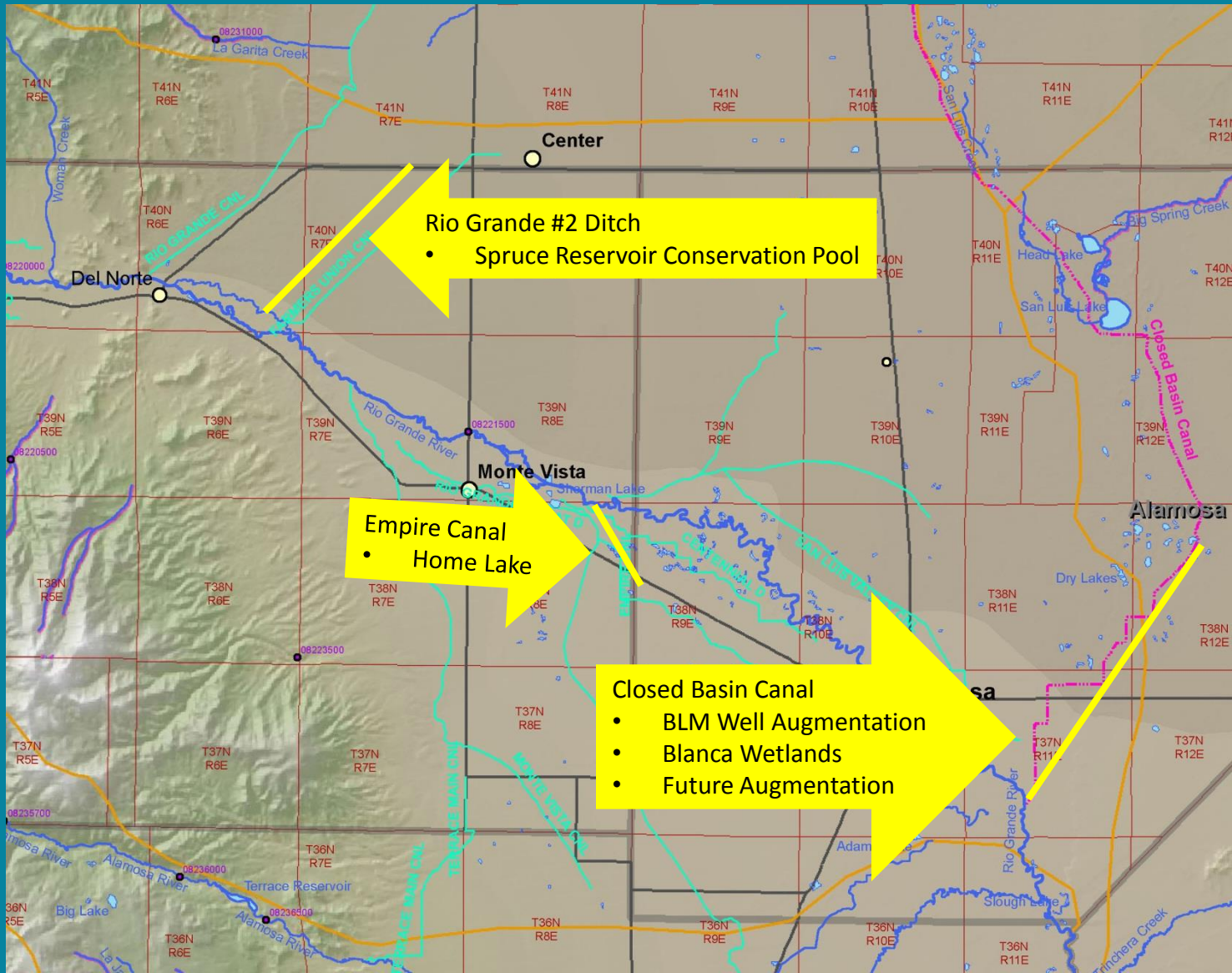


- Anaconda Ditch
 - Hunter Reservoir Conservation Pool
 - Shaw Reservoir Conservation Pool
- Meadow Glen Ditch
 - Pogue Reservoir Conservation Pool
 - Regan Reservoir Conservation Pool
 - Spruce Reservoir Conservation Pool
 - Shaw Reservoir Conservation Pool

