

Department of Natural Resources

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Jared Polis, Governor

Dan Gibbs, DNR Executive Director

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TO: Colorado Water Conservation Board Members

FROM: Amy Ostdiek

DATE: July 21, 2021

**SUBJECT:** Agenda Item 14: Demand Management Feasibility Investigation Update

### Staff recommendation:

Staff recommends that the Board adopt the Demand Management decision-making roadmap attached hereto as Exhibit A.

### **Background**

The Upper Basin States of the Colorado River Basin are currently investigating the feasibility of a potential Demand Management program. Demand Management is the concept of temporary, voluntary, and compensated reductions in consumptive use. The conserved water would be used to ensure ongoing compliance with the 1922 Colorado River Compact. The Demand Management Storage Agreement, one element of the 2019 Drought Contingency Plan (DCP), provides the authorization for the Upper Division States to store water created pursuant to a Demand Management program in Lake Powell. The water would only be used for Compact compliance purposes at the direction of the Upper Colorado River Commission. Whether a program is established and how such a program would operate are still open questions. Each Upper Division State must make an initial determination that Demand Management is feasible before moving forward with creating a potential program.

The mission of the Colorado Water Conservation Board is to conserve, develop, protect, and manage Colorado's water for present and future generations. In carrying out this mission, CWCB is the agency authorized to determine whether Demand Management is feasible for Colorado. Following adoption of the DCP in March 2019 and after significant discussion by the Board and key stakeholders, the CWCB Board adopted the 2019 Work Plan to help guide the initial stage of the feasibility investigation. This work was focused on identifying key threshold issues associated with a potential Demand Management program. Pursuant to the 2019 Work Plan, staff convened workgroups that met throughout the 2019-2020 Fiscal Year. Staff provided regular updates to the Board and received guidance and input throughout the implementation of the 2019 Work Plan. A summary of work completed pursuant to the 2019 Work Plan is available in the July 2020 update to the Board.



Following Board discussion through workshops and Board meetings, the Board adopted the Step II Work Plan in November 2020. In this Work Plan, the Board directed staff to develop a framework of a Demand Management program, to be used to generate discussion about potential Demand Management program design and a range of potential implementation options. Staff developed the draft framework in early 2021, then engaged a wide range of stakeholders to solicit feedback on the framework, including through workshops, updates, and other outreach as detailed in the Step II Work Plan. Staff has provided regular updates to the Board throughout implementation of the Step II Work Plan.

Additionally, during this time the literature review was completed pursuant to Board guidance both through the 2019 Work Plan and pursuant to the Step II Work Plan direction to "[a]nalyze and learn from existing, ongoing, and/or new programs and projects." The process was designed to collect as much information as possible to inform the Board's discussion and process for the Demand Management Feasibility Investigation in July 2021 and beyond.

### Status Update on Implementation of Step II Work Plan

The framework was released in March 2021, and from March - June 2021, staff conducted public outreach regarding the framework, including:

- Six workgroup meetings: Staff conducting meetings with six of the workgroups previously convened pursuant to the 2019 Work Plan to receive input on whether workgroup members' input is adequately captured in the framework.
- Nine Basin Roundtable meetings: Staff presented to and requested input from the nine Basin Roundtables.
- *IBCC meetings and input:* Staff presented to the Interbasin Compact Committee on the framework and solicited specific input on the Framework. Staff plans to facilitate continued discussion at the October IBCC meeting.
- Three public workshops: Staff hosted three public workshops to receive input on the framework, each focused on specific subject matters.
- Public listening session: Staff hosted a public listening session to receive additional input on the framework.
- EngageCWCB Survey: Staff developed an informational website and a survey soliciting feedback on the framework.
- Demand Management informational video (to be released): Staff worked with a consultant to develop an informational video regarding Demand Management to reach those who may be interested but have been unable to attend previous meetings or may not otherwise be involved in the discussion at this time. This yet-to-be-released video directs viewers to CWCB's website for more information and to learn how to engage.
- Additional presentations as requested: In addition to the above-referenced items, staff also presented the framework and provided opportunities for discussion and input upon request.
- Written input: Staff also invited written comments relating to the framework.

All input received on the Framework to date is provided in Exhibit B to this memo. Note that input received through workshops and public meetings is captured in summaries, as well as directly in the attached framework through comment bubbles.



Additionally, throughout this process, staff has worked with a team of consultants to achieve the following public outreach and engagement tasks, pursuant to the Step II Work Plan:

- Developed a communications toolkit designed to assist Demand Management messaging, provided electronically to the Board members previously.
- Developed strategies to make better use of various communications networks, including but not limited to social media, improved graphics and informational documents, and use of informational videos.
- Developed a database of stakeholders who have provided input, attended meetings, or otherwise shown interest in the Demand Management Feasibility Investigation, which will be used going forward to distribute information and solicit feedback on the ongoing feasibility investigation.
- Ongoing and continued engagement with Tribal Nations regarding Demand Management and the Framework on a sovereign-to-sovereign basis.

### **Context for Decision Making**

In the Step II Work Plan, the Board adopted a lens through which to make decisions relating to Demand Management feasibility. The Work Plan breaks the feasibility question into three subquestions:

- (1) Achievability: The focus of this inquiry is whether it is technically possible to achieve a functioning Demand Management program within Colorado, and contemplates questions such as whether it is possible to verify and track water conservation, whether there are mechanisms available to track environmental benefits and impacts, whether it is possible to develop an appropriately robust outreach plan for a potential Demand Management program, and whether a funding source may be available.
- (2) Worthwhile for Colorado: The focus of this inquiry is whether even if a program is technically achievable it is worthwhile from Colorado's perspective. The scope of this question includes whether a Demand Management program may be established in a way that is proportional and equitable and avoids or mitigates unacceptable adverse impacts within the state.
- (3) Advisability: The focus of this inquiry is whether it is advisable for Colorado to make a feasibility determination within the broader context of Colorado River issues and strategy. This is a determination that will likely incorporate input from other states and the Upper Colorado River Commission, and therefore will be an evolving analysis. Given the quickly changing circumstances and ongoing investigation by the Upper Colorado River Commission, this determination would likely be made at the point in time after the first two questions are considered.

### **Next Steps**

### Roadmap for decision making

Within this context, the purpose of this agenda item is to discuss a potential roadmap for Board decision making to assist the Board in progressing in the Demand Management feasibility investigation. Staff suggests that the Board adopt the decision-making roadmap



attached as Exhibit A. As shown in this roadmap, staff suggests the questions relating to achievability be considered first, followed by questions relating to whether a Demand Management program may be worthwhile from Colorado's perspective, noting that answers to the "achievability" questions may help to frame and inform the analysis of whether Demand Management may be advisable.

In considering the attached roadmap for decision making, the Board may consider the following questions:

- (1) Does this roadmap adequately capture and organize the key milestones you envision in board decision making relating to Demand Management?
- (2) In considering the categories of decisions to be made relating to achievability, what are some specific questions you believe need to be answered relating to each subject in order to determine whether Demand Management is achievable for Colorado?
- (3) In considering the potential decisions to be made in the future, what are your thoughts on appropriate timing of decision-making?

### Resources to support decision making

In addition to information and resources previously provided, the following items are attached hereto, designed to assist the Board in its decision-making process:

Input received to date on the Framework (Exhibit B)
Literature review completed by the consultant team (Exhibit C)



Colorado Water Conservation Board Demand Management Feasibility Investigation Exhibit A - DRAFT Roadmap for Decision Making July 2021

### Achievability

[Tentatively to begin September 2021; subject to change]

- Monitoring & Verification: is it technically possible to monitor and verify conserved consumptive use within Colorado as required for a potential Demand Management program? - Tentatively September 2021
- Environmental Considerations: is it technically possible to track and monitor potential environmental impacts and benefits? Tentatively September 2021
- Education & Outreach: is it possible to develop an outreach plan for a Demand Management program that would increase general water education, motivate participation in the program, and help to inform program design? - Tentatively September 2021
- Funding: given the above determinations, is it possible to secure a funding source to pay for a Demand Management program? - Pending

### Worthwhile for Colorado

[Tentatively to begin November 2021; subject to change]

- Proportionality considerations: Can Colorado establish a Demand Management program that prioritizes avoidance of disproportionate negative economic or environmental impacts to any single subbasin or region within Colorado while protecting the legal rights of water rights holders, consistent with the Board's November 2018 Support and Policy Statement? Pending IBCC input to be received in October 2021, informing Board discussion in November 2021 and beyond
- Analyses and findings of UCRC and other states: Based on information gained from the UCRC feasibility investigation and those ongoing in the other Upper Division States, would a Demand Management program be worthwhile from Colorado's perspective? -Investigation ongoing

# EXHIBIT B

# Input Received, Spring – Summer 2021

This Exhibit includes various input received on the Framework and the Demand Management Feasibility Investigation generally in Spring-Summer 2021, including meeting summaries, survey responses, letters, and other feedback received. In addition, the final document is the draft Framework with comment bubbles that correspond with specific input heard at public meetings.



# **Stakeholder Input**

### **CWCB Demand Management Feasibility Investigation**

Spring - Summer 2021

### **Contents:**

**Demand Management Workgroup Workshop Meeting Summaries** 

**Economics and Local Government Workgroup** 

**Funding Workgroup** 

**Agricultural Impacts Workgroup** 

**Environmental Considerations Workgroup** 

Monitoring & Verification Workgroup

**Education & Outreach Workgroup** 

**Public Workshop Meeting Summaries** 

**Demand Management Public Workshop #1** 

<u>Demand Management Public Workshop #2</u>

**Demand Management Public Workshop #3** 

**Public Listening Session Meeting Summary** 

**EngageCWCB Survey Responses** 

Stakeholder Letters

Meeting summaries prepared for CWCB by Emily Zmak, CDR Associates. This document is intended to summarize stakeholder input and does not necessarily represent the views or opinions of CWCB staff or Board.



# Demand Management Workgroup Workshop Meeting Summaries

**DEMAND MANAGEMENT FRAMEWORK MEETINGS**Spring 2021



## **Economics and Local Government Workgroup**

### DEMAND MANAGEMENT FRAMEWORK MEETING

April 20, 2021 | 12:00 - 1:30p

Version 1 of the draft demand management framework is available for review here.

### **Discussion Highlights**

Following presentations on the demand management framework ("framework") by Amy Ostdiek, CWCB, and Mark Smith, Colorado College, the Economics and Local Government Workgroup ("workgroup") had a facilitated discussion on the content within the workgroup's focus area.

The overall discussion focused on:

- The framework and the elements, trade-offs, and considerations captured within it; and
- Informing the CWCB Board's decision-making process.

### Framework Feedback

It is difficult to present both details and an uncomplicated overview in the same framework.
 The right-hand column could be clarified with a title along the lines of "considerations" or "interconnected issues." Issues should be captured in a consistent and accurate way.
 The A-B-C columns should better illustrate the escalation in complexity.
 "Do no harm" is a guiding principle that should be captured as fundamental to all topics / sections.
 Additional clarity around municipal participation would be helpful.
 Impacts to local government are closely connected to agriculture. The consultation category should capture that agriculture is a key component in addressing community impacts.
 Water efficiency programs may be more disruptive than currently captured in the framework.
 Green spaces are an important consideration to capture.
 Mitigation funds should be directly linked to the sector impacted.
 Iterative mitigation would allow communities to incorporate lessons-learned and/or unexpected impacts into mitigation measures.

- Does surplus water count as consumptive use?
   What criteria should be used to judge whether or not demand management is a good idea?
- □ What does proportionality mean?
- How much would other agencies be involved in a demand management program?



# **Funding Workgroup**

### **DEMAND MANAGEMENT FRAMEWORK MEETING**

April 21, 2021 | 10:30 - 12:00

Version 1 of the draft demand management framework is available for review here.

### **Discussion Highlights**

Following presentations on the demand management framework ("framework") by Amy Ostdiek, CWCB, and Brett Bovee, Westwater Research, the Funding Workgroup ("workgroup") had a facilitated discussion on the content captured within the workgroup's focus area.

The overall discussion focused on:

- The framework and the elements, trade-offs, and considerations captured within it; and
- Informing the CWCB Board's decision-making process.

### Framework Feedback

Consider clarifying the budgets' inclusion of one-time costs and early investments.
Both fees and taxes should be considered as funding sources.
Federal investments could be captured in the commentary as a potential funding source.
The current presentation of costs begs the question, "Why would you pay more for the same amount of water?" The framework could articulate that the B- and C-columns fund worthwhile secondary
benefits, such as consistency and mitigation. Attractive program components may have additional costs.
There should be an expansive consideration of financing and funding, such as looking towards supply chains to broaden the pool of fee-payers.
Costs should be considered on a perpetual basis, not solely an annual or near-term basis.
Municipal participants would need to consider revenues and possible rate pressures, which would have impacts on low income communities and raise issues like bill affordability and customer assistance.
Cost equity could be captured. There are different impacts and benefits to different geographies, water consumers, and economies.
The framework could capture opportunity costs. Understanding opportunity costs could help clarify whether an entity should participate or not.
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### **Open Questions**

Ш	now expansive are the references to water users? Direct users, secondary users?
	What is the optimum program? Defining that would be helpful in considering financing.
	Can the demand management model be built in a way that it is transferable to other Basins?

□ What is the benefit for the cost and effort of the program?



# **Agricultural Impacts Workgroup**

### **DEMAND MANAGEMENT FRAMEWORK MEETING**

April 22, 2021 | 10:00 - 11:30a

**MEETING PURPOSE:** To ensure that the framework responds to workgroup members' initial feedback, and to solicit additional input on framework elements.

Version 1 of the draft demand management framework is available for review here.

### **Discussion Highlights**

Following presentations on the demand management framework ("framework") by Amy Ostdiek, CWCB, and Brett Bovee, Westwater Research, the Agricultural Impacts Workgroup ("workgroup") had a facilitated discussion on the content captured within the workgroup's focus area.

The overall discussion focused on:

- The framework and the elements, trade-offs, and considerations captured within it; and
- Informing the CWCB Board's decision-making process.

### Framework Feedback

Communicate the range of options' pros and cons, as well as financial and opportunity costs
 Consider addressing holistic sustainability and resiliency to future impacts within the framework
 A demand management program should treat producers fairly
 Consider intra-system impacts to ensure that nonparticipants are unaffected
 Pre-existing procedures, operations, and governance requirements for irrigation providers are constraints that a program would work within; for example, not all systems have individual water rights
 System compensation is an important consideration, although is only represented in Column C
 Soil health is a potential secondary benefit. The state could provide optional techniques or technical services to producers for improving soil health during fallowing. This could be a participation incentive.
 While the framework recognizes legal damages, it does not mention inconveniences. Someone will always be inconvenienced; early engagement could mitigate non-damaging impacts.
 Local benefit will stem from farmer compensation. Development funds could build and support agricultural economies, although the majority of the money should go to the program participants.
 Not all potential participants will be appropriate participants.

- $\hfill \square$  Will there be a mandatory crop type to prevent further landscape damage?
- ☐ How much will be paid to producers?
- □ Who pays for technical assistance offered to program participants?



# **Environmental Considerations Workgroup**

### DEMAND MANAGEMENT FRAMEWORK MEETING

April 26, 2021 | 2:00 - 3:30p

**MEETING PURPOSE:** To ensure that the framework responds to workgroup members' initial feedback, and to solicit additional input on framework elements.

Version 1 of the draft demand management framework is available for review here.

### **Discussion Highlights**

Following presentations on the demand management framework ("framework") by Amy Ostdiek, CWCB, and Jordan Dimick and Bailey Leppek, SGM Engineering, the Environmental Considerations Workgroup ("workgroup") had a facilitated discussion on the content captured within the workgroup's focus area.

The overall discussion focused on:

- The framework and the elements, trade-offs, and considerations captured within it; and
- Informing the CWCB Board's decision-making process.

### Framework Feedback

- ☐ The framework is a useful tool for evaluating trade-offs
- □ A successful program would provide resilience for the environment and recognize holistic environmental benefits
- Proportionality and fairness should be linked to discussions about water and costs
- □ Assessing net benefit should work within existing local environmental rules and guidance
- □ A long-term program will evaluate environmental benefit / impact through a different lens than a short-term program; for example, the timing of flows matters more in a long-term program
- Review language for implications or assumptions of adverse risk caused by some participants
- ☐ The value of water will factor into the proportionality discussion, and the more complicated the program, the more financially difficult it will be to launch the program

- □ What long-term programmatic options exist outside of the drought contingency plan timeframe?
- ☐ How can a demand management program be linked to other state programs to achieve win-win outcomes for environmental benefit?



# **Monitoring & Verification Workgroup**

### DEMAND MANAGEMENT FRAMEWORK MEETING

April 30, 2021 | 12:00 - 1:30p

**MEETING PURPOSE:** To ensure that the framework responds to workgroup members' initial feedback, and to solicit additional input on framework elements.

Version 1 of the draft demand management framework is available for review here.

### **Discussion Highlights**

Following presentations on the demand management framework ("framework") by Amy Ostdiek, CWCB, and Jordan Dimick, SGM Engineering, the Monitoring and Verification Workgroup ("workgroup") had a facilitated discussion on the content captured within the workgroup's focus area.

The overall discussion focused on:

- The framework and the elements, trade-offs, and considerations captured within it; and
- Informing the CWCB Board's decision-making process.

### Framework Feedback

- □ Interconnected issues include potential environmental benefits, transmountain diversion projects, and agricultural techniques like deficit irrigation.
- ☐ The purpose of monitoring and verification is to accurately quantify what wet water has been added to the system, so functionality, accuracy, and efficacy are key themes.
- ☐ The references to time are not as accurate when referring to historical diversion rates. Consider taking out the "or" in the cell discussing bypass diversions, because of the potential disconnect between CCU on the west slope and historical diversion rates.
- □ Terms benefit from careful definitions. For example, conserved consumptive use may mean different things when discussing CCU in the Colorado River system or on the East Slope.
- □ Monitoring and verification in multiple systems is complex, and considerations include historic canal losses, potential telemetry, and field return flows.
- □ There are a variety of tools and resources available to potential DM participants.
- ☐ Grounding the A-B-C columns in hypotheticals would help to build more detail and illustrate a program.
- Equity considerations are less applicable to monitoring and verification than other workgroup topics.
- Consider building options for future participation from other sectors, like industry or environmental.
- □ Column A approaches to monitoring and verification may be too simplistic for many DM programs.

### **Open Questions**

□ How will pilot programs inform the framework?



# **Education & Outreach Workgroup**

### **DEMAND MANAGEMENT FRAMEWORK MEETING**

May 3, 2021 | 1:30 - 3:00p

**MEETING PURPOSE:** To ensure that the framework responds to workgroup members' initial feedback, and to solicit additional input on framework elements.

Version 1 of the draft demand management framework is available for review here.

### **Discussion Highlights**

Following presentations on the demand management framework ("framework") by Amy Ostdiek, CWCB, and Emily Zmak, CDR Associates, the Education and Outreach Workgroup ("workgroup") had a facilitated discussion on the content captured within the workgroup's focus area.

The overall discussion focused on:

- The framework and the elements, trade-offs, and considerations captured within it; and
- Informing the CWCB Board's decision-making process.

### Framework Feedback

Clarify messaging around purpose, motivation, and objectives.
Outreach should give a clearer sense of the options to illustrate what implementation would look like.
With a statewide program, messaging outside of Column C would be difficult because of the scale.
Consider adding additional detail to capture the increasing complexities for message development. The
range could capture the basic process for message development; and at a higher level, message
specificity for certain geographies or target demographics.
Education and outreach should identify target audiences for different messages. This process could
include co-developing messages with the target audiences.
A feedback loop will build trust and develop a better program.
While the general public could benefit from general water education about curtailment and drought,
targeted audiences should be DM program participants and other impacted stakeholders.
Simplifying the framework's presentation would assist with engagement and interpretability.
The framework does not capture the "why" (advisability) nor climate change.
Frame issues around shared values, such as individual agency and the program's facilitation of choice.

- ☐ How are impacts being communicated? To what level of detail?
- □ How do messages change by audience and geography?



# **Public Workshop Meeting Summaries**

### **DEMAND MANAGEMENT FEASIBILITY INVESTIGATION**

June 2021



# **Demand Management Public Workshop #1**

### **PUBLIC WORKSHOP MEETING #1**

June 1, 2021 | 1:00 - 2:30p

### **Discussion Highlights**

Following presentations on the Demand Management Framework ("Framework") by Amy Ostdiek, CWCB; the Monitoring & Verification section by Jordan Dimick, SGM; and the Environmental Considerations category by Bailey Leppek, SMG; the Public Workshop #1 had a facilitated discussion on the Framework categories Monitoring & Verification ("M&V") and Environmental Considerations.

### Framework Feedback

Participants' priority considerations included: creating a truly voluntary program; ensuring effectiveness; balancing accuracy and implementability; and maximizing benefits to environment
Concern that M&V is complicated enough without combining it with the issue of proportionality
Consider clarifying the language regarding municipalities on the West and East Slopes
Broad concern for understanding how this framework is going to inform the CWCB decision-making
and implementation processes
Shift to hypotheticals to illustrate what requirements might be for each category
Broaden the lens to include West Slope municipalities and industrial water users
Concern about the significant costs of issues-management
Define what shepherding water from remote and/or rural locations to the state line looks like
Consider other options for incentivizing environmental benefits
The state could consider a minimum and more robust requirement for environment
Considering equity and proporitionality in M&V adds an additional, complicated layer
Gaps in the framework include the state's process for shepherding water; clarity on state measurement
rules or mechanisms; and pilots to address transmountain projects and environmental impacts
Incorporate relative time, accuracy, and costs into the Framework's A-B-C options
Concern that incentives are shifting away from compact compliance and toward environmental benefit

How to connect the Framework to decision-making and implementation at the CWCB?
How does the Demand Management program work in different locations and elevations?
How will the Board make decisions about the A, B, and C columns? And how does the Framework
inform feasibility?
How could a program incentivize a C-column approach to the environment without or beyond money?
What does the cost look like? Where does the funding come from?
What is the process for shepherding water to the state line?



# **Demand Management Public Workshop #2**

### **PUBLIC WORKSHOP MEETING #2**

June 14, 2021 | 11:30 - 1:00p

### **Discussion Highlights**

Following presentations on the Demand Management Framework ("Framework") by Amy Ostdiek, CWCB; the Economic Impacts & Local Governments section by Brett Bovee, WestWater Research; and the Agricultural Impacts section by Angie Fowler, SGM; the Public Workshop #2 had a facilitated discussion on the Framework categories Economic Impacts & Local Governments and Agricultural Impacts.

### Framework Feedback

Provide technical details about what Demand Management would encompass and look like in
application, specifically for farmers and ranchers in the Colorado River Basin
Interest in exploring the legal details of Demand Management in the Framework
Concern about how to address claims of injury and how to prevent injury
Consider defining alternative or innovative incentives for Demand Management participants beyond money, especially for municipalities
Define the long-term implications for rural communities and the impacts to the agricultural sector
Consider storing water in reservoirs within the state, rather directly in Lake Powell, to provide more
internal control
Develop clear direction for next steps and approach
If participants are going to give up water for a few years, they need assurance that the program will provide insurance from curtailment
Desire for a program to align with growing season schedules and ranch operations
Impacts will likely be very localized and specific, so the Framework should include a process to evaluate
and resolve local impacts in a responsive manner
Consider secondary impacts of a program, such as health care

How to ensure that one sector or region doesn't bear all the burden?			
How best to prepare water users for the new normal of water scarcity?			
What are the considerations and agreements that must be reached with the other Upper Basin states			
that are not encompassed by the Framework?			
Would the Demand Management program work with other state agencies?			
How is Demand Management different from existing programs like the ATM program?			
How is CWCB considering abandonment or speculation issues of water rights?			
Can other people object to an applicant's Demand Management application?			
How will the pricing of water work?			
What does "temporary" entail (years, months)?			



# **Demand Management Public Workshop #3**

### **PUBLIC WORKSHOP MEETING #3**

June 14, 2021 | 1:30 - 3:00p

### **Discussion Highlights**

Following presentations on the Demand Management Framework ("Framework") by Amy Ostdiek, CWCB; and the Education & Outreach and Process Consideration sections by Emily Zmak, CDR Associates, the Public Workshop #3 had a facilitated discussion on the Framework categories Education & Outreach and Process Considerations.

### **Framework Feedback**

Foster broader understanding for water providers and users about Demand Management's purpose and goals
Turn the Framework into action through clearly-defined next steps and process clarity, and push up the contingent decision
Define and articulate the problem of compact curtailment as the alternative to Demand Management
Engage actual water users to better understand problems and obstacles for potential participants, which may require making the process more clearly defined
Be intentional in special engagement with the Ute Tribe
Create Spanish-language newsletters and informational documents about Demand Management, and partner with Latino organizations to assist with translation and messaging
Add specificity about the audiences that should be targeted for outreach to better define the goals
Stakeholder education needs to be informed by a real process, data, and programmatic information
Group consensus that Column C in Process Considerations is needed to mitigate user concerns and
ensure program success
Incorporate process transparency with the public, especially around lessons-learned and successes
Include a technical state role or service to help water users apply and develop applications

Where are the other Upper Basin States in their processes?
What is the worst-case scenario without Demand Management?
Who are the key audiences, and what are the messages those audiences need to hear?
How to engage water users to inform the planning process?
How to reach stakeholders who have not shown up to CWCB's engagement opportunities?
How do we communicate water and water challenges with diverse and historically underserved
populations?



# Public Listening Session Meeting Summary

### **DEMAND MANAGEMENT FEASIBILITY INVESTIGATION**

June 29, 2021

### **Discussion Preface**

Following brief presentations on the Demand Management process by Greg Johnson, CWCB, and Emily Zmak, CDR Associates, meeting participants provided comment about the Demand Management framework; the work done to date; organizational positions pertaining to the proposed Demand Management program; and/or personal thoughts and reactions to the concept of Demand Management. Comments were limited to five minutes per participant, and were otherwise unrestricted.

Participants were encouraged to submit written comment in addition to the statements summarized below.

### **Comment Summaries**

### **Aaron Citron, The Nature Conservancy**

- Recognizing the ongoing bad hydrology and need for cohesive Colorado River policy, he encourages CWCB to pursue Demand Management as a critical piece in a suite of tools to address Colorado River issues
- Encourages CWCB to capture trade-offs in the framework document and to include sideboards to benefit rivers, protect communities, and ensure proportionality
- Advocates for advancing policies that would build a Demand Management program, which could include pilots and demonstrations to illustrate how a program could function

#### Mark Harris, Grand Valley Water Users

- He believes that the process to-date and the Demand Management framework have adequately captured the concept of Demand Management
- Now that the initial work is done, it is time to answer questions like, "So what?" and "What now?" Encourages CWCB to try a compensated, voluntary, and temporary program.
- Believes that many farmers, ranchers, and their organizations are willing to find solutions
- Supports CWCB's identification of practical solutions, and believes that trying something new is the best way to answer the important questions
- Urges CWCB to articulate the next steps in the Demand Management process and develop a timeline

### Tom Gray, Yampa/White/Green Basin Roundtable

- Are there hard parameters or sideboards about what Demand Management would look like and, if not, when will the hard parameters begin to be established? Encourages the development of hard statements for people to grapple with and respond to.
- Will staff make a recommendation to the Board about next steps?



#### **Don West, Colorado Water Exchange**

- Regarding the Monitoring and Verification section of the Framework, he advocates for a combination of the A and B Columns
- Is comfortable with the state's Lease Fallow tool, probably in Column B
- Encourages transparency around crop coefficients; in particular, taking a statement like, "For this program, the state will use X crop coefficient with Y elevation adjustments."
- What is the role of municipalities in conserved consumptive use? The framework focuses on the agricultural aspect.

#### Alden Vanden Brink, White River

- He believes that Demand Management adds to the crisis, and that it adds a target on agriculture
- The White River has depended on flood irrigation and artificial recharge for more than 100 years
- Encourages developing more reservoir space to alleviate compounding pressures on the White
- Would like a no-injury clause to protect White River users

### Jeff Meyers, Yampa/White/Green Basin Roundtable

- He believes that motivation to deal with the drought is strong
- The framework document is valuable; however, the detail, complexity, and presentation means it is not the most accessible document
- Encourages CWCB to include language in the framework that defines equity as a means of ensuring all Colorado basins participate on an equitable basis
- A key issue is return flow, namely the ecosystem benefits of flood irrigation
- Feels that there is not a lot of knowledge about what Demand Management might mean or how seriously the hydrology is, so sees education and outreach as critical in this process
- Would be helpful to know from the State Engineer what curtailment might look like

### Abby Burk, Audubon

- Both birds and people dependent on the Colorado River have been impacted by water supplies
- Demand Management is an alternative to curtailment and provides flexibility for Colorado
- Audubon is supportive of a Demand Management program to protect Colorado and other water users, and to yield environmental benefits; encourages CWCB to move forward and avoid delays
- Believes the framework is a good start: the next step is to evaluate the trade offs and develop a program that can be one tool in the toolbox

### **Austin Vincent, Colorado Farm Bureau**

- Agriculture is one of the state's largest economies, especially on the West Slope and in rural areas
- Wants to help find the solution to western water supplies and to avoid risk of curtailment
- Colorado Farm Bureau supports temporary, voluntary, and compensated programs that share the load with municipal, in-stream, environmental, and recreational flows
- Wants to have attainable goals that supports producers and creates a practical program
- Encourages CWCB to use existing programs and state agencies in a Demand Management program
- Encourages CWCB to expand education and outreach with farmers / producers on the West Slope

### **Orla Bannan, Western Resource Advocates**

- Has submitted written comments to CWCB
- Sees the need for urgent action because of the bad hydrology
- Encourages CWCB to look for next steps and find win-win environmental benefits



### Chris Treese, ret. Colorado River District, consulting with Southwest Colorado River District

- Has submitted written comments to CWCB from the Southwest Colorado River District Board
- Characterizes the Southwest guidelines as skeptical-but-constructive, and articulates a commitment by their Board to remain engaged in Demand Management discussions
- Principally concerned with protecting agriculture and ensuring that a Demand Management program not target agriculture, nor encourage speculation in Western Colorado's agricultural waters
- Remains mindful of the consequences of both a Demand Management program and compact administration, which is not equitable, compensated, nor voluntary



# **EngageCWCB Survey Responses**

### **DEMAND MANAGEMENT FEASIBILITY INVESTIGATION**

Questions	Engage CWCB Survey Responses  Questions				
What river basins are you interested in?	Southwest River Basin	Southwest River Basin	Yampa-White-Green River Basin	Colorado River Basin	Arkansas River Basin Colorado River Basin Gunnison-Uncompahgre River Basin North Platte River Basin Rio Grande River Basin South Platte River Basin Southwest River Basin Yampa-White-Green River Basin
From your perspective, Demand Management (select all that apply):					
Would benefit agricultural water users overall.	x	X		x	
Would hurt agricultural water users overall.			x		
Would benefit urban water users overall.	X	X			
Would hurt urban water users overall.			X		
Is an opportunity for the entire state to collaborate for the benefit of the Colorado River.		X	x	X	X
Is an opportunity for Colorado to insure itself against mandatory curtailment in the Colorado River Basin.	x			X	X
Is an opportunity to build resilience in rural communities.			Х		x
Is a program that individual producers should be able to choose to participate in.	х	X	X	X	X
Is a program that communities should be able to provide feedback on.	X	x	х		X
Is a program that municipalities should be able to choose to participate in.	X	x	х	X	X
How might a Demand Management program potentially benefit or impact you individually?	To avoid the potentially devastating economic impacts of a Colorado River water curtailment on the west slope.	Probably not much effect	Increased likelihood of low stream flows in the summer, fall, and winter months reducing ability for irrigation (rising food cost), recreation (angling, canoeing, waterfowl), community water restrictions, degrades drinking water quality (water aesthetics, increased water treatment cost passed to the consumer), increase of nuisance aquatic vegetative species, increased tax burden risk due to seasonal low impacts on threatened and endanger species that live in our rivers (successes and dollars expended, invested, from protecting these species), increase concentration of wildlife to lands for available food, forage, water, winter range security, private land owner wildlife impacts and conflicts, loss of productive ag lands, create great dependence upon purchasing outside livestock feed source to maintain herd, livestock herd reductions due to loss of feed, secondary economic impacts from loss of agriculture, recreation, community water conservation losses to personal income (car washes, lawn care, plumbers), increased utility rates, increased to NPDES water quality standards and community waste water treatment processes	Rationalizing the approach to dealing with threats to the r Colorado Basin, including agriculture, from climate change, hydrologic volatility, and related pressures. Waiting for the train wreck, slow or fast is a poor choice.	program that results in negative impacts to rivers and watersheds would impact me directly. 3. Wildfires have devastating effects on people, communities, rivers, watersheds and the wildlife they support. The potential for participating fields to increase wildfire risk needs to be evaluated before projects are accepted.
How might a Demand Management program potentially benefit or impact your community?	Avoiding the economic impacts of a curtailment.	Perhaps excess water could be dinted from city supplies for compensation. Protection from a call.	[Ditto]	See #6	See response above.

What topics or concerns would you like addressed in the next phase of the feasibility investigation?	Piloting the use of auctions to determine who gets paid and how much.	How to maintain the Colorado River system when water reserves are depleted due to continued drought and or aridification. Impacts to alluvial storage and agriculture return flows. Impacts to basins and water users dependent upon alluvial storage and return flows from agriculture. Quantify the injury to water users when storage is depleted. Quantify how basins without storage are impacted. Why does Colorado not want to use the states full Colorado Compact allocation? Why is Colorado anti-water storage for compact protection purposes? What risk are there and growing while Colorado continues to vet DCP and DM? Is there valuable time being lost to get critical projects done to offset or lessen drought and aridification impacts while the water political world vets DCP and DM? What will happen to an area, community, region should water not be available? What is the States plan for areas that lack adequate drought resiliency? What legal risk is the state opening if a DM program is developed and people run out of water due to a Colorado Approved or Sponsor DM program? Does "no-jury" come into the DCP/DM equation?	How will flows be shepherded to Lake Powell (or any other storage bucket)? Is storage in Lake Powell the best alternative (in light of tremendous evaporation loss); should storage in Colorado reservoir be explored as a first alternative, with delivery to Powell on an as needed bases? These matters are not included in the Framework.
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design document recently co-authored by Dr. Bonnie Colby from the University of Arizona and the Colorado River Research Group. https://climas.arizona.
edu/publication/report/water-auctions-design-implementation-and-evaluation Additionally, below are a couple of opinion pieces that I co-authored regarding the use of auctions to reduce Colorado River Water use. Fresh Water News, August 19, 2020 Opinion: Use auctions to set prices for Colorado River Water use. Fresh water News, August 19, 2020 Opinion: Use auctions to set prices for Colorado River drought pool https://www.

way the potential program is being considered?

prices for cloirados niver drought; pool https://www. watereducation.colorado.org/fresh-water-news/opinionuse-auctions-to-set-prices-for-colorado-river-drought-pool/ The Colorado Sun, September 14, 2020 Opinion: Colorado needs a water market to reduce Colorado River water use https://coloradosun.com/2020/09/13/colorado-rivercompact-denver-water-opinion/? utm\_source-ActiveCampaign&utm\_medium=email&utm\_co

I have previously commented to the CWCB that it needs to

pilot the use of auctions. Auctions are a fair and equitable

means to determine who gets paid and by how much. It is

also fair to who pays the bill. The attached concept paper

outlines the use of auctions. Attached is a water auction

ntent=A+fragile+foundation+for+vaccines+%
2F+Lauren+Boebert+s+rise+%
2F+State+sues+USPS+over+voting+misinfo+%
2F+After+Suncor+settlement&utm\_campaign=Sunriser++9%2F14%2F2020&yeo\_ee=NoyTw1V3BKXqNdy12gTAw%
3D%3D I will be happy to help the CWCB think through how
to design water auctions and the market structures required

to implement any Demand Management Program.

I think the market should determine price. Mostly excess storage will be the best source.

secondary impacts to other water users. Each basin is different and should be treated as such. "No-injury" should be implemented. Yampa/White/Green Basin Roundtable Recommended Draft Demand Management Statement Executive Summary Context In the face of persistent drought and anticipated long-term growth in demand for water, Colorado and the other 6 Colorado River Basin states have prepared a Drought Contingency Plan (DCP). One element of that plan is to investigate the feasibility of Demand Management (DM). If implemented, DM will become a future program which, on a voluntary, temporary, and compensated basis, will reduce water use by individual. public, and commercial water rights holders, to avoid administration of the Colorado River Compact on the Colorado River, Statement of Principles Given the context for DM in Colorado, the Yampa/White/Green River Basin Roundtable considers the following concepts to be important in the development of a DM program: 1. Preservation of Quality of Life in the Y/W/G River Basin: Any DM program must preserve and enhance agriculture, local communities, and economies in our basin, while protecting municipal delivery, addressing environmental needs as well as recreational water use, and offering locally accepted methods to reduce consumptive use without injury. 2. Equity of Responsibility and Opportunity: A DM program must be structured to ensure that no river basin nor single water user group (i.e, Ag, M&I) bears a disproportionate share of DM responsibility, and to provide DM opportunities to all water right holders on a reasonably equitable basis. To ensure equity, some form of inter-basin apportionment is required, 3, Guided Market: The State of Colorado should establish a marketplace for DM water transactions that is structured to ensure/mandate fairness and transparency. 4. Recreation and Environment: Any DM program must consider/analyze its impacts on environmental and recreational needs, including those resulting from changes in water supply and/or timing of flows, and must not adversely impact these water uses and their contributions to local economies. 5. Rural Communities: Any DM program must evaluate and address all impacts that could result to rural communities, including negative economic, cultural, or social impacts. 6. Compensation for Value of Water Conserved: Any DM program must fairly compensate a participant who foregoes use of a water right. Compensation must be based on all economic impacts to the participant and not solely on the loss of income from the crop or product not produced. 7. Trans-Mountain Diversions (TMDs): Basins which benefit from water diverted from the Upper Colorado River must be considered as part of the CRS, with applicable DM responsibilities and opportunities, and subject to equitable apportionment for DM purposes. Any DM program must prohibit trans

Very dangerous program that opens up unintended

We need to consider lower case demand management, that being water conservation, learning what we can, as we wrestle with upper case DM as a part of DCP; dm is coming ready or not.

The Framework does a good job summarizing the threshold issues and alternatives discussed in each DM workgroup, but its still too abstract and vague. I think it is time to put one or more strawmen out there so people can react. And by strawman, I mean an outline of a potential program with specific components.



## **Stakeholder Letters Submitted to CWCB**

### **DEMAND MANAGEMENT FEASIBILITY INVESTIGATION**

# Grand Valley Water Users Association Comments to CWCB DM Framework Listening Session June 29, 2021

I am Mark Harris General Manager of GVWUA in the Grand Valley

Thanks to all of you inside and outside the CWCB that have worked diligently to get us to this DM Framework to this point.

I am not going to make specific comments on the contents of the Framework or discuss the process by which it has been developed, but we do believe the process and the resulting document provides an adequate exploration of the appropriate issues and provides a place from which to continue the search for real time and real world solutions to the use of DM as a part of DCP and perhaps on what we call lower case dm....productive approaches to water conservation that are a part of all our futures.

What I do want to share briefly is what I am being asked by the Board I serve and the farmers and other water users we deal with every day.

### What folks want to know is the "so what" and "what now"....

We hear a pretty clear concern with the state of the River, compounded by weather concerns, and by extension the fate of the GVWUA and the Grand Valley in the face of these challenges. People are asking us what we managers, the CWCB, organizations like the River District, and other organizations are doing to effectively deal with the outcomes of worsening trends and increased volatility, not just for this year and the very near term, but for the longer term as well.

They wonder how these DM explorations address the very real problems they see coming?

Our organization knows that many farmers and ranchers know how to create CCU, and even perhaps how to deal with it within their own organization or on their ditch. But the larger question I am asked is SO HOW move on and WHERE is the vehicle by which we do something productive with that water potentially made available in a voluntary, temporary, and compensated basis in several geographies by various methods.

Who is working on that that they ask? And when? What's next after all this talk they ask? Can't we try something?

Well the GVWUA submits that the time to work on answering those challenges is upon us. We recognize, acknowledge, and respect the very real differences in opinion that many of our peers and partners have regarding these difficult issues. But we also believe that many farmers, ranchers, and the organizations that serve them remain willing to find a productive way forward for agriculture and the State of Colorado, if for no other reason than it is in our best interest to do so.

Agriculture will be as heavily impacted by the solutions to the water problems we face as we are from the problems themselves.

Finally, we support CWCB's identification and funding of appropriate, practical, PROGRAMMATIC PILOT PROJECTS that help understand how to administer the CCU that many people already know how to create.

I know I am not telling you anything new when I say that the only way to really raise the important questions and to identify the positive and negative consequences of our actions is to try something.

You have heard me use his analogy before, but here it is one more time.

You can sit in the coffee shop all winter and talk about, cuss and discuss, and second a new crop for next spring. **But sometime you just gotta take the planter to the field.....**and you may get a few blanks, and you may abandon the plan in favor of another one next year, but you know you have to be trying something every year. Embracing the past too tightly does not help us deal with the future.

There is no other way to advance the agenda without taking some well-considered risk. And all those involved in creating the FRAMEWORK have done that. We urge the CWCB to take aggressive action toward putting this time and effort to continued good use, clearly articulating the next steps in the DM process, and creating a projected schedule by which it can be accomplished.

It doesn't look like the water and the weather are not going to wait for us.

Thanks for time this afternoon and good luck.



July 6, 2021

Colorado Water Conservation Board of Directors 1313 Sherman Street, Room 718 Denver, Colorado 80203

RE: Colorado Drought Contingency Plan - Demand Management

Dear Honored Member of the Colorado Water Conservation Board of Directors

The Rio Blanco Water Conservancy District (RBWCD) would like to say it is a pleasure to provide comment on Demand Management however recognizing our present state of drought and continued aridification this is proving to push a level of conversation not many are fully prepared for nor comfortable with. There is more gratifying task we all would rather be doing in our water world but here we are today in our drought-stricken region formulating a plan for a better tomorrow. Evidently all of us were chosen in one fashion or another to be part of this crucial topic in preparation for our future generation's water security. Changing times for sure.

The winds of change are upon us, and we recognize the need for adaption to our changing environment. Being such, the RBWCD believes it is imperative for the CWCB to understand the function of the White River Basin with respect to Drought Contingency Planning (DCP) - Demand Management (DM). We believe no other Colorado water basin in our great state functions as we do nor has done so for such an extend period.

Our White River community is cultivated around areas of alluvial gravel deposits that have been washed out from the Flat Tops and high desert plains over the millennium recharged by snow, rains, and flood irrigation. The combination of these is what keeps the water available for our community needs. With the reduction in snowpack and seasonal rains not to forget increased temperatures, this has impacted our ability to put water to full beneficial use due to the lack of directly available supply from the stream or retiming of water while also reducing the alluvium storage.



Under normal years with average precipitation, flood irrigation plays an immense role "topping-off" our White River alluvial aquifers but with the loss of direct flows and seasonal precipitation less water is available to be applied shorting the alluvial aquifer storage not to forget the natural recharge occurrence which our White River basin is dependent upon. Once the alluvium is full water eventually migrates back to the stream as return flows for other later in the season beneficial water reuse. Typical return flow season is from late summer to late winter months.

For DM discussion purposes, the White River basin has: 2 municipalities, Meeker (ground water supply) and Rangely (direct diversion surface water supply) supporting a population of about 6,400 citizens; limited industry that continues to be sequestered; recreation; and agriculture. A DM program imposed upon the municipalities will have limited conserved consumptive use with the small population, industrial water use is an incredibly small quantity, recreation is non-consumptive, so that leaves agriculture to take care of the lion's share of water for a White River DM program. As the DM program is rolling out with uncertain side boards, we must presume any Conserved Consumptive Use will be primarily sacrificed by agriculture which is the life blood of our basin hydrology. Take away or restrict flood irrigation and we eat away at the primary drought insurance policy of our community and stream ecology shorting alluvial recharge and return flows, which has been encountered during previous drought-stricken years.

Unlike other Colorado basin's, the White River is void of any real storage for drought or contingency protections hence part of the purpose and need for RBWCD along Yellow Jacket Water Conservancy District, Town of Rangely, and Rio Blanco County to aggressively push for Wolf Creek Reservoir. Our community is progressing with our Drought Contingency Plan that includes physical storage because we understand the vulnerability to our present system and how storage provides water user flexibility. White River constituents currently face an imminent municipal, agricultural, environmental, and economic catastrophe without a resilient water supply then add DM on top of our already tasked and limited water resources? The picture is grim for our community to say the very least. What happens to our towns if there is over conservation as part of a DM program and our water supply is eliminated or injuriously reduced due to the dry up of agriculture or another DM alternative? Where do we turn to then to carry us through these water short times? Critical storage is not here yet and as DM is evolving there will become more need and reliance upon storage. We ask, what are the states



plans to carry our district water needs through when water is already past the state line as part of a state Drought Contingency Plan and basins lack critical components for drought resiliency?

By keeping water in the stream and out of our alluvium by reducing flood irrigation what affect will this have upon stream ecology or the threatened and endangers fishes that reside here later in the season with reduced alluvium storage and return flows? What happens to the considerable investments made for the protection and recovery of our threatened and endangered species or recreational fishery species? Modeling completed for the White River demonstrates low to no stream flow risk to be very real.

Proponents for a DM program express climate change as a purpose and need for such a program yet are they taking into consideration the impacts to drying areas up removing green belts from playing a roll in carbon sequestration and the associated atmospheric cooling these areas provide? Perhaps in place of drying areas up we should be wetting areas using the plants and soils for what they have to offer. How does a browned pasture or field aid or play into a warming climate? Are we treating a symptom as opposed to implementing part of a cure by not wetting and activating these carbon bioreactors?

Part of the DM discussion includes conserved water to be stored downstream in Lake Powell. The district finds this approach unique since once the water has exited Colorado the multiple beneficial uses of our precious resource are no longer possible to Colorado water users. Has the state completed a Cost/Benefit analysis quantifying the benefits to our state by keeping the conserved consumptive use within our boarders? Our analysis has shown the financial benefits keeping water within our basin with the short list detailing; increased economic diversity, healthier municipalities, greater agriculture security, more recreation, stronger healthier stream ecology, and increased carbon sequestration. The White River, while not having formal representation to the DM framework development, is unaware of any attempt by the state to quantify such an analysis. Seeing this, the RWBCD recommends the state quantify these benefits as part of the DM process in a truly representative, open, and transparent means without prejudice including entities or individuals having a truly vested stake in any DM program. This includes entities statutorily created for water conservation such as water conservancy and conservation districts who have additional concepts for DM yet not part of the conversation.



"The Colorado Water Conservation Board's mission is to conserve, develop, protect, and manage Colorado's water for present and future generations." We understand and agree with this complex mission also realizing the state has a legal obligation to meet the Colorado River Compact. Not a simple task. In the instance of DCP and DM is the state truly looking for the wellbeing of our White River community? We see DM evolving around continued or expanded trans-mountain diversions, restrict less-developed basins/regions, and benefit the lower Colorado River basin states all of which is elated to in the DM Framework.

Through a public process created by HOUSE BILL 05-1177 "COLORADO WATER FOR THE 21ST CENTURY ACT" the Yampa-White-Green Basin Round Table unanimously created seven (7) Principles specific to Demands Management. The RBWCD believes these principles are important and MUST be an essential part of any DM program. The principles are: <a href="https://drive.google.com/file/d/1YpIQhFCnzzK5FgZ5mQO0Eo8Y19kmDak6/view">https://drive.google.com/file/d/1YpIQhFCnzzK5FgZ5mQO0Eo8Y19kmDak6/view</a>

- 1. Preservation of Quality of Life in the Y/W/G River Basin: Any DM program must preserve and enhance all aspects of quality of life in our basin, including agriculture, local communities, and local economies, while protecting municipal delivery, addressing environmental needs as well as recreational water use, and offering locally-accepted methods to reduce consumptive use without injury.
- 2. Equity of Responsibility and Opportunity: A DM program must be structured to ensure that no river basin nor single water user group (i.e, Ag, M&I) bears a disproportionate share of DM responsibility, and to provide opportunities for all water right holders to participate on a reasonably-equitable basis. To ensure equity, some form of inter-basin apportionment is required.
- 3. Guided Market: The State of Colorado should establish a marketplace for DM water transactions that is equitable and transparent.
- 4. Rural Communities: Any DM program must evaluate and address all impacts that could result to rural communities, including negative economic, cultural, or social impacts.
- 5. Recreation and Environment: Any DM program must consider/analyze its impacts on environmental and recreational needs, including those resulting from changes in water supply and/or timing of flows. Any DM program should strive to benefit, and must not adversely impact, environmental and recreational water uses and their contributions to local economies.
- 6. Compensation for Value of Water Conserved: Any DM program must fairly compensate participants. Compensation should be based on all economic impacts to the participant and not solely on the loss of income from the crop or product not produced.



7. Trans-Mountain Diversions (TMDs): Basins which benefit from water diverted from the Upper Colorado River must be considered as part of the CRS, with applicable DM responsibilities and opportunities, and subject to equitable apportionment for DM purposes. Any DM program must prohibit trans-mountain diverters from purchasing Western Slope water to meet a DM responsibility.

The Rio Blanco Water Conservancy District unequivocally believes in water conservation and the overlaying rationale for DM but we question the looming injury such a program will have to our basin water users. We continue progressing our locally driven drought planning efforts that includes considerable water conservation imploring upon the CWCB and other state water agencies part of the DM development framework to keep the intricacies and lack of drought resiliency of our White River community in mind as the states DCP evolves. We must reiterate, significant desire to participate in a DM type program is evident in our White River basin however, we lack critical tools necessary for drought and over conservation resiliency. Basin storage is a vital component of our drought planning and must be part of any successful DM program.

Thank you for the opportunity to provide comment.

Wade Cox Board President Rio Blanco Water Conservancy District

Wade Klin



June 30, 2021

Ms. Amy Ostdiek Colorado Water Conservation Board 1313 Sherman Street, Suite 718 Denver, Colorado 80203

Delivered via electronic mail to amy.ostdiek@state.co.us

Re: Comments on Demand Management Feasibility Investigation

Dear Ms. Ostdiek,

On behalf of Trout Unlimited ("TU"), I am pleased to offer these comments on the Demand Management Feasibility Investigation (the "Investigation") and the Demand Management Framework (the "Framework"). TU appreciates the hard work of the Colorado Water Conservation Board ("CWCB") and its staff in leading the Investigation and in developing the Framework, and we appreciate the opportunity to provide input on these important issues.