- Minor Ditch
 - Goose Reservoir Conservation Pool
 - Regan Reservoir Conservation Pool
 - Spruce Reservoir Conservation Pool
 - Shaw Reservoir Conservation Pool
 - Davie Ranch Annual Operation
- Ehrowitz and Bauer Ditches
 - Goose Reservoir Conservation Pool
 - Regan Reservoir Conservation Pool
 - Shaw Reservoir Conservation Pool



CPW Obligations Del Norte Gage to Closed Basin Canal



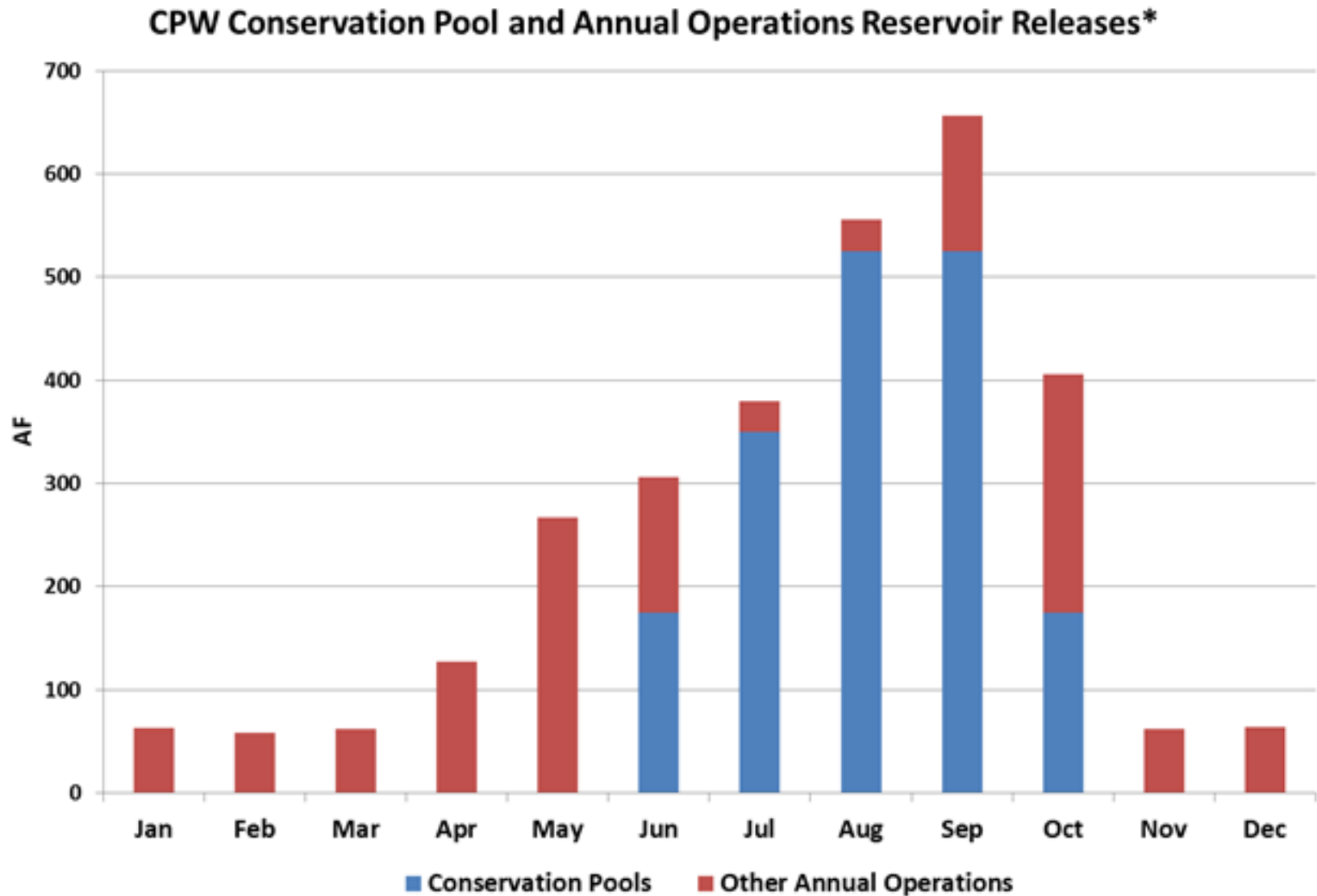
Rio Grande North Channel



Farmers Union Canal Headgate

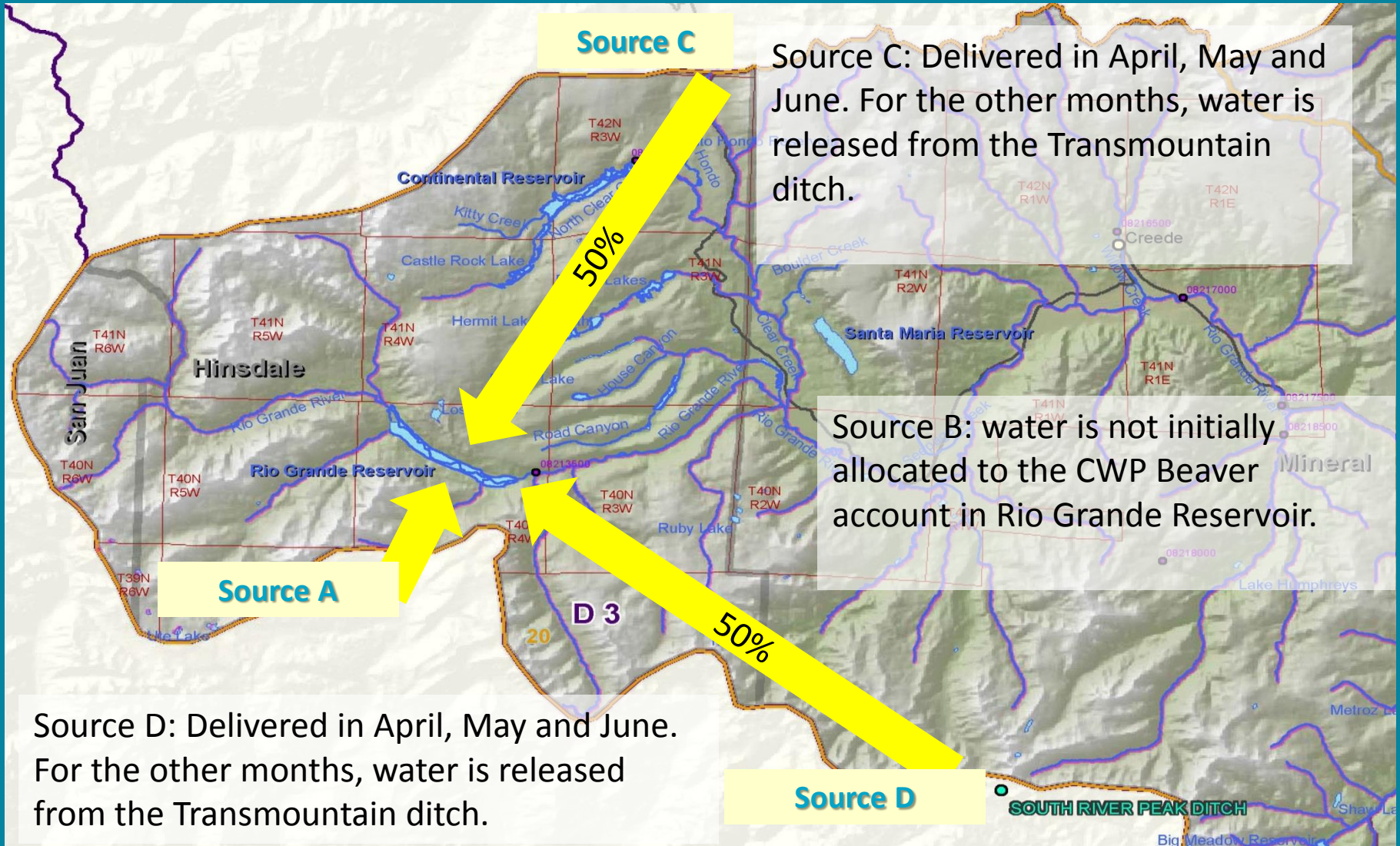


CPW Monthly Obligations



* Does not include hatcheries or Russell Lakes

Rio Grande Reservoir Account Inflows – Direct Delivery, Exchange or Substitution



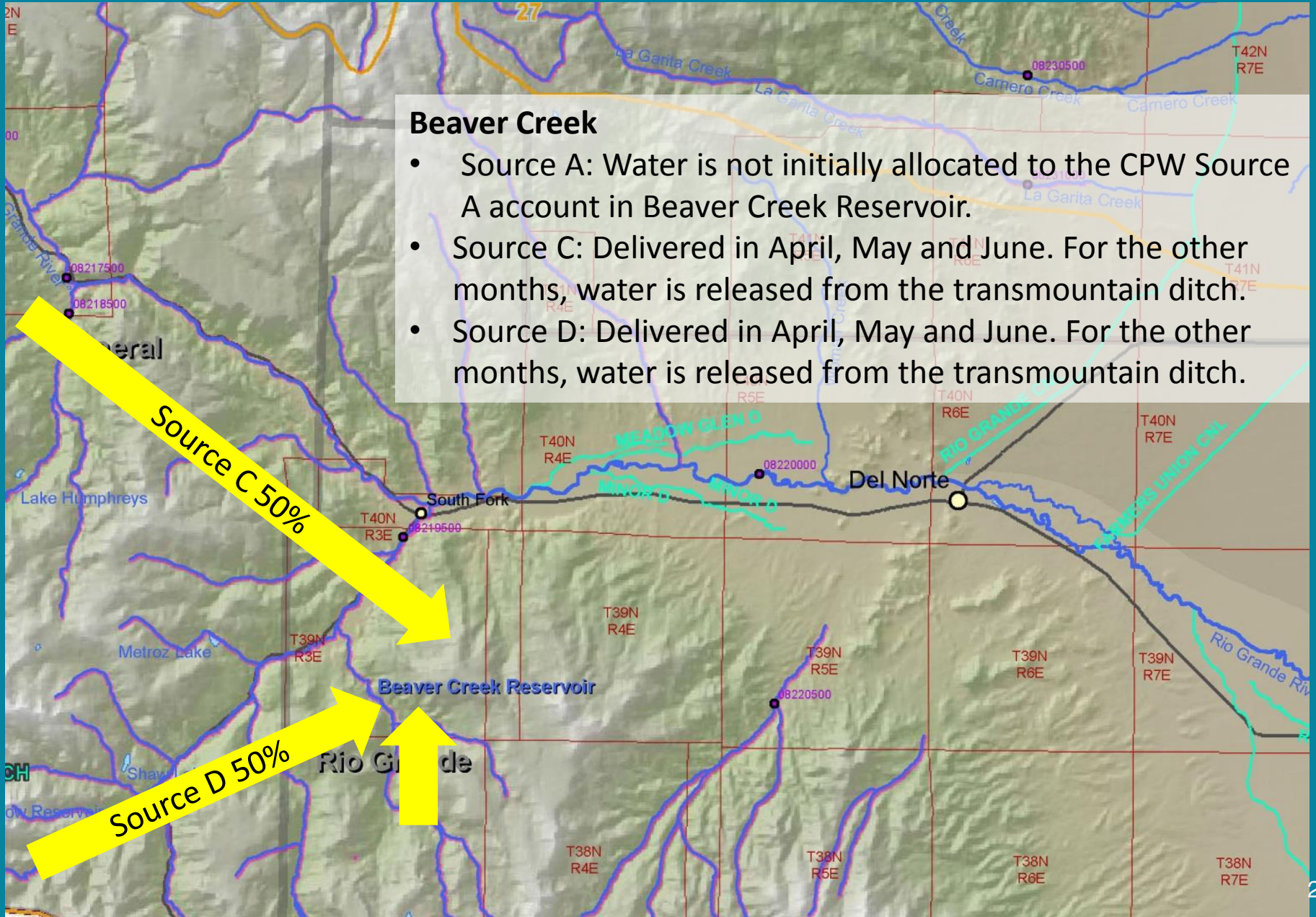
Beaver Creek Reservoir Account Inflows

Beaver Creek

- Source A: Water is not initially allocated to the CPW Source A account in Beaver Creek Reservoir.
- Source C: Delivered in April, May and June. For the other months, water is released from the transmountain ditch.
- Source D: Delivered in April, May and June. For the other months, water is released from the transmountain ditch.