As you will recall, in August of 2020, TU sent you a letter commenting on a number of issues related to demand management and the CWCB's Demand Management Feasibility Investigation. A copy of TU's 2020 letter is attached for your reference. Many of the issues we discussed in our 2020 letter remain outstanding or unresolved. While we recognize that demand management is complex and while we appreciate that development of the Framework has been time-consuming for CWCB staff, as an overriding matter we would have liked to have seen more progress towards resolution of demand management issues over the past year. Going forward, as we discuss in more detail below, it is important that the CWCB increase the pace of the Investigation.

### **Declining Climatic Conditions Require Swift Action**

As you know well, climatic conditions across the Colorado River basin are in decline. Another year of hot and dry conditions has dramatically reduced runoff into an already-low Lake Powell, which is now approaching the lowest level since its filling in the early 1960s. The U.S. Bureau of Reclamation ("Reclamation") recently declared a Stage 1 shortage on the Colorado River, and Reclamation is projecting a further decline in water availability by 2022, which would trigger harsh curtailment measures under the 1922 Colorado River Compact. The need for action is urgent, and the CWCB must act now to advance the development of a demand management program, even if there is not 100% consensus across the state regarding the parameters of a demand management program.

### Failure to Act Could Have Devastating Consequences

Failure to take action to address the declining hydrological conditions in the Colorado River basin could lead to severe economic disruption, litigation, or federal intervention. In other words, delays make it more likely that Colorado will suffer negative consequences or lose local control over shaping how to respond to the worsening climatic conditions in the Colorado River basin. Such a loss of control is not in the state's best interest. While there may be some hard choices in structuring a voluntary demand management program, the consequences of not acting could be significantly more disruptive to Colorado.

### **Demand Management is Critical**

Reducing Colorado's risks under the 1922 Colorado River Compact will require a multitude of responses, with demand management likely being the most important. The upper Colorado River basin states' plan to release water from several upper basin reservoirs to bolster Lake Powell levels is an important tool, but it is a temporary fix that will not on its own prevent declines in Lake Powell elevations. Other solutions, including expanded water conservation and reuse, land use planning, infrastructure improvements, and investments in healthy watersheds will also be required. Demand management may be the most powerful risk-reduction response available.

### A Pilot Program Would Help Advance the Investigation

The 2019 Drought Contingency Plan ("DCP"), which provided the upper basin states a seven-year opportunity to test demand management and store the conserved water in Lake Powell, expires in 2026. If the upper basin states are going to learn how a demand management program can work, it is imperative to launch a pilot program as soon as possible. Otherwise, we would be missing the opportunity to learn as much as we can during the DCP window. The CWCB should commit to initiating a new, multi-year pilot program with projects across different water use sectors and geographies as soon as possible. Given our past involvement in the System Conservation Pilot Program and other on-the-ground demonstration projects in the years since then, TU looks forward to working actively with our partners in the agricultural community to develop projects under a pilot program.

### Conclusion

Trout Unlimited urges the State of Colorado to act quickly and decisively towards the development of a demand management program, and we look forward to continuing to work with the Colorado Water Conservation Board towards this goal. Thank you for the opportunity to provide these comments.

Sincerely,

Drew Peternell

Set\_11



June 28, 2021

Colorado Water Conservation Board 1313 Sherman St., 7<sup>th</sup> Floor Denver, CO 80203

Via: demandmanagement@state.co.us

RE: Response to Request for Input on Demand Management Feasibility Decision

Dear Members,

The Theodore Roosevelt Conservation Partnership is a coalition of 60 hunter, angler, science and outdoor recreation groups working to ensure all Americans have quality places to hunt and fish. The TRCP has worked for most of its 20 years primarily with federal agencies but also with state governments on water issues of importance, including trying to correct the water demand-supply imbalance in the Colorado River Basin because of the importance of the Basin's habitat for fish and wildlife. We have been following the Colorado Water Conservation Board's efforts to determine the feasibility of a Demand Management program closely, including by serving on the Environmental Values Work Group in 2020.

Because TRCP staff will not be able to attend the Demand Management Framework Public Listening Session June 29<sup>th</sup> from 5-7 pm, we ask the Board to consider our comments below as it determines Colorado's next steps.

#### Context:

As the Board is well aware, this year's extreme drought conditions come on top of a 20 year mega-drought. The hydrology for the Basin's rivers and reservoirs is simply dire. If the Bureau of Reclamation's most recent <u>24-month study</u> projections are true, Lake Powell may decline to elevation 3525 during the 2022 water year, triggering reductions in hydropower production at Glen Canyon Dam and putting Upper Basin cities, ranches and recreational water users at real risk for compact curtailment.

As a result, time is of the essence for the Board to identify and implement tools to help Colorado's water users collectively, including those who value our rivers for recreational benefit. Absent state solutions, individual water users will take individual action that may not help the State, its fish and wildlife, or even downstream water users. And, while the TRCP is aware of the Upper Colorado River Commission is also evaluating the feasibility of demand

management, its process cannot answer state-specific questions, so Colorado must find answers to its own issues rather than waiting for that investigation to conclude.

Delay will make it more likely that Colorado loses control to shape the responses best for its community of water users. Without action, Colorado's water users are at ever greater risk of severe economic disruption and potentially even litigation or federal intervention. Compared to those risks, which only grow with each dry year, it is worth the Board taking a leadership role to structure a demand management program, along with other tools (like the one-time reservoir releases current under discussion) to address the Basin's water challenges.

Further delay of pilots and a full demand management program in Colorado will also add to the existing burdens for Latino communities in Colorado and the Colorado River Basin. One third of U.S. Latinos live within Colorado River Basin states, including ours. As a group, Latinos are more likely to face health impacts from climate change than others. And, one cannot imagine a demographic more supportive of building resilient water systems that serve people, fish and wildlife. An astonishing 96% of Latinos in the West support funding to modernize water infrastructure and restore natural areas in ways that improve drought resilience, while 93% agree that, notwithstanding state budget shortfalls, it is imperative to fund protection of states lands, water and wildlife. Without adequate responses to drought and climate change – which is primarily expressed in terms of drought and fire in the West, including Colorado – Latinos will continue to feel the disproportionate adverse health impacts and other effects of climate change and drought. It is therefore incumbent on the CWCB to act expeditiously to stand up programs like demand management and others, that can build climate and drought resiliency without delay.

The Board, with its staff of policy, technical and legal experts, and having conducted several years of public outreach regarding demand management and other tools, is best positioned to act in a way that will best serve Colorado's people and water resources, including the fish and wildlife that resource supports. The Board must lead on demand management but also work with other agencies, water users and communities of interest to expand water conservation and reuse, promote land use plans that fosters efficient water use, fund upgrades to aging less efficient water infrastructure and invest in healthy forests and watersheds.

### **Framework Comments and Next Steps**

The draft framework does a good job of laying out the many factors, and thus decisions that the Board would have to make to set up and implement an equitable, voluntary and effective demand management program. But the framework does not provide a way to evaluate the tradeoffs – costs and benefits – amongst those decisions. For example, with knowing the financial cost of choosing a simple, more complex or robust alternative for any one factor, the CWCB cannot know how that choice may constrain what other choices would be available based solely on their cost. While a more sophisticated decision support tool, along with more complete data, e.g., on the cost of various choices, would help the Board, given the need for quick action, there is not the time available to optimize a program at inception.

If the Board is going to set up a demand management program, not only the hydrology, but the seven-year timeline of the 2019 Drought Contingency Plan, demands action within the year. The States, Reclamation, and others have begun renegotiating the 2007 Interim Shortage Guidelines, which must also be completed in 2026. If the Upper Basin states are going to learn anything from a demand management program, they must launch that program and implement associated projects as soon as possible. A demand management program cannot help in a practical matter, or provide lessons useful for the renegotiation unless it is in place before the crisis, not after the horse is out of the barn.

We encourage the CWCB to be practical and focus on moving quickly beyond the Framework to seek solutions and implement a pilot program that incorporates a diverse range of pilot projects. There are too many additional complex questions that will also take time to answer. We encourage the CWCB staff to focus on identifying and answering key questions and supporting additional pilot projects, including hypothetical exercises in certain circumstances, as a good approach. A range of pilots is needed, incorporating diverse geographies and project types, including not only agricultural projects, but also transmountain diversion, industrial, and other projects. The conceptual proposal for a programmatic pilot from the Agricultural Impacts Demand Management Workgroup can be a starting point.

Because of the State's interests in, and in some respects, responsibilities for maintaining fish and wildlife habitat, as well as the economic benefits of recreational water use, the Board's next steps should include an analysis of potential environmental co-benefits in pilot project design or a full demand management program. Such co-benefits only become more critical in the face of changing hydrology and increasing aridification, which affect native and important non-native game species alike. Pilots as well as a full program both have the potential to impact recreational and environmental flows, either positively or negatively. We urge the state to incorporate an analysis of environmental and recreation needs and potential benefits and impacts, as well as quantitative monitoring and verification of those, in pilots and any DM program.

Thank you in advance for your consideration,

Melinda Kassen, Sr. Counsel Jared Romero, Director of Strategic Partnerships

# Feedback on the CWCB Demand Management Framework

By the Y/W/G Basin Roundtable Big River Committee
June, 2021

#### The Framework and Review Process

The CWCB DM Framework document contains a great deal of detailed information about DM issues and solutions, primarily gleaned from and organized around the DM Work Group discussions. The conceptual framework, based on 3 levels of solutions to address issues, is a well-thought-out approach to presenting the issues that have surface and some proposed solutions for them.

Members of the Y/W/G BRC have reviewed the Framework document in detail, and summarized their comments, suggestions, and questions in the brief that follows. The BRC chose to review the Framework document by comparing it to the Y/W/G Executive Summary of DM Principles ("Principles") published in March of this year. For each Framework topic and subtopic, members of the BRC reviewed solutions to determine whether or not those solutions aligned with or were counter to the Principles. Note that several subtopics in the Framework document are not addressed, as they do not appear to intersect with the Principles.

Comments and questions are generally divided into 2 parts; an initial section that highlights high-level comments and suggestions, and a more detailed discussion of several important topics and sub-topics contained in the Framework.

### **High-Level Issue Discussion**

Following is a summary of high-level comments and suggestions:

- 1. Purpose and Goal of DM. The DM Framework should state clearly that the overarching purpose of any DM program is to reduce consumptive water usage in order to avoid a Compact call (Y/W/G Context). Although the idea of yielding conserved consumptive use and the goal of placing 500KAF in a pool in Lake Powell are discussed in the Underlying Assumptions of the doc, these were both missed by several reviewers, and it would be helpful if they were more clearly stated at the outset.
- 2. Shared Responsibility/Opportunity and Apportionment. The DM Framework should also state clearly that all CRS basins and water rights holders will share in responsibility and opportunity of the DM program (Y/W/G Principles 2, 7.) Specifically, no discussion of projects from Industrial water users is provided, while Municipal subtopics emphasize 'support'; several reviewers commented that the document is focused on Ag. While TMD projects are discussed, nowhere does the Framework indicate the requirement that TMD diverters participate in DM. Finally, no discussion of inter-basin apportionment, or some other means of ensuring shared responsibility/opportunity between and among basins, is offered.

#### **Detailed Issue Discussion**

Each of the topics and subtopics that intersect with the Y/W/G DM Principles was discussed to determine whether and to what degree each was aligned. Following is a summary of that review:

Major Topic 1: Monitoring and Verification (Agricultural DM Project)

Subtopic: Maintain Return Flows

Option A – (Y/W/G Principles 1, 4, 5): Does not align. Failure to maintain return flows will be detrimental to ag, urban/suburban water users, and recreation in our basin during the late summer/fall season.

Option B – (Y/W/G Principles 1, 4, 5): Could align, provided that adequate storage was available.

Option C – (Y/W/G Principles 1, 4, 5): Would align by providing locally-sourced return flow. However, the solution seems impossibly complex and costly.

Major Topic 1: Monitoring and Verification (Transmountain DM Project)

Subtopic: Measure Water Returned to Stream

Option A – (Y/W/G Principle 7): Does not align. Absent some form of accounting validation (as provided for in the next subtopic), a simple estimate provided by the TMD operator would leave room for a range of harmful outcomes. For example, the TMD operator could simply overestimate the amount of water to be diverted at that diversion point, and take credit for a greater DM impact than was actually earned.

Option B – (Y/W/G Principle 7): Does align. This approach, to which an auditable provision should be added, would help to ensure that the conserved consumptive use claimed is not simply replaced by other Western Slope waters in a 'shell game'.

Option C – (Y/W/G Principle 7): Does align. This approach is the most thorough, but probably is impractical to implement.

Subtopic: Verify Conserved Consumptive Use Occurs on the East Slope

Option A – (Y/W/G Principle 7): Does align. An auditable provision should be added to this statement, but this approach would prevent the 'shell game' tactic that allows a TMD operator to simply switch one West Slope source for another while claiming a DM contribution.

Option B – (Y/W/G Principle 7): Does align, slightly better than Option A but an auditable provision should be added.

Option C – (Y/W/G Principle 7): Does align, but seems overly complicated and expensive.

\*\* Note: This subtopic title could be considered misleading; perhaps a better name would be: 'Verify Accuracy of Accounting for Foregoing TM Diversion and that Conserved Consumptive Use Occurs on the East Slope'. Subtopic: Coordinate Environment and Other Benefits

Option A – (Y/W/G Principles 1, 4, 5, 7): Does align. Option A does not provide any additional benefit, but it does not involve negative impact.

Option B – (Y/W/G Principles 1, 4, 5, 7): Does align. The provision for temporary storage in a Western Slope reservoir helps to mitigate environmental and other impacts.

Option C – (Y/W/G Principles 1, 4, 5, 7): Does align (see comments for Option B) but is too complex and costly for actual implementation.

# Major Topic 3: Environmental Considerations

Subtopic: Assessing Net Benefit or Impact

Option A – (Y/W/G Principles 1, 2, 4, 5): Does align, provided that benefits to Y/W/G basin and communities are part of the consideration.

Option B – (Y/W/G Principles 1, 2, 4, 5): Does align, provided that benefits to Y/W/G basin and communities are part of the consideration.

Option C – (Y/W/G Principles 1, 2, 4, 5): Does align, provided that benefits to Y/W/G basin and communities are part of the consideration.

Subtopic: Strategies to Incentivize Benefits

Option A – (Y/W/G Principles 2, 4): Does align. Ensures that all DM contributors have equal opportunity to participate.

Option B – (Y/W/G Principles 2, 3, 4): Does not align. Given hydrology, this option prioritizes participation by main stem users over tributary users.

Option C – (Y/W/G Principles 2, 3, 4): Does not align. Given hydrology, this option prioritizes participation by main stem users over tributary users.

Subtopic: Strategies to Avoid, Offset or Mitigate any Potential Negative Impacts

Option A – (Y/W/G Principles 2, 4): Does not align. Provides no benefit to Y/W/G basin users or communities.

Option B – (Y/W/G Principles 2, 4): Does align. Solutions provided would help to mitigate return flow issues and community impacts.

Option C – (Y/W/G Principles 2, 4): Does align, but seems too complex and costly.

\*\* Note: This subtopic is very broad; some reviewers needed more context.

Major Topic 4: Economic Impact and Local Government (All DM Projects)

Subtopic: Support for Municipal Participants

Option A – (Y/W/G Principle 2, 7): May align, depending on implementation. Accounting verification required; as many municipals have conservation plans, it will be necessary to distinguish between permanent programs and CCU for DM.

Option B – (Y/W/G Principle 2, 3, 7): Does not align. Comments under Option A apply. But beyond those accounting factors, support for municipal project development provided in addition to DM compensation would constitute a large advantage for municipal projects, resulting in inequitable solutions.

Option C – (Y/W/G Principle 2, 3, 7): Does not align. Comments under Options A and B apply. And in addition to those considerations, this Option would potentially require the state of CO to make subjective decisions regarding the applicability secondary and tertiary impacts to DM, then to fund those which are deemed applicable. Ultimately, this Option is unsustainable.

Subtopic: Municipal Sector Mitigation

Option A – (Y/W/G Principle 1, 2, 4, 7): May align, depending on implementation. While this Option does not provide DM-based funding mitigation, it does allow for locally-accepted methods and decision-making.

Option B – (Y/W/G Principle 1, 2, 3, 4, 7): Does align, but involves complexities and subjective, bureaucratic judgements that would render it non-operational.

Option C – (Y/W/G Principle 1, 2, 3, 4, 7): Does align. This Option improves on the previous one by asserting non-subjective protocols. However, it would be complex and costly to implement, and very likely would not be sustainable.

Major Topic 5: Agricultural Impacts

Subtopic: Agricultural Mitigation

Option A – (Y/W/G Principle 1, 6): Does align, provided that compensation for participation is equitable. The goals for Ag Impacts (equitability, mitigating non-farm impacts, guided market, alignment with growing seasons) can and should met through appropriate funding for participants.

Option B – (Y/W/G Principle 1, 3, 6): Does align, but involves complexities and bureaucracy that would be difficult to sustain, and are unnecessary if compensation for participants is equitable.

Option C – (Y/W/G Principle 1, 3, 6): Does align, but involves complexities and bureaucracy that would be difficult to sustain, and are unnecessary if compensation for participants is equitable. Would likely be too costly to implement.

Subtopic: Agricultural Participant Field Requirements

Option A – (Y/W/G Principle 6): Does align. The operating principle asserted here is that the individual landowner holds a property right about which he/she is entitled to make decisions.

He/she has incentive to protect the value of that property through appropriate weed and pest control.

Option B – (Y/W/G Principle 3, 6): May align, depending on implementation. Providing assistance or support at the request of the individual landowner is appropriate. Enforced regulations for private property should not be implemented.

Option C – (Y/W/G Principle 3, 6): May align, depending on implementation. Providing assistance or support at the request of the individual landowner is appropriate. Enforced regulations for private property should not be implemented. Additional staffing may add cost that is unsustainable.

# Yampa/White/Green Basin Roundtable Demand Management Statement

# **Executive Summary**

### **Context**

In the face of persistent drought and anticipated long-term growth in demand for water, Colorado and the other six Colorado River Basin states have prepared a Drought Contingency Plan (DCP). One element of that plan is to investigate the feasibility of Demand Management (DM). If implemented, DM will become a future program which, on a voluntary, temporary, and compensated basis, will reduce water use by individual, public, and commercial water rights holders, to avoid administration of the Colorado River Compact on the Colorado River.

# Statement of Principles

Given the context for DM in Colorado, the Yampa/White/Green River Basin Roundtable considers the following concepts to be important in the development of a DM program:

- Preservation of Quality of Life in the Y/W/G River Basin: Any DM program must preserve and enhance all aspects of quality of life in our basin, including agriculture, local communities, and local economies, while protecting municipal delivery, addressing environmental needs as well as recreational water use, and offering locally-accepted methods to reduce consumptive use without injury.
- 2. Equity of Responsibility and Opportunity: A DM program must be structured to ensure that no river basin nor single water user group (i.e, Ag, M&I) bears a disproportionate share of DM responsibility, and to provide opportunities for all water right holders to participate on a reasonably-equitable basis. To ensure equity, some form of inter-basin apportionment is required.
- 3. Guided Market: The State of Colorado should establish a marketplace for DM water transactions that is equitable and transparent.
- 4. Rural Communities: Any DM program must evaluate and address all impacts that could result to rural communities, including negative economic, cultural, or social impacts.
- 5. Recreation and Environment: Any DM program must consider/analyze its impacts on environmental and recreational needs, including those resulting from changes in water supply and/or timing of flows. Any DM program should strive to benefit, and must not adversely impact, environmental and recreational water uses and their contributions to local economies.
- 6. Compensation for Value of Water Conserved: Any DM program must fairly compensate participants. Compensation should be based on all economic impacts to the participant and not solely on the loss of income from the crop or product not produced.
- 7. Trans-Mountain Diversions (TMDs): Basins which benefit from water diverted from the Upper Colorado River must be considered as part of the CRS, with applicable DM responsibilities and opportunities, and subject to equitable apportionment for DM purposes. Any DM program must prohibit trans-mountain diverters from purchasing Western Slope water to meet a DM responsibility.



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June 28, 2021

Submitted by email

# **RE: Demand Management Framework Comments**

Dear Colorado Water Conservation Board members and staff:

The Nature Conservancy (TNC) appreciates the Colorado Water Conservation Board (CWCB) request for feedback on the Demand Management (DM) framework. We opted to send a letter rather than fill out the survey due the complexity of the issue and desire to provide more information than the survey could provide.

TNC is a global environmental nonprofit working in Colorado for over 55 years to create a world where people and nature can thrive. Our mission is to conserve the lands and waters on which all life depends. TNC has over one million members and works in all 50 states and impacts conservation in 72 countries and territories across the world.

Reservoirs in the Colorado River Basin, filled to the brim at the end of the 20th century, are at historic lows. By 2060, demand for water from the Colorado River may exceed supply by more than 3.2 million acre-feet. Coming up short could put at risk the drinking water supplies of almost 40 million people in the Southwest, agricultural production, endangered species, the health of our rivers, and future economic growth, as well as the Colorado River's \$26 billion outdoor recreation economy with its quarter-million jobs. With so much at stake, we have been following CWCB efforts to determine the feasibility of a Demand Management program closely, and four TNC staff members served on the CWCB's demand management work groups.

Now, another year of hot and dry conditions have dramatically reduced run-off into an already low Lake Powell, which is now approaching the lowest level since its filling in the early 1960s. The U.S. Bureau of Reclamation recently projected that by early 2022, Lake Powell is likely to decline to elevation 3,525 feet—a level that would result in reduced hydropower production at Glen Canyon Dam and would put the Upper Basin at risk of triggering harsh curtailment measures under the 1922 Colorado River Compact. These unprecedented conditions require that Colorado decision-makers act swiftly and decisively to develop and implement a plan and tools to protect and manage Colorado's water and rivers for present and future generations.

Existing conditions require a multitude of responses, and demand management is a vital tool to address the Upper Basin's water challenges. The Upper Basin states' plan to release water from

several Upper Basin reservoirs to bolster Lake Powell levels is one important tool, but it is a temporary fix that won't prevent risky declines in Lake Powell on its own. Other solutions, including expanded water conservation and reuse, land use planning, infrastructure improvements, and investments to improve the health of forests and watersheds will also be required. Demand management, based on the bedrock principles of "temporary, voluntary, and compensated," and with sideboards to avoid disproportionate impacts and ensure environmental protection, may be one of the most useful risk-reduction responses available.

With hydrology rapidly degrading, the longer we wait to develop effective tools to collectively mitigate risk the more likely we are to lose local control in shaping how Colorado will respond and what tools will be available to us.

The CWCB draft framework is a good start in laying out the many decisions needed to set up and implement an equitable, voluntary, and effective demand management program. The Framework is a good summary of the State of Colorado's demand management feasibility evaluation, but it does not provide a way to evaluate tradeoffs and benefits to aid in decision-making. The framework is very detailed, which can be useful in understanding the State's process to date; however, its complexity may also be confusing to many stakeholders. As is, it provides a concise high-level summary of key workgroup concepts and issues. However, it cannot be used as a decision-making tool because it lacks a way to evaluate or consider tradeoffs and benefits between the various components of one category and the implications of that component choice on other categories.

We believe that CWCB decision-makers must evaluate trade-offs, make the hard calls, and develop a demand management program that can be in place as one tool if the situation continues to decline. The state should not let the desire for the perfect be the enemy of the workable—the current and projected hydrology doesn't allow Colorado to wait for 100 % consensus. Now is the time for the CWCB to move forward so it has a plan and a program in place *before* a crisis.

**Inaction or undue delay could lead to severe economic disruption, litigation, and even federal intervention.** While there may be some hard choices in structuring a voluntary demand management program and no one wants to reduce their water use, the consequences of not having a plan to address the crisis will be severe and costly. The decision to proceed or delay needs to be made in the full context of what can happen if dry years continue. There won't be any do-overs and curtailment without any siderails seems like a risky path for Colorado. The CWCB, with its staff and legal experts and the benefit of extensive public outreach, is positioned to make good decisions that best serve Colorado's people and water resources.

Many states in the Upper Basin are deferring to the UCRC feasibility process. That process is important but will not answer state-specific questions. Colorado must find answers to its own issues and concerns rather than waiting for the UCRC investigation to conclude.

The 2019 Drought Contingency Plan, which provided the Upper Basin States with a seven-year opportunity to test demand management and store the water conserved in Lake Powell, expires in 2026. The States, Reclamation, and others have begun renegotiating the 2007 Interim Shortage

Guidelines, which must also be completed by 2026. If the Upper Basin states are going to learn how a demand management program can work, it seems that we are missing the opportunity to learn as much as we can during the DCP window to experiment with different approaches and pilot programs.

We encourage the CWCB to focus on moving quickly beyond the Framework to seek solutions and implement a program that incorporates a diverse range of pilot projects. We hope that the State will not linger on the process of finalizing or improving the Framework. We encourage the CWCB staff to focus on identifying and answering key questions and supporting additional pilot projects, including hypothetical exercises in certain circumstances, as a good approach. A range of pilots is needed, incorporating diverse geographies and project types, including not only agricultural projects, but also transmountain diversion, industrial, and other projects. The Agricultural Impacts Demand Management Workgroup shared a conceptual proposal for a programmatic pilot that offers opportunities for systematic exploration of the multiple objectives identified by the State and other interested parties.

The State has interests in and responsibilities for maintaining environmental, fish and wildlife, and recreational water uses and values. These only become more critical in the face of changing hydrology and increasing climate change driven drought. A demand management program has the potential to positively or negatively impact recreational and environmental flows, including target flows for endangered species. We urge the state to create a demand management program that benefits rivers and that incorporates in program and project development and implementation an analysis of environmental and recreation needs and potential benefits and impacts, as well as quantitative monitoring and verification of project benefits and impacts.

We thank the CWCB staff for their work in developing the framework and commend them on their efforts to ensure a robust and open conversation about demand management in Colorado.

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Sincerely,

Carlos E. Fernandez
Colorado State Director

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CC:
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# DEMAND MANAGEMENT: Preliminary Guiding Principles Adopted June 10, 2021

The principles outlined below are intended to guide Southwestern Water Conservation District (SWCD) in its evaluation of and input to any Demand Management (DM) program the state of Colorado, in cooperation with the other three Upper Basin states, may advance.

SWCD has not adopted a position of support, opposition or neutrality on the feasibility or development, let alone implementation, of a DM program within the Upper Basin. There are simply too many unknowns at this point. DM is an evolving concept; accordingly, this is a living policy document that will be reviewed periodically to reflect changing program elements, evaluations, and goals of DM in Colorado and the Upper Basin.

SWCD was created by the General Assembly in 1941 to lead in the conservation, use and development of the water resources of the San Juan and Dolores river basins, both of which are tributary to the Colorado River. SWCD's organic act also includes the charge "to safeguard for Colorado, all waters to which the state of Colorado is equitably entitled." Demand management is a novel concept that, if implemented, has the potential to alter water use and administration within the Upper Basin and, on a more local level, within SWCD's boundaries. Accordingly, SWCD will remain involved in the evaluation and potential formation and implementation of any DM program Colorado may pursue.

# **Colorado River Basin Drought Contingency Plans:**

At least since the turn of this century, the security and sustainability of Colorado River water supply has been in question. The basin is currently experiencing one of the worst hydrologic cycles in recorded history. Continuing drought, resulting in worsening water supply and storage conditions, increases the risk of curtailment in the Upper Basin.

To reduce the risk of Lake Powell and Lake Mead declining to critically low levels, the United States Department of the Interior (Interior) and the seven Colorado River basin states agreed to develop and implement plans to overlay the 2007 Interim Guidelines addressing forecasted low reservoir elevations if the drought continued. The resulting Colorado River Drought Contingency Plans (DCP) were submitted to Congress on March 19, 2019. On April 16, 2019, then President Trump signed the Colorado River Drought Contingency Plan Authorization Act into law. This bill requires Interior to execute the Colorado River Drought Contingency Plans without delay and to operate applicable Colorado River System reservoirs accordingly.

For its part, the Upper Division states of Colorado, New Mexico, Utah and Wyoming committed to three primary strategies to address the impacts of continued drought in the basin. The first strategy, weather modification, was already being implemented across the basin and needed no federal legislation so was not included as part of the legislation passed in the Upper Basin's Drought Contingency Plan (DCP). The other two strategies focus directly on the goal to minimize the risk of water levels at Lake Powell falling below target elevations: an immediate response and a multi-year plan. The second strategy, articulated in the Drought Response Operations Agreement of the Upper Basin's DCP, is an immediate response measure designed to utilize operational adjustments or releases from the Colorado River Storage Project Act (CRSPA) Initial Units to bolster storage levels at Lake Powell when Lake Powell approaches a critical low elevation of 3,525' MSL. The Drought Response Operations Agreement also provides mechanisms for recovering storage at those same CRSPA Initial Units in subsequent years.

The Upper Basin's longer-term strategy is to explore the feasibility of developing and implementing a new demand management program that could generate water savings by either temporarily reducing existing water use within the Upper Basin or augmenting supplies with imported water. Under the Upper Basin's DCP, up to 500,000 acre-feet of DM water savings can be stored in the CRSPA Initial Units to help assure continued compliance with the Colorado River Compact under certain circumstances.

Most of the investigations and discussions pertaining to DM to date, have been focused on generating DM "water savings" through the voluntary, compensated and temporary reduction of historically consumptively used (HCU) water within the Upper Basin in order to assist with Colorado River Compact compliance. As a result, the guiding principles set forth below are based on the assumption that DM water will be generated in this manner.

# **Guiding Principles:**

The foundational elements of any DM program must be voluntary, temporary, and compensated reductions in use of water that was being beneficially used under existing rights that otherwise would have depleted Colorado River basin flows within the Upper Basin.

SWCD believes DM is not a panacea. Additional options and alternatives (e.g., forest management, groundwater storage, weather modification, non-native phreatophyte removal, importing water from outside of the Colorado River basin) should be equally and fully explored as we work towards the goal of supply security and sustainability in the Colorado River basin.

Exploration of DM must be just one part of the comprehensive, basin-wide strategy for addressing shortand long-term water supply and demand imbalance that may be included in the next set of Interim Guidelines currently in negotiations regarding the operations of Lake Mead and Lake Powell for future Colorado Compact compliance.

SWCD pledges to evaluate DM as one of many possible strategies to provide flexibility and reduce the risk of curtailment in the Upper Basin.

SWCD will participate in the exploration and potential formation of any Colorado DM program to ensure any proposed program is capable of achieving its stated objectives and that adverse consequences are avoided, minimized, or fully mitigated.

Any DM program must operate within Colorado's Prior Appropriation Doctrine. The creation, storage, delivery and use of DM water must not injure any existing water right within Colorado.

Before deciding whether it would be feasible to adopt, let alone implement, a DM program within Colorado, the State must commit to developing the technical platform necessary to demonstrate that a program can be accomplished without injury to other users within Colorado, at a sufficient scale, and that any conserved water can be conserved, protected, and ultimately delivered for Compact compliance.

Any DM program must ensure equitable and proportional participation from all basins consuming Colorado River water as well as all regions and sectors of Colorado's economy. SWCD acknowledges that "equity" and "proportionality" are critical but undefined terms within the context of demand management. Both are currently the subject of statewide focus.

Transmountain diverters of Colorado River water must participate in DM using water that was historically diverted and beneficially used under decreed transmountain water rights. Transmountain diverters must not be allowed to purchase or otherwise rely upon other water supplies that originate in the Colorado River Basin in order to accomplish their proportional participation in DM.

A successful DM program can help ensure the safety and economic health of all Coloradans. Accordingly, the considerable funding required for DM must not target water right holders, water users, or other specific groups.

Colorado's DM program, if any, must be designed and implemented to support and aid sustaining Colorado's predominantly family- and locally-owned agriculture.

Storage of DM "savings" should be in CRSPA Initial Units that are located as high in the system as practicable.

Releases of DM water from storage should only be made by the Upper Colorado River Commission for the purpose of helping the Upper Division States assure continued compliance with Article III of the Colorado River Compact without impairing the right to exercise existing Upper Basin water rights in the future. Such releases should be timed, to the extent practicable, to provide the greatest economic, environmental, and recreational benefits.

Any DM program must not encourage or reward speculation in Colorado water resources.

Any DM program must recognize there will be impacts resulting from implementation of DM, and that impacts, both positive and negative, will be neither equally nor equitably distributed. Therefore, any DM program must include adequate mitigation for those individuals, water districts and ditch and reservoir companies, and communities impacted by implementation of a DM program. Additionally, DM mitigation should be designed to provide a net benefit to participating individuals, water projects, and their communities.

The evaluation of DM's feasibility, appropriateness, and whether DM is a timely and worthwhile pursuit must be approached without prejudice. In other words, a determination of infeasibility, inappropriateness or unworthiness must be honestly evaluated.

In order to 'test' DM and to allow for incremental implementation and accrual of meaningful DM savings, SWCD recognizes that initial implementation of DM may be required at a pilot or demonstration scale. However, any pilot or demonstration DM program must be conducted in conformance with Colorado water law, without injury to other water users and without prejudice regarding its conclusions or consequences.

As it continues to evaluate the appropriateness of DM, SWCD will remain mindful of the severe consequences of Compact Administration, which could force involuntary, and uncompensated water curtailments that could, in turn, result in disproportionate impacts to certain water users, economic sectors and geographic regions.

SWCD appreciates the CWCB's outreach and inclusivity in its evaluation process to date. SWCD pledges its continued, constructive participation with the state in its DM investigations.

#### **Future Process:**

SWCD will continue to explore demand management, including by proactively identifying and communicating its concerns regarding disproportionate and negative impacts potentially resulting from implementation of DM.

SWCD will continue to reach out to water districts, Tribes, and other interested parties in its on-going evaluation and assessment of DM.

SWCD will continue to evaluate water supply, water rights, and water uses and their respective relationships to Compact compliance.

SWCD will collaborate closely with the Colorado River District in order to maintain, to the greatest extent possible, harmony on DM between the two districts.

SWCD will continue to engage in all appropriate Colorado River Compact discussions.

# COLORADO WATER CONSERVATION BOARD Protecting Colorado Water DEMAND MANAGEMENT FRAMEWORK

As part of Colorado's <u>Demand Management</u> Feasibility Investigation (see <u>Work Plan</u>) led by the Colorado Water Conservation Board (CWCB), this document includes a Demand Management Framework focusing on various issues associated with a potential Demand Management program.

While reviewing, note that the following Demand Management Framework draft is:

- For a potential Demand Management program that would involve temporary, voluntary, and compensated reductions in consumptive water use pursuant to the Demand Management Storage Agreement.
- Not a Demand Management program, but rather a tool for discussion regarding a potential program, which is not a foregone conclusion.
- Designed to be iterative, and there will likely be multiple updated versions released as the discussion progresses.
- Designed to show a broad range of implementation options, without showing preference for any given option.
- Set up using a range from A to C, designed to roughly correlate with level of complexity for the various implementation options. These designations do not correlate with any value judgments about which option may be best.
- Not intended to represent any commitments or guarantees regarding viability of a program design. For example, some options presented may have budgetary or other constraints.
- Intended to be used as a tool for discussion across Colorado about what may work and what may not work in a potential Demand Management program from varying perspectives, and any information gathered throughout this process is intended to assist CWCB in determining whether Demand Management may be achievable, worthwhile, and advisable from Colorado's perspective.
- Not intended to represent any position of the CWCB or the State of Colorado regarding the feasibility of Demand Management.

To provide feedback on this Framework document, please email <u>demandmanagement@state.co.us</u> or visit <u>engagecwcb.org</u>.



# Where We've Been Where Where We've Been Where Where We've Been Where Where

# **Underlying Assumptions of Demand Management (DM) Program:**

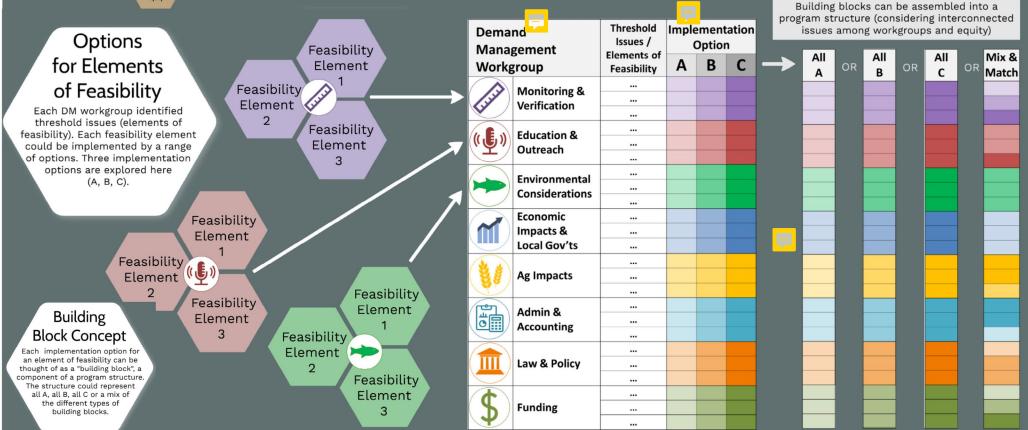
DM program would be run, managed, and regulated by the State of Colorado and/or through UCRC.

DM program would yield conserved consumptive use and would be compliant with all applicable law.

DM program would be bound by the Demand Management Storage Agreement (500,000 AF pool in Lake Powell and all other provisions).

All projects would be reviewed to ensure compliance with applicable federal and state laws, interstate agreements, and existing programs and processes.

Ongoing coordination with the Tribal Nations would be an important element of any potential program design.



<sup>\*</sup>Note that Law & Policy and Administration & Accounting elements are not included in this analysis.

Protecting Colorado Water 2 | 3.2021

	DRAFT DM Program Structure Matrix of Building Blocks				DRAFT
DM Workgroup  Guiding Principles	Threshold Issues / Elements of Feasibility	A	Implementation Option	C C	Interconnected Issues, T eoffs, and Equity Considerations
Timeframe and scale of		All potential op	। vtions may impact or be impacted by the timefr	ame and scale of a DM Program.	
Monitoring & Verification (Agricultural DM Project)  Honest, accurate, transparent, and defensible	Measure water returned to stream	Bypace of diversions (streamflow an percent eservoir releases, if applicable) if the physical and legal availability can be easily determined; or estimate the amount of conserved consumptive use through moderate engineering estimates (such as reducing historical diversion rates) to protect downstream users.	Diversion of the irrigation supply (streamflow and/or reservoir releases, if applicable) into a ditch at a flume with a stage/discharge recorder, after which would be returned to the stream.	Diversion of the irrigation supply (streamflow d/or reservoir releases, if applicable) into a ditch h multiple real-time recording devices and a telemetry system to remotely monitor diversions and the measured returns of the irrigation supply to the stream.	Simplifying the measurement and verification requirements may underestimate the amount of based on the need to use constitutions and/or estimates.  Increasing the measurement and verification requirements may result in increased instrumentation requirements, longer review and/or enrollment periods, and may increase program costs, but could result in greater amounts of credits/water generated for individual DM projects.
<ul> <li>Protective of other water users</li> <li>As simple, easy, and flexible as possible</li> </ul>	Conduct a consumptive use analysis	Use the Division of Water Resources' Lease Fallow To estimate historical consumptive use (conservatively underestimating to protect downstream users).	Complete a general site-specific potential consumptive use analysis, similar to a Substitute Water Supply Plan (SWSP), to estimate consumptive use, while considering the available diversion data and/or historical remote sensing data and/or aerial photographs.	Complete a detailed site-specific engineering analysis, similar to a water court change case, with parcel specific representative data to determine historical consumptive use and return flows.	Equity considerations include participation across diverse geographic areas, wide-spread locations within a stream system, wide-ranging ditch system complexities, and agricultural sectors/markets.
<ul> <li>Participation adds water to the Colorado River Basin – not solely a retiming of</li> </ul>	Estimate the residual field consumptive use	Complete fallowing, removal of deep-rooted crops, and management practices to prevent inadvertent irrigation with visual inspections.	Full or split fallowing with ongoing measurement of groundwater levels and/or visual soil moisture inspections.	Split fallowing, irrigation of lower consumptive crops, or deficit irrigation with ongoing measurement of applied irrigation supplies, soil moisture, and remote sensing.	<b>=</b>
depletions	Maintain return flows	Bypass of diversions pethological immediate delivery or both the consumptive use and return flow portions of the irrigation supply back to the stream after measurement.	Develop unit response functions (URFs) to determine the timing of delayed return flows to the stream and replace in time from legally available contracted supplies (reservoir releases or augmentation credits).	Determine the historical return flow patterns through a site-specific study and then construct and equip a recharge or infiltration pond with measurement devices near the fallowed field to maintain historical return flows in time, location, and amount.	Simplifying the monitoring and verification requirements for return flow maintenance may increase participation in a DM program, but could decrease streamflow absent a supply to replace lagged irrigation return flows.  Increasing the monitoring and verification requirements for return flow maintenance may reduce participation in a DM program, but could be more protective of streamflow by identifying a supply to replace lagged irrigation return flows.
Monitoring & Verification (Transmountain DM Project)	Measure water returned to stream	Bypass of diversions if the physical and legal availability can be easily determined; or estimate the amount of conserved consumptive use using moderate engineering estimates (such as reducing historical diversion rates) to protect downstream users.	Diversion of the transmountain supply for measurement in a flume with a stage/discharge recorder, after which would be returned to the stream OR measurement of reservoir release.	Diversion of the transmountain supply with real- time recording devices and a telemetry system to remotely monitor measured returns/releases of the transmountain supply to the stream.	Simplifying the measurement and verification requirements may underestimate the amount of credits/water generated attributable for a DM project based on the need to use conservative assumptions and/or estimates.  Increasing the measurement and verification requirements may result in increased instrumentation requirements, longer review and/or enrollment periods, and may increase program costs, but

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Protecting Colorado Water 3 | 3.2021

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<ul> <li>Honest, accurate, transparent, and defensible</li> <li>Protective of other water users</li> <li>As simple, easy, and flexible as possible</li> <li>Participation adds water to the Colorado River Basin – not a retiming of depletions</li> </ul>	Verify conserved consumptive use occurs on the East Slope	Water user provides accounting demonstrating the reduction of West Slope deliveries for a DM activity did not result in additional West Slope diversions from another of its transmountain systems or contractual supply.	Water user provides accounting demonstrating the reduction of West Slope deliveries for a DM activity was offset by another East Slope supply or through a reduction in the overall demand of its customers.	Water user maintains double accounting records for several years to confirm that a DM activity in one year wasn't offset by retiming of future Colorado River depletions in subsequent years. This includes all reservoir accounting records and the reconciliation of carryover storage of West Slope supplies in East Slope reservoirs.	could result in greater amounts of credits/water generated for individual DM projects.  Equity considerations include participation across diverse East Slope geographic areas, wide-spread locations of individual TMD projects, wide-ranging TMD system complexities, and ability to share conserved consumptive use impacts across all users within a DM participant's system.
Monitoring & Verification (Process considerations for all projects)	Coordinate environmental and other benefits	Qualitatively demonstrate an increase in streamflow after bypassing a transmountain diversion and/or divert, measure, and return flows to the stream.  No additional measurement structures are required above what is deemed necessary to verify measurement of water returned to the stream.	Qualitatively demonstrate that temporary storage in a West Slope reservoir for a planned release bolsters non-consumptive, environmental and flow related benefits.  Impacts and benefits evaluated qualitatively only. No additional measurement structures are required above what is deemed necessary to verify measurement of water returned to the stream and reservoir operations.	Quantitatively demonstrate that temporary storage in a West Slope reservoir for multi-benefit planned releases bolsters non-consumptive, environmental, and flow related benefits.  Impacts and benefits evaluated quantitatively. Measurement needs could include flumes for measuring bypass of diversions and/or return flows; additional stream gages; measurements of water quality, etc. Accounting required to monitor a project's net effect (e.g. lagged return flow accretion timing, etc.).	Foregone agricultural and TMD diversions could provide additional benefits for non-consumptive uses and environmental flow needs both immediately after release and/or after temporary storage.  Incorporating West Slope storage to manage releases of foregone agricultural and TMD diversions could maximize flexibility and bolster non-consumptive and environmental flow needs, but would result in additional evaporative losses and would reduce water generated by an individual DM project. Incorporating West Slope storage could also increase the requirements for measuring, verifying, and quantifying environmental benefits and/or impacts.

DM Program Structure Matrix of Building Blocks

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Protecting Colorado Water 4 | 3.2021

		DRAFT	DM Program Struc	ture Matrix of Building Blocks	DRAFT
Fducation & Outreach Transparent and inclusive stakeholder engagement to shape the	Water education (to engage broad audiences)	State creates detailed website resources, issues press releases, conducts interviews, and delegates many education tasks to PEPO, WEco, and other partners.	State partners with groups such as WEco, PEPO, educators, cooperative extension or similar entity, and universities to implement a series of education activities; implements a targeted communications plan; offers webinars to partner organizations; some new audience engagement.	State brings on staff or runds education to travel statewide for strategic teaching efforts rooted in drought and water shortage knowledge; partners extensively; communicates broads ale (i.e. radio, billboards, TV) to new water audiences.	"Change management" is an ongoing and resource-intensive effort to evolve both the program design and the state's attitudes towards water use.
Address     communication     gaps with     message     consistency,     partner networks,     and virtual     engagement      Water education     at the state	Stakeholder engagement (to inform the program)	State builds upon successes of preexisting programs. Utilizing Board and IBCC input, and updated website comment functionality, the state develops a DM program with assistance from consultants or others as needed and appropriate.	Leveraging the Board, Roundtables, IBCC, CWC, conservation districts, and public meetings, the State leads a public input process to inform a DM program and geography. As the program is developed, stakeholders are invited to address the CWCB Board to proactively identify and discuss how the program is working from varying perspectives and geographies.	The state engages a broad and diverse range of stakeholders over an extended period. As the program is developed and implemented, stakeholders are invited to address the CWCB Board to proactively identify and discuss how the program is working from varying perspectives and geographies. Based on this input, elements of the DM program are appropriately tailored to local needs across the state. An iterative process with evolving program options.	More localized programs may mean that some programs cost the state more, and other programs cost the State less. Stakeholders would need to determine whether it is fair for taxpayer dollars to be included inequitably for the sake of equity.  While an evolving program structure may be desirable as a mechanism to proactively avoid or mitigate potential negative impacts, it may make it more difficult to ensure a clear, predictable process is in place.  If a DM program is established, CWCB will coordinate with other state agencies relating to conflict resolution processes available.
at the state, regional, and local levels  Include an equity lens in all engagement and communication	Program marketing (to ensure participation)	State remains active in water forums like CWC; implements marketing plan as needed to target audiences; maximizes pre-existing participants. No active solicitation. Assumes participants would approach state.	State partners with local actors to assist with program marketing; implements proactive marketing plan to target audiences using annual allocated funds.	State opens local offices to be liaisons between the state and program participants; extensive marketing; maximizes new program participants. State has a role in co-developing applications with new applicants.	The "bang for the buck" considerations would need to be weighed by decision makers and stakeholders regarding the extent to which additional efforts yield increased program participation.  Lower levels of marketing would limit the State's ability to educate / market for increased participation in certain geographies / sectors.  Smaller operations, non-English speakers, and nontraditional participants such as mining or food industry would benefit from higher levels of implementation.  Proportionality of program adoption would require active marketing and education efforts in areas with lower levels of implementation.
Environmental Considerations  Achieve a net environmental benefit over time, and across hydrologic conditions and geographies	How potential environmental benefits and impacts are considered	Environmental benefits and impacts (flow needs, affected habitat, and/or species, alignment with other plans or efforts, etc.) considered through existing review processes and frameworks.	Identify potential environmental benefits and impacts and associated risks for potential projects. Evaluate possibility of realizing potential benefits and mitigating potential impacts. Coordinate with other agencies to identify and track potential benefits and impacts, including CPW and others as appropriate.	Consider each item in a comprehensive list of potential benefits and impacts. Public stakeholder engagement could be required for large projects. This may include consultation with local entities or with a committee of experts to assess local needs and impacts. Evaluate possibility of realizing potential benefits and mitigating potential impacts. Coordinate with other agencies and local entities to identify and track potential benefits and impacts, including CPW and others as appropriate.	<b>P</b>

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Protecting Colorado Water 5 | 3.2021

	DRAFT DM Program Structure Matrix of Building Blocks DRAFT				DRAFT
<ul> <li>Provide opportunities for projects with new environmental benefits</li> </ul>	Delicite of	Environmental benefit or impact of a given project is assessed through existing review processes and frameworks.	List of environmental considerations evaluated qualitatively for benefits or impacts. Net benefit or impact of a project is evaluated qualitatively based on evaluation of considerations.	List of environmental considerations evaluated quantitatively for benefits or impacts. Net benefit or impact of a project is evaluated quantitatively and qualitatively based on the evaluation of considerations. Evaluate risks and tradeoffs.	More comprehensive environmental assessments could be burdensome to potential applicants as well as the State. However, greater risk of adverse impacts or lost opportunities if these assessments are not conducted.
<ul> <li>Not harm the environment</li> <li>Evaluate project environmental</li> </ul>	Strategies to incentivize benefits	No incentives provided for projects with potential environmental benefits.	Preference and/or additional monetary or program incentive given to projects with net environmental benefits.	Preference and/or additional monetary or program incentive given to projects with greater net environmental benefits. Potential partnerships with NGOs and/or local organizations to support the assessment of potential benefits.	Coordinate efforts on incentivizing benefits with local governments to streamline approval. Opportunities for collaboration on a county/local level.
benefits/impacts without creating an unnecessarily burdensome process for applicants  Identify project impacts/benefits to environmer resources, including flow, water quality, affected habitats etc.	avoid, offset, or mitigate any negative impacts	No additional strategies implemented to avoid, offset, or mitigate any potential negative impacts.	Evaluate the program as a whole for opportunities for partnership(s) to add environmental value (enhance benefits or avoid, offset, and or mitigate negative impacts). Examples: potential storage and retiming of return flows in an upstream reservoir to increase benefits and/or mitigation measures.	Evaluate specific projects for opportunities for partnership(s) to add environmental value (enhance benefits or avoid, offset, and or mitigate negative impacts). Examples: Potential partnerships with NGOs and/or local organizations to help in realizing benefits and mitigating potential impacts and provide additional funding, programs, or opportunities. Potential projects could include watershed restoration work, diversion structure improvements, etc.	These are very similar to the options for monitoring and verification. Additional mitigation measures would require additional funding.  Measurement and quantification of potential environmental benefits and/or impacts would have monitoring and verification components or requirements (see Monitoring & Verification).
Economic Impacts     Local Government	st municipal participants	Existing programs and funding sources are used to support municipal participants.	State consults with and provides support for municipal participants in developing projects.	State identifies other programs that may be coordinated to support municipal participation and assists in facilitating more significant conservation programs. State consults with local governmental entities to identify appropriate mitigation opportunities.	A water efficiency program is not temperary. However, it is likely to be the least disruptive option.  Municipal participant may eliminate or minimize impact municipal water customers.  However, mechanism of municipal participation and/or reliance on other water sources may impact water availability for other users.
<ul> <li>Program should seek to create no benefits for water users</li> <li>Program operations should be transparent &amp; collaborative</li> </ul>	Municipal sector mitigation	Existing programs and funding sources are used relating to municipal sector mitigation.  Municipalities may take steps to avoid secondary impacts to their customers.	State more actively works to identify and track potential secondary impacts to municipalities resulting from participation in the program. A portion of project compensation spent on mitigation efforts. Mitigation payments are made to municipalities or communities.	State sets specific protocol and mechanisms for identifying and tracking potential secondary impacts resulting from municipal participation. A larger portion of compensation spent on mitigation with a defined list of required mitigation actions dependent upon type of project activity. State partners with local governmental entities to identify appropriate mitigation opportunities.	Potential impacts to system reliability depending upon type of municipal participation.  Mitigation measures taken by municipalities may have impacts outside their municipal boundaries.  Municipalities with fewer resources may be less able to mitigate potential impacts on their own, resulting in areas of low socioeconomic status potentially having lower access to green spaces or other resources.

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Protecting Colorado Water 6 | 3.2021

	DRAFT DM Program Structure Matrix of Building Blocks DRAFT				DRAFT
	Consultation with local governments to track impacts and develop mitigation measures	General education and outreach to inform local governmental entities, water boards of DM program. State does not consult with municipal participants or local governments to identify, track, or mitigate potential impacts and identify potential benefits to local economies resulting from a DM Program.	State consults with program participant and/or local governmental agencies to identify potential impacts and mitigation strategies, for all types of project activity, and to identify potential benefits to local economies and communities relating to a DM Program, as well as strategies to increase benefits.	Inter-governmental Agreement (IGA) or similar framework developed to facilitate robust and iterative consultation process with local governments and other entities to address local concerns and mitigate local impacts, with specific strategy and focus on mitigating or avoiding potential adverse impacts and increasing potential benefits, for all types of project activity.	Less consultation with local governments may result in increased se impacts that are not adequately tracked and mitigated.  There is a varying level of resources and capacity available for local governments to facilitate coordination and mitigation efforts. This variation may affect the extent to which impacts are tracked and mitigation measures implemented across the state.  Consultation with the Colorado Municipal League and Regional Councils of Governments may be helpful in determining appropriate parties and mechanisms for engagement.
Ag Impacts  Equitable & proportional across state  Minimize & mitigate off-farm impacts  Program should be a structured & guided market  Program operations need to align with growing season	Agricultural sector mitigation	Existing programs and funding sources are used to promote agricultural viability.	Fund is established to provide compensation to local entity for community economic development fund. Grant program established to assist with local agricultural and economic viability.	State and partners make efforts to identify potential secondary impacts. Fund established that potentially provides compensation for mitigation, some of which is distributed to water management entity servicing property, while a portion is distributed to local/rural economic development or other appropriate organization. Additional staff time targeted at mitigating agricultural sector impacts to non-participants. Dependent on funding availability and identification of appropriate funding source.	Limiting the community development fund to verifiable DM impacts would present additional complexity, but would perhaps ver costs or avoid reimbursement of economic impacts beyond State's control; alternatively a community fund that supports projects regardless of verifiable impact would be easier to manage and generate positive community outcomes. State verification of poor intial impacts could be costly and difficult to accomplish.  Assess impacts to tenant farmers and land rental prices through community outreach efforts, noting it may be challenging to community outreach efforts.  Community impacts in sovereign Tribal Nations may require alternative structure.
growing season schedules	Agricultural participant field requirements	No field requirements	State works with cooperative extension, other local agencies to establish guidelines for cover crops (for annual crops) and weed and pest control measures (for perennial crops). State partners/contracts with cooperative extension or similar entity for technical assistance and limited monitoring of compliance.	State works with cooperative extension, other local agencies to establish guidelines for cover crops (for annual crops) and weed and pest control measures (for annual and perennial crops). State provides staffing for technical assistance and monitoring of compliance.	Cover cropping could add complexity to monitoring and verification of consumptive use; soil health practices such as conservation tillage could reduce Monitoring & Verification complexity; development of any mitigation guidelines would likely require input from the United States Department of Agriculture, Colorado Department of Agriculture, and cooperative extension. Cover cropping could provide additional environmental benefits; select cover crops could help offset impacts to livestock feed complexity it in and provide additional revenue for the participant.  Producers may lack knowledge of cover cropping techniques. Though cover crops may create additional costs, state may work with USDA NRCS to offset participant cost of any on-farm mitigation requirements. There may be federal crop insurance implications.

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Protecting Colorado Water 7 | 3.2021

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	Agricultural participant assistance	Existing programs and resources in place are utilized to facilitate agricultural participant assistance to help fully realize potential benefits of participation or mitigate potential impacts.	State creates a grant or cooperative contracting program with the university cooperative extension service, conservation districts, or similar technical service providers, to offer technical assistance and help fully realize potential benefits of participation or mitigate agronomic impacts from the DM program to the participants.	State creates additional staff capacity responsible for assisting in fully realizing benefits of participation or mitigation of impacts from the DM program to the participants. Position manages a budget for technical assistance and mitigating impacts.	Participants would likely need technical assistance in both navigating any potential DM in-take process and in selecting/implementing mitigation measures (e.g. cover cropping); providing the ability to grant or contract with third parties would likely reduce programs costs and address state capacity concerns.  Producer participants familiar with working with agricultural service providers may be more willing to work with a trusted contract to versus state staff.  In addition to direct technical assistance, online information regarding any DM sign-up process or agronomic impacts and best management practices would be helpful and more accessible
Process Considerations	Soliciting projects Application requirements	No state solicitation  Participants are not required to submit information regarding mitigation, monitoring, or other elements with their application. No certification program due to open enrollment process.	Annual grant funding for entities to identify & develop project applications  Select mitigation & monitoring elements must have been completed or substantially planned for application.	State staff support & grant funding for identifying & developing project applications  Select mitigation & monitoring elements must have been completed or substantially planned for application. A certification process ensures that project applications meet minimum requirements.	
	Project selection process	Open enrollment (first come, first serve) for projects of any duration. No certification processes. Review is done on a project-specific basis.	Annual RFP process without any certification process. Coordination with local governments, entities, others to facilitate a "guided market" approach aimed at ensuring a program aligns with specific goals and does not create unacceptable adverse impacts (see Economic Impacts and Local Governments and Agricultural Impacts sections).	Annual RFP process with certification required. Clear protocol developed, incorporating coordination with local governments, entities, others, to establish a "guided market" approach designed to ensure the program aligns with specific goals and values and does not create unacceptable adverse impacts (see Economic Impacts and Local Governments and Agricultural Impacts sections).	Care should be taken to ensure that the timing of the application, review, and approval process align with when agricultural participants make operational decisions
	Localization and program evolution	No additional protocol put in place to localize and/or evolve a program to local needs.	Review of DM program put in place at specific milestone to consider successes, lessons learned, and stakeholder feedback. The review directly informs future program management across the state.	Regular review of the DM program to consider successes, lessons learned, and stakeholder feedback. The review directly informs program management at local level. The review is public, transparent, and available for comment.	Depending on the level and scale at which programs evolve, there may be program differences (perceived as inequity) over time at the Basin levels.  Local agencies / entities have different statutes, capacity, jurisdictions, resources, knowledge, and mobilization. Different basins can engage at different levels.

DM Program Structure Matrix of Building Blocks

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Protecting Colorado Water 8 | 3.2021

		DRAFT	DM Program Struc	ture Matrix of Building Blocks	DRAFT
Funding  Portfolio of funding sources should be considered  Costs would be influenced by many factors	Range of annual costs	\$3M - \$16M  Example Cost Breakdown: 10% Program Costs 90% Compensation Cost	\$5M - \$20M  Example Cost Breakdown: 30% Program Costs 70% Compensation Cost	\$12M - \$30M  Example Cost Breakdown: 65% Program Costs 35% Compensation Cost	Payment offered may impact who is interested and able to participate, which may affect proportionality in terms of sector and region.  Compensation range reflects that some may be willing to participate at lower cost than others, and in some cases additional compensation may be available outside of state fund.
including program design, scale, and participation	Funding Sources	Compensation paid by State through budget reallocation	Compensation paid by State through	Compensation paid by State through blend of multiple sources.	<b>□</b>

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Protecting Colorado Water 9 | 3.2021

# EXHIBIT C Literature Review

# Demand Management Feasibility Investigation Literature Review July 2021



**Consultant Team** 

**CDR Associates** 

**SGM** 

WestWater Research / Colorado College



# Table of Contents

Introduction	3
SECTION 1 – FEASIBILITY INVESTIGATION BACKGROUND	4
Investigation Background	4
2019 Work Plan	4
Step II Work Plan	4
Consultant Team	5
SECTION 2 – LITERATURE REVIEW OVERVIEW	<i>6</i>
SECTION 3 – AGRICULTURAL IMPACTS - LITERATURE REVIEW & ANALYSES	<i>6</i>
Literature Review	6
What we know	<i>6</i>
Key Takeaways	<u>9</u>
Data Gaps	
SECTION 4 – ECONOMICS & LOCAL GOVERNMENTS – LITERATURE REVIEW & ANA	
Literature Review	
What we know	
Additional Work Completed	
Key Takeaways	
Data Gaps	
SECTION 5 – EDUCATION AND OUTREACH – LITERATURE REVIEW & ANALYSES	
Literature Review Literature Review & ANALYSES	
What we know	
Additional Work Completed	
Program Manager Interviews	
Key Takeaways	
SECTION 6 – ENVIRONMENTAL CONSIDERATIONS – LITERATURE REVIEW	
Literature Review	
What we Know	
Additional Considerations	
Key Takeaways	
Data Gaps	
SECTION 7 – FUNDING – LITERATURE REVIEW & ANALYSES	
Literature Review	
What we know	
Key Takeaways	39



# Demand Management Feasibility Investigation Literature Review

# PROTECTING COLORADO WATER

Data Gaps	40
SECTION 8 – MONITORING & VERIFICATION – LITERATURE REVIEW	41
Literature Review	41
What we know	42
Themes	44
Key Takeaways	45
Data Gaps	
ACRONYMS	47



# Introduction

In 2019, the consultant team was retained to conduct a literature review relating to topics that correlate with the workgroups convened pursuant to the 2019 Work Plan adopted by the Colorado Water Conservation Board. The consultant team was directed to conduct a literature review and to identify key data gaps in the literature to help inform Colorado's Demand Management Feasibility Investigation.

The consultant team conducted the literature review, as well as additional research and interviews in some cases to inform their findings. This report summarizes the consultant team's findings in the following topic areas:

- Agricultural Impacts
- Economic Impacts and Local Governments
- Education and Outreach
- Environmental Considerations
- Funding
- Monitoring and Verification

## Each section of this report captures:

- A summary of the literature review
- A summary of work completed in addition to the literature review
- Key takeaways
- Data gaps

The Administration and Accounting and Law and Policy workgroups were not associated with the Consultant Team's scopes and therefore not included in this report.



# SECTION 1 – FEASIBILITY INVESTIGATION BACKGROUND

Colorado is currently investigating the feasibility of a potential Demand Management (DM) program. Demand Management is the concept of temporary, voluntary, and compensated reductions in the consumptive use of water in the Upper Colorado River Basin. Each of the Upper Colorado River Basin States (also referred to as the Upper Division States) are conducting their own investigations to determine whether a potential program would be feasible from their states' perspectives.

It is beyond the scope of this document to provide an overview of the minimum requirements to establish a Demand Management Program. However, more information relating to the Drought Contingency Plan (DCP) and associated agreements can be found at the following website: <a href="https://www.usbr.gov/dcp/index.html">https://www.usbr.gov/dcp/index.html</a>.

# **Investigation Background**

The DM Feasibility Investigation (Investigation) follows direction of the CWCB Board in the Support and Policy Statements adopted in November 2018, the 2019 Work Plan (Step I), and the most recent Step II Work Plan approved in November 2020.

# 2019 Work Plan

The 2019 Work Plan (Step I) had three primary components:

- 1. Establish **workgroups** comprised of subject-matter experts and key Colorado River stakeholders, which were directed to meet publicly at least four times in Fiscal Year 2019-20, and to identify key threshold issues for board consideration
- 2. **Regional workshops** designed to facilitate the public discussion around DM and provide opportunities for CWCB staff updates on the Investigation; and
- 3. Continued education and outreach.

In addition, the CWCB Board directed staff to facilitate a literature review, completed by the Consultant Team.

The July 2020 Board meeting included a presentation of the summary of workgroup discussions and other work found at the following website:

 $\underline{https://dnrweblink.state.co.us/cwcb/0/edoc/212695/8} \underline{Demand\%20Management\%20Update.pdf?searchid} \underline{=a1d2b86a-6aab-4b53-b5dc-e3dd570b71fb}$ 

### Step II Work Plan

Following the 2019 Work Plan, the Board adopted the Step II Work Plan, which contemplates exploration of potential program design options through development of a Framework. Figure 1 shows how information gained in the 2019 Work Plan has helped to inform the Framework, which shows a range of implementation options and program design options.



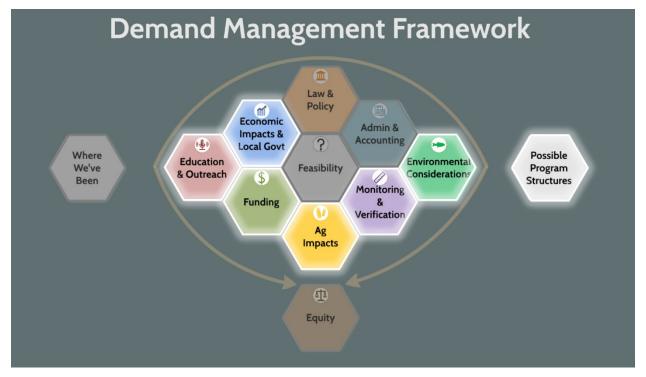


Figure 1. Demand Management Framework. The white highlighted tiles depict the Consultant Team's focus workgroups.

#### **Consultant Team**

The DM Consultant Team is comprised of three consultant firms that were responsible for different tasks. Each team member reviewed information from the workgroups, conducted a comprehensive literature review, and some conducted additional analyses and interviews. A list of each team member and their specific focus-area(s) are:

- CDR
  - Education and Outreach (E&O)
- WestWater Research & Colorado College
  - o Agricultural impacts
  - Economics and Local Governments
  - Funding
- **SGM** 
  - Monitoring and Verification
  - **Environmental Considerations**



# **SECTION 2 – LITERATURE REVIEW OVERVIEW**

A comprehensive list of the documents reviewed by the Consultant Team is included in **Exhibit A**. The following sections summarize the literature reviews and analyses of the Consultant Team. While compiling the individual components of the literature review, the Consultant Team identified interconnected issues that were relevant across specific workgroup topics. Pertinent areas of overlap were included in each applicable section.

# SECTION 3 – AGRICULTURAL IMPACTS - LITERATURE REVIEW & ANALYSES

WestWater Research led the Agricultural Impacts literature review. The tasks associated with their work specifically included:

- Participation in the final meeting of the Agricultural Impacts workgroup as a listener.
- Compilation and review of past studies and research regarding the agricultural impacts of water conservation and reduced irrigation projects in the Western U.S.
- Analysis of design elements of a DM program as they relate to agricultural impacts.
- Identification of knowledge or data gaps in the ability to understand and evaluate agricultural impacts of a DM program and individual DM project activities in the agricultural sector.

This report section provides a summary of the literature review research findings.

# **Literature Review**

There is an extensive body of knowledge and library of past research studies on the impacts of reduced irrigation activities. This section summarizes some high-level summary points from the literature review.

#### What we know

Demand management is the reduction of consumptive water use. The types of activities that can be undertaken in the agricultural sector to reduce consumptive water use are focused on reduced irrigation, which can take on a variety of forms such as: full-season fallowing, split-season fallowing, rotational fallowing, deficit irrigation, and crop switching. Each demand management activity will have different economic effects which depend upon the existing water use and crop and livestock production on a farm or ranch property. It is also important to distinguish demand management activities as those resulting in water conservation or conserved consumptive use, and not activities that result in greater water use efficiency which do not generally result in a reduction in consumptive use. The following two sections (below) expand upon the on-farm and off-farm impacts of agricultural demand management activities.

#### **On-Farm Impacts**

All demand management activities that may be implemented in the agricultural sector will reduce the irrigation water supply to the crop. Various types of irrigation reduction are possible for a given operation, but the primary (expected) methods are listed in the above paragraph. On-farm impacts of demand management activities are described in the points below.

• Crop Yield. In the Colorado agricultural sector, a reduction in consumptive water use is expected to result in a reduction of crop yield. This is the most direct impact of reduced irrigation and will result in



# Demand Management Feasibility Investigation – FINAL REPORT PROTECTING COLORADO WATER

reduced income for the producer. The extent of yield reduction depends on the crop type, extent of water stress, and timing of water stress.

- Crop Quality. The quality of the harvested crop or grazed pasture is often influenced by reduced irrigation, with both positive and negative quality changes documented. Particularly for alfalfa and grass hay cut for sale, quality influences price and therefore has an impact on producer income.
- Management Impacts. A variety of management impacts exist for reduced irrigation activities. For hay and pasture fields, there are expected to be significant and multi-year management impacts from large-scale reduced irrigation. Hay fields and pastures can take several years to establish and reduced stand density and quality changes from reduced irrigation can result in disruptions to operations. For cattle ranchers, reduced pasture production can impact herd sizes, health, and genetics, particularly if supplemental feed is not easily acquired. These impacts are expected to scale down with reduced demand management activity and forage crops are unique in their ability to scale with various irrigation inputs. For annual crops, full-season fallowing and crop switching are the most likely activities to be implemented and disruptions to operations are expected to be less than multi-year forage crops. Also, specialty annual crops are likely to see greater operational and management impacts compared to commodity crops. One aspect that is universal is the negative impact to business relationships that comes with not producing (or producing less of) a crop or agricultural product, which forces customers (buyers) to look elsewhere. The temporary reduction in agricultural production could impact the long-term business plans for producers.

# **Off-Farm Impacts**

The off-farm impacts of reduced irrigation and agricultural production that come with demand management can touch upon multiple economic sectors in a community. Additional information on off-farm impacts is provided in the Economics & Local Government section of this report. For this report section, off-farm impacts will focus only on the agricultural sector. Off-farm impacts are organized into the following three categories: (1) hydrologic, (2) economic, and (3) agronomic.

#### **Hydrologic Impacts**

Irrigation activities change the natural hydrologic flow patterns in a watershed. These changes are often documented in the engineering studies that accompany water right change of use applications in water court. Cessation or reduction of irrigation results in a similar but reversed change to flow patterns. For many areas in Colorado, irrigation has been occurring for well over a century, such that both natural and human reliance on the irrigation flow patterns has occurred. Reduced irrigation due to demand management may result in the following hydrologic impacts:

- Increased annual streamflow volumes due to reduced crop consumptive use and reduced losses in the
  conveyance and application systems. Annual volume increases are the underlying reason for conducting
  demand management activities.
- A shift in the timing of streamflow with increases during the spring snowmelt period and reductions during the late summer and fall seasons. This shift results from not holding back spring runoff flows through irrigation diversion and land application.
- Reduction in canal flows serving multiple producers, such as irrigation districts and mutual ditch
  companies, which can negatively impact canal operations. Less carriage or "push" water can create
  hydraulic problems on ditch systems, particularly affecting neighboring producers needing elevation
  head in the canals and those located at the tail-end of ditches.
- A shift in the timing and volume of streamflow may result from changes in groundwater pumping for irrigation. Aquifer water levels may also increase with reduced pumping across a large area.



### **Economic Impacts**

The off-farm economic impacts are tied to the flows of money into agricultural production and out of agricultural sales. In other words, off-farm economic impacts relate to an agricultural producer's typical spending habits and his/her modified spending habits under demand management. For production inputs, it is common to look at crop enterprise budgets developed by university extension offices to understand input types and values. The dollar value of operating costs (per acre) in the crop budget tables provide an indication of the relative economic impact resulting from reduced purchases by the producer because of demand management. For example, the 2018 budgets indicate that alfalfa hay has operating costs totaling \$334 per acre or \$86 per ton of hay production. Most of these operating costs will scale down with reduced production (yield) under demand management. Fixed costs identified in the crop budgets are not expected to change significantly under demand management activities.

The economic impact of modifications to spending that typically results from agricultural net income is more difficult to quantify and predict. Demand management activities will be compensated, and compensation amounts will need to be greater than the expected loss in agricultural net income to incentivize participation from agricultural producers. The off-farm economic impact from spending depends upon the source of compensation funds and whether the compensation income is spent locally or not. Limited data from two surveys indicate that approximately half to nearly all of the compensation payments will be spent locally.

The two money flows described above (inputs to and spending from agricultural production) are based on an owner-operator farm system. Many farms and ranches in Western Colorado have absentee landowners and are farmed by long-term lease tenants. An additional economic impact results to tenant farms if the landowner decides to participate in demand management activities without collaborating with the lease tenant. Demand management can disrupt the owner-tenant relationship because compensation payments to the owner may not be shared with the tenant, who will experience lost production and income. Landowners are incentivized to work with their lease tenants before participating in demand management activities to maintain a beneficial relationship with the tenant and to maintain market lease rates for the property.

#### Agronomic Impacts

The off-farm agronomic impacts relate to weeds, pests, and dust. A field that is participating in demand management can be a nuisance to neighboring fields due to these issues and therefore weed, pest, and dust management are often required as part of short-term and permanent fallowing plans. The extent of impact if such management actions are not taken is site dependent, based on field location, soil types, and localized infestation issues. Many of these agronomic impacts can be mitigated through cover crop establishment on fallowed fields and weed & pest controls on perennial forages.

The following illustration in **Figure 3** provides a conceptual model for thinking about the agricultural impacts of demand management and captures many of the themes identified in the literature review.



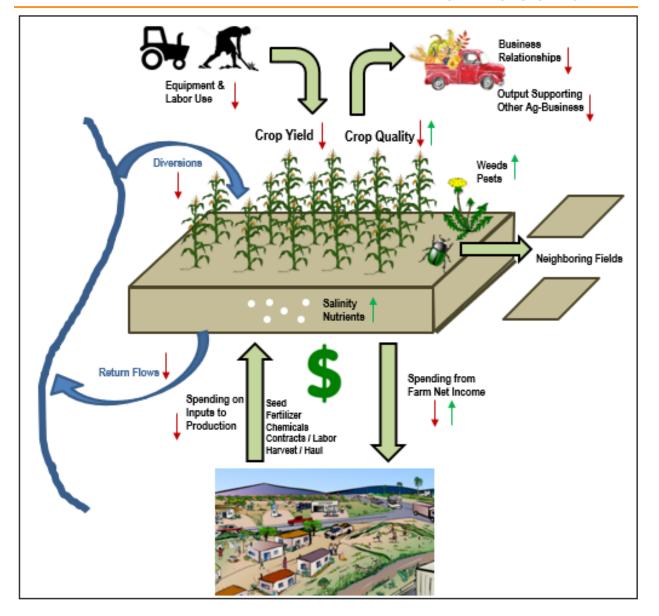


Figure 2. Conceptual Model of Agricultural Impacts from Demand Management Activities.

# **Key Takeaways**

- **Develop Educational Resources for Producers.** The CWCB may work with the Colorado Department of Agriculture, Colorado State University Extension, Natural Resource Conservation Service, and other land management groups to develop a guide for agricultural producers on how to apply for and conduct demand management activities while minimizing on-farm and off-farm impacts. The guide may be organized by crop type and demand management activity and may present best management practices (BMPs) for reduced irrigation. In addition, technical staff support may be funded and supported to assist producers in designing their demand management programs.
- Ensure Contracting Aligns with Seasonal Cycles. The CWCB may ensure that the application, review, and approval process is timed to align with when producers make decisions and investments each growing season. For example, project contracts by October 1 of the preceding year would be best, by January 1 of the activity year would be good, and by approximately March 1 of the activity year is



## Demand Management Feasibility Investigation – FINAL REPORT PROTECTING COLORADO WATER

necessary. If a rolling application process is used, then a demand management program may build in sufficient time to allow the producer to adjust investments and business commitments prior to activity implementation.

- Limit Demand Management Activity Duration. The available research suggests that partial-season reduction in irrigation on perennial forage crops, particularly alfalfa, can be achieved without significant and lasting damage to the forage stand. Full-season fallowing can be conducted on perennial forages but is best suited to the latter years of a stand when re-establishment is planned. For annual crops, multiple continuous years of demand management will require diligent management of weeds and pests. In general, agricultural impacts are less if specific fields do not participate in complete full-season fallow activities for multiple consecutive years.
- **Develop a Guide for Compensation Calculations.** This review identifies multiple on-farm and off-farm elements that compensation payments may consider. The CWCB may develop a simple guidance worksheet that helps producers understand the various costs that are likely to be incurred in demand management activities. Compensation payments are expected to be customized by each producer and operation, but general guidelines may be helpful to ensure that producers do not experience unforeseen costs as part of the program.
- **Limit Concentration of Activities**. An important tool in program design to minimize significant offfarm impacts of demand management activities is to limit the geographic concentration of projects. Demand management will be structured as a voluntary program and therefore the program may place maximum limits on the number of irrigated acres approved for participation in demand management by river basin or county.
- Mitigate Off-Farm Impacts. This review identifies hydrologic, economic, and agronomic impacts
  from demand management activities that the program may be designed to minimize and/or mitigate,
  and the following mitigation elements may be considered by CWCB. It is difficult to quantify the offfarm impacts for each specific project such that a program may look to implement standardized policies
  and payments that will apply to all projects.
- Hydrologic Impacts: Hydrologic impacts to off-site water users can be evaluated using standard engineering techniques such as those applied in Substitute Water Supply Plan (SWSP) applications. In addition, the CWCB may consider including mitigation payments to the managing ditch company, irrigation district, or other water user association as part of project costs (as applicable) to mitigate impacts to canal operations on larger systems.
- Economic Impacts: The on-farm economic impacts are expected to be fully addressed through compensation payments determined by the producer. Program design may be more concerned with off-farm economic impacts, which can partly be minimized through project selection. Mitigation payments to local governments may be a consideration of a demand management program, and these payments can be used for grant or loan programs for qualifying businesses or other economic development initiatives. The need for mitigation payments to local governments has not been definitively determined based on our research. It will be difficult to customize economic impact mitigation for each project due to uncertainty and privacy concerns with producer finances, such that a program may look to develop mitigation approaches applied uniformly to certain categories of demand management projects.
- Agronomic Impacts: Both on-farm and off-farm agronomic impacts can be minimized with a requirement that all farms and ranches participating in demand management conduct weed and pest control measures as part of the proposed projects. For perennial forages, this is likely to consist of various integrated approaches to maintaining a healthy forage stand. For annual crops, this is likely to require the establishment of a cover crop. A program may consider a requirement for field management techniques, such as cover cropping and weed & pest controls. CWCB may consider the compilation and



### Demand Management Feasibility Investigation – FINAL REPORT

#### PROTECTING COLORADO WATER

development of information resources to assist producers in determining the best cover crop and weed & pest control measures for their operation.

#### **Data Gaps**

There are two types of data gaps associated with the assessment of agricultural impacts: (1) those currently present in evaluating the feasibility of a demand management program, and (2) those that are likely to be present when evaluating the impacts of specific demand management projects.

#### Data Gaps in Evaluating the Feasibility of Demand Management

No major data gaps concerning agricultural impacts are identified that would significantly benefit an evaluation of demand management feasibility. Significant resources have been applied in studying demand management concepts for the past 8 years. Additional studies that are presently underway or near completion will also add to our understanding of agricultural impacts. Most of the data gaps identified during our analysis were focused on other subject areas, such as quantification of consumptive use savings and facilitation of program activities. The following data gaps related to agricultural impacts were identified:

- The costs, benefits, and impacts of crop switching and deficit irrigating as demand management activities. Most of the research we reviewed focused on partial and full-season cessation of irrigation on perennial forage stands. There are several outstanding questions about how (and if) crop-switching and deficit irrigation would work as demand management activities.
- The impact of demand management activities on the availability of hay for livestock operations. Demand management activities at a small scale will result in reduced hay production locally may require local purchase of supplemental hay. At a large scale, there are uncertainties about how the hay market would respond and how hay availability would be impacted. It is possible that demand management impacts would mirror past drought periods with a similar reduction in hay production.
- Additional information on specific best management practices for managing a field that is experiencing reduced irrigation, particularly a full-season fallowing. It is well-established that cover crop establishment for annual crops and various weed and pest control measures for perennial forage crops are critical to mitigating impacts, but specific information on practices relevant to different Western Slope agricultural zones would be beneficial. This information could form the basis for guides assisting producers in project implementation.

Further research and information on the above topics would be beneficial but is not likely to significantly change the existing knowledge base on agricultural impacts of demand management activities. Agricultural impacts will often be site-specific. The CWCB may consider additional pilot projects to expand the diversity of project examples. The pilots are not expected to provide definitive findings but rather improved perspective on likely impacts.

#### Data Gaps in Quantifying Impacts of Specific Demand Management Projects

The agricultural impacts associated with specific demand management projects will need to be addressed as part of compensation payments and program design. On-farm impacts will be site specific and standardized impact metrics are unlikely to be useful across operations. Each producer may evaluate the expected impacts, with available information resources and technical assistance, and incorporate impacts into proposed compensation terms. Off-farm impacts are a greater concern for program design, and program design is anticipated to mitigate off-farm impacts more than information gaps addressed during the application and review process.



### SECTION 4 – ECONOMICS & LOCAL GOVERNMENTS – LITERATURE REVIEW & ANALYSES

WestWater Research worked with Dr. Mark Smith from the Colorado College Economics Department to lead the Economics & Local Governments processes for the Investigation. The tasks associated with these efforts specifically included:

- Participation in the final meeting of the Economic Impacts & Local Governments workgroup as a listener.
- Compilation and review of past studies and research regarding the economic impacts of water conservation projects in the agricultural and municipal water use sectors.
- Analysis of design elements of a DM program as they relate to economic impacts.
- Identification of knowledge or data gaps in the ability to understand and evaluate economic impacts of a DM program and individual DM project activities in the agricultural and municipal sectors.
- Implementation of a survey of 19 municipal water providers in Colorado to better understand the municipal perspective on a DM program and anticipated DM activities.

#### Literature Review

There is an extensive body of knowledge and library of past research studies on the impacts of reduced irrigation activities, or demand management types of projects in the agricultural sector. There is also an extensive knowledge base on municipal water conservation; however, there is a general lack of information on voluntary, compensated, and temporary reduction of water use in the municipal sector. This section summarizes key points from the literature review on economic impacts.

#### What we know

To evaluate the economic impacts of demand management, it is necessary to consider both the direct impacts of reducing water use through demand management activities, and the indirect effects of reduced water use. These are often referred to as the primary and secondary impacts of an action or decision. An expanded discussion on the primary and secondary impacts of agricultural and municipal demand management is provided in subsequent sections. In brief they are:

- Agricultural Demand Management. Irrigation water is one of many inputs to crop production. Reduced water use results in less production as the primary impact of demand management. Secondary impacts reflect the other economic sectors that are affected by both reduced water use and reduced production. Backward-linked impacts result from the producer spending less on production inputs, such as seed, fertilizer, labor, and other items. Forward-linked impacts result from less harvested crop feeding into agri-businesses and other industries.
- Municipal Demand Management. Municipal water providers provide a service which allows their customers to live and work, enjoy a good quality of life (health, safety, and happiness), and allows businesses to function. Direct water uses in a municipal system are varied and diverse. Reduced water use results in less service, which can be reflected in various ways in a community as the primary impact depending on how both the water utility and individual customers choose to implement demand reduction. Secondary impacts reflect the nature of conservation activities and can include impacts to urban vegetation, property values, and wildlife habitat, among others. It is important to acknowledge



### Demand Management Feasibility Investigation Literature Review

PROTECTING COLORADO WATER

that there remains significant uncertainty on how demand management will be achieved in the municipal sector and if demand management activities will impact municipal water use customers.

#### **Economic Impacts of Reduced Agricultural Water Use**

The economic impact of reducing water use in the agricultural sector has been studied in many locations and was previously reviewed for the Colorado Water Bank Working Group and for the Colorado River District. In addition, there are active studies occurring on the West Slope that will aid in the understanding of secondary economic impacts. The secondary or regional economic impacts of demand management activities primarily depends on the type of agricultural operation (crop type, farm size, location) and the type of activity to reduce water use. This section provides a high-level summary of economic impacts from reduced agricultural water use. Additional information on agricultural impacts is provided in a separate review for the Agricultural Impacts in the preceding section of this report.

#### Actions to Reduce Agricultural Water Use

Demand management is the reduction of consumptive water use. The types of activities that can be undertaken to reduce consumptive water use are focused on reduced irrigation, which can take on a variety of forms such as: full-season fallowing, split-season fallowing, rotational fallowing, deficit irrigation, and crop switching. Each demand management activity will have different economic effects which depend upon the existing water use and crop and livestock production on a farm or ranch property. It is also important to distinguish demand management activities as those resulting in water conservation or conserved consumptive use, and not activities that result in greater water use efficiency which do not generally result in a reduction in consumptive use.

#### **Direct On-Farm Impacts**

All demand management activities that may be implemented in the agricultural sector will reduce the irrigation water supply to the crop and will be compensated. The net income to the producer under demand management is expected to be positive to motivate participation, with compensation payments exceeding the on-farm costs associated with demand management activities. Compensation payments need to consider the following on-farm impacts of demand management activities:

- Reduced Crop Yield. In the Colorado agricultural sector, a reduction in consumptive water use is expected to result in a reduction of crop yield. This is the most direct impact of reduced irrigation and will result in reduced income for the producer. The extent of yield reduction depends on the crop type, extent of water stress, and timing of water stress.
- Modified Crop Quality. The quality of the harvested crop or grazed pasture is often influenced by
  reduced irrigation, with both positive and negative quality changes documented. Particularly for alfalfa
  and grass hay cut for sale, quality influences price and therefore has an impact on producer income. For
  annual crops, reduced irrigation may result in an unmarketable product.
- Negative Farm Management Impacts. A variety of management impacts result from reduced irrigation and reduced production. One universal impact is the negative impact to business relationships that comes with not producing (or producing less of) a crop or agricultural product, which forces customers (buyers) to look elsewhere. The temporary reduction in agricultural production could impact the long-term business plans for producers. For hay and pasture fields, there are expected to be significant and multi-year management impacts. For cattle ranchers, reduced pasture production can impact herd sizes, health, and genetics. The on-farm impacts on cattle ranches are a function of location and scale of reduced production. In remote areas where access to supplemental hay is limited and associated replacement costs are high, the on-farm impact of reduced forage is expected to be relatively high. For areas that have access to hay for maintaining herds, a smaller on-farm impact is expected and can be estimated as the cost of acquiring supplemental hay for feed. For annual crops, full-season



fallowing and crop switching are the most likely activities to be implemented and disruptions to operations are expected to be less than multi-year forage crops.

• Costs of Mitigation Activities. In addition to changes in irrigation practices, the producer will likely need to invest in certain on-farm projects to reduce the off-farm impact of the demand management activities. These mitigation activities and projects are anticipated to include: (1) cover crop establishment on fallowed fields, (2) new weed and pest control measures on perennial forage stands, and (3) replacement water sources to prevent injury to downstream water users.

The positive net income to the producer results in positive on-farm economic impacts of demand management. An important point is that positive on-farm impacts will only result if the compensation paid for demand management activities exceeds the combined cost of the on-farm impacts listed above. A premium above these on-farm costs is expected to motivate participation and to address risk and uncertainty to agricultural operations.

#### Off-Farm Impacts

The off-farm impacts of reduced irrigation and agricultural production that come with demand management can touch upon multiple economic sectors in a community. Off-farm impacts can also be positive and negative depending on the economic sector and location. For this review, off-farm impacts are divided into two broad categories below.

#### Costs / Negative Impacts

Secondary economic effects of reduced irrigation involve all sectors of the regional economy that directly or indirectly transact with irrigated agriculture. Some of the secondary impacts considered likely to occur include:

- Loss in the value of output, personal income, and employment resulting from reduced spending in industries that provide inputs and support services to agriculture (referred to as backward-linked industries),
- Loss of output, personal income, and employment in sectors that use agricultural outputs as inputs to production (referred to as forward-linked industries),
- Effects caused by changes in net income spending in the region, and
- Changes in local tax revenues.

When agricultural production declines in a region, the reduced crop production results in a lower expenditure on agricultural inputs (first round effect). As a result, workers, stores, and support services directly related to agriculture reduce spending within the economy (second round effect) and the businesses that they buy from reduce their spending (third round effect), and so on. In addition, reduced agricultural production can lead to reduced activity for agri-businesses that rely on harvested crop inputs, resulting in further economic loss. These impacts are sometimes referred to as the multiplier effect.

The results of the recent 2020 economic study of demand management in Western Colorado indicate an indirect effect multiplier of approximately 0.34 and an induced effect multiplier of approximately 0.40, resulting in a total backward-linked economic impact equal to approximately 0.74, equal to 74% of reduced agricultural on-farm production. Additional forward-linked effects on the livestock industry were estimated to have a multiplier of 0.3, or 30% of direct agricultural output. In total, the secondary economic impacts of demand management were estimated to have a multiplier of 1.04 relative to the lost agricultural production value. This study indicates that secondary economic impacts of demand management are roughly equal to the primary on-farm economic impacts of lost production value.

The impact on businesses and economic sectors that utilize farm output (forward-linked industries) depends largely on the crop type and presence of food products and food processing industries in the region. For

### Demand Management Feasibility Investigation Literature Review



PROTECTING COLORADO WATER

most of the Western Slope, irrigation is practiced producing forage crops in support of the livestock industry. Hay trucking and slaughter facilities are two forward-linked industries that may be impacted by reduced forage production. The 2020 economic analysis of demand management indicated potential forward-linked impacts equal to approximately 30% of lost agricultural output.

The economic impact of modifications to spending that typically results from agricultural net income is more difficult to quantify and predict. Demand management activities will be compensated, and compensation amounts will need to be greater than the expected loss in agricultural net income to incentivize participation from agricultural producers. The off-farm economic impact from spending depends upon the source of compensation funds and whether the compensation income is spent locally or not. The 2020 economic analysis of demand management in Western Colorado indicated that compensation payments may or may not offset secondary economic impacts, depending on the extent to which payments are spent locally within the region.

The two money flows described above (inputs to and spending from agricultural production) are based on an owner-operator farm system. Many farms and ranches in Western Colorado have absentee landowners and are farmed by long-term lease tenants. An additional negative impact results to tenant farms if the landowner decides to participate in demand management activities without collaborating with the lease tenant. Demand management can disrupt the owner-tenant relationship because compensation payments to the owner may not be shared with the tenant, who will experience lost production and income. Landowners are incentivized to work with their lease tenants before participating in demand management activities to maintain a beneficial relationship with the tenant and to maintain market lease rates for the property.

In addition to the negative effects associated with changes to agricultural production, there are several environmental and recreational impacts to consider that result from a change in the timing of water flows. Irrigation, and specifically flood irrigation from surface water sources, slows the movement of water across the landscape through soil infiltration and return flows back to the stream channel. The result is that snowmelt runoff peak flows are reduced through irrigation diversion and late-summer low-flows are increased from return flows. The long-term presence of irrigated agriculture across much of the Western Slope has resulted in an environment and recreational economies that are built on this altered hydrology. Modifying the timing and magnitude of streamflow may cause additional negative economic impacts. In particular, the following are noted:

- Wetland and Wet Meadow Habitat. Many irrigation ditch and canal systems have wetlands and wet meadow habitat that have been formed by irrigation practices. In addition, the canals may also provide important riparian habitat. The inefficiency of surface conveyance and flood irrigation often results in habitat development down-gradient from irrigated parcels and ditch systems. A reduction in irrigation could result in negative impacts to these habitats and environmental resources. Wetland mitigation bank credits on the Western Slope have varied values depending on location and type of wetland credit.
- Decreased Late-Season Flows for Recreational Activities. Water-based recreation activities, and particularly fishing and boating, could be negatively impacted by a reduction in late-season streamflow. Negative effects are only anticipated to be noticeable on smaller tributary creek and river systems. The effects are also dependent on the relative scale of reduced irrigation and streamflow impact. The methods and concepts presented in previous research for recreational benefits of improved streamflow could be modified to consider the recreational costs of reduced late-season flows.

#### Benefits / Positive Impacts

The possible economic benefits of demand management activities are derived from two sources: (1) higher net income to the producer resulting in greater spending, and (2) modified hydrology resulting in greater streamflow annual volume and changes to streamflow timing. In addition, previous research on off-farm benefits identified possible salinity control benefits resulting from not leaching salts in the soil profile.

### Demand Management Feasibility Investigation Literature Review



PROTECTING COLORADO WATER

The benefit of higher net income to agricultural producers has an uncertain benefit to the surrounding economy that is largely dependent on how the additional income is spent. As stated previously, limited survey data indicate that past water conservation projects have seen half to nearly all of the compensation payments spent locally. The off-farm benefits of compensation spending may be significantly reduced if projects have absentee landowners located out of the local region. The temporary nature of demand management activities helps to ensure that project participants will maintain their properties and agricultural operations, which helps to ensure local benefit of the compensation payments.

The off-farm benefits of modified hydrology are specific to a location and project, as modified hydrology may also result in off-farm costs (see above). Downstream of the project site, annual streamflow volume will be greater based on the demand management activities. The timing and magnitude of increased streamflow is critical to understanding whether a benefit results from water conservation activities. Previous research on two System Conservation Pilot Program (SCPP) projects in Colorado and Wyoming found that these two water conservation projects resulted in nominal off-farm benefits besides salinity control. The research does indicate that off-farm benefits are expected to increase with larger volumes of water conservation activity. The following points summarize benefit concepts by various end uses:

- Recreation. The recreational benefit of modified hydrology is most likely to impact fishing and boating activity. The benefit can be estimated as a combination of: (1) the increase in number of visitor days, and/or (2) the increased value (enjoyment) of each visitor day. For both boating and fishing, the timing of additional streamflow needs to indicate a significant improvement to result in a measurable benefit.
- Environment. The environmental benefit is typically evaluated based on the presence of threatened or endangered species. The benefit may represent reduced recovery program costs or societal benefits of improved species habitat. Similar to recreation, environmental benefits are expected to be most significant if the modified hydrology represents a significant improvement in streamflow and the timing of flow increase is critical to realizing an environmental benefit.
- **Hydropower**. Run of river hydropower facilities are likely to see a direct benefit of larger streamflow volume as long as diversion capacity is not a limiting factor. Dam hydropower facilities are less likely to see a hydropower benefit unless the modified hydrology results in significant flow volume increases or the timing of flow increase occurs outside of the snowmelt period.
- Salinity. Reduced irrigation results in less deep percolation below the crop root zone and less leaching of salts in the soil profile into subsurface flows. In areas of the Colorado River Basin where active salinity reduction projects are in place, the benefit of reduced leaching can be significant.
- Municipal. Municipalities may enjoy benefits of reduced risk of Compact administration, since the goal
  of a potential Demand Management program would be to ensure ongoing compliance by the Upper
  Division States with the Colorado River Compact. This benefit is significant and is a primary driver of
  current efforts.

#### Mitigation of Negative Economic Impacts

Mitigation of negative economic impacts associated with water supply development projects and large water transfers is most often accomplished through federal and state environmental permits and is usually motivated by legal requirements to provide mitigation. For small and localized water transfers from agriculture to other uses, mitigation is not typically a legal requirement besides ensuring non-injury to other water right holders. Water right transfers often have negative economic impacts that are not mitigated. For a demand management program, mitigation may be evaluated and categorized based on on-farm and off-farm impacts. On-farm economic impacts are expected to be fully mitigated through compensation payments defined by the producer. Program design may be more concerned with off-farm impacts. Potential off-farm economic mitigation measures include:



- Mitigation Payments to the Affected Community. Mitigation payments, in addition to producer compensation, could be a component of a demand management program. The payments would be utilized for local community investments, which might take the form of grant and loan programs administered by county or other local governments, capital investment in specific economic development projects or infrastructure needs, and/or direct payments to local governments. Previous research identified three water transfer programs that provided explicit mitigation payments to local communities, ranging from 4% to 30% of producer compensation. These mitigation payments were provided primarily as a lump sum payment at the start of a multi-year water transfer program which probably would not be applicable under a demand management program. Two challenges with mitigation payments have been identified: (1) distributional challenges caused by mitigation efforts not targeting the most impacted sectors of the local economy, and (2) geographic challenges associated with dispersed project sites and impacts across the West Slope. These challenges may be addressed through a combination of mitigation payment investment rules and local oversight of mitigation payment spending.
- Alternative Cropping & Land Uses on Participating Properties. Creating an economic use of the participating lands during the period of demand management activities is a possible mitigation tool. Alternative cropping with a low water use requirement is a possibility but will reduce the conserved consumptive use benefits of demand management activities. Dryland grazing is a widely applicable alternative land use that may provide some limited economic activity. The types of alternative land uses are likely to be site-specific but investments could be made on properties to generate alternative economic activity, particularly if the property is intending to conduct demand management activities over multiple years.
- Compensation Payments as Mitigation. Most of the water transfer programs previously reviewed did not include any additional mitigation payments or policies to offset negative secondary (off-farm) impacts. Many programs may consider the compensation payments to the producer to be sufficient mitigation of local economic impacts. As stated previously, the suitability of compensation payments as mitigation for off-farm impacts is directly tied to the spending habits of producers in demand management years.

The economic effects of modified hydrology due to demand management activities are previously noted as potentially: (1) environmental impact of lost wetland and riparian habitat, and (2) recreational impact of modified streamflow for boating and fishing activities.

#### **Economic Impacts of Reduced Municipal Water Use**

This section first provides examples of reduced water use in the municipal sector, followed by a discussion of direct and indirect economic impacts of municipal conservation activities. There remains uncertainty as to how municipal demand management will be quantified, particularly for trans-basin diversions diverting from the Colorado River Basin to the Front Range. It is possible that a municipal utility could accomplish verifiable demand management through operations and management without requiring a modification in water use at the customer level. For this analysis, municipal demand management is evaluated assuming that water use reductions occur. The economic impacts described in this section provide context but may or may not be applicable to demand management in the municipal sector depending on how a potential program gets vetted and what demand management activities are implemented.

#### Context of Municipal Water Conservation in Colorado

Over the past 30 years both the Federal government and State of Colorado have enacted laws that have impacted both water conservation and water use efficiency for municipal water providers. These laws now guide municipal water use in three critical areas: (1) plumbing fixtures, (2) landscaping and outdoor water use, and (3) motivating municipal planning for efficient water use and effective drought response.

#### PROTECTING COLORADO WATER

Context is critical in understanding the operating space for future efficiency and conservation efforts in the municipal sector. Past municipal water efficiency efforts have significantly reduced per capita water consumption. Colorado statewide municipal water use rate (per person) has declined from about 240 gallons, per-capita, per-day (gpcd) in 2000 to about 160 gpcd in 2015. In the future, these municipal water conservation savings and efficiency benefits have become "hardened" into baseline consumption, such that they will likely not be available to provide for future demand management. The greatest potential for additional conservation and demand reduction is expected to be in the following five areas: (1) further limiting water use in residential and commercial landscaping, (2) extending low-flow plumbing fixture requirements into older homes and commercial properties, (3) extending efficiency requirements to smaller water providers, (4) adopting smart metering to reduce losses and inefficiencies in the distribution system and in-home, and (5) modifying water use habits and practices.

#### Actions to Reduce Municipal Water Use

Actions to reduce municipal water use have often been divided into two categories: (1) water conservation and (2) water use efficiency. Water conservation temporarily reduces water use in response to drought or supply disruption and may be scaled back once the supply disruption ends. Water use efficiency, on the other hand, aims at maximizing the water end use benefit while minimizing waste, and efficiency practices often continue indefinitely and may be expanded. Both water conservation and water use efficiency can be achieved by policies and programs designed by municipal water providers.

Cities such as Denver, Fort Collins, and Colorado Springs, where water conservation and efficiency programs have existed for over 20 years, have seen a significant reduction in per capita water use through implementing many practices. These actions have also resulted in demand hardening. The implications for hardened water demand and past conservation efforts might be considered when establishing a baseline municipal water use for demand management. In evaluating and selecting conservation and efficiency activities, municipalities have a range of criteria that could be applied.

Municipalities also have the option to make conservation activities mandatory through policy changes. Research shows that mandatory strategies yield more water savings than those that are voluntary. However, if well implemented and tied to attractive rebates, voluntary options can be effective as well.

#### **Direct Economic Impacts**

Water conservation programs directly impact water providers in three ways:

- Revenue loss from selling less water. Water supply has high fixed costs. Dams, reservoirs, tunnels, pipelines, treatment plants and distribution systems are all major capital investments. Once these investments have been made, the variable cost of moving an added cubic foot through the system is low. Given these high capital costs, it is more cost-efficient to have one provider serving a broad geographic area to distribute these costs over a larger customer base. Therefore, water utilities are either municipally owned or regulated by a water district. Municipal water providers have several ways of recovering their fixed cost including tap fees for new construction, monthly service charges on existing customers, and the unit charge on the volume used (water rate). Where fixed costs are covered by tap fees and the monthly service charge, water conservation activities will have less impact on utility revenues. If these costs are allocated to the water rate, conservation may result in reduced operating revenue. Rates are often adjusted periodically to offset the impact of water conservation, and to respond to inflation and other cost increases associated with capital projects and operations.
- Costs of running conservation programs. Program costs will vary significantly with the size of the
  provider and the ambition of the conservation program. Water conservation programs range from public
  awareness and education to subsidies for turf removal and replacing landscape irrigation. Cost efficiency
  requires that suppliers begin with the lowest unit cost activities. Equity implies that water conservation



opportunities are not denied to low-income households that may lack the resources to adopt more efficient water use practices.