Source C 50%

Source D 50%

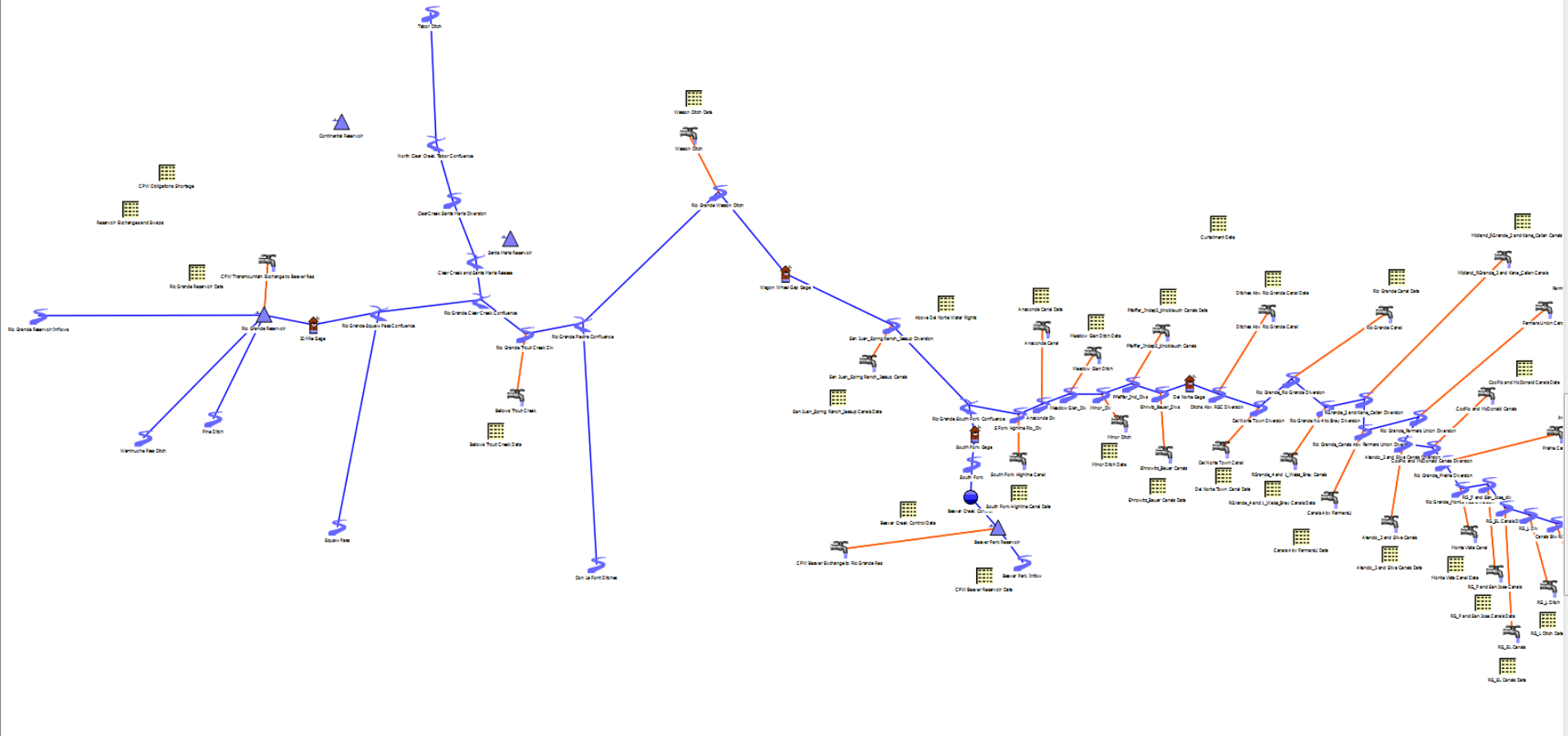


Simulation View

RiverWareVIEWER 6.3.2 - CPW_Snythetic_Scenario_2e 7-1 v1.mdl.gz

File Control Workspace Policy DMI Accounting Utilities Units Help

Simulation View



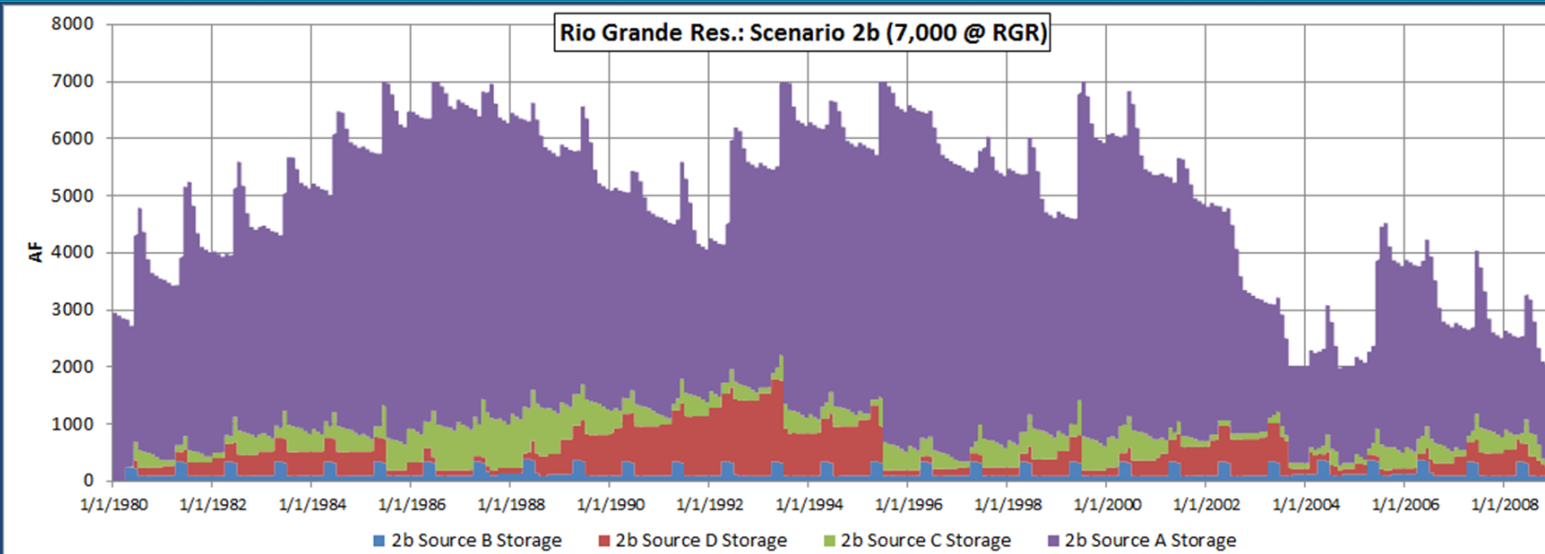
Modeling Implementation

- CPW water resources staff developed synthetic yields
- Obligations developed as an interactive process with local CPW staff and water commissioner
- Model rules developed based on interviews with CPW staff
- CPW provided initial model assumptions and DWC provided results
- Additional model runs conducted based on initial results
- Interactive process resulted in greater understanding of
 - CPW's obligations
 - Yields of its water rights portfolio under various scenarios
 - Ability to meet obligations and shortages with various storage levels
 - How to coordinate operations between Beaver and Rio Grande storage pools to meet obligations and also provide streamflow benefits during critical periods