• Impacts on wastewater treatment. Wastewater treatment is affected when the influent flow to the treatment plant becomes more concentrated and thus more difficult to treat to the desired effluent standard. The problem is particularly acute when effluent is reused in either potable or non-potable systems.

These direct economic impacts may be a component of the compensation or benefit sought by an individual municipal water utility seeking to conduct demand management (water use reduction) activities. Like the agricultural sector, the balance of compensation (or direct benefit) versus direct economic impact will determine the overall net impact to municipal water utilities.

#### **Indirect Economic Impacts**

Indirect impacts on urban areas are largely livability and quality of life effects. The business effects are likely to be somewhat isolated as relatively few commercial activities depend upon water. It is possible that landscaping businesses will see a decline, and heavy water use industries may struggle if pricing is used to encourage conservation. The livability impacts may be considerable and widespread, especially if conservation actions result in the die off of established trees and the desolation of parks and other urban green spaces. Unlike the indirect impacts in agriculture, these municipal impacts are not anticipated to result in reduced commercial activity and reduced profits. Nevertheless, Colorado attracts and retains both people and industry because it is a desirable place to live, both for its abundant natural beauty as well as its pleasant towns and cities with a high quality of life. These attributes that attract and retain economic activity are put at risk if significant municipal water conservation activities were to occur. A municipal water utility may incorporate some indirect impacts into its proposed compensation for conducting demand management activities, particularly those impacts that are within municipal control.

#### Mitigating Negative Economic Impacts

Demand management in the municipal sector may require new levels of both conservation and efficiency, and these activities may result in economic impacts as described above. Direct economic impacts to the municipal utility are expected to be evaluated by the utility and incorporated into any requested compensation to conduct demand management. Indirect impacts may or may not be included as part of the requested compensation and are a greater concern for demand management program administration and design. The following mitigation activities are targeted at both direct and indirect impacts of municipal demand management activities.

- Colorado's Water Plan. The state's 2015 water plan, "...sets forth the measurable objectives, goals, and actions by which Colorado will address its projected future water needs and measure its progress all built on our shared values." The plan was developed to address supply gaps resulting from a possible doubling of the state's population by 2050. Section 6.3 identifies many actions under (1) municipal water conservation, (2) water reuse, (3) land use, (4) agricultural conservation, efficiency, and reuse, (5) self-supplied industrial conservation and reuse, and (6) state agency conservation. The conservation and efficiency measures identified in the Plan provide a foundation for future demand management efforts.
- Regionalization. Front Range municipalities could examine the potential benefits of regionalizing supplies to improve reliability by taking advantage of a more diversified portfolio of water supplies. It is possible that future droughts will differentially impact streamflow conditions across the state. In addition, some metro Denver suppliers are primarily dependent upon Denver Basin groundwater. By jointly managing both surface and groundwater supplies, cooperating utilities may be able to firm up supplies under demand management.



- Water conservation extension programs. Current CWCB water conservation guidelines apply only to utilities that serve over 6,000 accounts. The state's largest suppliers have already instituted a range of programs to conserve water. The state could fund extension programs that enable large utilities to provide the same programs to smaller utilities which could take advantage of conservation options that are both proven and lowest cost. For example, smart meters could be installed by small utilities who then contract for data support from a utility that has already set up a system. An extension program represents a knowledge transfer to smaller water utilities to help ensure that demand management activities are effective and cost-efficient.
- Conservation pricing. Raising prices and/or implementing an increasing block rate structure on customers are both used to reduce water demand. In contrast to mandatory water restrictions, the effectiveness of using higher prices to reduce demand is less certain. Conservation pricing is also utilized to respond to successful water conservation to cover fixed costs with less water sales. Raising prices has a disproportional impact on low-income households. When using conservation pricing, utilities may establish low-income assistance programs and consider rebates for additional revenue to avoid these negative impacts. Approximately 85 percent of Front Range and eastern slope water providers, and 77 percent of western slope water providers, have such tiered rate structures.
- Xeriscape assistance programs. Municipal demand management is expected to fall heavily on outdoor
  water uses by residences, businesses, and institutions. Large-scale water use reduction may involve turf
  removal and many indirect impacts results from the loss of tress and green spaces. Some of these indirect
  impacts can be mitigated by replacing turf with xeriscape plants and landscaping. Several Colorado
  communities provide education and financial assistance for water users to modify their landscaping to
  a xeriscape design.
- **Urban Forestry**. Many indirect impacts from water conservation result from loss of trees and urban green spaces that provide many community benefits that enhance the livability of towns and cities. Demand management may provide options for cities to maintain existing trees and even expand urban forests into low-income neighborhoods that often have fewer trees. Tree canopy mapping often reflects income inequality and Colorado is no exception. The tree canopy in Colorado Springs neighborhoods, for instance, ranges from less than 5% in low-income to more than 50% in high-income neighborhoods. Planting trees in low-income neighborhoods would both reduce inequality and increase air and water quality benefits for all. Targeted investments for tree health, such as direct irrigation and fertilization, is a way to reduce stress on the urban trees.
- Turf Conversion in Parks. Demand management may involve redesign of urban parks to reduce water use. Vast green spaces may give way to more selective green spaces, artificial turf on playing fields, and more extensive use of xeriscape. In addition, continued irrigation of trees in parks when turf is removed is an important consideration. In general, municipalities may consider maintaining parks and outdoor green spaces even if residential and commercial irrigation is reduced because of the community benefits.
- **Project vs. Programmatic Demand Management.** A demand management program may anticipate supporting both project (i.e., single entity) as well as programmatic (e.g. universal smart metering) as strategies for creating conserved consumptive use. Establishing a baseline, monitoring, and verifying savings generated over many users will be critical for any programmatic approach.
- Water Energy Nexus. Colorado has 25 operating thermal power plants that all require water for cooling. Retiring these plants and replacing them with wind and solar farms will reduce both consumptive water uses and greenhouse gas emissions a double-dividend.



#### **Additional Work Completed**

WestWater performed interviews with municipalities across the State to investigate demand management related to municipal operations. A memorandum summarizing municipal interviews is available upon request.

#### **Key Takeaways**

These key considerations are based on the literature review summarized in previous sections. The following activities and policy elements are key considerations related to the specific purpose of reducing and/or mitigating economic impacts of demand management activities.

- Mitigation Payments in Program Design. The feasibility investigation may consider a program that includes mitigation payments to offset indirect economic impacts, particularly for agricultural demand management projects. Mitigation funding requirements might be established as part of program design and should likely be standardized across all projects. Standard mitigation payments would avoid the process of evaluating economic impacts of each proposed project and will provide certainty to the program participants and funders. The mitigation funding might be given to local governments to make local decisions on spending the money.
- Ensure that the Program is Voluntary. From an economic perspective, it is important that demand management remain a voluntary program without any requirement or mandate to participate and reduce water use. In both the agricultural and municipal sectors, there is a large amount of diversity in risk, ability to pay, direct and indirect impacts, and required compensation related to demand management. A voluntary program ensures that significant direct economic impacts do not occur to specific water users and communities.
- Include Environmental and Recreational Benefits and Impacts in Project Review. The process of soliciting and evaluating demand management projects is not yet determined. The CWCB might consider some form of analysis and reporting on the environmental and recreational benefits of proposed demand management projects as part of the review process. It is important to distinguish that this type of analysis is not part of informing mitigation requirements but instead for supporting projects that may provide a specific benefit.
- Leverage Other Funding Sources. Reduced water use may result in other benefits and there may be
  other programs established to provide funding resources for reducing water use and/or realizing these
  indirect benefits. A demand management program could look to develop and publish (online) a reference
  list of complementary funding programs and sources for consideration by project participants. Example
  and possible funding sources include the Environmental Protection Agency (EPA), U.S. Bureau of
  Reclamation (USBR), Natural Resources Conservation Service (NRCS), and U.S. Fish and Wildlife
  Service (USFWS).
- Indirect Impacts of Reduced Municipal Water Use. Our literature review did not provide definitive findings on the scope or scale of indirect impacts related to reduced municipal water use, particularly for: (1) environmental impacts of reduced outdoor water use, (2) social and community impacts of reduced outdoor water use, and (3) equity implications of reduced water use. The CWCB may consider developing a work plan to better understand these impacts. Consider potential benefits and impacts for east slope agriculture (supplemental sources of water).



#### **Data Gaps**

This section provides a discussion of two types of data gaps: (1) those currently present in evaluating the feasibility of a demand management program, and (2) those that are likely to be present when evaluating the impacts of specific demand management projects.

#### Data Gaps in Evaluating the Economic Feasibility of Demand Management

The economic feasibility of demand management can be better evaluated when demand management activities are better defined, particularly for the municipal sector. Most of the data gaps identified during our analysis were focused on other subject areas, such as definition of qualifying activities and program administration. The following data gaps related to economic impacts were identified:

#### Agricultural Sector

- Further research may consider the definition of standard economic multipliers specific to West Slope agriculture for informing mitigation payments. Further work could be done to generate one or more standard multipliers which would be used to define mitigation payments for agricultural demand management projects. These multipliers may be used to determine the full costs of each project and make equivalent comparisons between projects. The 2020 economic analysis for Western Colorado provides an information basis to define these multipliers.
- Additional data gaps are identified in the Agricultural Impacts section of this report that should be incorporated into this economic review.

#### Municipal Sector

- Further research may be done to better define municipal demand management activities. The impacts of municipal demand management activities stem from a better definition of those activities, and impacts are difficult to evaluate without this definition. The municipal sector may not have to or be willing to reduce end uses of water to achieve demand management.
- Additional research could evaluate the ability to reduce municipal water use. It is expected that the
  municipal utilities will propose to conduct demand management activities based on system-specific
  analysis. In terms of understanding feasibility of demand management, the state might consider an
  analysis looking at the broad feasibility of additional water use reductions in the municipal sector. The
  following elements might be included in such an analysis:
  - Evaluating the existing water efficiency practices across the state to identify the potential water savings from: (a) retrofitting pre-compliance homes and commercial buildings with low flow fixtures; (b) extending proven water efficiency programs into smaller water providers; (c) reducing non-revenue water lost through systems leakage. Such efforts can generate consistent, long-term water savings.
  - Evaluating the effectiveness and experience of Colorado water providers with water pricing strategies. Water providers have used a range of conservation pricing strategies to reduce water use. These include tiered rates, seasonal pricing, conservation surcharges, and tap fees. These strategies could be assessed for effectiveness, revenue impact and fairness. Water managers may find the experience of other utilities, within Colorado and with which they are likely to have some familiarity, more compelling than experience from other states and countries.
  - Evaluating the impacts of reduced outdoor watering. The major savings in municipal water uses will likely come from reductions in outdoor water use. Practices to reduce outdoor water use have been widely applied, but we have limited understanding of the impacts on urban livability and options to mitigate these impacts.



### Demand Management Feasibility Investigation Literature Review

#### PROTECTING COLORADO WATER

Further evaluate the indirect impacts of reduced municipal water use. This literature review provides
information on past research related to the indirect impacts of reduced water use in the municipal
sector. Our review indicates that more information is needed on the impacts of water efficiency and
conservation efforts on inequality and on environmental resources beyond urban landscaping.
Academic papers and utility reports note the importance of these indirect impacts; however, studies
that attempt to measure or quantify such impacts have not been identified.

#### Data Gaps in Evaluating Economic Impacts of Specific Demand Management Project

The economic impacts associated with specific demand management projects will need to be addressed as part of compensation payments and program design. Direct impacts will be site specific for farm operations and municipal water systems. Each demand management applicant or participant is likely to evaluate the expected direct impacts, with available information resources and technical assistance, and incorporate impacts into proposed compensation terms. Indirect impacts are a greater concern for program design, and program design is anticipated to mitigate indirect impacts more than information gaps that are addressed during the application and review process. Project-specific economic analyses will be difficult to conduct due to cost and timing.



# SECTION 5 – EDUCATION AND OUTREACH – LITERATURE REVIEW & ANALYSES

CDR Associates led the Education and Outreach (E&O) and Statewide Engagement processes for the Investigation. The tasks associated with these efforts specifically included:

- Participating in the Education and Outreach workgroup meetings.
- Conducting a literature review that analyzed and summarized the existing knowledge of education and outreach strategies, lessons learned, and data gaps.
- Conducting program manager interviews that collected first-hand data on education and outreach for existing water conservation and efficiency programs.
- Supporting CWCB with Statewide Engagement planning and facilitation.
- Developing a summary of the key considerations and practical education and outreach strategies relating to a potential DM program that integrates the findings from the literature review and feedback from the Education and Outreach workgroup and other key stakeholders.

The education and outreach findings detailed in this report align with the CWCB's additional policy goal statements to work with water rights holders and stakeholders in determining the feasibility of DM in Colorado:

- (6) Prioritize avoidance of disproportionate negative economic or environmental impacts to any single subbasin or region within Colorado while protecting the legal rights of water rights holders. The Board will work with water rights holders and stakeholders to assess the feasibility of and promote mechanisms for obtaining roughly proportionate contributions of water consumptively used from the Colorado River System to a Demand Management program over a given timeframe from participants on each side of the Continental Divide.
- (8) Consider and be fully informed by the input and considerations of water rights holders and stakeholders potentially impacted by application of demand management strategies within Colorado, and institute a public review process for any such proposed demand management program.

#### Literature Review

#### CDR's literature review aimed to:

- Identify education and outreach lessons learned from similar policy efforts.
- Develop key considerations and/or engagement toolkit (strategies and tactics) for consideration in next steps of the Investigation.
- Identify decision milestones and tradeoffs for future consideration.

The key findings informed the E&O goals and parameters for a potential DM program, as well as considerations linked to messaging, trust building, and program localization / evolution.

The literature review evaluation examined the literature through the following thematic questions:

- What would motivate people to participate in the Demand Management program?
- What components of a DM program excite potential participants? How do you build support for change? How do you build interest in a program like this?





- What disincentivizes people?
- How do you build trust in a low-trust environment? How do you build regional cooperation in a context of competition?
- Who was the target audience of the program? How familiar were people / do people need to be before adopting the program? How was the program messaged or marketed? How do you tailor messages (benefits, impacts) to different audiences?

Overall, the literature was vague in specific detail around E&O efforts, although general themes have proved to be informative for the exploration of the feasibility of a hypothetical DM framework. The literature reviewed for education and outreach themes included:

- Summary of "Lessons Learned" from UCRC's "Final Report: Colorado River System Conservation Pilot Program in the Upper Colorado River Basin", by UCRC & Wilson Water Group, 2018
- Lessons Learned from the System Conservation Partnership Program, by The Nature Conservancy, February 2016
- GVWUA Final Report on the Conserved Consumptive Use Pilot Projects, by GVWUA and J-U-B Engineers, 2019
- TNC Briefing Paper: Upper Basin Demand Management and Water Banking, by The Nature Conservancy, 2019
- Exploring Perceptions of a Voluntary Agricultural Water Conservation Program on the Western Slope of Colorado by MacIlroy, Colorado State University, 2019
- Towards Regional Sustainability Assessment Utilizing Community Based Participatory Research, Sustainability Indicators, and Future Scenario Modeling, by Dubinsky, CU Denver, 2019
- Urban Water Conservation in the Sacramento, California Region during the 2014-2016 Drought, by Talbot, UC Davis, 2019
- The Poudre Water Sharing Working Group: A Report to the CWCB, by The Poudre Water Sharing Working Group, 2015
- Appendix C: 2018 System Conservation Pilot Program Update, by the Upper Colorado River Commission, 2018

#### What we know

Education, outreach, and engagement is critical to the success of a program. The most perfectly designed program, without willing participants, will not accomplish the goals of a demand management program.

There is no one-size-fits-all solution: we know that each of Colorado's distinct sub-basins will need a contextualized approach, and an approach that keeps Colorado's residents at the heart of the solution.

Based upon the literature review and program manager interviews, the overarching E&O principles for designing and implementing a demand management program are:

- Engagement to develop and tailor the program to community needs: outreach prior to and during the exploration into the feasibility of a program to ensure it represents the potential participants.
- Motivate participation in a demand management program: following the establishment of a demand management program, marketing and outreach to program participants may align with local values, motivations to apply, and messages that resonate with community identities.



• Water education on broad policy impacts and benefits of the program: to inform and educate the broader public on the risks of inaction and the statewide benefits that justify the State's investment in a demand management program.

#### **Additional Work Completed**

#### **Program Manager Interviews**

Program manager interviews were conducted by CDR Associates following the literature review to fill in data gaps around education and outreach. In particular, the goal was to supplement the Investigation with information about how water conservation programs undertake education, outreach, communication, and marketing efforts.

#### **Program Managers Interviewed**

Program managers were selected because of their experience designing, managing, and/or evolving water efficiency programs for agricultural or municipal audiences. Program managers were from organizations including:

- Palo Verde Irrigation District
- San Luis Valley Subdistrict 1
- Colorado River Water Conservation District
- Central Platte Natural Resource District (NRD)
- North Platte NRD
- Tri-Basin NRD
- Twin Platte NRD

- Idaho Snake River
- NRCS CREP Programs
- Metropolitan Fallowing Program
- Denver Water
- City of Westminster
- Republic River Conservation District
- Resource Central

#### **Methodology / Interview Approach**

The goal of the interviews was to better understand successes, lessons learned, and techniques linked to education and outreach on water conservation programs. Interviewees were promised that quotes and comments would not be directly attributed to them. Meetings were not recorded to encourage candidness. The interviews ran approximately 45 to 60 minutes via Zoom or telephone.

The following questions guided the interview discussions:

- 1. Please describe your conservation / efficiency program.
- 2. Was extensive outreach conducted before the program was established?
- 3. If the program was voluntary, what motivated participation in the demand management program?
- 4. What were the general outreach strategies and specific tactics implemented?
- 5. What would you have done differently if you had a chance?
- 6. Who else would you recommend we speak with for more information?

#### **Interview Key Themes**

The following description of seven key themes represent topics and sentiments heard in two or more interviews. The intent is to identify and describe themes for further discussion with stakeholders, and not to prescribe solutions or remedies. The rural designation includes agriculture and small municipal perspectives. The urban perspective captures dense areas.

Rural Themes



- 1. Localization and evolution of the program
- 2. Proactive and hardcopy outreach
- 3. Trust-building with stakeholders
- 4. Inclusion in process

#### Localization and evolution of the program

A program that remains reflective of community needs results in higher participation. Several of the interviewees reported that by engaging with farmers about their needs, the co-developed program led to participation that exceeded expectations. One interviewee from the San Luis Valley takes a farm-by-farm approach to ask, "What do you need? What isn't good about the current program? What works for you?" By applying a variety of soft skills, the interviewee links input to programs.

This approach is evident in the San Luis Valley's half-usage pilot program. The program started with discussions with farmers, grew with Board input, and then our interviewee aligned the concept with timelines and budgets. The pilot was originally budgeted at \$120,000; it surpassed that in the first week of enrollment, and in total a pool of \$1,000,000 funded pilot participation.

#### Proactive and hardcopy outreach

Whereas some communities are familiar and comfortable with digital outreach and marketing, many of the agricultural-oriented interviewees emphasized that their outreach prioritizes tried-and-true methods. In part, this approach works because of the average age of producers (in some communities, interviewees estimated the average age was 50 years old). The interviewee from Nebraska's Central Platte NRD used outreach like mailed quarterly newsletters; newspaper articles; radio advertisements in the spring and fall to target farmers on tractors listening to market updates and farm news; annual information meetings; and the development of an NRD radio jingle.

#### Trust-building with stakeholders

Interviewees with agricultural audiences emphasized that implementing a program in ag communities takes time. "If you're going to do something like this, you've got to be in it for the long term," said one of the NRD interviewees, "There's no better PR than a satisfied customer." Producers are risk averse. In the interviewee's case, his conservation program's first year had poor participation; the following years benefited from local talk, trust, and evidence of the program's benefit.

Similarly, the San Luis Valley interviewee credited programmatic success to personal relationships. When communication can go both ways, particularly in getting questions answered, then individuals feel more confident in making a well-informed decision.

#### *Inclusion in process*

A theme echoed throughout the agricultural interviews was the importance of process inclusion for producers, farmers, ranchers, and rural water users. Ideally, decisions are made at a local level by local program managers or, even better, by potential program participants.

#### Urban Themes

- 5. Defining motivation for participation
- 6. Ease of application and program management
- 7. Engaging water managers and local government leaders

#### Defining motivation for participation

For urban residents and water providers, interviewees linked successful programs to marketing aligned with participants' motivations. For household users, participants in water efficiency and conservation programs typically identified water savings as the primary motivator. As a Front Range interviewee said, "The target audience is people who want to do the right thing. They understand that Colorado is semi-arid and that



they're putting too much water into their landscape." And, in a City of Westminster survey, customers identified the top two reasons for promoting water efficiency as: "It ensures long-term water supply security" and "Water is a limited resource."

For municipalities and water providers, motivators are efficiency, impact, and adaptation to the local context. One interviewee highlighted that "blanket solutions" for reducing consumptive use are difficult, as water providers have a strong sense of identity for their customers and organization. Additionally, most municipalities and water providers run lean organizations: few have dedicated staff to developing and implementing water efficiency programs. Programs need to be efficiently managed to align with capacity and need to have tangible impact to make the resources worthwhile.

#### Ease of application and program management

The ease of application to a program was a motivator at both the household- and water provider-levels, and the ease of program management was a motivator for water providers. Interviewees felt that complex processes would not be successful due to reasons including household attention spans, the level of effort to maintain a program, and the staff needed to run complex programs.

Engaging water managers and local government leaders

Two interviewees found success in implementing programs via water managers and local government leaders. Buy-in from local government leaders increases the likelihood of program implementation, because it provides visibility about a program and, often, elevates the prioritization and timeline of a program's implementation.

#### Outreach Strategies and Tactics

Interviewees pointed to a spectrum of strategies and tactics to increase participation, raise awareness, and market a program. The tactics have been divided into two categories (municipalities / urban water users and agricultural / rural water users), because approaches varied widely depending on the local context of the interviewee.

#### Municipalities / Urban Water Users

#### Messaging

• Simplify and tailor messaging: for example, consider urban programs Cash for Grass or Slow the Flow

#### Internal Communication Methods

- Reduce barriers to marketing and program management for staff unfamiliar with outreach, such as premade marketing toolkits:
- Flyer templates
- Sample social media posts separated out by month, with corresponding photos
- Editable text that can be used in micro-, medium-, or long-form media
- Ads for local newspapers
- Customer-service trainings for staff

#### External Communication Methods

- Create opportunities for in-person engagement and relationship-building
- For example, offer free audits to get a water expert into someone's home, educate that customer, build relationships, and trust, and connect them to pre-existing programs
- Outreach in consistent and audience-appropriate places.



- Strategies include:
- Utility bill inserts
- Direct mail
- Targeted social media promotion
- NextDoor posts and ads
- Posts in small local papers
- Joint press releases, often with a customer testimony
- E-news lists
- A customer survey asked: "What's the best way to reach you about water efficiency programs?"
- 42% flyers and inserts in my bill
- 40% messages on my bill
- 10% social media
- 15% website
- Advertise incentives to target audiences like developers, HOAs, and hot development areas

#### Leveraging Values

- Use data-based decision-making to inform and urban programs
- Define goals around scale and geography to help program managers have an equitable, balanced, and efficient approach to simplify applications for target participants

#### Agricultural / Rural Water Users

#### Messaging

- Codefined messaging: ask potential users what they need, and what would or wouldn't work. Then shape a message based on their input.
- Relationships are more important than words. Messaging may follow rapport and trust with the community.
- One-size won't fit all. Farmers have diversity in operations; different crop types have different needs.

#### Internal Communication Methods

- Training program employees
- Calls with the State on possible program changes

#### External Communication Methods

- Consider timing of outreach, such as radio ads during harvest season and newsletters in off-seasons
- Having a participant-centric approach is important for long-term participation in the program
- Outreach in consistent and audience-appropriate places. These include:
- Radio
- Radio ads in spring and fall to correlate with the timeframe that farmers are listening to market updates on their tractors



- Customized radio jingle
- Radio interviews
- Town halls, producer meetings, symposiums, and webinars
- Have included features like guest speakers and presentations about new innovations
- Provide updates on programs, aquifer levels, hydrology changes
- Newspaper updates, articles, and newsletter postings
- Newsletters and information bulletins
- Fact sheets and flyers
- Website content
- Blog to provide narrative about key issues
- Guest writers
- Press releases
- Social media, although not as successful because of age of producers
- Board member marketing, word-of-mouth marketing
- School water education on a variety of issues; best interaction with 4th, 5th, 6th graders
- Text (SMS) communication between program managers and participants for quick updates
- Local office locations allow people to come learn about conservation programs for their area

#### Leveraging Values

- Trust and relationships between a program manager and local communities, which could look like:
- Co-learning: host opportunities for producer / farmer roundtables to inform programmatic decisions
- Upfront time commitments: state how long a pilot or program will be around, and then be consistent.
- Long-term strategy: "There's no better PR than a satisfied customer."

#### **Key Takeaways**

The following statements capture overarching takeaways from the Education and Outreach literature review and interviews conducted, and represent common considerations for establishing buy-in for a future potential DM program.

- Motivations to participate. Motivation to participate is connected to information, clarity, and education about the program objectives and larger economic / social / environmental issues. Addressing these motivations includes: ensuring the protection of water rights and confirming that participation in compact security is a beneficial use under Colorado Water Law; defining short- and long-term financial benefits for participants, especially to reduce risk and increase profitability; and educating potential participants on the process, goals, and program details, to provide the context needed to relate a program to personal situations.
- Build Support for a Demand Management Program. Develop local communication strategies and partner with local, established networks to communicate messages. Involve communities as early as possible in program design. Inclusion of trusted local and state representatives will result in a program with higher agricultural water user participation. Additionally, align a program with producer values



like free-market economies and flexibility in operation and production schedules. Institutionalize into the program benefits for sustainable agriculture and rural communities. Create general policy parameters and rules to facilitate flexibility for the program to fit local stakeholder needs, maximize community benefits, and respond to local concerns.

- **Disincentives.** Primary reasons for nonparticipation include misconceptions about program purpose, local attitudes towards water conservation / fallowing, and concern about impacts to the economy and community. Potential participants are hesitant about overly public information about specific projects. Perceptions about whether a demand management program is necessary or unnecessary is closely linked to how an individual perceives Colorado River Basin water issues.
- Build Trust and Regional Cooperation. Local outreach builds trust, relationships, and community buy-in, especially when outreach results in impact and influence. Prioritize face-to-face meetings, ranging from town halls to door-to-door messaging within sub-basins. Develop clear, well-defined scenarios to help communities understand potential benefits or impacts of policy choices. Facilitate opportunities for communities to participate and/or access in research methods, datasets, reporting, and models. Enlist local key stakeholders and non-governmental organizations (NGOs) to participate in program outreach. Communicate with stakeholders, landowners, ditch and reservoir companies, and general irrigators before, during, and after projects. Define decisions that can be made at the local level, instead of the state or federal levels.
- Defining and Communicating with Target Audiences. Audiences with preexisting relationships with CWCB and/or partner organizations are more likely to participate in conservation programs. Use communication channels that are appropriate to the target audience. Consider the timing of messages, so the target audience has the bandwidth to engage on potentially applying to a program. Be clear and consistent in messaging so that potential participants receive one message. Develop a multi-pronged approach so that messaging to rural and urban audiences happens at state, regional, and local levels. Build upon existing water messaging platforms, such as Water Efficiency Plans and communications related to drought.

In addition to the literature review, CDR has helped facilitate the stakeholder engagement process relating to the Demand Management Framework and Demand Management more generally. Therefore, in lieu of an analysis of data gaps relating to Education & Outreach, the following section provides key observations relating to Colorado-specific issues and values. Further engagement can continue to inform what elements of a potential Demand Management program are acceptable to different sectors and communities, what elements or areas need further exploration or discussion, and what elements have buy-in or support.

#### Coloradan Values: A Commentary

Following the Statewide Engagement effort to engage diverse perspectives, CDR Associates provided the following anecdotal commentary to articulate Colorado-specific values. The following commentary is in no way comprehensive nor universal. However, an understanding of Colorado-specific values can help inform the advisability of a program.

#### Individual Choice

Coloradans appreciate individual choice and discourage government oversight. This value was articulated in rural and urban contexts; for example, producers participate in fallowing programs when it suits their financial objectives or personal lifestyles, and homeowners participate in municipal conservation programs to beautify yards or protect the environment.

Any potential demand management program may align with the value to participate when and where Coloradans choose to. Similarly, messaging and motivation for a demand management program might



recognize that individual choice applies to demand management but does not apply to Compact administration, which would not be voluntary or compensated.

#### Local Control

Colorado's government is designed to support and empower local control, and this is a value shared by many in the state. Many Coloradans support decision-making made at the lowest level of government possible, including town councils and county commissions. This value seems especially true on the West Slope.

Any potential demand management program may incorporate the role of local government and local decision-making into its decision-making. Inclusion from the start, such as in shaping the program framework and in designing mechanisms to protect against unintended impacts, would likely build local trust and buy-in.

#### Agricultural Participation in Decision Making

Agricultural communities--including many who would be eligible participants for a potential demand management program--value participation in decision-making. Agricultural stakeholders want to shape the decisions that would impact their ways of life, income, community well-being, and local economies.

Any potential demand management program may proactively include agricultural communities in the process. This includes program development, program implementation, and any changes to the program after its launch. Agricultural participants would be critical to the success of a demand management program in achieving conserved consumptive use.

# SECTION 6 – ENVIRONMENTAL CONSIDERATIONS – LITERATURE REVIEW

SGM led the Environmental Considerations processes for the Investigation. The tasks associated with these efforts specifically included:

- Review and develop environmental criteria for assessing impacts of potential demand management activities.
- Identify data gaps, tradeoffs, and interrelated topics relevant to the Environmental Considerations
  workgroup and assist in determining methods to address data gaps as directed, as identified in the
  literature review.
- Summarize instream flow, environmental and recreational issues relating to past water conservation programs.

#### **Literature Review**

SGM reviewed various types of water savings, water banking, pilot projects and/or water conservation reports (listed in **Exhibit A**) and information to understand how environmental considerations, impacts and net benefits, were considered or how they influenced projects to balance these needs. Like the Monitoring and Verification literature review, SGM reviewed this information to understand how future projects could inform the integration of environmental considerations for a potential DM program, including:

• Current methodologies, data, and information to measure environmental attributes both in the agricultural and municipal contexts.



- Details associated with consumptive use and conservation estimation and monitoring, verification methods, and related issues.
- Data gaps and methods for being able to consider and measure environmental attributes within the DM monitoring and verification process.

SGM took the direction of the Environmental Considerations workgroup and summarized key topics, criteria, and considerations relating to previous conservation projects (**Exhibit B**). Summary information included:

- Primarily purpose/goal of the project.
- Key takeaways.
- Project location.
- Program name, administration, structure, nature and duration of project practice.
- Tools uses to assess environmental impacts.
- Impacts to streamflow including magnitude, frequency, duration, timing, rate of change in hydrologic conditions, and return flow impacts.
- Impacts to species including critical stream reaches, critical land or riparian habitat, and list of species impacted.
- Impacts to water quality including salinity, temperature, and other constituents.
- Environmental considerations tradeoffs predicted outcome from activities, and proportionality.
- Ability to offset losses to environmental services and opportunities to incentivize environmental components for CCU projects.
- Evaluation of impacts (positive or negative) to instream flows, stream or watershed management plans, critical habitat, state species of concern, basin roundtable environmental values, conservation strategies, and other community goals and/or projects.

#### What we Know

Overall, the literature review concluded that most projects and studies did not consider nor measure how conserved consumptive use impacts or benefits environmental attributes. However, there was recognition in some studies that the environment benefits with increased streamflows due to lower diversions. In general, these streamflow impacts were correlated to better fish habitat due to higher instream flow and lower temperatures.

There was recognition that the following key elements might influence environmental impacts or benefits, and in some instances, offered suggestions for integrating potential mechanisms for measuring these benefits and impacts.

#### **Streamflow Impacts**

Generally, the literature found increased streamflow could benefit the environment. "Environmental Water Transactions in the Colorado River Basin: A Closer Look" (Stanford Woods Institute for the Environment, 2018, Exhibit A) reviewed instream flow projects including the SCPP projects. Notably, the report found that "although the total amount of water restored by these transactions is very small compared to the overall water budget of the basin, in certain watersheds, transactions have provided significant benefits for local streamflow." Specifically, these were the Price River watershed in Utah and the Green River watershed in Wyoming.

Another report, "Salmon recovery in the Columbia River basin: analysis of measures affecting agriculture" (Aillery et al, 1999, Exhibit A) focused on the impact of diverted water and the impact of decreased streamflow on salmon species. Specifically, it found "flow alterations have significantly increased travel time for iuvenile fish migrating to the ocean, a primary factor in reduced survival rates." The report investigates different methods to increase streamflow in the Columbia River basin. As this relates to a DM program, increased streamflow to move water to Lake Powell could have positive impacts on fish species.

#### **Modeling**

The literature identified the importance of modeling to be able to fully predict changes in streamflow during a demand management program. Currently, the models do not handle extra pools of water in the reservoirs and would need to be updated to help appropriately drive reservoir operation. In "Considerations for Modeling a Water Bank at the Aspinall Unit with Current Environmental Flows," (Hydros Consulting, 2011, Exhibit A), StateMod could be most easily reconfigured to simulate environmental flow targets (through Black Canyon and at Whitewater), including base flow and peak flow targets. However, modeling was not done in this analysis, so there are no results to share on how the water banking project would impact flows.

#### **Species**

Throughout the literature, different fish species are discussed with a focus on trout and salmon populations in the Western United States. One of the secondary benefits of the SCPP projects included increased streamflow in the Middle Piney Creek. As streamflow decreases, water temperature tends to rise, "often beyond ideal thresholds and also reduces available habitat." The GV CUPP (J-U-B Engineers Inc., 2017, Exhibit A) found "increased water in the river resulted in \$23,000 of estimated savings not spent on endangered fish programs." More broadly in the United States, adding minimum flow requirements for the Snake River at Lower Granite Dam, and for the Columbia River at McNary Dam has improved salmon and steelhead populations (Aillery et al, 1999, Exhibit A).

#### **Water Quality**

Salinity impacts were discussed in four of the reports reviewed, mostly reviewing projects in the Grand River Valley. During the SCPP, it was estimated that the "2017 Grand Valley water conservation project is estimated to have reduced salt loading to the Colorado River by 4,960 tons." (UCRC, 2018, Exhibit A). In the Colorado River District's "Colorado River Water Bank Feasibility Study: Phase 2," (MWH, 2013, Exhibit A) water quality impacts are discussed with focus on salinity and selenium. "Salinity and selenium issues may make fallowing or deficit irrigation more attractive to Project farmers, as impacted lands might be taken out of production with less impact on overall yields. In addition, reduced irrigation of these lands may have benefits in improved quality of return flows." In this study, salinity effects (not affected or marginally affected) were a screening criterion used to select candidate systems representing a broad range of characteristics. In the "Infographic: Grand Valley Pilot Project Secondary Benefits," (TNC, 2019, Exhibit A) reduced irrigation "on salty soils improved water quality and resulted in an estimated savings of \$282,720 from money not spent on other measures to reduce salinity." However, another review, "Research Synthesis: Agronomic Impacts of Reduction Irrigation," (Culp and Kelly, 2019, Exhibit A) raises the concern that "salt will move to the surface of the soil during periods of fallowing." If this occurs, "a preplanting leaching irrigation" may be required which could "reduce the water savings from fallowing."

#### Additional Considerations

A summary of additional project considerations from the literature suggested the following to promote the inclusion of environmental attributes. These considerations are also discussed in the M&V section.

• Using streamflow station data helps understand the impacts to streamflow from foregone diversions.



- Increasing water in the river could result in savings due to less spending on endangered fish programs in studies
- Reducing irrigation on salt soils could improve water quality and save money on salinity reduction programs.
- Maintaining historical return flows may be a challenge and may require storage and timed releases or construction of recharge basins but could offer net environmental benefits.
- Reducing irrigation on salty soils may improve water quality and reduce costs for salinity reduction programs. However, salty soils should be monitored as extra irrigation may be needed in subsequent years to perform leaching irrigation reducing the long-term water savings.
- Increasing streamflows keeps temperatures low, improving fish habitats.

#### **Key Takeaways**

The key takeaways relating to a potential DM Program that support Environmental Considerations aligns with the need to ensure ongoing Compact compliance, however, there is a strong need to fill in the data gaps to be able to measure the potential impacts or benefits associated with the streamflow impacts.

List of key things that would support measuring impacts or benefits include:

- Local Support and Participation. Enlist local key stakeholders and non-governmental organizations (NGOs) to partner and realize opportunities to provide a net environmental benefit.
- Alternatives Analysis. Initiate a high-level assessment of environmental impacts of all recommended and alternate water management strategies considered.
- Expand Project Purpose to Consider Additional Objectives. The literature review revealed that many of the demand management programs did not have an environmental focus.

#### **Data Gaps**

The following data gaps were identified in the Environmental Considerations literature review:

- **Data**. Measured data on the impacts on fallowing and deficit irrigation on downstream streamflow and environmental resources due to changes in return flows.
- Modeling. The actual timing and reduction in depletions will require return flow modeling
- Instrumentation and Monitoring Equipment. There will be a need for cost effective flow monitoring to gage the environmental benefits in specific locations

The Environmental Considerations workgroup identified specific issues of interest to be considered in the literature review. SGM looked for mentions of these items and the following issues were not addressed in the 54 documents reviewed:

- Stream Management Plan/Watershed Management Plan objectives.
- Basin Round Tables environmental values lists/mapping.
- Colorado River Cutthroat Trout conservation strategy.
- Other known community/entity project.
- Environmental specific tradeoffs.
- Other known community/entity projects.



# SECTION 7 – FUNDING – LITERATURE REVIEW & ANALYSES

WestWater Research led the Funding processes for the Investigation. The tasks associated with these efforts specifically included:

- Participation in the final meeting of the Funding Workgroup as a listener.
- Compilation and review of past studies and research regarding the costs and funding structures for other water conservation programs in the Western U.S. like a DM program.
- Analysis of design elements of a DM program as they relate to costs and beneficiaries.
- Identification of knowledge or data gaps in the ability to understand and evaluate the costs and funding options for a DM program.

#### **Literature Review**

There was found to be a lack of literature and past research on the costs and funding structures for demand management types of water conservation programs. WestWater compiled data and conducted original research on other water conservation programs in the Western U.S. to support the funding analysis.

#### What we know

#### **Cost Components of Example Demand Management Programs**

This section provides an inventory and analysis of other "demand management" programs in the Western U.S. In identifying comparable programs, the following selection criteria and loose definition were applied: (1) voluntary, (2) compensated, (3) consumptive water use reduction that is (4) temporary for any piece of land and is distinguished from two-party transactions because it is (5) operated by a single entity as a program over multiple years, often with a (6) regulatory or policy driver. Pilot projects were included. The costs of demand management vary by the type of water use (demand) being managed and reduced. Costs are significantly different between the agricultural and municipal sectors.

#### Agricultural Demand Management

Most of the demand management programs identified in the Western U.S. have been programs to reduce agricultural water use in order to utilize the savings for an alternative water use, such as municipal or environmental. A total of 17 example agricultural demand management programs were identified in more than 6 different states. A range of entities have developed and administered the agricultural demand management programs, including municipal water agencies, state government agencies, local / regional water districts, and others. The following cost components were identified in reviewing the example agricultural demand management programs:

- Water Costs. As defined above, all example demand management programs were compensated and therefore all had a water cost associated with agricultural conservation activities. The water costs reflect various factors: (1) the foregone agricultural value, or lost net revenue, (2) the program compensation structure and term, and (3) the type of demand management activity. A more expansive discussion of agricultural economic impacts from conducting demand management activities is provided in a previous section of this report. The water costs for agricultural participants in a Colorado demand management program are likely to reflect the predominance of perennial forage crops on the Colorado West Slope.
- Administration Costs. All of the example demand management programs had administrative costs, with an average annual cost \$40 per acre-foot. Administration costs include regulatory approvals to



### Demand Management Feasibility Investigation Literature Review

PROTECTING COLORADO WATER

initiate projects and annual monitoring and verification activities. In one example, these costs were paid by the participating landowners and were covered as part of the compensation (water cost). With the exception of the Catlin Canal Pilot Project on the Lower Arkansas River, administration costs ranged from \$4 to \$48 per annual acre-foot (AF) of demand reduction. The Catlin Canal Pilot Project had estimated administration costs of \$167 per AF, per year which reflects the attributes of this project and relatively stringent administrative requirements found in Colorado and particularly along the Front Range.

• Mitigation Costs. Only 5 of the 17 example demand management programs included mitigation payments to offset economic and related secondary (indirect) impacts from reduced agricultural water use. For the 5 programs that include mitigation as part of the program, the mitigation payments ranged from \$2 to \$86 per annual AF of water use reduction, with an average annual payment of approximately \$50 per AF.

#### Municipal Demand Management

The activities to achieve demand management in the municipal sector remain uncertain, and it is likely that municipal water providers will take different approaches to implement demand management within their systems. This funding analysis considers municipal demand management through water conservation as one potential method, but it is recognized that it may not be broadly applicable. Water conservation was selected because most Colorado municipal water providers have a water conservation program or plan of activities that can be evaluated for example costs of demand management. Unlike the agricultural examples described in the previous section, municipal programs are typically not intended to produce a transferable water supply to another use. Municipal demand management programs are typically targeted at one of the following objectives:

- 1. Permanently reducing individual customer water use through a variety of indoor and outdoor water conservation and efficiency activities, including public outreach, rebate programs, tiered or water budget rate structures, home water audits, and others.
- 2. Temporarily reducing both individual customer and municipal-scale water use in response to a potential water supply shortage due to drought, infrastructure damage, or other emergencies. Regulatory measures are often applied to achieve demand management, such as every other day outdoor watering, bans or limitations on certain water uses, and temporary increases to water billing rates.

Any potential Demand Management program in Colorado would be voluntary, temporary, and compensated. Municipal demand management examples do not necessarily align with all three characteristics. Water conservation program activities in the first category above have associated direct costs (compensation) and are voluntary actions but are often intended to result in permanent water use reduction. The second category of regulatory actions are intended to be temporary but are often not voluntary or compensated. For this analysis, the cost of municipal demand management references observed costs of permanent municipal water conservation programs, but it may be recognized that temporary demand management can be achieved in the municipal sector and historically has been more likely to occur through regulatory (policy) actions at little to no direct cost. In addition, many municipal water providers may look to implement demand management activities with no water service impact to their customers and therefore with no water conservation actions by their customers.

The costs of municipal demand management were evaluated using two approaches and datasets:

• Municipal Conservation Activities. Municipal demand management is achieved through a combination of activities, such as those listed above. These activities each have an estimated water demand reduction and cost. Previous research indicates that indoor residential conservation activities have costs that are roughly 50% of the outdoor conservation activities. The costs also increase with greater degrees of water demand reduction. In total, past research indicates municipal conservation



activities having total direct costs of \$500 per AF or more. This cost is likely to represent a permanent water use reduction, and the annual equivalent cost is estimated at approximately \$20 per AF based on a 4% discount rate over an indefinite period.

• Municipal Conservation Programs. Many municipal water providers have annual water conservation programs with associated budgets to achieve demand reduction. Instead of looking at the cost of individual activities, it is helpful to look at the overall costs of municipal water conservation programs to understand the administrative costs, the inefficiencies in program spending, the effects of program activities that do not have associated costs, and the impact of growth in the number of service customers. A historical analysis of municipal demand management over the period 2000-2020 was completed for 9 example municipal water providers who utilize Colorado River Basin supplies. The average unit cost was found to be approximately \$1,500 per AF of demand reduction, which is considered to better reflect the total cost of achieving overall volume reductions in municipal demand, as opposed to reductions in per-person water use rates.

#### Municipal demand management costs in Colorado may consider two important factors:

- Trans-Basin Diversions. Most municipal water use in the Colorado River Basin in Colorado is sourced from trans-basin diversions to the Front Range. These trans-basin diversions have historically not had any return flows to the Colorado River system from municipal effluent, and therefore any municipal diversion demand reduction from these trans-basin diversions is effectively a reduction in consumptive use from the Colorado River Basin. This contrasts with municipal water users located in the Colorado River Basin, who would mostly realize consumptive use savings only from a reduction in outdoor watering uses.
- Water Supply Portfolio. Most Front Range municipal water providers, particularly the largest volume users, have a water supply portfolio that sources water from a variety of river systems and projects. The composition of municipal water supplies that are sourced from the Colorado River system as a portion of the overall supply portfolio influences how total municipal demand management activities relate to water diversion reductions in the Colorado River Basin. Available data indicates that municipal water utilities in Colorado that are reliant on the Colorado River Basin for a portion of their water supply have 50% to 60% of their water supply sourced from other water systems. Therefore, municipal water providers would need to specifically reduce Colorado River Basin sources commensurate with demand management activities, otherwise the unit costs per volume of Colorado River water use reduction would potentially double.

#### **Cost Factors for Demand Management Program**

Cost estimates of a DM program are inherently uncertain because the costs can vary significantly depending on the following factors (among others):

- Funding. The funding structure of a demand management program is expected to influence costs, and particularly the amount of state government funding required. Decisions about who pays for demand management influences who bears the costs but also impacts the cost itself.
- Scale / Volume. Costs are directly a function of scale, or the annual volume of demand management being implemented. At the present time and for the near term, the scale of demand management in Colorado will be limited by volume of the conservation pool in Lake Powell created by the DCP. The annual volume of demand management will depend on how much space within the conservation pool is available to Colorado and how fast that space is intended to be filled.
- Timing. Costs escalate under emergency action, which has long motivated planning efforts in various subject areas. Demand management activities in the agricultural and municipal sectors may be more difficult and more costly to achieve during a drought, or if activities are required due to pending water



shortages or Compact administration. A multi-year consistent demand management program is expected to carry lower costs than a program that is reacting to stressful conditions.

- Project Selection Process & Equity Policies. The process for selecting demand management projects may influence program costs, depending on what type of process is established, how applicants are identified and evaluated, and how projects are compared. Several of the Workgroups have had discussions supporting equity in a demand management program, including water use sector equity between agricultural and municipal water users and spatial equity to limit the concentration (and associated impacts) of demand management activities. Implementing regulatory limits to provide for equity is expected to increase costs, due to a reduction in the pool of potential projects and deviation from a lowest-cost system of project selection.
- Administrative Process. The process established to conduct an upfront review of each project application, and the process established for monitoring and verification of project activities are both significant factors in overall project costs. It will be important to establish a review and monitoring process for the demand management program that is not cost prohibitive. Another aspect of approval is any environmental review and mitigation that is required as part of the program.
- Participant Requirements. Compensation payments are expected to reflect any lost economic opportunity associated with reduced water use, and any costs associated with meeting program requirements. As described in a separate section of this report, participant requirements may include cover crops, weed and pest controls, and other elements to reduce off-farm impacts.
- Mitigation. In addition to compensation paid to participants, there may be mitigation payments paid to offset economic and environment impacts resulting from the projects. Example mitigation includes: (1) payments to the larger ditch company or irrigation district for operational impacts, (2) payments to the county to offset economic impacts, (3) payments to an environmental organization to offset wetland or riparian impacts.
- Economic Factors. The multi-year and potentially multi-decade timeline of a demand management program results in various economic factors influencing costs. Some examples include: (1) agricultural commodity market prices influencing compensation payments, (2) interest rates influencing the cost of capital outlays, (3) inflation influencing all prices & costs, (4) population and economic growth influencing water supply & demand imbalances and water transaction values. There are other factors to consider, but the underlying point is that a variety of factors outside of the program's design and control will influence program costs.

### **Key Takeaways**

The takeaways provided in this section are crafted to advance the demand management discussion and feasibility analysis in Colorado.

- Activity & Scale. Proactive programs that aim for annual demand management activities over a longer
  period of time are a more cost-effective method, as opposed to a surge of activity during a drought or
  other stressor. Therefore, funding sources may be structured to be reliable and consistent. Costs of
  demand management activities are a primary consideration if the program is publicly funded.
- Certification Process. Several of the time-intensive and costly aspects of project review and approval can be completed upfront and remain valid for many years. Therefore, other successful demand management programs have been designed with a certification process for projects that can allow each project to be thoroughly reviewed but also allow annual flexibility in participation.
- Minimize Seller Costs. To encourage participation in the demand management program, program design might avoid a significant cost burden for participants, or entities conducting demand



management activities. Monitoring and verification activities (and proving non-injury) may require the installation of equipment and annual data collection efforts. In addition, there may be mitigation costs associated with the ditch organization, local community, and environment. Upfront capital costs and mitigation costs could be incorporated into annual compensation payments. The program design may also consider state agency staff to conduct the initial reviews of applications and to assist in project administration. With these program design elements, the participant costs may be limited to developing application materials.

• Incorporate Monitoring & Verification Costs into Project Selection. The process of comparing and selecting project proposals requires that the full cost of the project be quantified. The compensation aspects of each proposal are expected to be defined by the participant. Monitoring and verification components of each project will be more difficult for the applicant to define. The costs of monitoring, verification, and administrative approval (to ensure non-injury) are expected to vary significantly across projects. Monitoring and verification costs could be evaluated with DNR assistance as part of a certification process and costs may be considered as a required element of each project application. An accurate evaluation of project proposals requires an "apples to apples" comparison of full project costs.

#### **Data Gaps**

This section provides a discussion of two types of data gaps: (1) those currently present in evaluating the feasibility of a demand management program, and (2) those that are likely to be present when structuring specific demand management funding options.

#### Data Gaps in Evaluating the Feasibility of Demand Management

The costs of demand management remain uncertain because of multiple variables and decision-points affecting the program. The preliminary estimates on cost feasibility may continue to be revisited by CWCB staff as the program design is explored. As continued analysis occurs, the following data gaps related to funding are identified:

- **Process Considerations**. Preliminary ideas on a program process are identified in the form of a single conceptual framework. The costs of a demand management program are inherently tied to the application and selection process, requirements for monitoring and verification, and project evaluation. It is expected that many of the data gaps involving process will be filled if, and as decisions are made regarding program structure.
- Program Requirements. Costs are also a function of program requirements, such as mitigation for local economic impacts and augmentation of stream depletions. Program costs can rise significantly depending on how program and participant requirements are defined.

#### **Data Gaps in Structuring Specific Funding Options**

The data gaps listed above for evaluating feasibility also apply to structuring specific funding options for demand management. Specific funding options can be developed once these data gaps are addressed.



# SECTION 8 – MONITORING & VERIFICATION – LITERATURE REVIEW

SGM led the Monitoring and Verification literature review for the Investigation. The tasks associated with these efforts specifically included:

- Participation in the final two meetings of the Monitoring and Verification workgroup as a listener.
- Compilation and review of past studies and research regarding M&V considerations and practices detailed in previous CCU and ATM pilot projects, as well as western states water banking programs.
- Analysis of design elements for a potential DM program as they relate to M&V activities.
- Identification of knowledge or data gaps for consideration of the implementation of M&V requirements in a potential DM program, along with individual DM M&V project requirements.

#### **Literature Review**

SGM reviewed various types of water savings, water banking, pilot projects and/or water conservation reports and information that had similar goals and could inform the feasibility of a DM program, including:

- Current methodologies, data, and information to measure DM and water conservation both in the agricultural and municipal contexts.
- Details associated with consumptive use and conservation estimation and monitoring, verification methods, and related issues.
- Data gaps and methods for being able to continue advancing the DM monitoring and verification process.

Overall, the reports captured a summary of pilot project, such as the System Conservation Pilot Program (SCPP), and water conservation activities in Colorado and other areas across the Rocky Mountain West. The literature review considered a wide array of documents including research papers, demand-side vs supply-side municipal studies, state-mandated water conservation programs in California, crop rotations, energy-water benefits, and ATM research. The reports (shown in **Exhibit A**) generally analyzed off-farm benefits, conserved consumptive use, lessons learned and environmental impacts.

To better record the breadth and depth of information available in the literature, SGM summarized key topics, criteria, and takeaways relating to previously completed projects within a table. Summary information included:

- Primarily purpose/goal of the project.
- Key takeaways.
- Project location.
- Program name, administration, structure, nature and duration of project practice.
- Source and amount of water conserved.
- Monitoring and verification requirements, equipment, and processes:
  - o Measurement of water returned to the stream.
  - o Consumptive use analyses.
  - o Estimate of residual field consumptive use.



- Return flow maintenance.
- Verification of conserved consumptive use.
- Coordination of benefits.
- o Municipal considerations.
- Implications for storage, hydropower, recreation, and environmental considerations.
- Program lessons learned, successes and/or challenges, tradeoffs, proportionality, and alignment with M&V workgroup guiding principles.
- Project data gaps, keys to success, identified challenges, and overall findings and lessons learned.

See Exhibit B for the comprehensive tables documenting the overall M&V literature review findings.

#### What we know

Overall, few of the reports focused on the specific methods, instruments, or techniques used for monitoring and verification activities. Almost all the literature identified that projects need to be evaluated at the individual field level, as no two projects are alike. Generally speaking, the measurement devices commonly used by irrigators and municipalities are adequate to monitor and verify demand management project activities. The challenge often identified in the literature wasn't inadequate devices, but a lack of measurement devices physically installed near the project area. At the project level, a combination of existing measurement devices and field visits were used to verify conservation projects were operating as planned. However, the literature often cited that detailed measurement and verification of the achieved conservation amount wasn't completed, rather that the conservation practices were implemented. As an example, the Grand Valley Water Users Association Conserved Consumptive Use Pilot Project (GV CCUPP) relied on an independent contractor to perform site visits throughout the project to verify fallowed fields, give advice for weed control, as needed, and document compliance. The reports and lessons learned from the project emphasized the importance of utilizing an independent contractor to the success of the project. Ultimately, this increased trust between the participants and the program administration. The literature also identified that widespread and readily available remote sensing may help with monitoring and verification practices in the future, as well as to understand the historical irrigation practices and potential conservation benefits at a proposed site.

#### **Consumptive Use Analysis**

There are multiple computer programs available that can reasonably estimate the amount of historical consumptive use of agricultural operations. Each program is slightly different and requires a certain amount of input data. The ability to estimate the historical consumptive use is predicated on the availability of adequate climate data, water diversion records, cropping information, and soil characteristics. For instance, the CU analyses of SCPP projects focused on the specific amounts and associated cost of conserved water. Overall, the SCPP resulted in an estimated consumptive use reduction from all 45 projects in 2015 through 2017 of 22,116 acre-feet (AF). Additionally, projects complete in 2018 increased the reduction of consumptive use by 25,097 AF for a total of 47,213 AF over the entire SCPP timeframe.

The System Conservation Pilot Program also considered the difference between estimated consumptive use reduction on the applications and the reduction calculated during the subsequent analysis. Overall, the application estimates underestimated the reduction by 2,728 AF (approximately 7%). The SCPP identified that in order to accurately calculate the actual CU conserved in a project, thorough on the ground measurements are needed. In addition, the GV CCUPP pilot program analyzed the conserved consumptive use compared to the number of acres enrolled in the project. They found in 2017 with 1,069 acres enrolled in the pilot project resulted in 2,715 AF of water conserved. Similarly, in 2018, 1,252 acres were enrolled



which conserved 3,178 AF with both years yielding approximately 2.5 AF of conserved water per acre enrolled in the GV CCUPP pilot program.

It is important to note that the purpose of the System Conservation Pilot Program was not to create quantifiable water savings in Lake Powell, but rather to test the concept of a program incorporating temporary, voluntary, compensated reductions in conserved consumptive use.

#### **Lessons Learned**

Three primary lessons learned from the SCPP include:

- Outreach & communication is essential.
- Operational & legal issues must be addressed at ditch company/irrigation district level.
- Simplifying the process allows for greater efficiency.

Multiple participants voiced concerns about "broader economic impacts and social issues for" their communities – emphasizing the necessity of outreach and communication. For monitoring and verification purposes, the SCPP literature emphasized the importance of supporting efforts to estimated conserved consumptive use and the independence of verification work from the local administrators (such as ditch company/irrigation district staff). Additionally, The GV CCUUP found there was an increased interest in participation after the first year of the program and similarly indicated the importance of independent monitoring and verification-built trust within the pilot program.

#### **Secondary Impacts**

The SCPP literature described the benefits of a DM-type program increased environmental flows, decreased cost of alternative habitat flow restoration projects, improved societal benefits from habitat flows for endangered species, reduced salinity loading in the Colorado River, and increased municipal and hydropower benefits. Other pilot projects in Colorado observed that increased flows contributed minimal improvement to the overall recreational flow needs. Some documents did consider temporary water transfers and the associated impact to instream flows (ISF). These transfers without legally changing the water rights resulted in irrigators conserving water through a variety of means and leaving some portion of that water instream, which generally bolstered flows during the irrigation season, but may have reduced non-irrigation season return flows within a stream segment. The SCPP was documented to have the added effect of enhancing streamflow, and it was further determined that the availability of consistent funding would be crucial to success of long-term demand management efforts, whether for streamflow, water security or (most likely) multiple objectives.

#### **SCPP Overview and General Findings**

- Focused on the general administration and process of running a demand management system rather than the specifics of monitoring and verification.
- Attempted to streamline the process for participants (irrigators) and keep the barriers to entering a program/project minimal.
- Concluded that the size of the ditch and its governance/bylaws greatly influenced how conserved water projects could be operationally achieved and accounted (for).
- Realized that the size of the ditch company changed how water was managed.

For example, large ditch companies diverted supplies and ran through their system; medium ditch companies diverted supplies and ran through their system or reduced their river headgate diversions; and small ditches reduced their river headgate diversions or closed it.



- Systems with multiple shareholders will likely require management participation (i.e., water users association or ditch company board) for success.
- The SCPP return flow maintenance practices were considered, but generally not adequately.
- Modelling considerations will need to be updated to handle water storage for potential demand management project operations.
- Flexibility to allow for locally driven solutions can drive higher engagement.

#### **ATM Pilot Project Overview and Findings**

- Avoided the need to go through a water court application process. However, complex monitoring and verification requirements may require a legal process that complicate the implementation of projects (historical consumptive use, change of use cases, etc.).
- Existing legal platforms to avoid water court are limited to instream flows leases, Substitute Water Supply Plan, and Interruptible Water Supply Agreement.
- These existing options have limitations and may not apply to every case or be useful in all projects so other options may need to be developed to avoid water court.
- Protection of vested water rights along with a flexible delivery schedules for M&I stakeholders are key for agricultural producers so they can keep growing crops/livestock.
- Guaranteed supplies are paramount for M&I water providers.
- An overall pilot project goal may be to reduce costs for M&I stakeholders such that ATMs are more affordable or more beneficial than buy-and-dry.
- The cost of installing new and/or highly accurate monitoring and verification equipment may be a participation barrier, depending upon the accounting and administration requirements.

#### **Additional Findings**

- Integrating local issues/sentiment was critical to the successful launch of conserved consumptive use pilot projects.
- Independent verification of project compliance helped maintain a level of trust and eliminated many interpersonal issues between irrigators, districts, and ditch companies.
- Sources of funding could cause contention if irrigators perceived a Front Range entity was paying for an area to be fallowed.
- Models worked well for estimating conserved consumptive use, though without on-farm analyses, the calculation of actual water savings was difficult to determine.
- Calculated estimate consumptive use and verification of conserved consumptive use in agriculture is improved with nearby climate stations.

#### **Themes**

The following statements capture overarching themes from the Monitoring and Verification literature review and represent common considerations for establishing buy-in for a future potential DM program.

#### Local data and input

Local focus was identified as one of the most crucial components for obtaining buy-in, finding project participants, and addressing misconceptions or apprehensions, etc. This theme cannot be emphasized



enough, as nearly every report highlighted this as contributing factor to the success of projects. Additional information surrounding the need for local data and input included:

- Generally, standard measurement equipment available and used by many irrigators and municipalities is adequate to monitor and verify conserved consumptive use projects. Locally, challenges may occur due to a lack of measurement devices, or with antiquated devices in poor condition.
- The availability of local data and equipment will inform the monitoring and verification needs and/or requirements for conserved consumptive use projects.
- A local presence is helpful to address any technical monitoring and verification needs. As a result, costs associated with local technical services for monitoring and verification could be significant.
- Regarding proportionality, M&I participants could more likely afford the engineering and legal costs than agricultural participants.
- Regarding proportionality, costs to support local technical services could prevent agricultural participation.
- Drought messaging can significantly influence a customer's response to whether or not they will conserve.

For instance, the Drought Monitor could indicate conditions that are too regional and general and not reflect site-specific conditions. This develops a lack of trust in the regional information and represents an opportunity to change practices.

#### Flexible program

- Each conserved consumptive use project is different. Therefore, a flexible program structure could be more attractive to prospective applicants, especially by considering local and regional needs.
- However, a flexible program structure could require more administrative coordination and effort and could take longer to develop.

#### **Infrastructure**

 Potential participants in future pilot projects may need significant investment in infrastructure to accurately monitory and verify the conserved water and to ensure that return flows are maintained to avoid injury to downstream users.

#### **Key Takeaways**

The key takeaways relating to a potential DM Program that support M&V activities were largely based on the observed themes and may be used to fill the identified data gaps. In summary they include:

- Utilize Local Resources. The literature indicated obtaining local data and input to drive a monitoring and verification implementation was key to building public trust in the program, as discussed in the Education and Outreach section. Local resources were instrumental to support efforts to estimate conserved consumptive use, address any technical monitoring and verification needs for participants, as well as to provide independence for verification work from the local administrators (such as ditch company/irrigation district staff).
- **Develop a Flexible Program.** Projects in different geographic regions will require different implementation methods, project operations and local support. A project in one area will have different soil conditions, crops, ditch operations, community relations, etc. than another project. Allowing program flexibility for different implementation options increased participation in the literature reviewed.



#### Demand Management Feasibility Investigation Literature Review PROTECTING COLORADO WATER

- Provide Funding to Support Investment in Measurement Infrastructure. The literature highlighted it is not uncommon to have good potential projects in areas which lack the infrastructure to be able to monitor and verify the project. The initial capital costs and ongoing operations and maintenance costs required to install the measurement structures needed for accurate monitoring and verification of conservation projects needs to be addressed to promote participation in those projects.
- Communicate with stakeholders, landowners, ditch, and reservoir companies before, during, and after projects. The literature highlighted the importance of working directly with the program participants and those whose operations were directly impacted by participant participation (i.e. ditch companies, reservoir companies, etc.) throughout the process to future participation and trust in the monitoring and verification process.
- Numerous takeaways from the E&O section, would support an effective M&V program implementation. The SCPP literature highlighted the importance of a local project champion to reach out to potential project stakeholders and then work through implementation challenges, including building trust in the monitoring and verification processes.

#### **Data Gaps**

- More data would need to be collected to fully monitor and verify project yields and the resulting system increases, impacts to downstream water users, and ultimate benefit to Lake Powell.
- While standard irrigation and municipal measurement devices will likely be adequate, there is not detailed information regarding equipment or measurement instrumentation recommendations and/or data processing methods.
- There is a need for significant investments in infrastructure to accurately account for any conserved water and to ensure that return flows are maintained to avoid injury to downstream users.
- Fallowing projects are easier for monitoring and verification purposes, as general techniques include site visits to document that a field isn't being irrigated, as well as to observe the growth of any vegetation along with a review of careful accounting practices.
- Verification requirements will likely be more challenging and detailed for non-fallowing projects, as producers will seek to reduce the consumptive use of plants, while still obtaining a harvest.
- Accurately assessing the CCU from deficit irrigation or alternative crops will be harder to quantify/verify, requires more monitoring and data collection, and ultimately relying on more rigorous technical analyses.
- There may be a need for improved coverage of climate stations in regions of Colorado to support M&V activities for some future pilot projects.
- ET estimation methods vary regarding the necessary data, processing techniques, and resultant accuracy. Generally, the more plentiful the data and rigorous the analyses, the greater the cost and accuracy. Future pilot projects may explore various technical options and the resultant CCU.



#### **ACRONYMS**

AF Acre-Feet

AFY Acre-Feet/Year

ATM Alternative Transfer Methods

Basin Colorado River Basin in Colorado

BMP Best Management Practice
CCU Conserved Consumptive Use

CCUPP Conserved Consumptive Use Pilot Program

CRWCD Colorado River Water Conservation District

CFS Cubic Feet per Second

CRCA Colorado River Cooperative Agreement

CU Consumptive Use CWA Clean Water Act

CWCB Colorado Water Conservation Board

CWP Colorado Water Plan

DCP Drought Contingency Plan

DM Demand Management

DMSA Demand Management Storage Agreement

DNR Department of Natural Resources

DWR Division of Water Resources

E&O Education and Outreach

EPA U.S. Environmental Protection Agency

GPCD Gallons Per-Capita per-Day

IBCC Interbasin Compact Committee

Investigation Demand Management Feasibility Investigation

ISF Instream Flow

MAF Million Acre-Feet

M&I Municipal and Industrial

M&V Monitoring and Verification

NGO Non-governmental organization

NRCS Natural Resources Conservation Service

PMT Project Management Team





SB Senate Bill

SEO State Engineer's Office

SWSP Substitute Water Supply Plan

TMD Transmountain Diversion

UCRC Upper Colorado River Commission

USBR U.S. Bureau of Reclamation

USFWS U.S. Fish and Wildlife Service

### Demand Management Literature Review

### EXHIBIT A



#### **Exhibit A. Summary of Literature Review Reports and Documents.**

Title	Year Published	Publisher/Authors
System Conservation Pilot Program Secondary Benefits: Final Report with Case Studies	2019	WestWater Research for TNC
Infographic: Grand Valley Pilot Project Secondary Benefits	2019	TNC
Research Synthesis: Agronomic Impacts of Reduction Irrigation	2019	Culp and Kelly for TNC
Final Report: Colorado River System Conservation Pilot Program in the Upper Colorado River Basin	2018	Upper Colorado River Commission
Final Report: Appendix C: 2018 System Conservation Pilot Program Update	2018	Upper Colorado River Commission
Pilot Program Funding Agreement	2014	Bureau of Reclamation
Colorado River Water Bank Feasibility Study: Phase 1	2012	Colorado River Water Conservation District
Colorado River Water Bank Feasibility Study: Phase 2	2013	For Colorado River District. By MWH.
Colorado River Compact Colorado water bank feasibility study: water supply technical memorandum. (Appendix B to Colorado River Water Bank Feasibility Study: Phase 1)	2012	Natural Resources Consulting Engineers, Inc
Exploring Perceptions of a Voluntary Agricultural Water Conservation Program on the Western Slope of Colorado	2019	MacIlroy, Colorado State University
Briefing Paper: Upper Basin Demand Management and Water Banking. Addressing Risk and Creating Certainty: Exploring Options for an Upper Basin Demand Management Program	2019	TNC
Colorado River Water Bank Work Group: An Overview of Previous Studies & Reports	2018	Colorado River Water Bank Working Group
GVWUA Final Report on the Conserved Consumptive Use Pilot Projects	2019	GVWUA and J-U-B Engineers
Lessons Learned from the System Conservation Partnership Program	2016	The Nature Conservancy



Title	Year Published	Publisher/Authors
Considerations for Modeling a Water Bank at the Aspinall Unit with Current Environmental Flows	2011	Hydro Consulting for TNC
Environmental Water Transactions in the Colorado River Basin: A Closer Look	2018	Stanford Woods Institute for the Environment
Lower Colorado River Basin Pilot Program	NA	Bureau of Reclamation
System Conservation: a collaborative approach to drought contingency planning the Upper Colorado River Basin	2017	Wyoming SEO Callaway, AWRA Impacts magazine
SNWA Water Resource Portfolio	2019	Southern Nevada Water Authority
Colorado River Basin Water Bank: Framework & Financial Analysis	2017	WestWater Research for TNC
Salmon recovery in the Columbia River basin: analysis of measures affecting agriculture	1999	Aillery et al, Marine Resource Economics
Feasibility of water efficiency and reuse technologies as demand-side strategies for urban water management	2017	Berhanu et al, Journal of Industrial Ecology
Response to water crisis: How do Iranian farmers think about and intent in relation to switching from rice to less water-dependent crops?	2019	Boazar et al, Journal of Hydrology
Temporary water transfers for urban water supply during drought	1992	Clark, CSU
Flexible water allocations and rotational delivery combined adapt irrigation systems to drought	2018	Cody, K.C., Ecology and Society
Water trading innovations: reducing agricultural consumptive use to improve adaptation to scarcity	2017	Colby (Ch. 3.1.4), Book eds Ziolkowska & Petersen
Towards regional sustainability assessment utilizing community based participatory research, sustainability indicators, and future scenario modeling	2016	Dubinsky, CU Denver
Economic viability of deficit irrigation in the Western US	2018	Manning et al, Agricultural Water Management.
The role of groundwater trading in spatial water management	2014	Palazzo and Brozovic, Agricultural Water Management



Title	Year Published	Publisher/Authors
Evaluating the potentials of cropping adjustment for groundwater conservation and food production in the piedmont region of the North China Plain	2019	Ren et al, Stochastic Environmental Research & Risk Assessment
Opportunities for saving and reallocating agricultural water to alleviate water scarcity	2017	Richter et al., Water Policy
Urban water conservation in the Sacramento, California region during the 2014-2016 drought	2019	Talbot, UC Davis
Remote sensing assessments of consumptive use of agricultural water in western slope of Colorado	2016	Vashisht, Colorado State University,
Deficit irrigation and surface residue cover effects on dry bean yield, in-season soil water content, and irrigation water use efficiency in western Nebraska high plains	2018	Yonts et al, J. of Agricultural Water Management
Irrigation Efficiency and Water Balance of the Little Wind Unit on the Wind River Indian Reservation in Wyoming	2017	Rosado, U of Wyoming
Standardizing Temporary Water Transfer Procedures in Colorado	2020	Nicols, Peter D, et al, University of Denver Water Law Review
Use of Alternative Transfer Methods to Increase Water Supplies for Conejos Basin Agriculture, Municipal, and Environmental Purposes	2017	DiNatale Water Consultants
Development of Land Fallowing-Water Leasing in the Lower Arkansas Valley	2011	Trout, Raley, Montano, Witwer & Freeman, P.C.
Little Thompson Farm ATM Grant Completion Report	2018	Larimer County Natural Resources
HB13-1248 Catlin Canal Company Rotational Land Fallowing-Municipal Leasing Pilot Project	2018	The Lower Arkansas Valley Water Conservancy District, Ber Hill Greenleaf Ruscitti, LLP, & Martin and Wood Water Consultants, Inc.
Yampa Basin ATM Study	2014	TNC, Trout Unlimited & CDM Smith
Grand Valley Water Users Assn Conserved Consumptive Use Pilot Project Development: Process, Procedure, and Lessons Learned: Water Banking-Next Steps Part II	Mar- 17	J-U-B Engineers, Inc.



Title	Year Published	Publisher/Authors
Grand Valley Water Users Assn 2017 CCUPP In-Season Verification	2017	J-U-B Engineers, Inc.
Power Canal Capacity Report, Grand Valley Water Users Assn	Dec- 2015	Olsson Associates
Completion Report: Development of Practical Alternative Agricultural Water Transfer Measures for Preservation of Colorado Irrigated Agriculture	May- 2011	Brown and Caldwell
Final Project Report: Implementation of Deficit Irrigation Regimes: Demonstration & Outreach	May- 2016	Chavez, CSU
The Poudre Water Sharing Working Group: A Report to the CWCB	May- 2015	The Poudre Water Sharing Working Group
FLEX Water Market: Education and Implementation Phase	Dec- 2015	Brown and Caldwell, Ducks Unlimited, Aurora Water and LJCG
Alternatives to Permanent Dry Up of Formerly Irrigated Lands	Jun- 2013	DiNatale Water Consultants & CSU
Water Partnerships: an evaluation of alternative agricultural water transfer methods in the South Platte basin.	Mar- 2012	DiNatale Water Consultants, Inc.
Project Report: Lake Canal alternative agricultural practices and in-stream flow demonstration project	Jun- 2013	Colorado Water Innovation Cluster
Final Report of the Lower South Platte Irrigation Research and Demonstration Project	Jun- 2014	Hansen, Chavez, Garcia & Lytle

### Demand Management Literature Review

### **EXHIBIT B**

#### Exhibit B

This Exhibit includes 12 different tables that summarize the findings from the SGM Literature Review. There were 3 sets of documents [SCPP, Lit (General Literature), and ATM] considered across 4 different evaluation criteria (ATM, Environmental, General, and Monitoring & Verification). The following table provides a map of these exhibits.

Exhibit	<b>Document Category</b>	Criteria
B-1	SCPP	ATM
B-2	Lit (General Literature)	ATM
B-3	ATM	ATM
B-4	SCPP	Environmental Criteria
B-5	Lit (General Literature)	Environmental Criteria
B-6	ATM	Environmental Criteria
B-7	SCPP	General
B-8	Lit (General Literature)	General
B-9	ATM	General
B-10	SCPP	Monitoring & Verification
B-11	Lit (General Literature)	Monitoring & Verification
B-12	ATM	Monitoring & Verification

This table lists the various areas considered for each criterion.

Criteria Category	Specific Areas to Identify
	Identified Local Impacts
	Identified Regional Impacts
	Operational Type of Project
	Types of Crops
ATM	Agronomic Impacts
71111	<ul> <li>Yield</li> <li>Quality</li> <li>Recovery</li> <li>Water Quality Effects</li> <li>Soil Health Effects</li> </ul>
	Streamflow Impacts
	<ul> <li>Magnitude</li> <li>Frequency</li> <li>Duration</li> <li>Timing</li> <li>Rate of change of hydrologic conditions</li> <li>Return Flow Impacts</li> </ul>
	Species Impacts
	<ul> <li>Return Flow Impacts</li> <li>Critical Stream Reaches Impacted</li> <li>Critical Land or Riparian Habitat Impacted</li> <li>Species Impacted</li> </ul>
	Water Quality Impacts
Environmental Criteria	<ul><li>Salinity</li><li>Temperature</li><li>Other</li></ul>
	Data Gaps, Questions for Future Projects
	Tradeoffs – Resource Impacts
	Predicted outcome for applying "avoid, mitigate, offset" hierarchy
	Program Level Goals
	<ul> <li>No net loss to environmental services, recognizing tradeoffs</li> <li>Build incentives for projects with net environmental benefits</li> <li>For Proposed Future Transactions, Need to Evaluate Impacts (Positive or Negative) to:</li> </ul>
	<ul> <li>ISFs (or other flow targets)</li> <li>Stream Management Plan (SMP) or Watershed Management Plan (WMP) objectives</li> <li>Critical Habitat &amp; Flow Recommendations</li> <li>State Species of Concern</li> <li>Basin Roundtable (BRT) Environmental Values Lists/Mapping</li> <li>CRCT Conservation Strategy</li> <li>Other Known Community/Entity Projects</li> </ul>

	D (T')									
	Document Title									
	Publisher/Author(s)									
	Document Description									
	General Notes									
	Story Map (hyperlink)									
	Primary Purpose/Goal of Report or Study									
	Key Takeaways									
	Project Location Information									
	Project Location Description									
	Latitude									
	Longitude									
	Elevation									
	Demand Management Program Basics									
	DM Program/Activity Name									
	DM Program Structure									
General	Nature of DM Practices									
	Duration of DM Practices Implementation (Duration and Frequency)									
	Source and Amount of Conserved Water									
	Source of Water Conserved									
	Amount of Water Conserved – Conserved Consumptive Use									
	High Level Program Information									
	DM Program Administration									
	DM Program Monitoring and Verification Considerations									
	DM Program Education and Outreach Efforts									
	Tools Used to Measure General Outcomes									
	DM Program Funding Considerations									
	DM Economic Considerations									
	DM Agricultural Impacts Considerations									
	Recreation									
	Program Effectiveness									
	Lessons Learned									
	Program Successes and/or Challenges									
	Pros/Cons									
	Methodologies and/or Processes									
	Measurement of Water Returned to the Stream									
	Consumptive Use Analysis									
	Estimated Residual Field Consumptive Use									
Monitoring and	Return Flow Maintenance									
Verification	Verify Conserved Consumptive Use									
	Coordination of Benefits									
	Necessary Data and Equipment for Agricultural Participants									
	Representative Crop ET Data									
	Verification of Conserved Consumptive Use									
L	<u> </u>									

Sub-irrigation Reservoir Operations River Diversions & Foregone or Bypassed Diversions Lateral Delivery and Ditch Loss Irrigation and Non-irrigation Season Return Flows Resulting Streamflow Necessary Data and Equipment for Municipal Participants Reservoir Operations **River Diversions** Foregone or Bypassed Diversions Ditch or Pipeline Delivery Overall Collection Systems Monitor System-wide Operations to Verify Conserved Consumptive Use Detailed System-wide Accounting Records Program Level Considerations Tradeoffs - Value and/or Cost Implications for More Precise Data Proportionality M&V Workgroup Guiding Principles Honest, Accurate, and Defensible Protective of Other Water Users Simple, Easy, and Flexible Resulted in Added Water, rather than a Retiming of Depletions Lessons Learned Key Takeaways Data Gaps

> Keys to Success Identified Challenges

Overall Findings and Recommendations

## Exhibit B-1 SCPP Documents with ATM Criteria

									Additional ATM Specific Components				
									Agronomic Impacts (How long d	oes it take for a crop to	fully return to pre-fallow	na productivity?)	
Title	Date	Publisher/Authors	Description	Notes	Identified Local Impacts	Identified Regional Impacts	Operational Type of Project	Types of Crops	Yield	Quality	Recovery	Water Quality Effects	Soil Health Effects
SCPP-01 System Conservation Pilot Program Secondary Benefits: Final Report with Case Studies	2019	WestWater Research for TNC	also generated off-farm benefits by applying select methods to quantify off-farm benefits to two case studies in Colorado and Wyoming. Note from TNG An executive summary is also available, along with the control of t	Benefits assessed include increased environmental flows, decreased cost of alternative habitat flow restoration projects, societal benefits from chabitat flows for endangered species, estimates of dramatic savings in salinity control, and municipal and hydropower benefits. Increased flows for the evaluated Colorado projects contributed minimal improvement to the recreational flow needs. Cost savings were estimated by the cost of k existing augmentation plans used to meet environmental and salinity management needs.  Grand Valley Pilot Project paid farmers to voluntarly reduce their irrigation		Not discussed.	Annual projects.  Not discussed.	Not discussed.	Not discussed.  Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.  Not discussed.
SCPP-02 Infographic: Grand Valley Pilot Project Secondary Benefits	2019	TNC	Inis intographic summarizes the results or secondary benefits analysis as applied to the Grand Valley Pilot Project Case Study.	Grand valley First Project paid starners to voluntary reduce their irrigation water use in order to keep more water in the river to help increase water security within the Colorado River Basin in the face of ongoing drought. While focus was on water security several off-farm benefits occurs because of the project.	Not discussed.	Not discussed.	not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.
SCPP-03 Research Synthesis: Agronomic Impacts of Reduction Irrigation	s 2019	Culp and Kelly for TNC	limited irrigation to highlight key findings related to agronomic impacts of limited irrigation or other methods to reduce consumptive use of irrigation water in the Upper Colorado River Basin. The concluding section also identifies remaining research questions and suggests potential	Next steps and identified research needs include understanding impacts over a variety of geographies and crops, as well as long-term recovery. Management and operations needs include understanding the benefits of rotational fallowing, deficit imigation, and crop switching. Finally, there are d many needs in the verification of conserved consumptive use.	-Potentially prolonged recovery periods -Possibility for both positive and negative soil health changes. -Increased chance of weeds, pests, erosion, and loss of topsoil.	Not discussed.	Various irrigation water management studies including deficit irrigation, for full fallow, partial season irrigation, crop switching, dryland farmling, rotational fallowing, irrigation efficiency and water conservation.	corn, barley, wheat, sunflowers, beans, and tuber/root crops.	Affalfa: deficit irrigation can reduce yield by approximately 1-ton per acre in high elevations and 5-tons per acre in low elevations, with a similar reduction in yield for grass/hay. Limited irrigation can affect stand density of affalfa, especially in sandy soil in hotter climates.  -Corn: decrease in water of 50% will only reduce yield by 25%. It's better to restrict water during early stages.  -Barley: each day of severe stress during heading equal to one-bushel per acre reduction in yield. Water stress prior to or just after flowering most impacts barley.  -Wheat: stress during maturing resulted in 10% yield reduction, while stress during aerial vegetative steps had almost no effect on yield.  -Sunflower: decrease in water by 20% during early vegetative period reduced yield by 5%, while same reduction during flowering stage resulted in a 50% yield reduction.  -Beans: water stress during reproductive stages (flower and pod fill) has the greatest impact on yield. Moisture stress can reduce yield by 27%.  -Tuber & root crops: indeterminate crops can endure 4-5 days of moisture stress throughout the growing season with limited reduction in yield or quality. For potatoes any depletion past 80 percent leads to decreases in quality and/or yield.	increase with moderate water stress.  - Other crops can have similar qualities to fully irrigated crops. See yield comments (left).			Salt will move to the surface of the soil during periods of fallowing. Some fields may need a pre planting leaching irrigation, reducing the water - Recovery from limited irrigation may be affected by micronutrient availability.  - Deep roted crops (affalfa and com) will use moisture deeper in the soil; potentially reducing it groundwater level.  - No-Ill increased the amount of water stored in t soil dure to reduced evaporation, improved infiltration, reduced runoff, and increased snow catching.  - Fallowing is often an overall benefit to soil healt
SCPP-04 Final Report: Colorado River System Conservation Pilot Program in the Uppe Colorado River Basin	2018	Upper Colorado River Commission	Full SCPP report from UCRC; project list; Lesson learned: administration & implementation, operational, osubheneftirisk, legal constraints, outreach & education.	s List of future questions to be answered p4	Not discussed.	Not discussed.	deficit irrigation, alternative	beans, clover, triticale, small grains	Not discussed.	Not discussed.	Not discussed.	Not discussed.	- There can be benefits to agriculture through soi resting.
SCPP-05 Final Report: Appendix C: 2018 System Conservation Pilot Program Update	2018	Upper Colorado River Commission	2018 update to UCRC full report, including Appendices C (2018 update), D (2017 CU analysis), and E (2018 CU analysis)	Document includes Appendices C (2018 update), D (2017 CU analysis), and E (2018 CU analysis)	Not discussed.	Not discussed.	-fallow, split season deficit irrigation, and combination of fallow and split season deficit irrigation	alfalfa, corn, and a	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.
SCPP-06 Pilot Program Funding Agreement	2014	Bureau of Reclamation	2014 SCPP funding agreement between CRB entities	Reviews history of compacts, storage allowances, demand management efforts by signatories. Defines goals and parameters of SCPP/Identifies NRCS programs that might support on-farm conservation improvements: EQIP and SWPP & ensures that projects will coordinate with respective NRCS State Conservationists.	Not applicable for the pilot program agreement.	Not applicable for the pilot progran agreement.		Not applicable for the pilot program agreement.	Not applicable for the pilot program agreement.		Not applicable for the tt pilot program agreement		Not applicable for the pilot program agreement.
<u>SCPP-07</u> Colorado River Water Bank Feasibility Study: Phase 1	2012	Colorado River Water Conservation District		supply-use scenarios. App. A: categories of W/E slope water uses, App.		irrigation practices will impact local	and pasture grass.	small grains, corn,	a. Deficit irrigation on orchards and vineyards impacts yields and often has negative impacts the subsequent year's production.  - Fallowing is feasible for small grains and grain corn.  - Deficit irrigation is possible for all crops, but best suited for perennial forage crops of affalfs and pasture.  - Pasture can be deficit irrigated every year without significant long-term impacts, including minimized stand reduction.  - Alfalfa and pasture enter a stressed or dormant condition without significant loss of plant population or long-term crop damage.  - In some instances pastures and affalfa are grown successfully for many years without irrigation.  - In most areas, alfalfa and pasture will produce harvestable yields with limited or no irrigation.  - Deficit irrigation or no irrigation results in a significant decrease in yields.	provide an adequate water supply to grad for maintaining a health crop is in the early spring through the first harvest.	pasture not be over- grazed during stress	Not discussed.	Not discussed.
SCPP-08 Colorado River Water Bank Feasibility Study: Phase 2	2013	For Colorado River District. By MWH.	Water bank planning phase; test cases assessing on-farm impacts for representative irrigation systems	system evaluation, financial impacts on ag ops, operational scenarios & comparison to ATM work. App. A: Candidate system identification & evaluation; App. B Test Case site reports	diminished aesthetics, reduced	economy. e - Potential long-lasting effects on regional cattle herds Impacts to regional streamflows, water and wildlife aquifer rechange.	fallowing, split-season irrigation, split-field irrigation, longer-term rotational fallowing, e permanent fallowing	and row crops.	a, This was identified as a long-term study need, especially for high elevation pasture systems	. Not discussed.	Not discussed.	In areas underlain by the Mancos Shale, fallowing land will hel the water quality of return flows to the receiving stream.	
SCPP-09 Colorado River Compact Colorado wate bank feasibility study: water supply technical memorandum. (Appendix B to Colorado River Water Bank Feasibility Study: Phase 1)	2012	Natural Resources Consulting Engineers, Inc	Technical analysis for water bank feasibility study included in 2012 WB planning phase 1 report .pdf	Data section includes analysis, irrigated areas, water rights categories, and climate stations. Examined CU requirements (w/StateCU & Blanch Coddle), ET verification (Pennam-Monteth w/4 CoAgMet stations), and HCU (StateCU values for elevation bands in each division multiplied by irrigated acres). Water bank supply and cost "rallowing suitable for small grains, grain corn, & dry beans." Deficit Irr available for all crops but best suited to affalfa & pasture. "These crops combined account for over 88% of the acreage, irr CU, and supply-limited CU." Discusses split-season irrigation.	irrigation practices will impact local and	irrigation practices will impact local	and pasture grass.	small grains, corn,	s. Deficit irrigation on orchards and vineyards impacts yields and often has negative impacts of the subsequent year's production.  -Fallowing is feasible for small grains and grain cornDeficit irrigation is possible for all crops, but best suited for perennial forage crops of alfalfa and pasture.  -Pasture can be deficit irrigated every year without significant long-term impacts, including minimized stand reduction.  -Alfalfa and pasture enter a stressed or dormant condition without significant loss of plan population or long-term crop damage.  -In some instances pastures and alfalfa are grown successfully for many years without	provide an adequate water supply to grasses for maintaining a health crop is in the early	pasture not be over- grazed during stress y periods to protect the crowns of grasses which	Not discussed.	Not discussed.
SCPP-10 Exploring Perceptions of a Voluntary Agricultural Water Conservation Program on the Western Slope of Colorado	2019	MacIlroy, Colorado State University	and better understanding the socio-cultural components of a potential demand management program. The research, completed in Spring 2016 explored perceptions of demand management among stakeholders on the Western Slope throug individual interviews and focus groups. The findings shed light on the barriers and opportunitie for a demand management program, including ideas and feedback on what a successful program would look like, and why water users may or may would look like, and why water users may or may.	This is an interview-based report that covers perceptions of DM, definitions of voluntary, compensated, temporary, and equity (their words are proportional/parity)—and finds that these definitions are not straight-9, forward and must be carefully communicated. Explores relationships with water and landscape, as well as "sacred values of the Western Slope." If Addresses perceptions of DM in context of 2007 Interim Guidelines and proader basin-to-basin politics. Many interviewes doubt the visibility of a evoluntary compensated program, and even suggest that a mandatory uncompensated call would work better, avoid equity issues, and cost less moveral. Compensation was a very challenging topic, with differing views of DM as a burden vs opportunity. Highlights clash of free-market values with the perspective of water as a commodity—discussion of different role water plays for irrigators vs Front Range residents. Who bears responsible for the shortage problems (many dont see the Upper Basin at fault). Temporary program vs temporary participation—traught discussion. Discussion of Western Slope Sacred Values, how water and farming is part of identity. Numerous people suggested every water user curtail use and respect valer and that we should make water conservation part of being a Coloradan.	Not discussed	Not discussed	Not discussed	Not discussed	irigation. Not discussed	Not discussed	Not discussed.	Not discussed.	Not discussed.

									Additional ATM Specific Components				
									Agronomic Impacts (How Ion	g does it take for a crop to	fully return to pre-fallow	ing productivity?)	
Title	Date	Publisher/Authors	Description	Notes	Identified Local Impacts	Identified Regional Impacts	Operational Type of Project	Types of Crops	Yield	Quality	Recovery	Water Quality Effects	Soil Health Effects
SCPP-11 Briefing Paper: Upper Basin Demand Management and Water Banking. Addressing Risk and Creating Certainty: Exploring Options for an Upper Basin Demand Management Program	2019	TNC	the key issues to address in evaluating a demand management program and is offered in the spirit o promoting discussion and decision-making on how to structure, govern, finance, and implement such a program.	discusses how to reduce that risk. Asks many questions about Dm, program governace and structure, cost and funding, policy, measurement and verification, Identifies many of the key issues being addressed by CWCB DM workgroups. Key successes from SCPP are locally-driven solutions, minimizing impacts & maximizing benefits, e.g., through local coordination of projects. Tabulates past options considered for avoiding compact cutraliment.		Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.
SCPP-12 Colorado River Water Bank Work Group: An Overview of Previous Studies & Reports	2018		completed by the Colorado River Water Bank Work Group in their effort to provide information about what types of solutions may be available to preserve communities, agriculture, power production and the river itself.	This work includes a two-phase feasibility study, an assessment of how reduced irrigation for compact purposes would work with different irrigation systems on Colorado's West Slope, economic work on pricing and payments, and scientific research on the agronomic impacts of reduced irrigation.		Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed.	Not discussed.	Not discussed.
SCPP-13 GVWUA Final Report on the Conserved Consumptive Use Pilot Projects	2019		2019 Conserved Consumptive Use Pilot Projects completed by the Grand Valley Water Users Association (GWWUA). The initial part of the report provides a good summary of both the 2017 and 2018 pilots. Appendix H provides the details of the survey GWWUA completed of all participating producers, gathering their input on their experience and perspectives on the pilot project. Appendix I summarizes GWWUA's thinking more broadly on the pilot and demand management.			Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.
SCPP-14 Lessons Learned from the System Conservation Partnership Program	2016	The Nature Conservancy	TNC's lessons learned in their SCPP involvement, including lessons from Trout Unlimited and Colorado Water Trust	Top 3 lessons: outreach & communication is essential, operational & leg- issues must be addressed at ditch company/irrigation district level simpli the process for efficiency.		Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.
SCPP-15 Considerations for Modeling a Water Bank at the Aspinal Unit with Current Environmental Flows	2011	Hydro Consulting for TNC	River to assess their ability to simulate a potential water bank in the basin using the Aspinall Unit	StateMod, Aspinal PBOPEIS Model, and CRSS are evaluated for their capabilities to simulate Aspinal Unit operations, environmental flows, an potential water-banking, Specifically, this modeled the Black Carryon wateright, new SEIPED requirements at the Whitewater gage, and a water-banking option at Aspinall. Modifications to the Gunnison StateMod are necessary to simulate environmental flows and enhance reservoir accounting options.		Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.
SCPP-16 Environmental Water Transactions in the Colorado River Basin: A Closer Look	2018	Stanford Woods Institute for the Environment	extent of activity. Examines SCPP projects by this lens, given the ISF benefits of SCPP. Found that SCPP-funded projects had the effect of enhancing streamflow.	, , , ,		Not discussed.	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed.	Not discussed.	Not discussed.
SCPP-17 Lower Colorado River Basin Pilot	NA	Bureau of Reclamation		"Although the Pilot Program will be ongoing until 2035, as of 2019, future announcements of funding opportunities and requests for additional project proposals are not being contemplated."	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed
Program  SCPP-18  System Conservation: a collaborative approach to drought contingency planning the Upper Colorado River Basin	2017	Wyoming SEO Callaway, AWRA Impacts magazine	Description of Wyoming SCPP, how it works, participation, and future efforts.	project proposals are not being contempassor.  Neither extensive nor technical, but includes some description of process & participation.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.
SCPP-19 SNWA Water Resource Portfolio	2019	Southern Nevada Water Authority	Chapter from SNWA's water plan	Addresses temporary supplies including different aspects of Intentionally Created Surplus, recharge and banking, DCP, and conservation tools.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed	Not discussed.
SCPP-20 Colorado River Basin Water Bank: Framework & Financial Analysis	2017	WestWater Research for TNC	to scale up operations of the Water Bank and provides comparative costs and other factors to consider in different approaches to developing a water bank. The information is intended to provide	Evaluates 4 frameworks of a Colorado Basin water bank sufficient to address 250,000 AF of CCU: annual water bank leases, option leases in ortical years, non-option critical year leases, and response to a 1922 compact call. WestWater Research developed a cost-estimation spreadsheets based on the volume of water leases, number of associate acres, and number of farms or ranches leasing water.		Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.

# Exhibit B-2 Lit (Gen. Literature) Documents with ATM Criteria

						T	ı	Addit	ional ATM Specific Compo				
Title	Date	Publisher/Authors	Description	Notes	Identified Local Impacts	Identified Regional Impacts	Operational Type of Project	Types of Crops	Yield	onomic Impacts (How lor	ng does it take for a cro	o to fully return to pre-fallowing pro Water Quality Effects	Soil Health Effects
Lit-01 Salmon recovery in the Columbia River basin: analysis of measures affecting agriculture	1999		Analysis of ag impacts from salmon-recovery-related flow alterations in Columbia River	Investigates ag impacts of fish recovery measures "such as modified timing for dam releases, reservoir drawdown, and flow augmentation in the Columbia River basin, on the regional agricultural sector are evaluated. [] Results suggest that drawdown and/or minor reductions in irrigation water diversions would reduce producers' profits by less tha 1% of baseline levels. However, the most extreme scenario- a long drawdown period combined with a large reduction in irrigation diversions—would reduce producers' profits by \$35 million (2.5%) annually."	-	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.
Lit-02 Feasibility of water efficiency and reuse technologies as demand-side strategies for urban water management	2017	Berhanu et al, Journal of Industrial Ecology	Economic model of water cost provided by above-code water efficiency and reuse technologies, including variations & uncertainty analysis.	Estimates that efficiency and reuse can meet 85% of 50yr projected needs to the Lower Colorado River Authority service area (central TX)	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.
Lit-03 Response to water crisis: How do Iraniar farmers think about and intent in relation to switching from rice to less water-dependent crops?	2019	Boazar et al, Journal of Hydrology	Study of farmer response to gov't demand management, switching crops.	"Structural equation modeling showed that farmers' intention to change from rice cultivation to another crop is determined by personal norms, beliefs about their role and emotional considerations."	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.
Lit-04 Temporary water transfers for urban water supply during drought	1992	Clark, CSU	PhD dissertation modeling options for temporary water transfers	This research develops a water right option agreement (WROA) model, methods of analysis, and legal implementation strategy under Colorado law." Interviewed professionals, estimates costs, identified that WROA "can b superior in terms of cost, reliability, and operational flexibility to both water-right purchases and construction of additional reservoir storage.	Promote a water saving status among farming community.  Perhaps this is where getting information to support the No Action across the 5 Planning Horizons comes into play.	The paper recognized the need to quantify local drought conditions (as opposed to making the decision to have a temporary transfer on a statewide decision).      The need for the transfer and benefits are locally driven	storage, which could be considered in the regional	There is ,mention of Federal Water systems on page 24.	Not discussed.	Not discussed	Not discussed	Included a discussion on the Senate Bill 89-181 and the rulemaking by the SEO to implement water quality standards in review of water transfers Mentioned the use of the mass balance method or the mixing zone method to estimate the influence of flow on water quality standards	Not discussed
Lit-05 Flexible water allocations and rotational delivery combined adapt irrigation systems to drought	2018	Cody, K.C., Ecology and Society	self-governing irrigation systems.	Examines relationships between rules and physical context of water supplies; specifically the outcomes of water allocations between members and how they rotate water delivery.		Not discussed.	Not discussed.	Not discussed.	Not discussed.		Not discussed.		Not discussed.
Lit-06 Water trading innovations: reducing agricultural consumptive use to improve adaptation to scarcity	2017	Colby (Ch. 3.1.4), Book eds Ziolkowska & Petersen	Chapter from book "Competition for Water Resources: Experiences and Management Approaches in the US and Europe" collecting global examples/discussion of approaches and solutions to water supply scarcity, including western US	Ch 2.1.1: Challenges for US irrigated ag in the face of emerging demands and climate change, Ch 3.1.4: Water trading innovations: reducing agricultural consumptive use to improve adaptation to scarcity (reviews online trading systems to reduce transaction costs, methods for cost- effective verification of CCU, and other breakthroughs facilitating temporary & intermittent trading more feasible. Examples from AZ and CA (IID), NE, Australia, CO-Big Thompson.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.
Lit-07  Towards regional sustainability assessment utilizing community based participatory research, sustainability indicators, and future scenario modeling	2016	Dubinsky, CU Denver	PhD dissertation that identified San Luis Valley sustainabilit indicators and modeled future scenarios, developing a CU indicator for 1980-2010.  Conducted scenario modeling to guide decision-makers towards desired outcomes from policy decisions. Coupled sustainability indicators with future scenario modeling to sustainability indicators with future scenario modeling to inform the SLV stakeholders about a variety of social and environmental issues.  Results indicated that through specific shifting of cropping rotations and minimal land fallowing, SLV could reduce water use and Greenhouse Gas Emissions while increasing soil carbon and improving soil health. In addition, the solar energy development pathways investigated by this study showed that the potential exists to offset most or all of the region's GHG emissions.	Utilized Community Based Participatory Research to engagistakeholders & keep research relevant. Highlighted groundwater-dependence of St.V, suggests irrigation water use could be decreased 10% with shifts in crop regime and minimal fallowing.		Not discussed.	Fallowing, Crop shifting	Potato, alfalfa, small grain	Not discussed.	Not discussed.	Not discussed.		Used a green manure cover crop to promote soil health
Lit-08 Economic viability of deficit irrigation in the Western US	2018	Manning et al, Agricultural Water Management.	Research on agro-economics of deficit irrigation.	Deficit irrigation (DI) can be optimal during late growth and maturation stages given elevated water prices (depending o output price and production costs).		Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.
Lit-09 The role of groundwater trading in spatia water management	2014	Palazzo and Brozovic, Agricultural Water Management	Republican River Basin assessment of coupling surface- groundwater management.	Geospatial dataset of RRB irrigation wells modeling crop choice, land, and water use decisions by well. "Our analysis highlights the importance of the initial distribution of permits and the institutional context in which trading occurs." Cost savings from trading groundwater pumping are distributed unevenly between wells, counties, and groundwater management institutions.			Not discussed.				Not discussed.		Not discussed.
Lit-10  Evaluating the potentials of cropping adjustment for groundwater conservation and food production in the piedmont region of the North China Plain	2019	Ren et al, Stochastic Environmental Research & Risk Assessment	& water supply scenarios.	Framework for using a crop model & regression to predict effects of cropping adjustments on groundwater sustainability & crop production		Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.
Lit-11 Opportunities for saving and reallocating agricultural water to alleviate water scarcity	2017	Richter et al., Water Policy	<ul> <li>Review of literature &amp; internet to identify water-saving strategies in irrigated agriculture.</li> <li>Review of case studies in which water savings have been successfully transferred to other uses.</li> </ul>	- Catalogs water savings opportunities, claims of irrigation- efficiency savings potential, logistics of reallocating due to other ag diverting savings. Findings suggest considerable potential to reduce irrigation CU and that savings can be reallocated when proper consideration is given to water budget accounting.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.
Urban water conservation in the Sacramento, California region during the 2014-2016 drought	2019	Talbot, UC Davis	UC Davis Master's Thesis cataloging/analyzing supply & demand management actions under CA's drought policies.	Evaluates outdoor watering, public outreach, media role, water-related energy savings. Makes recommendations for urban water suppliers on revenue recovery, reducing use of rebates as demand management, and scaling drought response tasks for different levels of gov1. Summarizes & analyzes CA legislation establishing approval for long-term budget-based efficiency targets.		Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.