Interactive Results Display

Allows easy comparison of model runs

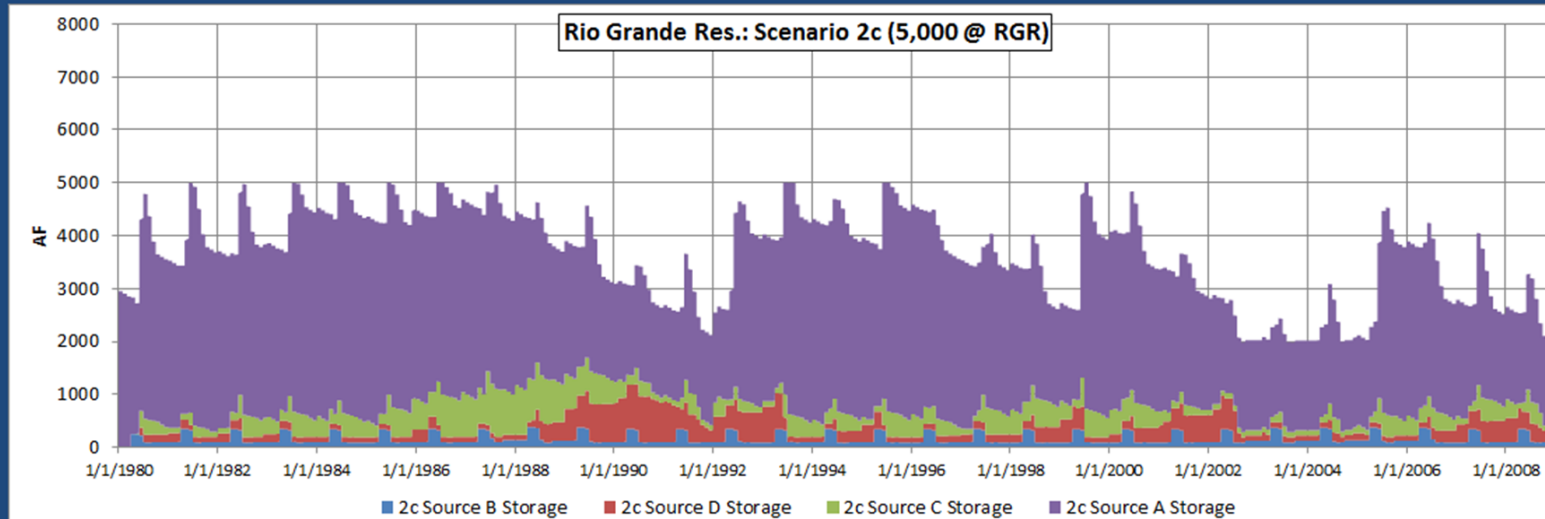


Scenario

2b (7,000 @ RGR)

Reservoir

Rio Grande Res.