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								Additi	I ional ATM Specific Compo	nents				
									Agronomic Impacts (How long does it take for a crop to fully return to pre-fallowing productivity?)					
Title	Date	Publisher/Authors	Description	Notes	Identified Local Impacts	Identified Regional Impacts	Operational Type of Project	Types of Crops	Yield	Quality	Recovery	Water Quality Effects	Soil Health Effects	
Lit-13 Remote sensing assessments of consumptive use of agricultural water in western slope of Colorado	2016	Vashisht, Colorado State University, Colorado	CU (CCU) on the West Slope	Used evapotranspiration (ET) observations at experimental plots of traditional irrigation and water-banking irrigation practices to evaluate methods of verifying CCU. Reviews methods for measuring and monitoring CU, discusses limitation and potential for ReSET remote sensing CU model.		Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	
Lit-14 Deficit irrigation and surface residue cover effects on dry bean yield, in-seasor soil water content, and irrigation water use efficiency in western Nebraska high plains	2018		crop yield	"Reducing irrigation water by 25% caused no significant yiel reduction and improved irrigation water use efficiency by 26%." Applying 50% Etc. resulted in 30% yield reductions, and planting directly in crop residue did not improve bean yield under deficit irrigation. Ample early season rainfall is a boon to pre-flowering deficit irrigation yields, but under normal-to-dry conditions post-flowering deficit yields more.		Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	
Lit-15 Irrigation Efficiency and Water Balance of the Little Wind Unit on the Wind River Indian Reservation in Wyoming	2017	Rosado, U of Wyoming	Unit	Uses ag water balance & geophysical techniques to quantify & locate water losses. "Large errors and data gaps associated with the inflows, outflows, diversions, and precipitation data, [which] identified specific needs for better data."	Paper not found									
Lit-16 Standardizing Temporary Water Transfer Procedures in Colorado				This article will describe the barriers in existing law to temporary transfers and the various approval mechanisms available under existing Colorado law. It will provide an assessment of the strengths and limitations of the existing transfer methods and make a recommendation for consolidation and standardization.	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	

## Exhibit B-3 ATM Documents with ATM Criteria

								l-	Additional ATM Specific Components				
									Agronomic Imp	acts (How long does it to	ake for a crop to fully ret	urn to pre-fallowing p	productivity?)
Title	Date	Publisher/Authors	Description	Notes	Identified Local Impacts	Identified Regional Impacts	Operational Type of Project	Types of Crops	Yield	Quality	Recovery	Water Quality Effects	Soil Health Effects
ATM-01 Use of Alternative Transfer Methods to Increase Water Supplies for Conejos Basin Agriculture, Municipal, and Environmental Purposes	2017	https://dnrweblink.state .co.us/cwcb/Electronic File.aspx?docid=20533 3&dbid=0		ATM w/ recreational and environmental benefits for municipal augmentation wienlargement of Trujillo Meadows Reservior. Stakeholder meetings for federal & state agencies, ag, and town aug needs. Model of ATM, details of benefits, recommended path fwd. Appendix A estimates of monthly inflows to reservoir. Water rights include USFS Reserved Rights decreed as ISF, interstate shepherding for flow through NM.	minimization, mid-summer streamflow,	Compact and river administration benefits	Storage expansion	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed
ATM-02 Development of Land Fallowing-Water Leasing in the Lower Arkansas Valley	2011	https://dnrweblink.state .co.us/cwcb/Electronic File.aspx?docid=19573 3&dbid=0	(Lower Valley) by the Lower Arkansas Valley Water Conservance	unnecessary at times due to trans-basin supply; considers monthly return flow "factors"; analysis	More water supply benefit to northern Munis, less water supply benefit to Lower Ark communities but \$\$ benefit to Lower Ark communities	Benefits farmers by giving them an option to not sell water/land and move out	Lease-Fallow, associated storage expansion	Not discussed	Potential benefit to reduced upstream irrigation	Not discussed	Not discussed	Improved due to reduced overall irrigation and improved irr. efficiency	Potential improvements to selenium, TDS, salinity, and hardness from reduced irrigation
ATM-03 Little Thompson Farm ATM Grant Completion Report	2018	https://www.larimer.org /sites/default/files/uploa ds/2018/larimer_county _atm_final_report.pdf	Study funded through CWCB 2015 ATM Grant. The Little Thompson Farm receives supply from Handy Ditch and Reservoir Company shares and 240 C-BT units. The consultant team found that "it was feasible for Larimer County to afford, from a water supply perspective, to sell some C-BT units (115) and share some other units (80) in some years, while still having sufficient water on the farm for corn and sugar beets, as well as crops that require less water." The study looks at aspects of feasibility, including: Economics; Farm Financial Viability under wet, dry, and very dry year scenarios; dry year water value. The report also investigates potential partnerships, and outlines the final water sharing agreement. "Larimer County sold 115 C-BT units to Broomfield and retained a first right of refusal to lease back these units for assessment cost plus 10%, when available." The report also discusses Lessons Learned and Future Considerations: Legal Hurdles/Barriers to Replication (Northern Rulemaking, Direct Flow Rights, Delivery Efficiency Impacts from Water Transfers); Public Perception & Political Will (Educating and Obtaining Support of Leadership, Public Support, Out of County Partners, Continued Education), Negotlating an ATM: Successful Tips, Tricks, and Tools (Establish and Pursue Goals with an Open Mind About Implementation, Minimize the Cooks and Trust Your Team).	erosino by forming large soil clods & enhancing infiltration); Class II and III soils, slopes 0.5%, not high enough for severe erosional problems; no/low-III also recommended to reduce direct evap, improve soil health, reduce fuel & costs; irrigation efficiency via contour farming, drip tritration SM& ET monitoring, druput tolerant	Reduced return flow from C-BT water to Little Thompson Creek; Overall, keeps farm viable; Helps shore up water security for Broomfield		Interruptable Water Supply Agreement	Com, sugar beets	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed
ATM-94 HB13-1248 Catlin Canal Company Rotational Land Fallowing-Municipal Leasing Pilot Project	2018	320/19%2001%2015% 202018%20Annual%20	municipal leasing pilot project under HB 13-1248: Irrigation Water Leasing Municipal Pilot Projects. This project aims to makes available up to 500 acre-feet of water for lease to three municipal water providers – the Town of Fowler, the City of Fountain, and the Security Water District (Municipal Participants)	Huge emphasis on return flows; using Lease Fallow Tool from DWR to calc available water & owed returns; "Pay As You Go" target deliveries for return flow; use of recharge structures supported well-timed return flows; augmentation station used for faster return flows and consumptive use water delivered to municipal participants; erosion & weed control included herbicide, disk tilling, cover crops (winter wheat, hay)	Not discussed	Not discussed	Lease-Fallow	Not discussed	Possibly no change but inconclusive due to 2018 being low water year and all-around reduced crop yield	Not discussed	No major issues found	Not discussed	No erosion, no noxious weeds
<u>ATM-05</u> Yampa Basin ATM Study	2014	.co.us/cwcb/0/edoc/19s 193/Yampa%20- %20NC%20Use%20of %20ATM%20to%20Me et%20Non%20%20Cor sumpt%20Needs_FINA LReport%203-28-	Study conducted by Trout Unlimited (TU) and funded by CWCB's Alternative Agricultural Water Transfers Grant Program. The purpose of the study was to identify locations in the Yampa Basin where potential ATM transactions could help to meet multiple uses (nonconsumptive needs and agricultural shortages), and identify types of ATM transactions most suitable for meeting multiple purposes. Ideal candidate reaches, as specified by project proponent TNC and its partners, would involve the following scenario:  1. Upstream agricultural water user with full or surplus irrigation supplies and transferable CU water  2. Downstream agricultural water user with an irrigation CU shortage (consumptive need)  3. A need for water in the reach between to improve flows for trout (including Colorado culthroat trout) or warmwater fish (nonconsumptive need)	return flows; more efficient irrigation improves water quality by lowering return flow contaminant transport, fewer excess nutrients due to fertigation in drip systems; TNC/TU partnership to support	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed
ATM-06 Grand Valley Water Users Assn Conserved Consumptive Use Pilot Project Development: Process, Procedure, and Lessons Learned: Water Banking-Next Steps Part II	42795	waterusers.com/upload	The Conserved Consumptive Use Pilot Project (CCUPP) is a pilot demand management project intended to test the mechanisms necessary for a Western Slope irrigation water provider to intentionally reduce consumptive use in a voluntary and compensated manner. This report summarizes the process of developing the CCUPP, the procedure used, and lessons learned.	Land management contract: manage weeds & plant growth, soil erosion (leave plant residue, tillage for clock, tillage for crust), wfmid-season visit to confirm mgnt, activities are consistent wicontract, interviewees concerned w/DM externalities including local economy & aesthetics. CCU verification procedures (Exhibit B) don't specify methods to verify CU on fallowed land, but does include sites visits to verify land mgmt, and explicitly prohibits any active plant growth on fallowed land	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed
ATM-07 Grand Valley Water Users Assn 2017 CCUPP In-Season Verification	2017	https://dnrweblink.state .co.us/cwcb/Electronic File.aspx?docid=20514 4&dbid=0	including verification forms for each program participant for 2017.	includes 2017 verification documentation including photographs, recommendations, comments/notes	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed
ATM-08 Power Canal Capacity Report, Grand Valley Water Users Assn	12/1/2015	https://dnrweblink.state .co.us/cwcb/Electronic File.aspx?docid=20181 3&dbid=0	(power canal) to deliver water to the Grand Valley Power Plant (GVPP). The report investigated the potential unused capacity within the Power Canal, including the potential for additional water to generate hydroelectric power.	temporary, voluntary. Lists current operations, water rights, data. Incomplete file in link, merged with 2017 Next Steps Part II	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed
ATM-09 Completion Report: Development of Practical Alternative Agricultural Water Transfer Measures for Preservation of Colorado Irrigated Agriculture	5/1/2011		An extensive evaluation to:  1) To identify barriers to implementation of alternative transfers and to describe potential strategies for overcoming barriers.  2) To develop tools for agricultural producers to evaluate the viability of potential alternative transfers.  3) To further actual alternative transfers by evaluating three demonstration projects that include owners of agricultural water rights and potential end users of the temporarily transferred water.	Extensive final report on ATM investigation & pilot on NE South Platte covering barriers (cost, risk/uncertainty, lack of supply, reluctance, power dynamic), needs and means to address barriers, Lease Evaluation Tool (AgLET) ag economics evaluator, exchange capacity analysis, flex market pilot project wi/Aurora.	outside of irrigation practices and M&I use	Overall tone that keeping ag is good and that buy-and-dry by M&I should be avoided	Flex Market w/ rotational fallowing, IWSA	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed

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									Additional ATM Specific Components				
										cts (How long does it ta	ake for a crop to fully ret	urn to pre-fallowing p	productivity?)
Title	Date	Publisher/Authors	Description	Notes	Identified Local Impacts	Identified Regional Impacts	Operational Type of Project	Types of Crops	Yield	Quality	Recovery	Water Quality Effects	Soil Health Effects
ATM-10 Final Project Report: Implementation of Deficit Irrigation Regimes: Demonstration & Outreach	May-16	https://dnrweblink.state .co.us/cwcb/Electronic File.aspx?docid=19931 7&dbid=0	Evaluation of different methods of monitoring orop water stress and consumptive use (CU) under deficit irrigation. Demonstrations, workshops, educational outreach on crop stress monitoring.	monitoring crop water stress and CU under deficit	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.
ATM-11 The Poudre Water Sharing Working Group: A Report to the CWCB	May-15	https://dnrweblink.state .co.us/cwcb/Electronic File.aspx?docid=19809 7&dbid=0		Final report of prototype ATM water sharing group between ag (North Poudre Irr Co, Water Supply & Storage Co. New Cache la Poudre Irr Co, and Larimer/Weld Irr Co) and muni (Fort Collins, Greeley, and Tri-Districts) on the Poudre River. Identified CCU calculation methods as a large barrier.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.
ATM-12 FLEX Water Market: Education and Implementation Phase	December-15		Investigation of FLEX water market implementation: engagements, index based pricing, theorizing on large-scale implementation, meetings between willing shareholders. The goal of this project was to successfully implement the FLEX Water Market concept through education, facilitation, and consultation, with specific focus on developing FLEX markets in Water Division 1 with municipal, industrial, agricultural, and environmental/ conservation partners. The team consulted with multiple potential partners, but in the end this project did not result in a water sharing agreement.	Investigation of FLEX water market implementation: engagements, index based pricing, theorizing on large-scale implementation, meetings between willing shareholders.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.		Not discussed.	Not discussed.	Not discussed.
ATM-13 Alternatives to Permanent Dry Up of Formerly Irrigated Lands	June-13	https://dnrweblink.state .co.us/cwcb/Electronic File.aspx?docid=19920 8&dbid=0	Review of benefits and issues of two alternatives to buy and dry that maintain some continued level of agricultural production: 1) Dry land farming, and 2) limited irrigation.	Review of benefits and issues of buy and dry and alternatives. Potential for conversion of ag land to dry land or deficit-irrigation, economic & maintenance issues w/dry land & deficit.		Same as previous column	Feasibility study: comparison of full irrigation to limited irrigation, and revegetation	Wheat corn, sorghum, alfalfa, pasture grass/hay, native grass, millet	Limited irrigation for Front Range (South Platte) parcels wouldn't typically have high enough yields to justify cost of farming due to lack of precipitation / Dry land farming results in very low yields but is cheaper than revegetation	Not discussed	Not discussed	Potential nutrient loading if high residual N in soils from previous crop- type and fertilization	Improper planning ahead of dry-up can lead to high residual N, high compaction, poor drainage, low organic matter, noxious weeds
ATM-14 Water Partnerships: an evaluation of alternative agricultural water transfer methods in the South Platte basin.	March-12	https://dnrweblink.state .co.us/cwcb/Electronic File.aspx?docid=19921 5&dbid=0	Water market experiment, survey of municipal & industrial providers on ATM practices, leases, evaluation of shared water bank scenarios on South Platte, focused on FRICO shareholders.	Water market experiment, survey of municipal & industrial providers on ATM practices, leases, evaluation of shared water bank scenarios on South Platte	From lab experiment results, shared water bank concept doesn't necessarily increase the efficiency of water usage in ag, but impacts are lessened by comparison to typical buy-and-dry	use more than it would during buy-	Feasibility study, survey, and some experiments to vet ATM concept called Shared Water Bank	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed
ATM-15 Project Report: Lake Canal alternative agricultural practices and in-stream flow demonstration project	June-13		Proof of concept project planning for ATMISF program on Lake Canal. Monitoring/verification based on deliveries, surface returns, inflow to recharge pits, and soil moisture sensors to verify return flows by lack/presence of moisture movement below the root zone. Project was not implemented due to ongoing water scarcity at the time (2012-2013) and inability to agree on a price. Describes extensive legal work to arrive at proof of concept.		Potential for enhanced flows in the river for environmental benefits		IWSA for deficit irrigation, with some fallowing	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed
ATM-16 Final Report of the Lower South Platte Irrigation Research and Demonstration Project	Jun-14	.co.us/cwcb/Electronic	the ReSET model of remote sensing. ReSET showed accuracy o 92-98% for fields under normal growing conditions and	sensing. ReSET showed accuracy of 92-98% for fields under normal growing conditions and successfully detected abnormal growing conditions to accordingly reduce ET estimates. 2.		Not discussed	Deficit Irrigation	Corn	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed
ATM-17 RGWCD Net Annual Replacement Plans	Reports exist for each year. Reviewed report for April 13, 2020	https://rgwcd.org/sd-1- annual-replacement- plan	Rio Grande Water Conservancy District plan to meet interstate compacts through forbearance agreements, leases for exchanges to meet streamflow criteria, temporary fallowing agreements, etc. Reviewed the 2020 Annual Replacement Plan (ARP), to meet requirements for the Plan Year under the provisions of the PWM for Subdistrict No. 1 decreed by the Division No. 3 Water Court in Case Nos. 2006CV64 and 2007CW52. This report describes a plan to remedy injurious stream depletions caused by the withdrawal of groundwater from Subdistrict Welts. This ARP includes a series of tables created by Subdistrict No. 1 staff and the RGDSS modeling team tabulating stream replacement quantities and locations resulting from Subdistrict No. 1 well groundwater withdrawals and a water portfolio to be used to replace such stream depletions.	meet interstate compacts through forbearance agreements, leases for exchanges to meet	Agriculture is still holding on to water rights and maintaining irrigation practices at limited capacity / More water in the stream and marginal improvement in aquifer	Agriculture is still holding on to water rights and maintaining irrigation practices at limited capacity / More water in the stream and marginal improvement in aquifer	-	Alfalfa, grain, and potatoes primarily; also oats, sudan grass hay, grass; other various crops	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed
ATM-18 Alternative Water Transfers in Colorado: A Review of Alternative Transfer Mechanisms for Front Range Municipalities	2016	https://www.edf.org/site s/default/files/alternativ e-water-transfers- colorado.pdf		Municipalities. The report conducted a screening analysis to identify potential case studies for a more detailed analysis of ATM, found 35	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed	Not discussed

### Exhibit B-4 SCPP Documents with Environ. Criteria

																				Next Steps					
						Streamflow (F	tydrology) impacts	1	Environmental Resources th	at May be Affected Species Impacts	1		Water Quality Impacts					Program level goa		aps, Questions for Fut For proposed future tra		evaluate impacts (positive	or negative) to:		
Title Date		Description	Notes					Rate of change of	of		Critical Land or Riparian Habitat				Tradeoffs - Resour	outcome from applying "avoid e mitigate, offset"		No net loss to env. services, recognizing	Build incentives for projects with net env. I benefits.	Si ol ISFs (or other flow p	MP or WMP Cr bjectives / flo roposed re	tical habitat & v ommendation State specie	BRT environmental CR of values lists/ co	RCT Oth	ther known ommunity /
System Conservation Pilot Program Secondary Bendfils: Pina Report with Case Brislins	WestWater Research for TNC	tes case study report locked at whether the decident in consumptive use in CEP projects the consumptive use in CEP projects the consumptive use in CEP projects the consumptive consumptive consumptive or case studies in Colorada and Vilyoning. Not use case studies in CeP projects with the consumptive consumptive consumptive studies, single with an ordinate report and projects projects because of the consumptive projects p	Benefits assessed include increased environmental flows, decreased out of alternative highler flow retendancy project, consistent of the property of the property of the property of the standard of demands asking in saling votar, and municipal to not hydrogenet sendits, locased flows for the evaluation to not project property of the property of the conditional property of the property of the control conditional property of the property of conditional property of the property of control property of the property of control property of the property of control pro	Magnitude  On See Table 4 for Monthly Flow Companison CCU, New Plane at lay of 15 mile seats, 100 p Flow  Plane There at lay of 15 mile seats, 100 p Flow  The flow contributions to the Coloratio Plane were estimated as only the CLD associated with the particular  and the contributions of the Coloratio Plane were estimated as only the CLD associated with the previous of the Coloration of	as h.' d	reach, BIOp Flow Recommendation for 15- mile Reach. WY: See Table 7 for Month Flow Comparison: CCU and	Triening  COS See Table 4 for Monthly Flow Compenition: COL (Rever Flower at boy of Recommendation for It families WY: See Table 1 for Monthly Flow WY: See Table 1 for Monthly Flow (Corest Estimated Flow Monthly Flow The data in Table 7 indicate that the text of the Corest Flower flower Recommendation flower flower Recommendation flower flower August and September streamflow.*	conditions  Not discussed		efforts and obligations defined under a recovery program for T&E fish species in the 15-mile reach directly below the project diversion point."	Impacted Not discussed.	Humpback Chub, Bonytall, and Razorback Sucker. Wyoming: Trout. *Increases in streamflow made possible by the Middle Piney Creek conservation projects would likely increase the quality of trout fishing, particularly if streamflow is a factor limition.	"Frartial season irrigation activities under the Canard Valley program a estimated to output most of the salithly benefit, as unmarated in seminated to output most of the salithly selection were found in the literature. It "Various estimates of salithly selection were found in the literature. It was analysis, remaining and taxding drive part terelements was estimated to be 4 thorsione." P2017 Colorado Salithly, Countrel Unit Sammary Valdicales self-in protection of 163,000 cm or 04,310 of Sammary Valdicales self-in protection of 163,000 cm or 04,310 of Similar Values are reported by NRCS in 2011, resulting in 34 tons p and an expected of 164,000 cm or 04,310 of similar Values are reported by NRCS in 2011, resulting in 34 tons p and an expected of 165,000 cm or 04,310 of similar Values are reported by NRCS in 2011, resulting in 34 tons p and an expected of 165,000 cm or 04,310 of similar values are reported by NRCS in 2011, resulting in 34 tons p and an expected of 165,000 cm or 04,310 of similar values are reported by NRCS in 2011, resulting in 34 tons p and a similar value of 165,000 cm or 04,310 of similar values are reported by NRCS in 2011, resulting in 34 tons p and a similar value of 165,000 cm or 04,310 of similar values are reported by NRCS in 2011, resulting in 34 tons p and a similar values are reported by NRCS in 2011, resulting in 34 tons p and a similar value of 165,000 cm or 04,310 of similar values are reported by NRCS in 2011, resulting in 34 tons p and a similar value of 165,000 cm or 04,310 of similar values are reported by NRCS in 2011, resulting in 34 tons p similar values are reported by NRCS in 2011, resulting in 34 tons p similar values are reported by NRCS in 2011, resulting in 34 tons p similar values are reported by NRCS in 2011, resulting in 34 tons p similar values are reported by NRCS in 2011, resulting in 34 tons p similar values are reported by NRCS in 2011, resulting in 34 tons p similar values are reported by NRCS in 2011, resulting in 34 tons p s	conservation projects would likely increase the quality of trout fishing, particularly if streamflow is a factor limiting trout productivity. Specifically, low streamflow tends to raise water temperature often beyond ideal	Impacts And discussed And discussed	hlerarchy Not discussed.	Proportional  Not discussed.	recognizing tradeoffs Not discussed.	benefits.  Not discussed.	pargets) p	rojects s	concern discussed. Not discussed	mapping str Not discussed. No	nservation cor rategy and it discussed. Not	ntity projects or discussed.
SCPP-02 Infographic Grand Valley Pilot Project Secondary Benefits	TNC	his infographic summarizes the results of econdary benefits analysis as applied to the rand Valley Pilot Project Case Study.	Grand Valley Pilot Project paid farmers to voluntarily reduce the irrigation water use in order to keep more water in the river to help increase water security within the Coborach Pilot Blash in the face of ongoing drought. White focus was on water security several off-farm benefits occurs because of the project.	"Increased water in the river resulted in \$23,000 of estimated savings not spent on endangered fish program	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	*Increased water in the river resulted in \$23,000 of estimated savings not spent on endangered fish programs.*	Not discussed.	"Increased water in the river resulted in \$23,000 of estimated savings not spent on endangered fish programs."	(after treatments)."  Reduced irrigation on sally soils improved water quality and resulted an estimated savings of \$282,720 from money not spent on other measures to reduce sallinity."	Not discussed.	lot discussed. Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed. N	ot discussed. No	discussed. Not discusse	l. Not discussed. No	ot discussed. Not	lot discussed.
SCPP-03. Research Symfletis: Agronomic Impacts of Reduction Impacts	Culp and Kelly for TNC	miled irrigation to highlight key findings related irrigationnois (masch of instead irrigation or other methods to reduce consumptive use of irrigation taste in the Upper Clorados River Basin. The nonducing section also identifies remaining search questions and suggests potential applications and possible next steps for a dema anagement program. The appendix summarize parameters of several of the studies reviewe (of the referenced reports and publications an validable on request.			Net discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	"Said will make the fluctuation of the sold purpy proces of failurings for the construction of the constr	Not discussed.	Not discussed. Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed. N	ot discussed. No	discussed. Not discussed	. Not discussed. No	ot discussed. Not	t discussed.
Final Report Collected Plans System Conservation File Report Collected Plans 1 2018 Conservation File Report Collected Store State Collected State Collect	Upper Colorado River L Commission	ull SCPP report from UCRC, project list; sessona learned: deministration, 6 preparational, costibilitation (a pipiementation, operational, costibilitation) and all constraints, colleged, 6 decision 15 in 15 in pipida is of UCRC, full report, including propendicals CQ (Did Logde), (D (2017 CU Logde), project (Cu Logde), and E (2018 CU analysis)	Lat of fibure questions to be answered pt  Document includes Appendices C (2018 spidale), D (2017 CU analysis), and E (2018 CU analysis)  and E (2018 CU analysis)	Impacts to flow not discussed.  Impacts to flow not discussed.	Not discussed.  Not discussed.	Not discussed.  Not discussed.	Not discussed.  Not discussed.	Not discussed.  Not discussed.	Not discussed.  Report addresses refur flows as a data gap / legal constraint flow-and gap in register and diversion practices reduce the analysis of the gap flows and gap flows a	Not discussed.  Not discussed	Not discussed.  Not discussed	Not discussed.  Not discussed.	Not discussed.  Not discussed.	Not discussed.	Not discussed.  Not discussed.  Not discussed.	Not discussed.  Not discussed.	Not discussed.  Not discussed.	Not discussed.	Not discussed.	Not discussed. N	ot discussed. No	discussed. Not discussed discussed. Not discussed.	Not discussed. No	ot discussed. Not	t discussed.
SCPP-66 Pilot Program Funding Agreement 2014	Bureau of Reclamation	014 SCPP funding agreement between CRB notices	Reviews history of compacts, storage allowances, demand management efforts by signatories. Defines goals and parameters of EUP-fleetifies NRCS programs that might support on-farm conservation improvements: EOP and SWEP ensures that projects will confinate with respective NRCS Start Conservationists.	Impacts to flow not discussed.	Not discussed.	Not discussed.	Not discussed:	Not discussed.	be considered to prevent injury to other water right holders and non-program participants.*  Not discussed.	Not discussed	Not discussed	Not discussed.	Not discussed.	Not discussed.	iot discussed. Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed. N	ot discussed. No	Not discussed.	I. Not discussed. No	ot discussed. Not	x discussed.
SCPP-07 Colorado River Water Bank Feasibility 2012 Study: Phase 1		Vater bank planning phase; conservative estim potential WB supplies, and demand for those applies.	asinculas potentia VIB uses, supply, magnitude & Requency of mod, supply use scenarios. App. A callegisties of WIB acquisities of WIB potential research, app. B: CRC VIB Fearblatty Study White Supply Technical Memo. App. C: Evil of CRC VIB Hydrological Scenarios w/UCRB model. App. C: Basic supply & use comparison scenarios for CRC VIB technical memo	frequency.	Not discussed	Not discussed	The report acknowledges "the actual timing and reduction in depletions would likely require some kind of return flow modeling."	Not discussed.	Return flow liming is recognized as a data gap. The actual timing and reduction in depletions would likely require some kind of return flow modeling."		Not discussed.	Not discussed.	Not discussed.	Not discussed.	ot discussed. Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	ot discussed. No	Not discussed.	l. Not discussed. No	ot discussed. Not	discussed.
Colonado River Water Basis Feasibility 2013 Bludy Phase 2	For Colorado River District. By MWH.	vitet bain jaming jhase, test cases assessi- cham tipacis for representative argation returns to the second second second second returns to the second second second second second second second second second second second	Candidate system identification & evaluation. App. B Test Case identification is evaluation. App. B Test Case identification in a contract of the system.	Inspirementation of fallowing or defect in rigidinor practices considered in the control of the	es en d		Next stops Sec 6.2 pg. 4.1 contribes to proposed as a questionness de l'acceptant de la pose de l'acceptant de	Not discussed.	bated in general that riskum flows are a concern of data gap with and day, and but insertment of riskum from less gap with and day, and the research of flows from less than the "And of the silve visits revealed offfencibles in water baseling insertmentation. First, one of the systems that discipular measurement of diseasables and within flows to directly the second diseasable and diseasables and the second diseasables in the most accounts and orderstables but it would be very flower and particularly diseasables and orderstables and the second diseasables and the second diseasables and the second diseasables and the second diseasables and the formation may be a second diseasable and the second diseasables and the second diseasables and the second diseasables and the formation may be second diseasables and the second diseasables and the second diseasables and the second diseasables and the formation may be second diseasables and the second diseasables and the second diseasables and the second diseasables and the formation and the second diseasables and the second diseasables and the second diseasables and the second diseasables and the second formation and the second diseasables and the second diseasables and the second diseasables and the second diseasables and the second diseasables and the second formation and the second diseasables and the second diseasables and the second diseasables and the second diseasables and the second diseasables and the second diseasables and the second diseasables and the second diseasables and the second diseasables and the second diseasables and the second diseasables and the second diseasables and the second diseasables and the second diseasables are second diseasables and the second diseasables are second diseasables and the second diseasables and the second diseasables are second diseasables and the second diseasables		Not discussed.		Stating and selection to season may make allowing or defect impacts on earlander to Profession for selection to Profession and selection of the selection.  In contrast the selection of the sele	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed. N	ot discussed. No	discussed. Not discusses	Not discussed. No	Not	t discussed.
Colorado River Compact Colorado water baris fearability study: water surph lectrical memorandum. (Appendix B to Colorado River Valuer Baint Fearability Study: Phase 1)	Natural Resources Consulting Engineers, Inc	echnical analysis for water bank feasibility abu	p) Data section includes analysis, intigated areas, water rights off-ategories, and climate stations. Examined CUI requirements (wildlasclut & Barry-Cridele), ET verification (Perman Medical values for development and Cookglet stations), and HCUI (Statict) values for elevation and Cookglet stations), and HCUI (Statict) values for elevation and cookgreen cookgreen and the station of the station	The reduction in diversions would include the irrigation editionnoise. The actual timing and reduction in depletions would like require some kind of return flow modeling.*	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Recognized as a data gap f next step: - The actual timing and reduction in depletions would likely require some kind of return flow modeling. <sup>4</sup>	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	tot discussed. Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed. N	ot discussed. No	discussed. Not discussed	. Not discussed. No	ot discussed. Not	I discussed.
Eugloning Perceptions of a Voluntary Agricultural Volunt Communition Regional Control State of the Perception of Colorado	MacItroy, Colorado	cipo articoja incluidas interviewa and social con- cepta incluida	inferiolismo of violating, comprendant, temporary, and equity, and equity of the control of violating, comprendant, temporary, and equity communicated. Explores instanciating with water and landcape temporary and equity communicated. Explores instanciating with water and landcape temporary and explores in the control of 2007 temporary and explores and ex		Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Ned discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Net discussed. N	No.	Not discussed.	Not discussed. No	Not	t discussed.
Biseling Paper Upper Basin Demand Management and Wilset Basking. Addressing Risk and Creating-Centaryl: Exploring Cyclions for an Upper Basin Demand Management Program	TNC s	un a program.	amonthy exclusions (Spore Sacion risk based on descript hydrolise) and discussions have breach and first. Ask an way greatmost and discussions have breach and first. Ask an way greatmost and such program governance and structure, coal and funding coaling and confectable, intellering any of the key fasces being addressed by CMCEA DM workgroups. Key misses being addressed by CMCEA DM workgroups. Key misses being addressed by CMCEA DM workgroups. Key misses being addressed by CMCEA DM workgroups. Key subject to a second property of the compact of the compact of the compact of the compact containment.		Not discussed.	Not discussed.	Not discussed.	Not discussed.	Return flows identified as a data gap? I next step from a lagor and an engineering statepoint for a program to protect water rights holders. "Visitar scens, state and fidential agencies, and other statematics will model accusate data of the rights and the statematics will model accusate data on trips, agreed upon methods for calculating water aswings and maintaining return. Inc. Willes stem of these are engineering sustained, policy may be needed to help brandate these concepts with the first and regulations of a long-term supersist to estimating and addressering return flow impacts.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	lot discussed. Not discussed.	Not discussed.	Not discussed.		Not discussed.	Not discussed. N	ot discussed. No	Not discussed. Not discussed		kt discussed. Not	t discussed.
Colorado Rest Model Bank Work Croop An Overview of Previous Studies & Reports	Colonedo Diversidados	implied by the Colonals Plane Water Bank (soc Group in the effort to provide Information Cook Group in the effort to provide Information Cook what types of solutions may be available to device committees and solutions are the available to device committees, and solutions provided to the control of the con	of how reduced ringston for compact purposes would see with different regions places an of Caudach West (Stope, according to the contract of the contract of the contract of the agreement impacts of reduced irrigation.		Not discussed.	Not discussed.	Colorado River Water Blank Feasibility Sulky/Plass 2: Niceno of the system had adequate measurement of diversions had adequate measurement of diversions recognity of the recognity of the recognity of the recognity of the recognity of the recognity of the recognity of the recognity of the recognity of the recognity of the recognity of the recognity of the specific plass of the Sieps 2: Estimate the potential impacts of fallowing or disk implastion of development of the recognity of development of the recognity of environmental resources due to changes in stam flows.	Not discussed.	Oaks candidate systems have related by the desemblance success. Resettles been stand how impacts, life within the control of the control of	Not discoused.	"Other benefits of impation could be impacted (late-season return flows, wildlife habitat, scenic open space)"	Not discussed.	Not discounted.	Not discussed.	Not discussed. Not discussed.	Not discussed.	Not discussed.		Not discussed.	Not discussed. N	ot discussed. No	Not discussed.		Not	t discussed.
GVWUA Final Report on the Conserved Consumptive Use Pilot Projects	GVWUA and J-U-B Engineers	119 Conserved Consumptive Use Plick Project manifested by the Grand Valley Water Users sociolation (GVWUIA). The initial part of the port provides a good summary of both the 201 40 2018 plots. Appendix H provides the detail the survey GVWUIA completed of the survey GVWUIA completed of the survey GVWUIA completed of input on cropping producers, galaveing their input on the properties of the properties of project. Appendix I summarizes GVWUIA inking more broadly on the pilot and demand snappement.		impact to farmers.		Not discussed.	Not discussed.		Setum flow impacts not discussed. More focused on CCU and impact to farmers.		Not discussed.	Not discussed.	Not discussed.		ot discussed. Not discussed.		Not discussed.				ot discussed. No		l. Not discussed. No		
SCEP.14 Lessons Learned from the System Conservation Partnership Program	The Nature Conservancy	NCS insposes learned in their SCPP involvement of the second of their second	or top 3 become colleach & communication is essential, operational & logic places must be addressed and this company linguistion district level simplify the process for stiffcusery.	repaids to fine not discussed.	Not discussed.	Not discussed.	When you focus on consumptive use checkchose, which about return fill on the decidence with about return fill on How do you prevent in jury and keep other water right holders and non-participants whole?"	Not discussed.	Identified as a data gay; neet step related to water rights. The current programs one of provided any wisched project many the current program of a data data data data data data data d	Not discussed:	Not discussed.	Not discussed.	Ned discussed.	Not discussed.	tot discussed. Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed. N	ot discussed. No	discussed. Not discussed	l. Not discussed. No	ot discussed. Not	t discussed.

																						Next Steps					
										Environmental Resources ti	nat May be Affected										Data Gaps,	, Questions for Future P	rojects				
							Streamflow (	(Hydrology) Impacts			Species Impacts			Water Quality Impacts					Pro	gram level goals	For	proposed future transac	tions, need to evaluate	impacts (positive or n	egative) to:		
Title	Date	Publisher/Authors	Description	Notes	Manniturie	Frequency	Duration	Timing	Rate of change of hydrologic conditions	of Return Flow Impacts	Critical Stream Reaches Impacted/where)	Critical Land or Riparian Habitat Impacted	Species Impacted	Salinity	Temperature C	Other	Tradeoffs - Resource	Predicted outcome from applying "avoid, mitigate, offset" biorarchy	env	ognizing projects	ncentives for	SMP or objecti s (or other flow propos	r WMP Critical habit ves / flow sed recommenda	at & tion State species of concern	BRT environmental values lists/	CRCT conservation strategy	Other known community / entity projects
SCPP.15. Considerations for Mosling is Bank at the Aspinal Unit with Environmental Flows			River to assess their ability to simulate a potent water bank in the basin using the Aspinali Unit	Statelot, Appared FDDEE Model, and CRSS are evaluated for explaints to instruct Appared to Programme Appared to Pr	to simulate environmental flow targets (through the Black Canyon and at Whitewater), including base flow and peak flow targets. However, modeling was not done in this smallysis, so there are no results to share on how the wate banking project would impact flows.	configuration could be chang to simulate environmental in targets (through the Black er Canyon and at Whitewater), including base flow and pea flow targets. However, modeling was not done in the analysis, so there are no	gedconfiguration could be ow changed to simulate environmental flow targets (through the Black Canyon is and at Whitewater), includid base flow and peak flow nis targets. However, modelin, was not done in this analys so there are no results to	could be changed to simulate environmental flow targets (through the Black Carryon and at Whitewater), in including base flow and peak flow targets in landlanged to the same show and peak flow the gradient analysis, so there are no results to share go on how the water banking project would exist impact flows.		Ossonesse have Stateful configuration is set up to mode from the Stateful configuration of control to stateful from the Steven stateful control to stateful control to the stateful control to stateful project sould repeat refer from the stateful control to stateful project sould repeat refer from the stateful control to the stateful control to the the stateful control to the stateful	3 environmental flow targets below Aspinal Unit considered:		Endangend Pish Species in the Upper Colorado River Basin, in the Gunnison River	Not discussed.	Ned decommend.	Not discussed.	Not discussed.	Not discussed.	Not discussed. Not	discussed. Not disc	oussed. Not	discussed. Not dis	Not discussed	I. Not discussed.	Not discussed.	Not discussed.	Not discussed.
Environmental Water Transact Colorado Rever Bases: A Clor			Review CFIS environmental transfers to tack settled of activity, Emerican SCPP projects and the settled of activity, Emerican places of the settled of the settled of places of the settled of projects had be effect of enhancing streamflow.	Analysis used UCRC 2018 First Report no new data 20,0008, view of ISF projects including SCPP projects.	Although he build amount of water sectored by three- mandations is very mid-compeaned by the creal washer manadations in very mid-compeaned by the creal washer hasher provided significant breedits for local desemblers. In a sectionally visit in Phero River washership of Usuh an 1711 afforms on the Price Phero Warren March 1711 afforms on the Price River washership of Leibour Camela 1711 afforms on the Price River washership of Leibour Camela 1711 afforms on the Price River washership of Leibour Camela 1711 afforms on the Price River was office afforms on the Price River, and contenses the channess the contenses when have not make a downstream to Laida Priceset. I washer the contenses the channess the contenses when washer washership of the prices of the contenses of the manadation of the prices of the contenses of the contenses of the minute streambership on the south of the prices of the minute streambership on the contenses of the prices of the minute streambership on the contenses of the contenses of the contenses of the contenses of the contenses of the minute streambership on the contenses of the prices of the minute streambership of the contenses of the contenses of the minute streambership of the contenses of the contenses of the minute streambership of the contenses of the contenses of the minute streambership of the contenses of the contenses of the minute streambership of the contenses of the contenses of the minute streambership of the contenses of the contenses of the minute streambership of the contenses of the contenses of the minute streambership of the contenses of the contenses of the minute streambership of the contenses of the contenses of the minute streambership of the contenses of the contenses of the minute streambership of the contenses of the contenses of the minute streambership of the contenses of the contenses of the minute streambership of the contenses of the contenses of the minute streambership of the contenses of the contenses of the minute streambership of the contenses of the	multiple benefits, including improving water security, issipiliting water conservation dools, supplementing farm a dools, supplementing farm a streamflow and aquatic conservation. There is obvious a supplementary between the goals in gromoting water conservation enhancing water security and improving water security and improving water security and primary purpose will usual sale fault the others. Progra flocused on one of these goals can benefit from support for se the other goals.	us of of one of the other of the other of other of the other of the other of the other o	Not discussed	Not discussed.	Naturn flow impacts and discussed	in Actions—TRIC has been working with the Champel  from which water uses on a gradually neckaging developed.  reduction and specific post in 2014, with a 5.0 CFB  reduction and topping cell in 2014, with a 5.0 CFB  reduction. These projects have added significant flows to a critical reach of the river. <sup>2</sup>		Not discussed.	Not discossed.	Ned discussed.	Not discussed.				Not discussed. Not disc			Not discussed				
SCPP-17 Lower Colorado River Basin Program	s Pilot NA	Bureau of Reclamation	phase	*Although the Pilot Program will be ongoing until 2005, so of 2019, fature amountments of funding opportunities and requests for additional project proposals are not being contemplated.*		Not discussed	Not discussed	Not discussed		Return flow impacts not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.		Not discussed.				discussed. Not disc		discussed. Not dis					
SCPP-18 System Conservation: a collal approach to drought conting planning the Upper Colorado R	gency	Wyoming SEO Callaway, AWRA Impacts magazine	Description of Wyoming SCPP, how it works, participation, and future efforts.  Chapter from SNWA's water plan	Neither extensive nor technical, but includes some description o process & participation.  Addresses temporary supplies including different aspects of		Not discussed.	Not discussed.  Not discussed.	Not discussed.  Not discussed.		Return flow impacts not discussed.	Not discussed.	Not discussed.  Not discussed.	Not discussed.	Not discussed.		Not discussed.				discussed. Not discussed. Not discussed.		discussed. Not dis	cussed. Not discussed				
SCPP-19 SNWA Water Resource Por	tfolio 2019	Southern Nevada Water Authority		Intentionally Created Surplus, recharge and banking, DCP, and conservation tools.	senses that the Drought Contingency Plan *keeps more water in the river for the benefit of all water users and the environment.*					Return flow impacts from temporary supplies not discussed Does generally mention that SNWA heavity relies upon reli flow credits (south as from wastewater treatment plants). Direct water reuse will reduce the amount of return-flow credits (which are reused indirectly).			Not discussed.			Not discussed.											
SCPP-20 Colorado River Basin Water Framework & Financial An		for TNC	This memo evaluates different framework concepts to scale up operations of the Water Bank and provides comparative costs and other factors to consider in different approaches to developing a water bank. The information is intended to provide concepts and preliminary rambers for TNC and the Water Bank Working Group to consider and discuss in ongoing Wate Bank development efforts.	leases, option leases in critical years, non-option critical year leases, and response to a 1922 compact call. WestWater Research developed a cost-estimation spreadsheets based on the volume of water leases, number of associated acres, and number of farms or ranches leasing water.	Impacts to flow not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Return flow impacts not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed. N	Not discussed.	Not discussed.	Not discussed.	Not discussed. Not	discussed. Not disc	oussed. Not	discussed. Not dis	cussed. Not discussed	I. Not discussed.	Not discussed.	Not discussed.	lot discussed.

# Exhibit B-5 Lit (Gen. Literature) Documents with Environmental Criteria

																		Next Steps						
				Environmental Resources that May be Affected		Streamflow (Hy	lydrology) Impacts			Species Impacts			Water Quality Impacts				Program level go	Data Gaps, Questions for Future Projects	For proposed future	transactions, need	o evaluate impacts (positiv	or negative) to:		
Title Date	Publisher/Author	rs Description	Notes				R	Rate of change								Predicted outcome from applying "avoid,	No net loss to			SMP or WMP objectives /	critical habitat & low	BRT environmental	CRCT Other	known
		Analysis of ag impacts from salmon-recovery-related flow	w Investigates ag impacts of fish recovery measures "such as: modified	Magnitude  Policy scenarios focus on alternative strategies to increase flow velocities	Frequency Duration Not discussed. Not dis	on Timing cussed. Not discus-	of or seed. N	of hydrologic conditions R Not discussed. R	Return Flow Impacts Return flow impacts not discussed.	Critical Stream Reaches Impacted (where Minimum flow objectives for Snake River at Lower Granite Dam, and for the Columbia	Critical Land or Riparian Habitat e) Impacted it Not discussed.	Species Impacted (what) Endangered species act	Salinity Not discussed.	Temperature Other Not discussed. Not discussed.	Tradeoffs - Resource Impact Not discussed.	applying "avoid, mitigate, offset" s hierarchy Pr Not discussed. N	recognizing reportional tradeoffs of discussed. Not discussed.	Build incentives for projects with net env. benefits. Not discussed.	ISFs (or other flow targets) Not discussed.	proposed r projects s Not discussed.	ecommendation State sper concern lot discussed. Not discus	ies of values lists/ c mapping s ed. Not discussed.	conservation commu strategy entity p Not discussed. Not dis-	unity / projects scussed.
Salmon recovery in the Columbia River basin: analysis of measures affecting agriculture	Aillery et al, Marine Resource Economic	atarasotta ir Lotoritosa Pover	with the control of the recovery measures "such as modified integrit of dam takease, reserved dawdorm, and for augmentation in a sequentiation in the control of the contro	In the Coldinate-Orace System? "For iterations move agricultive for internated travelling for juvenile find migrating to the colain, a primary factor in reduced survival rates."						Dower of Michary Dam		"Formal ESA listings for Columbia-Snake River salmon and steelhead populations tiggered formation of a recovery program." Minimum flow objectives for Snake River at Lower Granibe Darn, and for the Columbia River at McNary Days."												
Lit-62 Feasibility of water efficiency and reuse technologies as demand-side strategies for urban water management	Berhanu et al, Journ of Industrial Ecology	Economic model of water cost provided by above-code water efficiency and reuse technologies, including variational authority analysis.	Estimates that efficiency and reuse can meet 85% of 50yr projected ions needs to the Lower Colorado River Authority service area (central TX)	Impacts to flow not discussed. Focuses more on costs-benefits of various municipal efficiency practices.	Not discussed. Not dis	cussed. Not discuse	ssed. N-	Not discussed. R	Raturn flow impacts not discussed.	No assessment for environmental impacts associated with this specific study for the 2012 State Water Plan for Texas includes a high-level assessment of environmental impacts of all recommended and alternate	Not discussed.	Not discussed.	Not discussed.	Not discussed. Not discussed.	Not discussed.	Not discussed. N	ot discussed. Not discussed.	Net discussed.	Not discussed.	Not discussed.	lot discussed. Not discus	ed. Not discussed. P	lot discussed. Not dis	cussed.
Lit-63 Response to water crisis: How do Iranian farmers think about and intent in relation to switching from rice to less	Boazar et al, Journa Hydrology	Study of farmer response to gov't demand management, switching crops.	"Stuctural equation modeling showed that farmers' intertion to change from rice cultivation to another crop is determined by personal norms, beliefs about their role and emotional considerations."	Impacts to flow not discussed. Report Socuses instead on farmers' attitudes and believes around crop switching.	Not discussed. Not disc	cussed. Not discus	ssed. N	Not discussed. R	Return flow impacts not discussed.	water management strategies for Texas Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed. Not discussed.	Not discussed.	Not discussed. N	ot discussed. Not discussed.	Not discussed:	Not discussed.	Not discussed.	lot discussed. Not discus	ed. Not discussed.	lot discussed. Not dis	cussed.
Water-caperitates crops /	Clark, CSU	PhO dissertation modeling options for temporary water transfers	modul, methods of analysis, and signi implementation strategy under Colorado Ner Vinetriesel professional sectimates costs, identified and control of the colorado control of the colorado control operational flexibility to both valter-right purchases and construction of additional reservoir storage.	Impacts to flow are not discussed if your in more on surferious, legal, operational flumework and costs of temporary banelers.				<b>由</b> 凡语 編 凡 日 安省 安 7.5 38	Notices that the form y general, National consumption was and inflamment to the unit of the properties of the properties of the properties of the properties of the water by described profits of the water by described in the profits of the water by described in the profit of the water by described in the profit of the profits of the pr		Not discussed	Not discussed.	Not discussed.	Senate Bill 80-181 and rulemaking by the SEC implement water qualify standardist in review of trainfairs.  Mercinced the use of the balance method or the 200 membrod to estimat influence of floor on water qualify standards.	If the temporary transfer has in a significant deplation effects, deductions from the lisease's available credits may be negotiated for miligation of instream impa- other effects and appreciation and ar- sizing schange agreement may yield the more water for the user or	isted its or	Not discussed.	Not discussed.	Not discussed.	Not discussed.	tot discussed. Not discus	ed. Not discussed.	lot discussed. Not dis	bussed.
Lit-05 Flexible water allocations and rotational dislivery combined adapt irrigation systems to drought	Cody, K.C., Ecology and Society	self-governing iniquition systems.		discusses Long-term climate changes in the SLV. (specified kills) admissible that prior appropriation system already impacts environmental considerations. Unique return from dynamics on lade to administed with brushistic sccrit in which metallicy frome stat. (see that the second secon	Not discussed. Not dis	discussed. climate che runoff.	o atteamnious from DM practices not. The Appendix I described in the SLV, including timing of	54 15 24 4	regions and offer effect.  The bor statistical configurations that are possible by combining for the bor statistical configurations that are possible by combining for five and the statistical configuration and produced produced produced to the configuration and the statistical		Not discussed.	Not discussed.	The discussed	Not discussed. Not discussed.	Not discussed.	Not discussed. N	of discussed. Not discussed.	Not discussed.	Not discussed.	Not discussed.	tot discussed. Not discus	ed. Not discussed.	Not discussed. Not dise	nessed.
Water transpillations, reducing appointment comprehensive bit improve singulation to denotely singulation to denotely	Colley (Ch. 3.1.4), & else Zinforonska & Patersen	apprachise and subdone to water supply scenely, included to the supply scenely, included to the supply scene of the supply sce	wholing aprilluted consumption use to improve adjustants to sacrify depresses with soft agreement in readors research consumers and production and the second consumers are soft and soft a	increduction is regulated and implement fields have made histogroup and conclusion health or an extra control of the control		rouding pro- productions producte a so flows at a flows at an a solution of the solution of the action of the solution of the action of the ac	only a service of the control of the	N L C N O O M M M M M M M M M M M M M M M M M	Addisease with mit the register brimarily as a didd gay / next sings, which will be considered to the	Not discounsed	Not discussed	Not discussed.	Not discussed.	Not discussed. Not discussed.	Not discussed.  Not discussed.	Not discussed. N		Examples in Michaels  The Created Plants Natural Resources District (CPNRD) in 2007 approved a Water Banking Pricity in reduce the need to exposite integrates while settleming Plants Rever Treats in the sea to menderable beauti. CPNRD designes water right in the requirement of the contract of the cont	Not discussed.	Not discussed.	or discussed. Not discuss	ed. Not discussed. 9	Not discussed. Not dis	nussed.
Towards regional saturalisation and participatory research, sustainability indicators, and future scenario rendeling	Dubinsky, CU Denver	The constantion that described has to take valvey submission indicated for 1802-00 per constantion, developing of Constantion for 1802-00 per constantion, developing of Constantion described manufactures than policy decision-matters assumed bearing and consistent than professional constantion constantion and constant that the constantion constantion of the constantion of the constantion of the constantion of per constantion and constantion constantion of constantion and constantion of the constantion constantion of constantion of the constantion of the constantion of constantion of constant	Ul distallabeline & keep research reference Hydighted groundwater- lage periodic of EX. Appages insighter week us could be decreased 10% with shifts in crip regime and retirent fallowing.  If you have been a second or decreased of the crip regime and retirent fallowing.  If you have been a second or decreased of the crip regime and retirent fallowing.		Not discussed. Not dis	runoff (shiff	iff dom June to Mey) p.g. 66.		restant have engaged and discussed.	Not decision.	Discolates the argotistical of those registers and the compact conspicution. The compact conspicution, we have a complex to explain the constraint of the compact conspicution. This is a complex system and solily practice. This is a complex system consistent of the compact consistent of the compact consistent of the consistent co	on Not decased.	Not discussed.	Not discussed.  Not discussed.	Chair bis other family through the weighting communiss signification encounts of water, which reflects engogins ability to marketin a important for factor regional water important for factor regional water loss analyses so allocate water soon analyses so allocate water soon analyses so allocate water soon analyses so allocate water soon analyses so allocate soon analyses of a soon analyses analyses of a soon analyses (Coststems at al. 1008, 2014, 2 Coststems 2016).	st the steer of th	or discussed. Not discussed.	Tot discussed.			of discussed. Not discussed soft dis		Not discussed. Not dis	
Lit-48 Economic viability of deficit irrigation in the Western US	Manning et al, Agricultural Water Management.		stages given elevated water prices (depending on output price and production costs).									NOT CONCURRED.	TO CHALLESTON					The conclusation						
L1:49	Palazzo and Brozov Agricultural Water Management	ground-relation making-primate.	goodwate praying an distributed uneverly between wells, confeed and goodwater meangement tratitations.	with the fault impacts Republican flow the familiar interaction compacts (Regional Conference of Con				m d d d d d d d d d d d d d d d d d d d	The study in our date of general tunding under to model an applice used to model (with early to have model) as our of the application of the study of the study of the study of the study of the study of the form. Moving this bucketin of pumping the first from the new all models are study of the study of the study of the study of the tundent form to write and models of the set of the study of the study of implication and study of ficial or count in the set of the set of the set of the study of the study of the set of the set of the set of the set of — In the study area, subsiding steams deplaced notice the set of — In the study area, subsiding steams deplaced not the set of — In the study area, subsiding steams deplaced not the set of — In the study area, subsiding steams deplaced not the set of — In the study area, subsiding steams deplaced not the set of — In the study area, study of — In the study area, study of — In the study of the study of — In th	Nor discussed.	Not discovered.	Not discussed.	Ned discusses.	Not discussed. Not discussed.	Not discussed.		Not discussed. Not discussed.	Not discussed.	Not discussed.		tot discussed. Not discus			nessed.
Evaluating the potentials of cropping adjustment for groundwater conservation and food production in the pladmont region of the North China Plain	Ren et al, Stochasti Environmental Research & Risk Assessment		cropping adjustments on groundwater sustainability & crop production	Impacts to flow not discussed. Focuses more on nexus between food and water.		cussed. Not discus		Not discussed. N	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed. Not discussed.	Not discussed.		ot discussed. Not discussed.	Not discussed.			lot discussed. Not discus			aussed.
Opportunities for samp and estimating agricultural water to alleviate water searching	Richter et al., Water Policy			Teacurate destination of protected water servings in implication requires entered of the volunt of relater association facilities about of the weath for purphusey is likely and the protection of the protection of the protection produces and produced or protection of the protection of the property water and produces and produces are provided to the property water and produces are provided to the property produces and produces are provided to the property and the property of the property produces and the property produces are produced to the property produces and the property produces and the property produces are produced to the property produces and the property produces are produced to the property produces and the property produces are produced to the property produces and the produces produces and the produces produces are produced to the property produces produces and the produces produc		conservation water-savir changes in applied to 1 2, neglect flow back is creating mit benefits wit within while modified. It to counter- efficiency p which seprication consumptive volume avair	tion efforts on farms, and claims of ring popertial, have bounded solely not in the volume of waiter withdrawn or mind the control of the control of the solely of the control of the control of solely of the control of the control of solely of the control of solely of the control of solely of the control of solely of the control of solely of solely	e water	Antionochopies of an a data gap for the real regions and places fell to propose account for less promotion of under hopies and his minimum consequence of the propose account for less promotions and search general forms and the propose account for less solven or special for less desirable can expect for less facilities per account price (page 2), search control, consider principal control for less of less per search control, consider principal control for less than the search control, consider principal control for less to discontinuous search control for less perfections of return flows to discontinuous search control for less perfections of return flows to discontinuous search control for less perfections of return flows to discontinuous search perfections and search perfections are proposed to the proposed of return flows to discontinuous search perfections and proposed to the proposed of return flows to discontinuous search perfect perfect account of the proposed of return flows to discontinuous search perfect perfect account of the proposed of return flows to discontinuous search perfect perfect search perfect perfe			Not discussed.	no circumodidi.	Net discussed. Net discussed.	Paper recognizas enabling inc in agricultural production through the control of violate -awing programs and control of the control of the control will be farther depletade, often in point of complete dryling, with attendant bas of biodiversity a social and control of the control will be farther depletade, often in point of comprete dryling, with attendant bas of biodiversity a social and control of the control violation.	ocald grows sevels to the	Not discussed. Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed. Not discuss		Not discussed. Not disa	nundelid.
Litchan water conservation in the Sacramento, California region during the 2014-2016 drought	Talbot, UC Davis	UC Davis Master's Thesis catalogingsanayzing supply & demand management actions under CA's drought poticis control of the catalogic process of the catalogic process CSU Master's Thesis evaluating remote sensing for	Evaluates and/for watering, public optivation, mode note, water-catales amengy saving, hilder recommendation for urban water supplies on wavenur recovery, reducing use of relabilities and demand management. Summarica & Amiphica CA legislation establishing approval for fong- term budget-based efficiency largests.		Not discussed Not dis			p	Noted when municipal efficiency practices were enabled, waterwater productions plant efficiency practices were enabled. Other than that need mention, volum flow impacts or implications are not discussed. In the production of		Not discussed  Not discussed	keeping water in storage for environmental flows to keep sait water from moving up river from the opean, (pg. 22) and to "minimize the impacts of reduced flows from Folsom Lake on fish and wildlife." (pg. 74).	environmental flows to keep salf water from moving up river from the occent (fest) water releases to push back seawater), (pg. 22) and to "minimize the impacts of reduced flows from Folsom Lake on fish and wildlife." (pg. 74).	Not discussed. Not discussed.	Not discussed.			Sings puring were realized frough 1% wider communities efforts (GHO emission reductions and reduced With of electricity)						
Remote sensing assessments of consumptive use of agricultural water in western slope of Colorado	Vashisht, Colorado State University, Colorado	estimating monthly consumptive use (CU) and conserver (CCU) on the West Slope	Used evapotranspiration (ET) observations at experimental picts of d thatfornal irrigation and water-banking irrigation practices to evaluate methods of verifying CCU. Reviews methods for measuring and monitoring CU, discusses limitation and potential for ReSET remote senting CU model.  *Reducing irrigation water by 25% caused no significant yield reduction.	any DM practice.		cussed. Not discuss		C	Birdly mentioned as a data gap, in that many methods for quantifying ICU do not allow measurement of return flows.  Return flow impacts not discussed.	Not discussed.  Not discussed	Not discussed.  Not discussed	Not discussed.  Not discussed.	Not discussed.	Not discussed. Not discussed.  Not discussed.	Not discussed.  Not discussed.		ot discussed. Not discussed.	Not discussed.	Not discussed.		lot discussed. Not discus		Not discussed. Not dis	scussed.
Lit.14 Deficit irrigation and surface residue cover effects on dry bean yield, inseason soil water content, and irrigation water use efficiency in western Nebraska high plains	Yorts et al., J. of Agricultural Water Management	groundwater pumping; impacts of water use efficiency ar crop yield	nd and improved irrigation water use efficiency by 26%." Applying 50% Etc. resulted in 30% yield reductions, and planting directly in crop residue did not improve bean yield under deficit irrigation. Ample early season rainful is a born to pre-flowering deficit irrigation. Ample early under normal-to-dry conditions post-flowering deficit yields more.		reconstrained Not disk	Not discuse	No.	reconsisted R	присы поче присы пос высовняв.	www.wadCubbet	Prince CITS CLUB SMICE	woll Concuments.	venudilez	Not discussed.	rear ancussid.	reot omdussed. N	n www.xxxxxxxx. PROT discussived.	TOTAL MATERIAL MATERIA	evit oncussed.	owa assessed.	Not discus	PHOTOGRAPHIC. P	on continued. Not disk	madelli.
Lit-15 Intigation Efficiency and Water Balance of the Little Wind Unit on the Wind River Indian Reservation in Wyoming	Rosado, U of Wyon	Unit  Review of strenoths and challenges of existing legal	ind Uses ag water balance & geophysical techniques to quantify & locate water losses. "Large errors and data gaps associated with the inflows, outflows, diversions, and precipilation data", Larkini) identified specific needs for better data." This article will describe the barriers in existing law to temporary	Not addressed, other than addressing the need to find a streamlined	Not discussed. Not dis	cussed. Not discus-	ssed. N	Not discussed.	The difficulty of calculating and challenge of maintaining historical return	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed. Not discussed.	Not discussed.	Not discussed. N	ot discussed. Not discussed.	Not discussed.	Not discussed.	Not discussed.	lot discussed. Not discus	sed. Not discussed. It	Not discussed. Not dis	scussed.
Standardizing Temporary Water Transfer 2020 Procedures in Colorado	Nicols, Peter D, et a University of Denve Water Law Review	mechanisms for ATMs and recommendations for consolidation and standardization.	transfers and the various approval mechanisms available under existing Colerado law. It will provide an assessment of the energins and limitations of the existing transfer methods and make a recommendation for consolidation and standardization.	suppressent to calculating and maintaining return flows.				10 10 10 10 10 10 10 10 10 10 10 10 10 1	flows is recognized as part of the "No highry Raid" barrier and "Calculation of HCV barrier bi implementation. The Lease Fation Tool is recognized as a potential solution to simplify and streamline the revaluation process, described as a "harrsparent, simple, and streamlined approach". Also recommends the state engineer rulemaking address a streamlined approach to determine HCU and whem flows.															

# Exhibit B-6 ATM Documents with Environmental Criteria

																	Next Steps				
				Environmental Resources that May be Affect	ted	Streamflow (Hydrology) Impacts		Species Impacts			Water Quality Impacts					Program level goals	Data Gaps, Questions for Future Projects For proposed future transactions, need t	evaluate impacts (positive or	negative) to:		
Title	Date Publisher/Auth	ors Description	Notes			Rate of c	nange								Predicted outcome from applying "avoid, mitigate, offset"	No net loss to env. services, Build incentiv	for	SMP or WMP Cr objectives / flo	itical habitat &	IRT rivironmental CRCT	Other known
Use of Atlanuation Transfer Methods to Uncease Water Species for Consigning Basin Agriculture, Municipal, and Environmental Purposes	https://doi.webliek. 2017 - Australia - Au	primary objective of the TMR Study is to investigate the lauchiley of a critical will the all content energy frequency for the content of the content of the content of the content of the content of the content of content of the content of the content of the content of the content of content of the content of the content of the content of content of the content of the content of the content of content of the content of the content of content of the content of the content of content of	ATM or more advant and environmental based to be married sugmentation wirelespensed of Trajlock baselooks Reservoir Basedooks meetings be bread as faste operation and the bread of the state of the state of the state of the land. Appendix A selfenties of more land produces or search of the state of the state of the state of place trades of the state of the state of place trades of the state of the state of self-place of the state of self-place of the state of self-place of the state of self-place of self-place of self-place of self-place of self-place of self-place of self-place of self-place	Secused in a general series, due to ability to time releases from additional series of time releases from additional series of Technical several four a longer period during security. The security of the security of Coordinated operations of Rio Grande, Beaver Platon, and Trajlich Mediores Reservoires could provide for streamflow enhancements while registion yeek—purroping deplicative model should requisit yeek—purroping deplicative model should be used to wisheast the security of the control of the security of the security securi	Frequency Potential bandlis Potential bandlis Potential bandlis Potential bandlis Vestivosi visualis Vestivo	Indigenation of the control of the c	and flavor flow frequents  and flavor flow frequents  flowers flow fine flow to the variable historical states  flowers flowers flow flow flow when flowers  flowers flowers flowers  and are larged back to the news."	sepaide national quality aims specials diversity of downstreamed than protrologied streams to the protrologied streams leaves of diseasement support. "Improved quality downstreams due to prototogied stream volums after peak runnfor Gouds result in downstry downstreams due to prototogied stream volum stafer peak runnfor Gouds result in lower temperatures and improved dissolved oxygen."	middle watching) and boiling."	the reservoir explantain project area given in Table 7. Ferset Service Management Indicator species in Table 8.		water in mid-surrener will be enhance stream and fiparian values through a prolonged release of additional flow after the peak runoff. This will improve aquatic habitati downstream due to prolonged stream volume, lower temperatures, and higher levels of dissolved coygen."	Other increased disorded doygen as a result of polygen flow and lower temperatures from committee releases.			No net loss to em, services. Build incentive men, services, recognizing tradeoffs. Nord decused. Not decused.		proposed property s		alues lists! conservation against arranging arranging arranging of discussed. Not discussed.	
Development of Land P Relatively Whate Leasting in the Lower Arkstrate Volley	https://doi.vewblink. 2011 Fishage/Tacide tt Middle 4-0	DOID Trengs mail 2011 of containing a loss of failurespie was been program of the contained by the contained been program of the contained by the contained by the Commencery Children's An Children's An Children's An Children's And Children's An Children's And Children's And Children's Anderson Valley Sugar Dates Company, Inc. (Super Dates) Children's Valley Sugar Dates Company, Inc. (Super Dates) Children's Annual Children's Annual Children's Annual Children's Children's Annual Children's Annual Children's Children's Annual Children's Children's Annual Children's Children's Annual Children's Children'	Februs Rev media may sepain additional sedrange post prises believed. Return Review Consecuency of time of the prises believed the contractive of the contractive of the contractive of the contractive of the register of the contractive of the register of the contractive of the co	in an and an analysis of the second of the s	Not discussed. Not discussed.	Not discussed. Not discussed.	seed. Sources that ATMs will have to receive instruction between them to be palled by the control of excess and the control of	note of the state	Not discussed.	Not discussed.	The 1998 the 1903 performed a water qualify exclusion in Michaesa Valley for agreement of their features of the the second of the first four four features of the first	E R	Whate quality issues for implants discuss of the property of t	of bot discussed.	Not discussed. Not discussed	Not disconnect. Not disconnect	Not discussed.		Not discussed. In the control of the	Not discussed. Not discussed.	
ATMAS  Lists Trave-park ATM Greet  Compilation Report	https://www.lainine backsidefulffleekid do20218 blanner_cr _em_final_report;	Therefore Farm moderns supply from Intelly Dish and ex- tended the Tell Conference of the Tell Conference of the Conference of the Tell Conference of Tell Conf	sold fielding, controls weards, non-integrated correct cross, right, years, and the control of	of this, be Coulty relationed a sufficient read to regard, and of the country of	,		hon transduction applies (CET in the case). This case is a page of applies of the case of the case of the case of applies of the case of the case of the case of the case of devices. The pagest received opposites have finance been found. This first Case of separated in air most year implies and case of the case of the case of the case of the case of the case of the case of the case of pagest of the case of the case of the case of selection in case of the case of the case of selection in case of the case of the case of selection in case of the case of the case of selection in case of the case of the case of selection is case of the case of the case of selection is case of the case of the case of ATO as well the case of the case of the case of selection of the case of the case of pagestantial water, they do not device as cases of the case of the case of the case of case of the case of th	s s			one declaration.	No. discoulable.	NO GEOLOGICA	under agrinulum production in provincial con- position of the production of the prod	Mon Unicadament			No. descusion.			PAG CHICLIANG
HB15-1244 Called Card Company Postsonic Lar Following-Municipal Leasing Pilot Project	https://driversiblink. .oo.us/enceb/Unido 0200199.000194.00 0200199.000194.00 18000199.000194.000194.00 18000199.0	added Cyte of Fourtiers, and the Security West Chairt (Manages) - Participation 1, Security West	jerosion & weed commol included herbicide, disk \$50ng, cover as jeviner whate, hey?	race power accords.	Not discussed. Not discussed.	Timing of first his entirely and seed and seed and accounts for "Chair Plany and all endoses or the control of the Chair Plany and all endoses or an ability base." Since the first book displaying seed and all plans are controlled by one or and all plans. "Since and first his particularity of our and all plans, and off his year." Since the control of	and.  Solitorium were assigned to trace of impract adaptation. In consumption are warrished to the Managinal to consumption are warrished to the Managinal consumption and warrished to the Managina of the American Chappe excellent relation from the Managina of the Managi	Not discussed.		Considers concerns of invasion reposition protocols weeds plot militarine; Study form death in 2018. "The fallowing of historically to 1018, "The fallowing of history profilement treatment of the control of the control of the control of the control of the control of the control of the control of the control of	Not discussed.	Not discussed. N	Not decoased.	Not discussed.	Not discussed. Not discussed.	Not discussed. Not discussed	Not discussed.	Not discussed. No	Not discussed. Not discussed.	Not discussed. Not discussed.	Not discussed.
ATM 45 Variya Basin ATM Study	https://downeadclist. on.out/secutification/ prod/secutification/ 2014 Hold Market Hold School Hold Hold Hold School Hold Hold Hold Hold School Hold Hold Hold Hold Hold Hold Hold Hold	COCCTA Alameter Agrocultural Water Transfers General For Yangu Balan Water peritari Alf Meministration cold to make miligile uses (proconcurrent product alf Meministration cold in make miligile uses (proconcurrent water and product auditor). In the condition of the condition seather, as specified by proper proposers TVC and all seathers, as specified by proper proposers TVC and production of the condition of the condition seathers, as specified by proper proposers TVC and in a specified by the condition of the supplier riging conditions and the condition of the supplier riging conditions and the condition of the supplier riging and conditions are supplied and conditions with an engineer and conditions are conditions and the condition of the condition conditions are conditions and the condition conditions are conditions and the condition conditions are conditions and the condition and the conditions are conditions and the condition and the conditions are conditions and the condition and the condition of the condition and the conditions are conditions and the condition and the condition and the condition and the condition an	Josef Stanfalder danny seller in erdinant hancer nature have reflecter deposition process well equality by resident process resident process. The contract of the contract soliding systems. This TIV pertrained in a support instrument base soliding systems. This TIV pertrained in the contract soliding systems. This TIV pertrained in the contract soliding of the contract of the contract solid solid discountries. The contract solid solid discountries are solid solid discountries. The contract solid so	flow environmental benefit. "The ideal scenario to tion in accomplish the goal of relieving intigation a for shortages while meeting environmental needs	Not decement Not discussed	Study whose so the delibery in making up to forming when the CVD is auditive when will are leased by whether CVD is auditive was that is caused by which could be more distributed. Here, you will be sometiment of the country which long without the country which country whether the states whether an auditive and those when making the product of the country of the co	seed the Statistical analysis consolinated when the ediplated for substantial to the seed analysis and colleges of the seed analysis and colleges of the seed analysis and colleges of the seed analysis and the seed analysis and the seed analysis and the seed analysis and development of the seed analysis and development of the seed analysis and development of the seed analysis and the seed analy	relieving ringston shortages white meeting mentionermatin steels would consist of a base of sealer from a welfing spottness in rigidar. In the sealer from a welfing spottness in rigidar, sealer large from a welfing spottness in rigidar seather large in self-ride environmental need for higher flows, and then delivery of that water advantage in rigidar whose agricultural master gipt is whort. "Environmental needs correlated water gipt is whort." Environmental needs correlated water gipt is whort. "Environmental needs make the properties of the control of the seather (b) moderate and high risk locations identified in the Valketenhet Fow Evaluation Tool study, (c) (CMM Rinth. 2012, and (c) other stress means the control seathful by local belongston.		The skills (house a or missenance bound) and war ATIs on on your the MOTT count to be a second or the same of the MOTT count to the MOTT c	Figure a subtraction of memory comments between the and re- duced many. "When they prevent memory comments are tracted or force and the subtraction of the subtraction of the subtraction of the color politicals." Though the use of Sea is highly efficient only political subtraction of Sea is not subtracted along with the color political subtraction of the	No dimonsed.	Not discussed	Not discounsed.	Not discussed. And discussed.	Mild Secured. Size you had a feet of the control of	was found that water could be temporarily le the CWOS for the benefit of decreed ISF we y reaches." In selecting optimal reaches, the s oful looked at macmitude of shortages for interve	rems, it is discussed to discussed to the property of the prop	sis serietyng sig skerietyng skerietyng skerietyng sig skerietyng	Not discounsed. Not discounsed.	Not discussed
ATM-05 Grand Valley Water Users Asian Conserved Centrangible User Paid Conserved Centrangible User Paid Procedure, and Issonan Learned: Water Banking-Next Steps Pairt II  ATM-07 Grand Valley Water Users Asian 2017 CULPP 1-Season Verification	42795 01- 17_ccupp_projects opment_final.pdf	alley jillot demand management project intended to test the plotted provider to intensionally reduce consumptive use in a vettural provider to intensionally reduce consumptive use in a vettural and compensated manner. This report summarizes the process of developing the CCUPP, the procedure used, a leasons learned.	local economy & aeathetics; CCU verification procedures (6 dd don't specify methods to verify CU on fallowed land, but do include sites visits to verify land eight, and explicitly prohibit active plant growth on fallowed land. PP includes 2017 verification documentation including photogram	s), t t ding ding da any		Not discussed Not discussed  Not discussed Not discussed		Not discussed  Not discussed	Not discussed  Not discussed	Not discussed  Not discussed	Not discussed.	Not discussed. N	Net discussed.	Not discussed.  Not discussed.	Not discussed. Not discussed.  Not discussed.  Not discussed.	Not discussed. Not discussed.  Not discussed. Not discussed.	Net discussed.  Net discussed.		t discussed. Not discussed. 7  It discussed. Not discussed. 9		
Power Canal Capacity Report, Grand Valley Water Users Assn	https://dnrweblink. 12/1/2015 File.algpr?docid=2 3&dbid=0	water associated with CCU could be protected and returns to the Colorado River under a pilot project water bank? to convey CCU via unused capacity within the Orchard Mesa 0181 Valley Power Canal (power canal) to deliver water to the Grand Valley Power Plant ((SVP).) The report investigated the potential unused capacity within the Power Canal, includin	th Very brief report on "one potential mechanism through while dissociated with CCU could be protected and enturned to the Colonized Review under a pilot project water bank." Com- temporary, voluntary. Lists current operations, water rights, the complete file in first, merged with 2017 Next Diago Part 8.	report, but it is important to note that if CCU and water were diverted and delivered by means of data. excess capacity in the Power Canal, that water would not be available in stream for biological needs. However, as it would be delivered at the power plant, that water would be available in the		Not discussed Not discus	Not discussed	Not discussed	Not discussed	Not discussed.	Not discussed.	Not discussed. N	Not discussed.	Although not discussed in the report, using CCU for hydropower generation presents a tradeoff with keeping water in the river for biological needs.	Not discussed. Not discussed.	Not discussed. Not discussed.	Not discussed.	Not discussed. No	rt discussed. Not discussed.	tot discussed. Not discussed.	Not discussed.
Completion Report Development of Postcal Allender Agricultural Water Transcription of Colorado Infigured Agricultura Colorado Infigured Agricultura	5/1/2011 50.03/cvc/cvc/fribacky File.aspx/7docid=15 98.dbid=0	your control and an analysis of the control of the	Lease Evaluation Todi (Apt.ET) sig economics evaluatir, es repeatly availyant, fixe market plot project evil-acres.		In the demonstration demonstra	In the demonstration projects assessed, the well all not Red discussion of the demonstration	Douglowers Warf (the Fire Will March) final bearing from the fire fire Lot of Fire Cut in manifolder (in the fire was when injudice) in premium of the fire fire was when injudice in premium-only or temporarily factor single and an information of the fire fire fire and warf significant in elevativity account for the first in located carrow. Fire was related as the first in the first in forester carrow. Fire was followed in an interpretation of fire fire fire fire fire fire fire fire	ar a b y-	Potential resultable of using restings a related as incompression of an electronic process decounsed in Section 4.3. Wallering provide hashed benedits to bries, fait, and other wideling.	Using welfanish as a nethinge method for year to be a second of the control welfanish and other species.	Not discussed.	to to to to to	Protectial bornelis of using recharge extended as a component of alternative without as a component of alternative large component and a component of a memory of prophetors removal, cathon removal, prophetors removal, cathon questionties, make memory, and prophetors are moved, cathon prophetors are moved, cathon prophetors are moved, cathon prophetors are moved. The cathon of the cathon prophetors are moved. The cathon cathon prophetors ar	Note the tradeoff between creating welfarm with me environmental transfer and reducing the COLD generated.		Not discussed. Not discussed.	Not discussed.		nt discussed. Not discussed. If	oot discussed. Not discussed.	Not discussed.
ATM-16 Final Project Report: Implementation of Deficit Irrigation Regimes: Demonstration & Outreach	May-16 https://dnrweblink. .co.us/cwcb/Electri File.aspx?docid=19 7&dbid=0	onic Stress and Consumptive use (CO) under derick irrigation.  Demonstrations, workshops, educational outreach on crop stress monitoring.	outreach on crop stress monitoring.	crus								N		The second second	PROT CISCUSSED.	NO COCCESSED.	under Samenasserende				an unusers
ATM-11 The Poude Waser Sharing Working Group: A Report to the CWCB	https://documelylinks	Faul signord of Proximi Water Starting Working Crassy a proctopies. All You and water Starting rough Determine agricultural sears (North Proximi Int. Case Lau Laurenier March 1 cro) and Laurenia In Youker Cot, and Laurenier March 1 cro) and and the Proximi Int. Case Laurenier (Int. Case Laurenier (I	Vall root of printiple ATM weak and purpose between Share Roots (e.g., control of printiple and prin	he la juneral mentions of niedling to replace return tion obligations.		Not discussed Not discussed	and The apport tackes on the sead to recognize the com- tons, and described the sea a challenge. The many requir- tation and find interests are constructed of exchange for interesting the sead of the control of the con- struction of the control of the control of the con- struction of the control of the control of the con- struction of the control of the control of the con- struction of the control of the control of the con- trol of the control of the control of the control of the control of the control of the control of the consequence can be seen as the control of the control of the control of the control of the control of the con- trol of the control of the control of the control of the consequence the page who consequent the page of the consequence the page who consequence the page of the consequence the page who consequence the page of the consequence the page who control of the control of	s or or or or	Appendix A. by the report (poliuse) Femerlian provided by implicating algorithms) brothes on the benefit deprictating brothes on the benefit deprictating provides to wideth habitating, among the provides to wideth habitating, among the provides and acceptable. The appendix of the provides are applicable. The appendix of the provides are appendix of the brothest from ATM accivities.  Not discussed.			Not discussed. N	Not discussed.	Not discussed.	Not discussed. Not discussed.	Not discussed. Not discussed.	Not discussed.		of discussed. Not discussed. 9	or discussed. Not discussed.	
ATM-32 FLEX Water Mannal, Education and Implementation Phase	.co.us/cwcb/Electro	lowestigation of FLEX water market insprementation: organization, their subset princip, backeting on large-scale good of this project was to successfully implement the Law good of this project was to successfully implement the Law Water Market concept through electricins (califoliation, and project for the control of the Law conceptions, with specific focus on solvestings (FLEX market conceptions). The control of the Law electricins and the Law electricins and electricins and el	le Index based pricing, theolizing on large-scale implementation in meetings between willing shareholders.  It is not a second or the second o	merens, impedat to flow roll discussed, other than a few poweral minimum or meeting to replace return on, the children of needing to replace return flow diffiguitions.	Not discussed Not discussed	Not discussed Not discu	seed. The FLEX Water Melental is of horizontational by a foliose of the loss of inchanges less and other arrelational plannifical posteriors and the second second second second second posteriors per control to implement a FLEX Violent Melenta & site considerated what effects the change of an execution specific plannification of the second second second second plannification of the second second second second plannification of the second second second second plannification of the second second second second second second second second second second for the second second for the second second second for the second second for the second second for the second second for the seco		Peor discussed	Red discussed.	Not discussed	port discussed.	Nect ascussed.	Estemative discussed that may effect index based pricing. "The WFPPC may offer the baseline to which potential selects (or lessors) pound reference, but the index based on historical transactions in the makes of the select selection), the makes to select selection of competitives suffered from several defects that violate basic economic notion of competitives suffered from several defects that violate basic economic notion of competitives suffered from several defects that violate basic economic notion of competitives suffered from several defects that violate basic economic notion of competitives suffered from several defects suffered to the several subsects of the seve	Not discussed. Not discussed if	Not discussed. Not discussed.	Not disconnect.	Not discussed. No	Not discussed. Not discussed.	on discussed. Not discussed.	Not discussed.

																					Next Steps				
					Environmental Resources that May be A	Affected		Streamflow (Hydrology) Impacts			Species Impacts			Water Quality Impacts					Program level g	pals	Data Gaps, Questions for Future Projects  For proposed future transactions, need to evaluat	e impacts (positive	or negative) to:		
Title	Date	Publisher/Authors	Description	Notes	Mannitude	Frequency	Duration	Tireina	Rate of change of hydrologic	Return Flow Impacts	Critical Stream Reaches Impacted (where	Critical Land or Ricarian Habitat Imparted	Sparies Imparted (what)	Salinity	Temperature	Other	Tradeoffs - Resource Impacts	Predicted outcome from applying "avoid, mitigate, offset"	No net loss to env. services, recognizing tradeoffs iscussed. Not discussed.	0.041	ISFs (or other flow targets)	SMP or WMP objectives / proposed	Critical habitat &	BRT environment te species of values lists corn mapping discussed. Not discusse	ntal CRCT Other known I/ conservation community / strategy entity project
Abarration ATM-13 Abarration of Dry Ingeled Lands	p of June-13	https://domesblick.state on.us/cont/Electronic Electronic 1920 88-date-0	relieve of Sorbeits and Issues of the Silversians Solvey and  when the Solvey and Solvey Solv	Nation of horizontal and issues of they and dry and alternatives, producing for conversal or a light to they into of the dischargedon, which was the second of the secon	impacts to interesting and discussed.	Not discussed	Not discussed	eld discussed	Not discussed	Separate research research research from these transcents, their question and on the temperature research resea	Not decount	Control Land or Rigidate Mishallat Repeated September 1, 1997, 19		Previously arrigated fields toned to have bridge of waterly or include with the control of the c	The Not discussed.	promotes weed growth over native or introduced species. Cover crops can reduce soil N through plant uptake. Soil ca	Noted disadvantage of limited infigation: "The water court transfer of a portion of the historical consumptive use, with the remainder left for limited irrigation, is difficult not decree and administer because of the Negative part of historical setum flows and	Not discussed. Not di	Not discussed.	benefits.  Not discussed.	Not discount.	Not discussed		Not discussed. Not discussed	
ATM-14 Water Partnerships: an evaluati alternative agricultural water tra methods in the South Platte bs	in of March-12 min.	https://dnrweblink.state .oo.us/ovelt/Electronic File.aspx?docid=19921 58.dbid=0	revoiders on ATM practices, leases, evaluation of sharred valuet bank scenarios on South Plutte, focused on FRICO hareholders.	In ATM practices, leases, evaluation of shared water bank scenarios on South Plate						Saturn forces for FRCO shares had alwayd hosen quantified. The 40 Dense (Saze ho Acc) (24493) and the reculting dist)—wide change destribes consumptive use, tracing decrease and capacidas, rechange appealities, are that energy of return store, providing bethrical and water married reformation that in ort pytopsily available on english of sold or sold or sold or sold or provided the sold of the sold or english of sold or sold or english of sold or sold or english of sold or sold or english of sold or provided or english of sold or english or english of sold or english or	sign a lease in which the water is used to maintain insteam flows for river system recreation: 24.1% are willing, 48.3% are no willing.  One question asked if respondents are will to sign a lease in which the water is used to maintain wildfeb habitat: 23.3% are willing, 37.9 % are not willing.	it is	Peak conscioused.	NOL GRACIANAS.	NOS CINCULTURANO.	NO. GELUSANO.	delayed return flows may deter runzricpalities from leases (they would favor permanent agreements due to the high overhead coots).	NOT CONCLUSIONS.	INCLUSING.		tasked if respondents are willing to sign a lease in which the water is used to maintain instruent flows for fiver system recreation: 24.1% are willing, 48.3% are not willing.				
ATM-15 Project Report Like Cannel alter agricultural practices and in-strea agricultural practices and in-strea demonstration project	ative June-13	https://dnrweblink.state .co.us/cwcb/Electronic	urdice statum, inflow for exchange pith, and soil moisitum excensors overly return flows by laudicyseasor of moisture excensors overly return flows by laudicyseasor of moisture returnment toking the cost zone. Project was not implemented by the control of the firm policy 2013 and an excensive statum of the control of th	Rows by lank/presence of modulum movement below the root zone. Project and on the presented due to project goals or story of the Project and on the presented due to project goals search of the through the project of the project goals are the total state of the project goals and the project goals are to the project goals work to arrive at proof of concept.	would yield consumptive use that would be for stream flow enhancement in the Cache Poustre River between the Lake Canal Co. There diversing (notion of Fort Collins) and Greeley No. 3's river diversing (nests of Greeley). An agreement was not reached, impact; it was understood that return flows would be registered in time, amount, and los thereby causing no negative impact to streamflow.	e used eturn flows wou is to be replaced in 1.5 in time, amount, an location, thereby causing no negative impact is streamflow.	d return flows would to be replaced in d time, amount, and location, thereby	Direct the amount of sawed consumptive use water is concerneded, the Weller Growers will influence the entire of the delivery to the Poude River.	Not discussed	measurement of return flows and transferrable consumpti use was proposed rather than relying exclusively on the results of a historical use analysis to determine transferrable consumptive use and return flow obligations.	I neterrophible water supply agreement that mould yield consumptive use that would be used for stream flow enhancement in the Cache la Poude Flore between the Lake Cache la Coal relief Foreit between the Lake Canni & Co. 3 river diversion (north of Fort Collins) and the Gendelly No. 35 river diversion (yeast of Gendelly No. 35 river diversion (yeast of Gendelly No. 15 riversion (yeast of Gendelly No. 15 riversion (yeast of Gendelly No. 15 riversion (years of	Not discussed.	Not discussed.	Not decused.	Not discussed.	Net discussed.	Participants need to outline all their necessive/participants at the onset of the negotiation process otherwise it could have unintended consequences. For example, life in the negotiation process, it was discovered and an example of the consequences were never considered in the initial discossions. These elements added another layer of consequency to the waster transfer and marriagement.	Not discussed. Not di	Not discussed.	Not discussed.	Comments on the MFRA application to the SEO on health of the CVCCS.  SEF Section stated that it supported the efforts calmined in the MFRA proposal but had three comments reliated to CR S. SEP 242-2500.  11 but of the aim revision thour potential many produced to the section of the section of the comments reliated to CR S. SEP 242-2500.  12 but of the servin shows through more from programs and protection.  The proposed exchanges could potentially estands to reaches of the Possite River where CVCSB notice to the section of the Possite River where CVCSB notice to the section of the Possite River where CVCSB notice the section of the Possite River where CVCSB notice the section of the Possite River where CVCSB notice the section of the Possite River River River River River River (SEC SEC SEC SEC SEC SEC SEC SEC SEC SEC				
ATM-16 Final Report of the Lower South trigation Research and Demonst Project	Platte Jun-14		calculation & verification of consumptive water use and wate savings, such that water court requirements can be satisfied uses a stress coefficient, the crop water stress index CWSI, and the ReSET model of remote sensing. ReSET showed securacy of 92-96% for fields under normal growing couracy of 92-96% for fields under normal growing.	State were 1. Develop catastation in wiredation of consumptive and the sale of the sale o	and additional return flows may provide be to rivers and downsheam users.	Gve	Not discussed	of discussed	Not discussed	This goal of the althoution approach has been seen and make the costs in below seen when the case cause and practice. Taking vision flows seen which institutioning seen practice. Taking vision flows seen which is institutional practice. Market cream from the control of the control of the fact control of the control of the control of the fact control of the control of the control of the fact control of the control of the control of the desired control of the control of the control of the desired reduction guarantees from paid CLU see See purpose of the control of the control of the desired reduction of the control of the control of the desired reduction. The control of the desired reduction of of desired reducti	d	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed. Not di	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed. Not	discussed. Not discusse	Not discussed. Not discussed
ATM-17 RGWCD Net Annual Replacement	Reports exis for each year. Reviewed report for April 13, 2020	st https://igwod.org/isd-1- annual-replacement- plan	or exchanges to meet streamflow criteria, temporary including appearance, its Reviework to 2002 Aresus Para Guidening appearance, its Reviework to 2002 Aresus Para Guidening appearance, its Reviework to 2002 Aresus Para Guidening and Control of the Control of t	No Grands Water Commercing Dates if pain to most infectable composits through retension of general residence of general residence of commercial			Not discussed	ict discussed	Not discussed	Not discussed	Not discussed.	Not discussed.	Net discussed.	Not discussed.	Not discussed.	Net discussed.	Not discussed.	Not discussed. Not di	Socused. Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed. Not	discussed. Not discusse	Not discussed. Not discussed
Alternative Water Transfers in Co. A Review Transfers	er 2016		municipal water providers based on water source and semand size criteria. Two case study participants were	elegant conducted a screening analysis to identify potential case and a screening analysis to identify potential case and a screening analysis of the conducted analysis of the The case shall participate were identified. City of Fourties and the conducted analysis of the conducted analysis of the participate analysis for the best case stated findings include excorrespondings to the best ATMI practices to set those manifestation.	general is "to maintain or improve streams which support environmental and recreation activities" and that environmental interests be involved in water transfers. "The instrea-	low onnail cain are the two- the point libray, the ation or ons ween	Not discussed	kit discussed	Not discussed	The report remissions that in general, the sealer right held re- sponded to mealine-basic relation from general re- sponded to mealine-basic relation from general re- port countries and the sealer re- port countries are not impossible by the leasester or change.	general is "to maintain or improve streamfor which support environmental and recreation	Note of secured.	Net discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed.	Not discussed. Not dis	iscussed. Not discussed	Not discussed.	In the discussion of offerent transfer modes, the region of the control of the control of the control of the property members and the region may be important provide for regional from Such misses for lesses to the control of the control of the control of the COVIC in region to less of control of the control of of instances have been and delated as done of instances have been and delated as done of instances have been an of delated as done of instances have been an of delated as done of instances and delated as done of instances and delated as done of instances and delated as done and the control of the control of the language and the control of the language and the control of the language and the control of the language and the language and and the language and and and and and and and and	Not discussed.	Not discussed. Not	discussed. Not discusse	Not discussed. Not discussed

## Exhibit B-7 SCPP Documents with General Criteria

					Project Location	- Silventine		OM Program Emira		Source and Amount of	Comment Water						Fligh Level Program Street		Pro Pro	un Medianes	
Title Cale	Publisherikulturu Description	Notes	Primary Purpose   Steel of Report   Steely	Kay Takansaya (Madata(in Chipuba ) Cusi)	Project Location(s) Latitude Securiplies	Langitude Elevation (two)	DE Programitativity Name	DM Program Structure	Nation of DR Proclams	Destine of OM Pealine Implementation Implementation Conserved Conserved Conserved Conserved Conserved Conserved Conserved	outi of Water Conserved. red Consumptive Use (CCU)	GM Program Administration	OMProgram Manifesing & Verification Considerations	DE Program Education and Outmach Efforts	Tools Used in Massare Enrard Cultumes	SM Program Funding Considerations  SM Program Economic Contin	talions DE Program Agricultural Impacts Consideration	Fermalian	Program Lawrent Lawrend	Manifed Program Economics and/or Challenges	Program PresiCons
	This was vising report hoster of a souther the endudes in the consistence on an EUPP report of the products of the formatter of the contract o	the model's asserted include increased environmental forms, the increased could of admissible buildings without an object, which is almost the buildings without, variety in almost the board halfest from the moderage of upraints, residently of increased them for the contributed and hydrogeneer is medite, increased from the life mentaled followed purplets, buildhelded obtained for the contributed of the medited followed purplets, buildhelded obtained purplets of the medited followed purplets, buildings and see exceeding the contributed of the medited followed purplets of the medited follow	This propil expires whether he endudies in C 2 providing by the DCPF are provides of like in health is addition be rejected with of the south is questly the manuscript interface of line DCPF project case wholes. The health starked and included in this numerical has been too association include the following and included in the contraction of the lane same distribution include the following 3. Homestical included in the contraction of the lane was distributed in the following 5. Homestical included in the contraction of the lane was a single property of the lane of the lane was a single property of the lane with the lane was a single property of the lane with the lane was a single property of the lane with the lane was a single property of the lane with the lane was a single property of the lane with the lane was a single property of the lane with the lane was a single property of the lane with the lane was a single property of the lane was a single property of the lane with the lane was a single property of the lane with the lane was a single property of the lane with the lane was a single property of the lane with the lane was a single property of the lane was a single propert	Description of Proposit  Applications for the proposit of the set in \$10,000 are subset from the descinate distriction of CU excits to the Current Valley Process Plant.  In the Current Valley Process Plant 1, 100,000 over a relationship from the transparent of the Current Valley Process Plant 1, 100,000 over a relationship from the transparent of the description of the Current Valley of districtions of the Current Valley of the Current	Dural Valley (CO) CO-38.189107 Middle Proxy Cresh (WY) WY-42.814200 and	CO 10828010 CO 6703 Bye WV 11020804 WV 7587	siten Comerculos Plul Project in the Upper Accusin Nace Eastin ages Studies Liste 2008	PP-is, an effect initiated by the USBN with seromal-large. PP-initiaged under prevailents in seminder state house. PER-initiaged under prevailents in seminder state house. PER-initiate Pitter. PER-initiate Pitter. PER-initiate Pitter. PER-initiate Pitter. PER-initiate Initiate house. PER-initiate Pitter. PER-initiate Pitter. PER-initiate house. PER-initiate Pitter. PER-initiate PER-initiate Pitter. PER-initiate P	7: Pail Emmo Palow W. Ingulario after 191 1: Ingulario El 191 1: Ingulario after 81 1: Ingulario after 81	Colorado Rismo Colorado Rismo (CO), Plany Carel, (NP) Sala, van 7 Malia Piray Cont. (NP) 2016 1341, van 7 Malia Piray Cont. 2016 1341 1341 1341 1341 1341 1341 1341 13	they Proposed 3, 2005 AP CCCU Tolled down 1 Salains 2, many Coresis 130 CCCU Tolled in 27 AP CCCU Tolled in 2016, some	and.	lid decreard.	Tel descent.	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Lemmon Learned Survive Springs Conservation Parkets skip Program	TSC's beans barred in fact ECPP reclaiment, localing features from Total Unlimited and Catenate Visiter Total The Nature Community	Top 3 Insures culmands & communication is examined, approximant \$\int ping insures made in additional of dishi- company/religation dishink local simplify the presents for effectively.	Leasure hanned been the SCPP. The paper modify addresses the shoulder of the SCPP. Program Proceedings Project Development, Project Deplementation, Illian Rights & Yeller Law, Operational Source.	Fig. 3 houses.  Chirank E. Ammunisalan is resental.  Openind E. Ingilianan mad be addressed at dish sumpanyleigalise districtions.  Benjuly to process to a distance.	of SCPP projects. Program side lasts.	NA NA BO	The I	n program shoulder was not explored in detail.	nur e projeniu. Programatike nomine.	Condition of SCPP. Not decreased 1 and a Tod decrease people locks states of services of teasure learned from softer program.	own and a project had a life the law to be a linear a heart of home relies . See La	unami.	van manusand i melman lenume leamed only i Ber Lenamen Leamed.	non removated i minima limanos learned only ; the Limiters Learned		of demanated in feled. Eastern classification in contract and demanate in feled. Eastern the contract and contract and contract and contract and contract and contract in felescope felesc	come admini Deme med diseases in sideal. Pathispanis segrementi a desire lo plan sideal stopo in mon personnial fishio.	fild discount.	"Unknown de Assementation in neutral per de neuerond progene". "Whe havin is alien who they seed on maligue" inseem al for dish assempsylving date debits benet. "They by the prosens."	Reseases. The program should support relateding our natural communitive our and guidelows he relabilish stature following some should support related by the stature of held such as the stature of the s	that discussed is then not address larger peochers, subse- section learned in the addressed in falses years.
	Evaluation of energy-der-resides, of the Curreless New In a series between the little (in similar a principle of section 1 to the lands	Statellist, Augment PROVIDE Model, and CASSE are evaluated for find seguidation is strateful Augment Dat operations, environmental force, and patients useds beauting.	To bin report, neutral computer resoluts of the Coverino Victor same evaluated in secons that skilly in tracking a polestical suder hands to the hands using the depoid DM executives same for thesi conversaries appearables, included prodocentral flower	Our matrix of the matrix, somethy available related in the Maddled is the held uplot for replaceding and feeding stations having against additivitive Convolute leasts of movembases, and consists a distribution for the major description of the distribution of the distribution and the feed consists and what having the complete magnitude required the distribution and association.	Survivian Floor of the Asia.  Angle of Unit	NA NA Dia	in dimension is a modeling evaluation value on discussion of a CM program. Specifically existent enabling a water bank at the good Unit.	decement on analysis of the mining models in he — No. In inhunder soles harding in the Aspiral Unit.	danari.	NA, rest a project. Not discussed - rest a leaf a residency people had a residency shady. Model.	noed - not a project tod a		lid daward - malaling skelp	Not dissected enabling study.	Elabified Survivan Five Made:      Five Visual of the Survivan Five Made of the Survivan Fi	d danaged - making sludy. Hel danaged - making dudy.	fiel discussed	fiel discount	facility mains send in in malfacility died in the address appropriate made and only units harding, but also environment from a manading for site filling of the manadists and have alread under its appropriate.	Amongs, the second of the seco	Similabilities containing this latest options and will recopion the statistical containing the latest statistical flavor statistic rightly result areas, and have the error consult fill assumed by will see the containing will see in the containing will see in
SCEPAS Committees for Middlings a Notice Bank at the Angined Mid- 4th Current Endowmental Please	using the Aspiral Unit measures and the effective Committing for Mythe Committing for MC.	intelling, Agene MPACHE Mosts, and CMM are resistant to five regardless in which Against 10th in genetics, servicemental laws, and pointels with shorting. If generally, the models the limit Copyrum wire right, one EEPPOD empirements at the Followskin page, and a union, teaching upon a highest Mindelston in the Governor Haddlind are reservant in similar environmental laws, and enhance reservoir assumpting upliess.	Dall servoires and the offend on reservoir spendiem, including environmental form, for serving securities the left in het has been destined and sear part of the Applied measures in store and half up some models to mellan been following ringdom pairs to any compact and mellan the seque models for the such harding securities and securities and the security of the securities of the securities and the securities and securities for the securities and the securities of the securities of the securities of the data include that a falser assurable performed even control from each president and Applied with one of the securities of the securities of and preside a fluorishism for securities progressively more compiles or marked filtered sealer includes the securities progressively may compile and.	undelder injulien systems and shrapp heillites." Note for modeling seas and askadly store is differentee impact in anotonomised flow impacts.		i i	perfort								In Bladdord-Gorokon-Fixer Mariet  Fixe-Villers Bladdord-Gorokon-Fixer  dendoped by the PEO and IEE  A CHEEK Row-Viller Medical of the series  Calmador-Fixer basis  Colorador-Fixer basis  politication of the basis of the series  politication of the fixer basis of the series  politication of defaulted basis of salare  basis of the series of the series of the series  and the series of the series of the series  and the series of the series of the series  A series of the series of the series of the series  A series of the series of the series of the series  A series of the series of the series of the series  A series of the s						ensering of serb.
BCP ***	Ferinas CHB environmental transfers in Insalina child principi. Examines ECPP projects in this less, given to EP lemellas d ECPP. Franci But ECPP Academ projects had the offest of enhancing streamless.	Analysis wast UCRC 2018 Find Report, no new data.     20,0000 view of ISP projects including SCPP projects.	effective and the facility concepts at Buyinel father and daring a compared self.  The propose of this project is a second branches of secondaries and only be been formed by the best of the project of the content of the project of the content on solicity is send by the relative modeling up the real magnity of the Coltect on solicity is send by the relative modeling up the real magnity of the coltect of the project of the p	Medinigothanity, although formal traum, wifes or other anomalous of union rights for involvemental constraints lightly used in the 2 least, under rights believe, and conservation of groups have engaged in numerous less lessed, whethere death load do not involve a formal	Park of the Colorado  Factor satisfactor Artima, Colorado, Naca Mestos, Usida and Plymening (Paper 1), Nac data provide a brief sproppin.	NA. NA. Sale land 1 Cols No.	d a specific program, an american of considers, resulting in environmental iterative obtains consider training to environmental iterative colonials from Eminematoring California and long- monta.	In it, an exemple of environmental transactions, mainly for some harmonisms (i.e. not generated), including spill. You man harmonisms (i.e. not generated), including spill. You man harmon, temporary distinction and properties and policies in the properties of the control of the policies and the properties of the control of the spill of the policy of the control option, among the policy of the policy of the control option, among the policy of the policy of the policy of the policy of policy of policy	or reportinols al information reviewmental scales becausalism, reportuly expellated death that do red require a change in the fact scale regift but have the principal or flowing similar receivance or elemental mentaliting channels." Types of autions index alreadors explications have been proporty lateline bank alreadors explicate index and proporty lateline bank policy in information opposition, thickes to have under a between or you and changing dismoism who," who,	e CC for report inde d formal red informal red informal servanisme from 2014 - 2017.	er 2 (M) pg - NJ, Figure 7 - NJ spec TT, Figure 16 (MY) pg - 24 - House in Ne CO, NT House in Ne auth	reliarly described in 1 inches for embourselet subsense of preventions including executing in the ICCV and these funded by ICCOs. The open specifically reviewed from regarded is the authors by somewhite. ICCOs or by organizations the ICCOs entered are to.	Not discovered	Not decreased.	Time point to the humanion.* He Constitute body impacted.  'Think point is an investigation of the Constitute body impacted.  'Think point in the constitute of the constitute search of the constitute of the con	noises ICPP projects and other field discussed.  Beautifum matrixy landed by  100s.	Secondly discusses for impolaries of legal machanisms in allow shanges in a scalar right for environmental incidence have fit.	mysery fiel dissease.	Successional are provided to each sider for Colonials Say specifically one "Coday and Suprace Side Priction Consensing Fundation Principles "Consenses to Provide and User for Stationary Principles for Historian Consumption User  "Consenses to Provide and User for Stationary Principles for Historian Consumption User  "Consenses to Provide and User for Stationary Principles for Historian Consumption User	Examinate.  Indiginate and granting more conductably price after your with scalar conservation programs, Barly data partial is logical protections of their value rights and consemption our whom model in scale programs.  Consensation programs have bronzestel over the analysis posted.	fiel discounted
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School Constitution and Administra	Sewipton of Hypothy SC/F. has a works, participation, and falses whole.  Upwelly SEO Coloney, AUPA.	Neither solerates on technical, but includes some description of processes. It participation.	The paper describes the SCAT-Entityment, here it works, participation, blace effects.	Fix date, all property artificates have dated exactly what they seen controlled to de. NOSC comprises that (ICOP) is a lost that may hely provide extendly imported international soluted to the the shifty of decreand exacupations?	Wjuming (mit a project, fact an exercises) Describes Wjuming (s allerink below X participation X participation in SEPP.	NA NA 10	PFC combined SER Opening participation and SER Opening participation and SER Opening participation (SER Opening participation).	PF -majored programate deliating mash project, for the incident andre concarned, monthlering and verification or, duration and project of the control of the	I for vehicled polyech in Vijensing are agricultural, partial, some following polyech wine intigation in the largest encoupling out of value in the Cross and Little Enable Fines designs.	BOP 2015-2017 W. Net a project. Med discuss describes miles BOP program	total field a project.	net discussed in delat, hummer participants appreciated the numbers and of the Hale on Other	Finds is not discussed in defail and dates married.  Finds alone of each project is completed enoughly by a size which is recover entricated actions are certain of end  and is recover entricated actions are certain on any  married y accord date; building an easier imaging it end  downwise recovers are alone and is not by that the project  according to execute the experience.	Total Understates Visiter Visiter Proper Impact to moved participants. In the Fall of 2014, or solventh moving man hard in participants in motivate the data had first in and downward in shell energy line the data had first in and downward in shell energy line moving the participant in the properties of the first line in a participant and that incidenced of the last Engineers (Other was appendixed of	and the same of th	yeare from the proper conversalism contaction for the proper conversalism contaction of the proper conversalism of the proper conversalism of the conversalism of the conversal contact of the proper conversalism of the conversal conversalism of the conversal conversalism of the conversal conversalism of the conversal conversalism of the conversa	evalue are folial decreased in enough detail.	fiel discount	No december	Red discussed.	field discussed.
agemate to drought sortingmay planning the Usper Colonals Nove Basin	Impails magazine				-		è						. Acres are annual to said, that the project are completed as specified."	or parameter represent electric large estal like in a permanent program and that incolorment of the Bale Engineer's Office was appreciated.							