Scenario

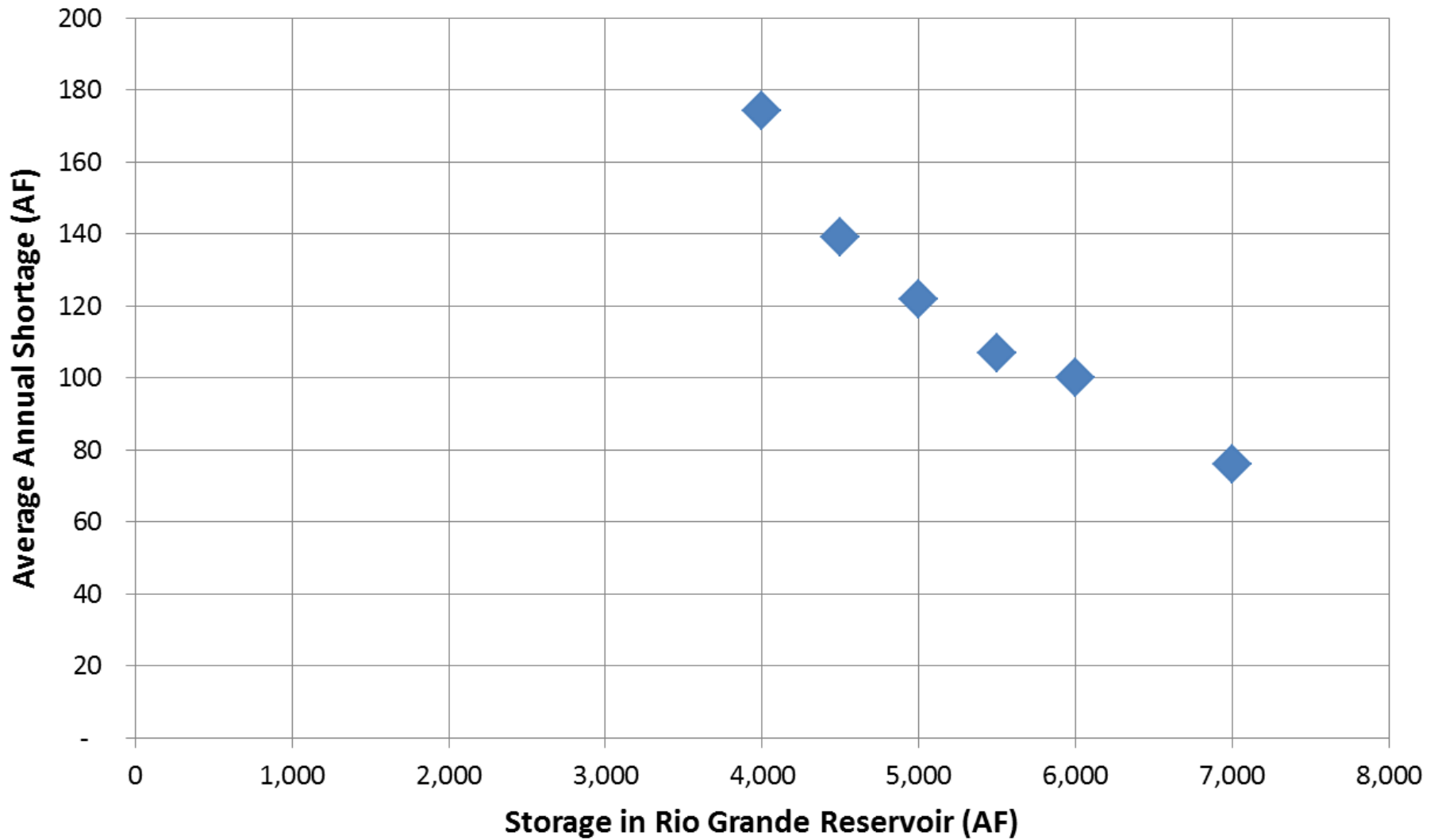
2c (5,000 @ RGR)

Reservoir

Rio Grande Res.



Total Shortage vs. Storage at Rio Grande Reservoir



Cooperative Project Status

- CPW implementing operations based on knowledge learned from modeling
- Negotiations on storage agreement
- CWCB provided \$10M in zero interest loan for Beaver Reservoir rehab
- CWCB provided \$5M in grants and future \$10M in grants/loans for Rio Grande Reservoir rehab



Cooperation Runs Through Rio Grande Agreement

Special to the Post | 11/28/12

[Back to the News Summaries](#)

A cooperative agreement among water users in the San Luis Valley this summer helped assure that water was delivered to agricultural producers and domestic users, and that river and stream flows were maintained for the benefit of wildlife and recreationists.

The Rio Grande Cooperative Project, a public-private partnership between Colorado Parks and Wildlife and the San Luis Valley Irrigation District, proved crucial during 2012 because snowpack reached only 15 percent of average in the mountains of south central Colorado.

"The agreement was critical because it enhanced flows in the Rio Grande and provided water during the critical low-flow period during October," said Steve Baer, a state water commissioner in the San Luis Valley.

Next Steps

- Simplified water rights, depletions and return flows
- Disaggregate streamflows to subbasin level
- Modify hydrology to evaluate potential impacts:
 - climate change
 - beetle kill
 - post-fire impacts
- Non-consumptive streamflow targets
- Additional user accounts for:
 - Compact and river administration
 - Groundwater management subdistricts
 - Municipal and Industrial users
- Scenarios for Rio Grande Basin Implementation Plan to evaluate future demands and meeting multiple objectives (River Smart Tools?)
- Data compatible with Colorado Decision Support System StateMod platform