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	70.	Political and States			Notice	Prinary Purpose / Saul of Regard / Shuly	Kay Takananya (Hadatalia Cajadan Casal)	Project Location(s) Cocaription				DM Program Sinushore	Name of the Principle	Practices replanerabilism Source (Program Co Structure and Programsy)	e of Water Amount of Water Conservations and Conservation Conservation Conservation (Conservation Conservation Conservation Conservation Conservation Conservation Conservation Conservation Conservation Conservation Cons	(M Program Administration	DIE Program Manifesing & Verification Consideration	DB Program Education and Culmonth Effort	to Tools Used in Manager Control Culture	nes DM Program Funding Considerations	DB Program Economic Compilerations	DR Program Agricultural Impacts Considerations	Fermation	Program Eastern Easternal	Manifed Program Scorenson and/or Challenges	Program ProsiCore
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# Exhibit B-8 Lit (Gen. Literature) Documents with General Criteria

						Project Location software	aton.	DM Program B	WEEK .	Searce Searce	and Amount of Concerved Water							High Level Program Structure		Program Effectiveness	
Yide Da	Publisher/Authors	Description	Notes	Printary Purpose / Goal of Report / Study	Key Takansuys (Related to Objective / Goal)	Project Location(s) Latitude II	.ongitude Elievation (feet) DM Program/Activi	Name DM Program Structure	Nature of DM Practices	Duration of DM Practices Implementation Source of Water (Program Conserved Duration and Frequency)	Amount of Water Conserved-Conserved Consumptive Use (CCU)	DM Program Administration	DM Program Munitoring & Verification Considerations	DM Program Education and Outreach Efforts	You's Used to Measure General Outcomes	DM Program Funding Considerations	DM Program Economic Considerations	DM Program Agricultural Impacts Considerations Re	reation Program Lessons Laureed	Identified Program Successes and/or Challenges	Program ProsiCons
Saleman recompy the Calumbia Rever basic analysis of seasures affecting agriculture	Albery et al, Marine Resource Europoisce	Analysis of agengacis from salmon-recursery relate attendance in Columbia Rheer	and from executing states any imposts or five recovery presences. "The second state of the second states of the second states are have augmentated in the Charleste Silver base, on the regions algorithm execution execution [—] Petershi and the second states of the second states of the second distribution execution and the second states of the second states are second states or profit against the second states are second states are second states or the second states are second states are second states or the second states are second states are the second states are second states are second states are second states are second states are second states are second states second states second states second states second states second state	The control of agreement in the element recovery without his described in the control of the co	invalidation agreement of this recovery remainsts, "such air modules brings to be a format of the regional agricultural resolution of the	Culturation Street NAM  States, ID, CR & WA  se	NA. NA. Augmentation of flows in the I Next Seath	Note Columbia - Not Glossened - book or provided resplication for the Columbia - Note of t		deven scenarios Idaho Water Bank and if recovery seminant water sundheed by LSSR	Placialisation has been purchasing water in the open found filter from some time. This Market time is place found as few bean raises that Market time. If you can deal to the place and as the place and a second time of the place of the plac	Analysis of economic impacts to ag for possible seasons to improve unition and teachesis population for teachesis population for the South Charitals River States.	Next discussed - resigned of Resources croped to the gift of the second of the second of the second of the second populations in the Steake-Collection River Steam.	That discussed - analysis of economic impacts to ag for possible summittee to improve althroic and exactled populations in the Studes Countries River Beach	that distanced - analysis of economic organity to go for peculiar locations in propose actions and searched policients in the distance and searched policients in the distance Countries from Rasin.	As the trible? has stated reductions to agricultural evaluations to the evaluation and the seed to the compensation by the federal government as a level high evaluation to cover profit losses.	Figure 7 accordance the present change is print for each of the 7 construction.  The 7 construction of the 7 construction and the 7 construction of 2001; or constru	The adults considered within long a model for a control and a control an	The dissert	The Security of profess security is report action and method population.	Not discounted - on analysis of provides transactes to response scribbon and stabilities of populations
Fearability of the efficiency and reuse reconscipling as a command-size at contract size at	Bethanu et al, Journal of Industrial Europy	Scononic model of water cost provided by above- work efficiency and reuse sochologies, including variations & uncertainty analysis.	code Submitted that efficiency and most can meet 60% of a stiplicated model to the Lawer Calculato River Authority services area (sentral TX)	yp. "Sicionate the such readily, healthin benefitied could of water processing by medicare-color word for the supplied of the such colors of the such as the such colors of the such as	And the second that difference and makes to the independent entire can make 50% of the pair projects in each first difference thereine projects desired and extending of the LONA various area. — We also without level invalidable downs to innecedure remotes of mout invalidable, parenting invalidable downs to innecedure remotes of mout invalidable, parenting invalidable from the second projects of mout in 100°CM. Occupied private entire of the valuable precisions are Experimentally and Section 100°CM. Occupied private entire of the valuability because are Experimentally distanced. Valuation distance of those wheat of an out buildings and buildings are partners well over 100°CM.		-97.792 550 Senand-olde management fil Management	urban water feet discussed:	Managed destandances management statistics 5 "down-order (paster use afficiency largered that equipmed by building county efficiency -2 mans shartdagges (building) county -2 mans shartdagges (building) county -3 mans shartdagges (building) -4 mans shartdagges -4 mans	Sot discussed. Municipal demand examplement activities.	Natt discussed.	feat implemented, studend by the Lower Colorado Four Authority (LORA)	er Mont discussion I.	тел большого.	No seasonment for environmental impacts escalabled with this specific shortly for the 2012 form Youth Plan for Feasi solitical a high- level passessment of environmental impacts of all recommendation and attenuate water an encommendation and attenuate water startagement strategies for Yessa	Studed the leveliped costs for technologies in a "registor- somediately" achieves versus a "replace-se-retor" achieves "replace-se-retor" achieves	date deur (2 minitor) - 1 artin.  Stancio P (Plus aggressitato (high Sou) and Resencio: Boscolo P (Plus aggressitato (high Sou) and Resencio: Boscolo P (Plus aggressitato (high Sou) and Plus aggress	Not discussed . Not discussed	This study highlight diseased assumptioned splanes to buildined water study produces and eventured a section of your test guide socionosistic will be supported to all the section of the	Not discussed.	Studied for several counts for Sectionary can a Projection introducingly Continues across a Projection or Continue Recognition of Section 2018, and the several to enclarate and several expects.
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Lines  Temporary warm transfers for unknown each except during strongers  water except during strongers	se bas, cite	PRES desertablish hasheling aglorine for bengunally or than dies	Ballishy to soft-water-topic purchases and construction additional reservoir storage.	The displaces of the execution has one an invalidity of the triffich, years belowing the seasons will be able to an an invalidity of the triffich, years to provide any section years of the providence of the p	Visibility of the adolpsis of inflational dryward supply solutions on agent that it is a seal of contribution of the adolpsis of inflation allowed still good and a contribution of inflation allowed still good and a seal of contribution of inflation allowed still good and a seal of the contribution of the contribution of the contribution of the contribution allowed contributions and and and and only the contribution of the contribution allowed contributions of the contribution of th	* 000,	Not detected.	Platformende à d'inveglir carbir equipy para a proguestal braineurs fin principanting a sur rigit option agressante (Principa The discipit sutter equipy les resolutions autoritate to the Stone Singapeers Chillion (Si for rivines and agressare uniter exerting Color articles.	Temporary transfers from Agraement (1995)     Agrae Option Agraement (1995)     Temporary Committee C	enigonaly) Aplicative	SOL GALLAGE.	auginuse positioties for consolation Anchoro agginuserina standardo dy seglicierra, timeyers, sed the parties and the part	Not discussed - Houses on discriminal and funding.	Conductable state restringer risk overs and conductable conductable state of security and securities addictables source and securities and securities addictables source and securities and securities and securities and securities and securities and securities and securities and securities are securities and securities and securities and securities and se	not mounted a discontract or the state Bill Se yellow the name of the state of the state of the state transfer of the state of the state state of state transfer.  National time and of the mass basis of the state of the state state of the state state of the state of the state state of the state state of the state of the state state of the state state of the state of the state state of the state state of the state of the sta	The epicht foliates on handing factors and has a wealth of information	The regard focuses on extractive tractive and task are elected of reformation	No. discussed.	The an electron traces are shown that is despite to the description of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the product of the contract of the contract of the contract of the contract of the product of the contract of the c	To Second	Not discussed.
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#### Exhibit B-9 ATM Documents with General Criteria

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## Exhibit B-10 SCPP Documents with M&V Criteria

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Find Report Contrade New System Conservation Plot Program in the Upper Colorado New Basin	2018 Slyper Culorada River Commission				(The last of considered streamforward diseasofties data made analyses from each state shadenging. In CD, StateCU, Hydrodians some relied upon and some generally sufficient.	Danielle.				gadjuda Jadjuda	s carcinated participation period and for water supply (restations).	amount stored. I SCPP report industries that count, single-user distries closed their ricer feedigate and simplified fragmen. Their observation. This	inadigates. This manufactural distriction and moultaid in unusued supplies returning to the few via radiated distringers or tailed lasts with stills refure from.					Pyllan direct measure Pyllan direct measure testioned for more an considered to more as	ement on fairs note sensing should be consistly quantity CCU.			operations, but resulted in additional additional playment perspective, Emake in a payment perspective, Emake reserving funds to pay the maximum to abbe nut reseasantly rending to use to funds, if less COU is achieved.	mysem unit.	Land Insignation Challeges are regarded (such as enters could research or managing clinicality ages and up fair middle hashing and produce to the country of		desirantes de la composition della composition d	I III.79 payments were made based on the estimated behavior OI valum, not the adhered COL incorporating a set, and average CU estimate in the application, would also program to broaded usuk based on the autored COL. A stage of micha would regard executing training all the maximum amount of COL, which likely another lise fully solvened amount affords to a solven man.	(%) (%)
												make direct measurement of those diversions impression.													<ul> <li>English conducted and installing the statistic is strapment satisfy the need to all makes the information of makes the statistic interestinate source satisfy to one water right underweed users, and protection from non-one of eater rights.</li> </ul>	**	The skilly is measure and projectly associal for each mobile is important to associately quantity CCU.	
		COTS update to UCRC full report, including figuredates C-(0018 update), D-(0017 CU enalysis), and E-(0018 CU analysis)	Document Includes Appendices C (2018 update), Ib (2017 CU analysis), and E (2018 CU analysis)	fluid discussed.	to general, the applicants in CO; NM, and UT unicidated including patential one-surprise was based on Modified Blaney-Cridide with an direction adjustment, while the applicants or Wysersey used remote sensed data [Landud salettle inaper); with the energy	17 (2018 (her options))  5. Assume one size of brigation provides one weeks: worth of is supply.  2. Assume the entire soll Joine	dissupport.  Char directed of districts for provided their property of their property of the district for district for day.	data Yunneadiy dinate station defined in each verificat potential CV using the daily Personan-Models's calculate sy C State valuelation (reduced by a Personan- entic controlled participation period. and particulations based on make supply lendations (pittle only calculations based on make supply lendations (pittle only calculations based on make supply lendations (pittle only calculations that distinct on the controlled pittle of the controlled only the calculation with SEO and the controlled only the calculation with SEO and the calculations are supply to the calculation of the calcula	nation gram. Yeld discussed. discusse and during an	Finded upon ready climate elation selected for each project. Daily allowed data each project. Daily allowed data elation selected elations required, and include all projectation and include all projects and and include all projects and include all	baled site visits staring project. Bod discussed. mediation. and approximit for photographs, and mediation of site visits. ("De-use of medity available.	You decused: SCPT projects were satisfied, in part to satisfied project to satisfied part to satisfied part to satisfied part to satisf	-3CPP projects were selected, to part, to: Not di dittar relating inharituature, including dish furnes below new, talend, another Sere inadigates.	SOLUMNIC POLICIANAL	This Stot decurses. Not discuss the discuss of the state	ed Not described. No	tot discussed.	toured. But distanced. The controlling guid- demonshish But vota- compositable middless flavor is a franche and the dealths of stable for SCFF are shed aller for	of SCPF was to Stary, bengotary, and Stary, bengotary, and Stary in the Upper thick to Late Picuel.	ICPF did not abbress proportionally directly. St ICPF did complete 19 projects to 2018 flour biles, in different river basins.	C dissassed.  OCFP did not directly soldiess this lesse, or have set a propert guid.  OCFP did should be needed as assumed for another address the prediction in this seesant.	Dol' discussed.	Not drawned.	Six multipathy SCPT projects were comprised and including 88 purispects allowed for underwised usual projects desired flates asked when projects allowed by more Profestly, but required more advantabilities remained flates asked when the projects allowed by more Profestly, but required more advantabilities remained and an appropriate belonging approved included projects and provided projects and an area projectors. The project payment is benefit and project payment acres payment.  The project payment is provided projects and projects and projects and acres and destinated an appropriate projects and projects.	end, in Ned discussed.  As A	Proused subsash confinued and use to ass directly responsible for ERTs of 2016 proposit through its haused and local subsash.	DIX oncreased program tracking generally required additional adminish blue coordination and efforts.	Based on the reported analyses, approximately 27,805 AP were curearized in 2019.  Only The control conditions in 2015, resulted in some participants achieving a leaser than average CCU volume.
SCPP-08 Proof Report Appendix C 2018 Syntem Conservation Plid Program Update	2016 Spper Culturals Rose Commission				Evapolismapmation with High Resolution and International Califoration).  The leak of considered silvandion and direations data made analyses from each	was filled during inspation and would be fully consumed d Demarker.	shemian man slaffin each sla	orde, consideration with distribut, or decumentum with SEC distribution	OOWK	Immpressions, humality, sublation schmain and wind opened. CUI (mil Pression Cuidale specific (adjuste	cida la calculate the patential durant by offendine procipi using a in Mindello se recultined Europy i calculation during the properti- ci contented participation period and for water supply limitations).	Selfow for, Selecut, and/or Series (madgates.	2-CPF proposits were extended, to part, in Mod of CPF proposits entering infections, rectivating pitch his bosses believe miner, indexed, another face mentioplies.  Dish loses: A SIGNET proposits manifested their proposition of their propositions and inclinate propositions and inclinate propositions and inclinate propositions and inclinate propositions are proposed in the proposition of their propositions and inclinate propositions are propositionally propositions and their propositions are propositionally propositions are propositionally propo					SCPF was not able to shelder the content of the shelder the content of the probability of the last of an One large daily lighters. Fullure denot measure reducementation, or one sontweethers for one and	of measurement devices one and dish company		s reducibles in table season settern Souns sharing the prop- set of the proposed of the prop- set of the property of the prop- set of the property of the prop-	-		Secretary princess.  OCCPP without the application to include more on form information, which reduced the abstract aims in announced to abstract and announced and other announced and other announced and other announced announced and other announced and proposed announced produced in the 2002, allowed for expendite efforts to execute contains before the staff of proposition and the announced an	D. Adminut, and So Dan			
		2014 SCPF landing agreement between CRB section.	Perviews failing of compacts, storage altinuances, demand management efforts by agradates, Delters gods and	field discussed.	Galle shallenging, In CD, StabCU, Sylvidiates aren relad upon and serve generally sulfished. Not discussed.	Not discussed. Not a	discovered. Not discovered.	4	Not discovered.	Not discounted. Shit disc	sivered. Not discussed.	Pol Gounne Pol Gounne	reculted in unused supplies returning to the form via national distinguis or tailed back with stills return town.  Stol discussed.  Stol discussed.	Oncorane. Not decision.	Not Not discussed. Not discussed.	ed Not decided to	lid discussed. Not di	sunsidered to more as sunsed. Not discussed.		To 3CPF agreement asknowledged the reed for a implement geographically diverse	I discussed. Paragraph 227 slates: the Parties desire to cooperate	Not deceased.	The establishment of the SCPP was exploitly for the following of agriculture	Not applicable for the plot program agreement.	Not applicable for the plot program agreement.	Not applicable for the plot program agreement.	Not applicable for the print program agreement.	Not applicable for the plint program agreement.
SCPF-05. PintProgram Funding Agreement	2016 Bureau of Reciprositio		management delicits by signalistics. Defines goals and parameters of ECPP, therefore NPCEI programs for eight spiped on farm manameters requirements. ECPP and DNSP ensures but projects will sounderable with respective TOPCE Siz- Connervations b.																0	a implement geographically diverse amenicalism measures in both the Upper and amer Colinals from Blacks, is mind (facilities) demonstrate the efficiency of colinade New Toylories wisher efficiency of colinade New Toylories wisher efficiency and adolps and manager the relative of water emaking in Lakes Mead and Powell.	with the coars of scales for agricultural purposes, among adverse economics and environmental enjands, and compressable volunturally exhaulters, of CUVsy follows		exploitly for the following of agriculture lends of increased uniter efficiency, where by other system houses or demands would be eliminated in reside created conserved uniter the sharings to Lates Pleasel and Mead on as to manage uniter elevation treats in Lates	15 to				
		Note: bank planning phase; consensative extinute of potential VMI copplex, and demand for those	Includes palential VIII uses, supply, magnitude & Teigency of reed, supply use scenarios. App. A: salespines of VIII slope action uses, App. B: CHEC VIII Presidentially Study Viiian Supply	Not discussed.	StateCD was used to estimate the origidate water requirement or consumptive trigidate.	e ET sectuation was sometimed. The saleg the Persons Shorkells. Date :	if addressed. Identified that return considerations and modeling were on farm analyse	savings through defail intuition are difficult to determin year. The report flowerd on a conceptual analysis and	ne without hid discussed.	ET vertication was considered. Not do using the Person Modelsh.	scened. Nid discussed.	Not decimant. Not decimant.	Not decimated. Not de	Occused. Assumed a 10% seduction in volume to Less Party due to com-	Not Not desirated. Not desired	ed Mildrand N	Code Code	et dala Sun: Net discussed. Silver Smallelly for prod Della, , and Yellow participation.	Luces to vary defact.	Not specifically addressed, but the report to see estimate the total pre-Compact water do	agricultural terror tony or in edited court institutions in C excited injury to exhibing each opposit.  Both is a suitable copy for fact in a suitable copy for fact insignation provide an	U  Mountains (facility concerning the arm debut singulars of particle and affails o particles the participation by growers.	white our rolling according on the second of the control Code second code of the control Code New Zystem, and to reduce satisfy, and of Net discussed.	An estimated 150,000 APInyaar is the maximum amount uses that could potentially be next town a titude thank.  Could be next by 20th whole implate on 100% of qualifying allitide and publishing years bolds.	On favo mentioning.     Advant mentioning.	The feedably of defail trigolism is cell- to long lates naccess and statelly of the	of 15 some areas of Shelon 7, good Compact valve shared in wearous is release to meet projection demands on triggle	Ber Cideron SM Program Eurosom Consideratives, Trest Shed in Silvenare Seemed Collaines, Prignan Eurosea Learned, Meridfied Program Successes and/or Challenge, and Eurosia Calendaria.
			maler uses, Ago, B. CHC VM Preability Study Visiter Supply Technical Memo, Ago, C. Elia of CCK IIII Hybridapi Samani aCUCRE model, Ago, D. Banin supply & use companion scenarios for CHC IIIII Inclinial memo		<ul> <li>BlainCU was used in estimate the impation water requirement or consumptive impation requirement.</li> <li>Local climate station were used within the StaticCU analyses.</li> </ul>	Carlesi, Della, Manson, and Yellow Jacker. All one seed in	ly important. Die CU sanings. Diffe cannot be grown as a cover a herause of its deep roof system impacts to return block to the river.	savings himself virgides are difficult to informative year. The report blowed an a conseptual analysis and ge Brough debut impation would be equal to the average when highliten was surfailed.	age monthly	using the Premium Standards, method with Colegithd data from Curton, Draft, Mannon, and Yellow Jacket.				Lees Party due to com spalers transit toures.			Manual Jan And	sarticipation.	2	ions referable the fold pine Compact value of spills in Discourse, 6, 8, 6, and 7 littlebury in the colorable Nove.  Assumed the Ward Stape pine Compact Ag- model by the source of water for the Waler land.	coale vale todget can ecolotisted.	increase the participation by growns.		- Could be not by 20% and be impaired to 20% of quality and the analyzation great battle. - Could be not by 20% and being place on 20% of quality and the analyzation great battle. - Could be not by 200% ability analysis on 22% of quality great and analyzation great battle. To binding Pred Com- traction of the 20% o	Others resolvering  Admit all resolvering controls of the control of t	Visite Sant.  - Fallwang and deficil intgation program tions teen implemented in other areas a socioes and analy provide a model for implementation.	all 3h same aman of Disblan 7, you'd Compain water shined in seasons's in shakea it meet linguish orderandor in tigate seasons's in shakea it meet linguish orderandor in tigate seasons's shakea in the same of control of the adopted to the shakea of the same of the same of the same plant in the same applied to the same of the same of the same of the same plant in the same of the same of the same of the same applied to the same of the same of the same aman. Author sections are as a same of the same of the same aman, but the same same of the same of the same of the same aman.	endor Challenges, and Encount Ceanned
SCPP-ST Calorisdo Note: Walle Earth Prantibility Study Photos 1	2012 Colorado River Water Consensation District																		.,   	Pidential users of a Water Bank supply studes their Stope MSE with pinch Compani state rights, East Stope MSE with pinch compani state rights, and Vent Stope ag- ance with officed users supplied by pinch compani state rights.				To provide upwarders of waging bild are in sept sensingly to make a desirability algorithm of the straights place of the compared towarders of the c	ICU.			
																								To 15 years, with the mind common values of 27 to Eyeans.  "The amount of CLO bear exists inglishes to soft eyeanth adopted on many feature.  "An estimated 8.6 violes of 87 to required to produce 1.0 lbm of affells.				
		Water bank planning phase, but cases assessing on fam impack for representative intgalian systems	nocludes carabilidate apolenos, scimenteg citheria & sethicilori, schiolis for eyelem mostudation, financial impacials son ang opis, operational scienciales & composition to ACM sexts. Appl. A. Carabilidate spices and settlements & composition to ACM sexts. Appl. A. Emol Com- combilidate spices and smithilidation. A publication, Appl. & Temi Com-	For Tigh elevation grass packer, the trigistion disensions is elevations are rainly enseared or recorded, making direct accounting of freezing CD STATE.	one: The tack of adequate measurement devices at the Epocked locations indicates the need for CV administrate location on remote	The tack of adequate That measurement devices at the E moor provide housings the Event	if density discussed, but paper in Direct Measure immediated fields for following fields on Carm measure discussions while a notifical sound in the control of the control	summent - Finduced degletions would be computed from summents of hids diventions less half influent films for a rough reduced I/O conditions from following or adult into	om dreed. Zatindy and selentum touwer may mal full CU. Satinating or defaul intigation more about basison. In control farmers, as trousded lands	ike - The availability of CuAgAM: As dear solite stations readily can help sometime polarization representation can 0.17 - Direct	united in "Methodologies to verify "Aid discussed.  ved consumption use" column.  [Measurement]	Mil decimant. Mil decimant.	Tot decimand. Hot d	ONLINAME. PAIL ORIGINAL	Tel: Tel: discussed. Mid discussed discussed.	ed. Not decisiond. No	of discussed. Not di	suned. Not discussed. Ceffold sitgation may be acceptable than related conference and production of the conference and conference and conf	to feasible and more  for installating in some only multiple over selfs multiple over selfs multiple	Triginal sussenting unbeta tricitabled system. As savage, otherstain, supply trimbed consumptions are lose of data in practicable as an lose of data in practicable as	surred measurements. Identified as a key old be all trees real. sometimedian.	Dee Table 10 for surveys of badeofs	This is the overall goal of the project is logged challenge is shelpheding the other in the CD Stabilities and the	to Cloud resources of reduced displation at the believed is not proclaim due to the officially of resourcing at number spondability return times as well as any time; permittion, and in the last of testimal elements for deplation, resource sources when all times resource and other source in auditors.	Subtracted Conduct research, or support research to be done by others, tids the feasibility to this.  If following or adult angulars on high brenders peakers.  If following or adult angulars on high brenders peakers.  If the conduct the subtraction and the following or ordinal residence or described in the conduction of the conduction	ad repairs. I Adversaciation of water banking for eyelens with multiple shareholders will and the security the architecture of each	The first case system interviews reaffirmed this understand and demonstrated that the challenges may be broad and carmine. Descriptions at 1864 facts will require a conserted	ing line previous comments.
			Condidir system identification & evaluation, App. 8 Test Caro life reports	when them are usely resourced or recorded, making dend consculing of Tempine TO of White.  I For private fittin systems, downsteen and relation those are included parties for the systems, downsteen and relation those are included parties of the systems of the system of the Foreign of the systems of the system of the systems of the Foreign of the system of the system of the systems of the development of the systems of the systems of the systems of the systems of the systems of the systems of the systems of the Foreign of the systems of the s	all the Eposped localisms indicates the need for CU solutidations based on menute sensing, meteorological data, or use of alamismal sales requirements by only type, elemation and integlation type. - StateMed and StateCU serve considered U during the screening activities.	mend for CU calculations based on remote sensing.  meleonological data, or use of selected mater requirements by hald strop type, electron and properties type.	se with substitution and to accord plate impacts is other integrates and eiths of geometricities found offer-habited, flatherine, etc.]. In other winter and geometricities return is should be measured.	consense. The followed angletines must be an empirical for the consense of the distribution of the size of the consense of the distribution of the size of the consense of the	eight be taken out of production with a repaid on overall yields. In addition, ion of one educated integrals of these banks may to added the second of the control of the Various per demand and harvest and serings (interties; fuel, takes, equipment	tes data Cop 1 Rend Main Main Main Main Main Main Main Main	Manasament Traid Differences de Médicals of Baltenation resignat Calabations or resignat Calabations of regions Use land Crop Water Requirements							saltings of haydratifie of violations. Novement, de estimation of CLV salting sould be more shalting to lask at anothers flour ethnik of autorigation. See It page summary	measurements and the	conage, elevation, supply britised consumption on on, type of district organization, priority of unite or oppy; amount of water supply; topy types, rethind of uniter debusy; bostom on tree, contains reticities to other varieties (glids, limition by basin, and satirity effects.			getting that notice to Lake Present or Lea's People.	monotonism when there are set at any simp providing, and it is that if their art district of deputing monotonism control than a final and the set of the s	To Thiss.  It following or shold a significance in high retrivation parallers.  I Exclude the production product of production of the companion of the companio	project's management (i.e., water user's to be able to accompany board in a successful.  measuring. Success of the Water Sank will be at Vitaler Sank will be at Vitaler Sank will be abundancy Simonia and agencies regarded to the project of the sank and publishing with the sank adjustment of the sank and authoring with the sank adjustment, and working with	and demonstrations that the shadeneges may be trivial and complex. Developing a Minde Response of the conditions of the shadened and secondaries of the condition of the conditi	
SCPF-88 Colorido Nov Yoder Sack Peachtly Study Phone 2	2013 Per Culturada Riser Diseasa. By Miller			measurement, Ex. 407 and adequate for observing larger sensemptive seen. These proposes would also require entimation of reduced CCU through remain sensing, reducating paid data, or pilet administe.  - Ad 40% size white remained difficulties to saler handling administration. First, connex 60 to explores had administra- seasurement of allowations and educations to develop entimations. The control of the sales and educations of a shallow throughout CCU through a mass bullation.		sipale signal suffic Con- side	tens will have measurement addition or historical data black for historical data black to exceed your paper and an arrange for Water Bank. I Melanchington Standard Son was before downloan, and return Dehibblic stall.	and on aerial pholography or sabrille imagery used to e age, evapoli anaphation (directly or indirectly), or up yet used data. Indirectly or indirectly or indirectly, or up yet and Catholishions of Consumptive Use - Maler use sooid or the reasest Colorado Agricultural Melonological Net data or other melonological of the Catholishion sould be	eclinate eclivities, tide, and tide facility to the facility t															Indicating a "An individual condition, reduction in grandinating point due to following or defail singuistic result affect the cite and qui- vidual teach. In present these conditions are not supportive of using imported suppresented tary to compensate for indicate such teach.  Licent deviation systems that support multiple plantings per part (e.g., not once and affect) or that have 2 or more part and official.	by of bear 2. Permittable and analysis specific photosist values because yet the suggests bear expected bear 2. Permittable and analysis specific photosist values parameter for the suggests bear expected point page 1.00 permittable page 1.00 permittable analysis of the page 1.00 permittable analysis of the page 1.00 permittable analysis of the page 1.00 permittable page	them to develop acceptable adminishable and operation policies.  A one-size file of accross to Water	4	
				measurement of discretions and return flows to directly solution temporer CLI Bringin a mass balance.			M. constant Driving a Standard Crois published Stein or computer peach could be used to be abouted.	sighted line or vary daily depending on data assistation, not Visite Requirements - Timehad is one sales require research data based on stop type, elevation, soil corall olines, and regiment before would be adopted. Mandaed of hir all pears, or well year? Juverage year? day year valu-	ensenth. Elizane, d'unitane, Lune c'ouald															In this Wilder Dank for one in Devices operations.  It workship that my implices appears all here removement capabilities or lincimized data without the assumbly one state of carriery to tribute lincimized has been removed on the difference beloness during and which force.  Column this hydroxide resultine and in which indicated produces in these references operations and which force, of the column things of the column three columns are the season of the columns and the columns are the columns of the columns are the colum		ainh für sompline administration, mannen and coldiffer, indifferent productions will not be resulted relations. Indied of lines, and some self-only for addressed as a bank in actually operated and adjusted in meet the needs of the set of selfing participants.		
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SCPF-68 Colorado Niver Cormand Colorado suder		Technical analysis for water bank translatity study, included in 2012 WIB planning phase 1 region pol .	Data sendin rotales analysis, logaled amea, water rights obligates, and direct stations. Examined CO requirements, loritation CO Millery, Coldey, ET vortication (Previous Ministry of Confight violations), and MCO (State CO volume for investigation of Confight violations), and MCO (State CO volume for investigation makes in each distance multiplied by register assets; Water being required and cool. "Ministry would be for small grains, grain care by leaves." Debts in available for all rough on level state of all the parties." These copys contributed account for over 85° to availage in CO. And supply friends CO. "Stockness upplied to availage in CO. And supply friends CO." Stockness upplied to availage in CO. And supply friends CO." Stockness upplied to availage in CO. And supply friends CO." Stockness upplied to availage in CO. And supply friends CO." Stockness upplied to a surgery in CO. And supply friends CO." Stockness upplied to a surgery in CO. And supply friends CO." Stockness upplied to a surgery in CO. And supply friends CO." Stockness upplied to a surgery in CO. And supply friends CO." Stockness upplied to a surgery in CO. And supply friends CO." Stockness upplied to a surgery in CO. And supply friends CO." Stockness upplied to a surgery in CO. And supply friends CO." Stockness upplied to a surgery in CO." And supply friends CO." Stockness upplied to a surgery in CO." And supply friends CO." Stockness upplied to a surgery in CO." And supply friends CO." Stockness upplied to a surgery in CO." And supply friends CO." Stockness upplied to a surgery in CO." And supply friends CO." Stockness upplied to a surgery in CO." And supplied the control of the control	Mid discussed. Ib K. B.	StateCI was used to estimate the impation water requirement or consumption intigation requirement.  Costs stimute distancement without the StateCIJ analyses.	AT verification was considered. Noti- using the Premium Shoriests. Size of method with Curlighted data Store Stuly Carlesi, Della, Manson, and Techno, Jackeri. Affail lands.	I addressed. Mentified that nature connoderations and modeling sense on firms analyse by important. The CO sensings. CO in mentiles after common to a some cosp aune of the deep roof system and	savings through defect intgation are difficult to determine. The report Sourced on a conception analyse and, go through either to regard to the average to when intigation was custated.	ne-without hid discussed it assumed it assumed in a second by a second by	ST verification was considered. Not dis- uning the Personan Stanfalls. method with Confighth data from Cortes, Chilla, Manuse, and Yatine Jacket.	tioned. Tild discussed.	Not decimant. Not decimant.	Not decimand.	decimand. Maximed a 10% industries in volume to Leve Farry day to be seen spalent Samull Senses.	Not Not discussed. Not discussed all	ed Mildraned No	of discussed. City, Code Manu- Jante	Mr date turn hid discussed. When freehilly for prod. Della, ingelion prodices on, participation.	Loons to vary deficit. N all thely increase programes Co. Co.	Not specifically addressed, but they did stimute the bind per Compact valve rights in de brokens 6, B, a and T tributary to the citizade Nove.  Assumed the Vired Stope per Compact Ag.	hits as autable only the field discussed.  This regardes provide an  make water budget can established.	Providing Sexibility concerning the am defail impation of parties and affalfa o increase the participation by growns.	of of Not decisions.	No eliminate 100,000 APpairs in the maximum amount constitut anoth policitating be med from a Yilling Balls. The child integration is 2010 of quality and an ordinate and positive great from. Could be med by 100 of debt integration on 12.0% of quality gradies and positive great from the child of the chil	med by	The headably of defail impation is orbot to long term nucleon and statistic of the Water Sank.  If allowing and defail origination programs have been implemented to other areas is success and sould provide a madel for	of the same awas of Disholon 7, you'd Compact vador showd in sensitivity is release to meet inligation demands on ringular senses also supplied will per Compact state. Stilled advisorable filled advisorable prolings will resed to be adopted to the dependent of the depolation to Leave Prop (a 10% beaution sense applied for this analysis. As the depolation of the depolation of the entry (a 10% beaution only years the broadboars associated with available under repoly could be subdisholding pender in name awas, bother continuing the name of water surface to a time of the continuing the name of water surface to a time the con-	Bose Calastron AV, AJ, AZ, AZ, and BZ
Coherable Flow Compact Coherable maker lases Translating shallow maker supply bentweet memorated on (Appendix Bite Coherable Flow Visite Book President) Bioly (Phase 1)	Malural Resources 2012 Cornsiding Engineers, Inc.		Wy bears." Deficit the available for all unique loof leed scaled for adults A peaker. "These unique controlled account for over 1876 the acreage, or CU, and supply-leeded CU." Discusses split season intigation.				acils to return Stone to the over.												1	could be the source of water for the Woder Land.  Puterslad users of a Wider Earth supply solicide. Weed Edge Mild with post-Compani- sation rights, Eard Edge Mild with post- compand water rights, and West Edge ag				quantition of eapply that are large enough to ment a subdiscript prices of the subtiliard price Companie demand, approximately 2000000 20000000000000000000000000000	bely for the format is because its clase Provided for great and distriction on exactly in the angular format is small as the format format is small as the format format format for the copy types provided on the Whol Stope.  20. Class St. Const. Const. St. Const. Const. St. C	in in the	for dry years the first later security of the auditobreate supply could be subclimited by grade in some sease, fulfer constraining the amount of water available to a Woles Earth.	
		This report was cheaped to assist in identifying and better understanding the socio-cultural emigrants of a judicial demand management program. The research, completed in Typing 2019.	This is an infendew-based report that covers perceptions of ER definitions of voluntary, compressated, temporary, and equity (fine world are proportional/pairly) and thois that these definitions are not charged forward and must be carefully.	I, Not discussed.	Not decimand	Not discussed. Not o	description (Not description)	4	Not discussed	Not discussed. Not dis-	sinesed. Mid discussed.	Not decimant. Not decimant.	Not decisional. Not de	decased. No decased	Not Not described. Not described	ed Not decisived. No	Sol discussed.	named. Not discussed. Mot discussed.	GA Su	ners with critical crops supplied by post- tionpoid saller rights.  No discussed	Nid discovered	Not decided	Not discussed	next common values of 2 fell gases. The annual of CCU free child impalses a site specific and dependent upon a re- lations. An estimated 16 inches of 8 T is required to produce 1.0 fee of affilia.  Not downward	Ned discussed	Not designed	Not discovered	Not described
SCPP-00 Explaining Personphisms of a Voluntary Agricultural Malar Conservation Pringram on the Westlern Elispe of Culticable	2019 Mailtoy Colorado Stale Grovestly	equived perceptions of demand management among states of the Mindelm Stope Drough redinduid interviews and those groups. The findings shad light on the bastiers and opportunities for a demand management program, including bleas and residuals on what a successful program model book.																										
Agricultural Stater Conservation Programs on the Virelann Stope of Cottorado	2019 State Crownsty	No, and why water users may or may not want to participate. An executive earnmany in also existed in.	equity insues, and circle here, corested. Compensation was a very shallowing high point, with different prices of DEM as a founder or opportunity. Highlights slash of their market values with the opportunity. Highlights slash of their market values with the opportunity. Highlights along a common properties of an extended or a common properties of different or scalar properties are required. Who bears exclude properties for the sharings conditions (many dark temperature) for the sharings conditions (many dark temperature) to type of Basin at Enally. Temperature and the sharing dark temperature of the sharings of the																									
		The briefing paper provides a general background on the OCF and demand management. It barries	program vs temporary participation-floring discussion. Discussion of Bendern Slope Sained Values, how water and terring is part of blentify Marenous people suggested every ratio use audid use and respect water and flad on should slotly available type Basen with based on thought fryshology and discusses have to reduce that this Aska many questions.	Mod discussed	Red decimals	Not discussed.	decimal Act decimal		NJ DELINEN	Not described.	ELECTRIC STREET	to declared	to decimal.	Section 62 decimal	Sur Surgery Surgery	ed 100 decision. No	or decident. Not a	and the desired		El deland	to use a discussion of	This was a discussion of options for a bowners it discussed how thresholy at	M. Sui deceased.	Provide landing for program densinguish and adversariation for the distrib companying plan distribute. Provide landing to distributions and other representates that landing the company and non-packingsing under users."	Not discussed.	Red discussed.	fiel discount.	FAC BOULDES
Birling Flopin Upper Easts Demand Management and Male Marking, Addressing Risk and Creating Certandy Explaining Options for an Upper Base Demand Management Pringson	2019 TNC	or top schools a dearest or Evidency is the epict of reanagement program and is offered in the epict of recombing discussion and decision-making on how is discussion, govern, finance, and explanment such a program.	secularly, program promises and verbidation, blendiffers and in serving policy, measurement and verbidation, blendiffers and of the lor rouns being addressed by CVICEI DM enobyticips. Key will be the property of the control of the control of regards & manifesting benefits, e.g. through limit coordination projects. Tabulating part options considered for avoiding compositation contributed.	;																	The second secon	Source of discussed him fleelight at least would be key as different geogra- ed require different implementation.						
*****		This conview disconnects communities the diables sampleful by the Catinade Nove Walet Stark Work Doug in their effect for provide information admin- strating their provided provided to senserve communities, applications, posser scalabilities and the river Seet.	This work includes a two phase breddily study an assessment of him reduced ringulars for sampaid purposes mode sock will offered integration systems on Contradict Vited Days, economics on Army and payments, and simetific research on the agreement impacts of reduced integration.	d Mid decreeed.	Trengy finance methods tend to under- estimate setti organed conditions but own- estimate dy-conditions on penture greenes on a morelly basis. "Conditionals of WK, MIPO and remote- sensing could be workable shatingy for conditions."	Not discussed.	deciment. Not deciment.	4	tild distanced.	Discusses mende sensing subminding discussed in a 2018. Website. Remain sensing could be used to according to	tioned and decision.	Pol douanni. Pol douanni.	Sid decisions. Not d	Oncored No. decrees	Part Met dissessed. Not dissues discussed.	ed. Not decided. No	of discussed. Not di	effects including:  - "Many factors may all oxygen deprivation,"  all factors for motions and	may have carryoner for find recovery including: with of time roof hales make update, roof	tol dissipated. No	I discount. Did discount.	Not discussed.	Not discussed.	Not deceased in an oversching manner.	"Share remarks in needed - and is currently fating performed - on high retroiding performed - on high retroiding performed in the impact of default impation stillangers on one-prelia and health. How high, execution performs are used primarity to support single-current call to health and the execution performs are used primarity to support single-current call to health and the	er, Desse see See	By withholding singulars for one season on high-viewation pass hapletis for following conditations were reade: improved to age qualify in year 1 (27 and NOT): Singularity readers point governing readulation of NON). Yealth slid and fully reasons when returned in full origination of	
Colonials River State State, Shalk Choop, An Overview of Province, Studies, 6. Reports	2018 Each Working Croop				continuous of ART and CCU.  **Spirit season intigation may season Affalfa plants to use more value during the hotter stocks.  **Spiriting to coops with lower water use or what seasons could also lower CU.													personal memory and a second control of the control	ratinged periods of direlat regreeth upon						tions into the control of the shallow on the part of the tenderanes to employ integration year spaces. We have a support to the part of the tenderanes to employ integration year periods of feed crops."		following seasons (pursuper reduction of EON). The seasonity of print reductions measured in this study may not produced participation in a water later program. Productions would need to be compressed for reduced yet by year of withfulting singulation and by at least the first seasoning year. When the season is the season of the season of the seasoning year. When the seasoning year is seasoning year, and the seasoning year. When the seasoning year of the insignation.	r da
		This report provides a summary of the 2018 and 3019 Conserved Consumption the Pfull Projects sumpleted by the Claim! Valley Wales Users Massaciation (2019/AL). The initial paid of the report accorders a proof summary of both the 2011 and	Zanci management contract: manager sensits it plant growth, to more plant print matter, things for stable, things the road; the plant plant matter, things the stable, things the road; which this plant plant plant and more stable schematics included which the plant plant plant plant and more stable schematics plant plant promised to verify clare distinct insulation for all clart speakly entries to verify clare distinct insulation for all clart speakly entries to verify clare distinct insulation (a) and an extraction of the plant plant plant in plant pla	Moder returned to the schools was not directly measured.	shof growing seasons could also lower CU CU was calculated using StateCU satisdations for the period of Satiswang.	Fields were required to be fully filled of followed and all weeds removed to eliminate residual field CU.	decased. Verification was followed and or	section with morthly sile shifts to shoully swife the felo sweets serve controlled observably or mechanisally.	tid was Not discussed.	Not discussed.  Cordan socially Education solds () in the	sized staff member performed by size visits to verify and mound rig. Any action terms from these a. member weeks have included the staff reports.	Not discussed. Measurement equipment mas already installed by COWAA and this was not discussed in about.	Suit Geograph. Suits Sui	other season return to serve out discussed.  Salt discussed.  Salt discussed.	Not Stocked. Not discussed.	ed. Not deposed. No	tol discovered. Not di	named. Not discussed. Not discussed.	trage organs during	Did discussed.	ing an outside.  The program worked to solden the other special program below solden. The other uses who special program have some and participating in the solden and outside solden and ensure they consider and outside seen nut havined.  Seen contains the sold outside seen nut havined.	The Sexibility offered by allowing participations the length of the Sallow period increase participation.	such to The program did need to added wide- riped 2018; 1,089 aims in the CCUPF - 2,7 and discrement. 2017; 1,282 aims in the CCUPF -3,11 and discrement wide	Copyring the program Smiller and working dimedy with participants and as Smithout culmants improved the participants Smithsmid.	and load. Steel measurement of abbid water and specific data to smily models was result	We fluidon by a Trief party helped keep think in the program and protected the progrity of participants in the program.	man normal by the second year of full intigation better store of This ** full discovered.	The key to a successful program is one that does not permanently remove eater from the land
SCPP.13  CVISUA Find Report on the Conserved Consumptive Like Plat Populs  Consumptive Like Plat Populs	2019 Striptown J-U-B Striptown	2018 piloto. Appendix IV provides the details of the nurvey (2701LA completed of all participating scalutures, galanting their layer due their experience and prespectives on the pilot proport. Appendix 1 summarized VVVIIAA's Totaling more broadly on the pilot and demand management.	B) dard specify controls in verify CU on followed land, but doe include after white is no By land regard, and explicitly profibilis, any active yield growth on followed land									obdal.  - Chrestinia sente ligipassed.	Biggin in Sultana Bidun Bidun Sultana	minion, were unity exceed disting the aboly princip, Countiere obligation season in those sense and observed.							the combinitier was control to be fully about.		es il conserved ealer					A successful program "most topport all head several adultional objections.  If a real support such state and a successful process and other successful.  If a real and non-apport such state and a successful process and other successful.  In made to real process and the support of the stream of the successful process and then specialises, or the streams over continuously.  If a real process we realize the section of the streams of the stre
			Top 3 theorems, collements & communication is recentled, operational & ingel because modifier addressed all dillois company foreign for a facility to process for afficient	Mid discussed.	Not discussed.	Mid discussed. Not o	discount. Not discount.		Not discussed.	Not discussed. Not disc	sineed Bd discussed.	Mot discussed. Mot discussed.	Tot document. Hot di	Document. Not deciment.	Not Statement. Not discussed.	ed. Not decided.	ld discussed. Not di	sussed. But discussed.		tit distance.	t dissassed. Not dissassed	Not decided	The discussed.	Not demonstrate	Red disseased.	Not dissussed.	Not discussed.	proximate in the control of the cont
SCPP-14 Lesavira Learned York The System Conservation Parlies thip Program	2016 The Nature Consensory																											
ECPT-15 Considerations for Ministring a Water East of the Appendix Lind with Current Environmental Flores	2011 Hydro Consulting for	Evaluation of computer models of the Classican- Nove to excess their adulty to structure a potential value to excess their adulty to structure to the exercises and the effect on reservoir operations, soluting environmental basis.	StateMad, August PROFES Model, and CRESS are evaluated feer capabilities to simulate Augustal Unit operations, environmental flows, and polential state dearting Specifically, this modeled the Black Compon water right, new SESPEC sequencements at the STERMENT water and an action backing opt of August StateMadelms is the Convenient StateMadel are	or find discussed.	Not decembed.	Not discovered.	desired. Not desired.	4	Not discovered.	Not discussed. Not disc	numeral Not discussed.	Not decimal. Not decimal.	Set december . Set d	Documed. Not documed.	Not Not descend. Not discussed.	ed Mildrand N	of discussed.	used. Not discussed. Not discussed.	•	tol descend.	discussed. Not discussed.	No. decorated.	Not desirated.	Not described.	ford discussed.	Not designed.	Not discovered.	Not discounted.
			e-regions, securioristic to the Controlled Administration of the Controlled Resident Administration of the property of the property in the Controlled Resident Administration of the property institution of the property in the Controlled Resident Administration of the Property in the Controlled Resident Administration of the Property in the Controlled Resident Re	Mid decurrent.	Not decided.	Not discussed.	designed. Not designed.	4	No. discount.	Not discussed. Not dis-	accessed. Mod discussed.	Tel Grandel Tel Grandel	Set decisions. Set d	denant. No denant.	No. Not described. Not describe	ed Nichaland N	of discount.	named. Mid discussed. Mid discussed.	-	tot discussed.	debased. Not debased.	No. decement.	No. december.	Mol dissassed.	Parl dissistant.	Not discussed.	Not discovered.	The discount
Employmental Total Transactions in the Colorado Plore Basin: A. Caner Look	2016 Station Woods 2016 Indials for the Environment	months, Understanding and Control and American indeed of activity, Examiness ECPP proposits by this lever, given the ISE bandles of ECPP. Framel but ECPP finding proposits had the offered of enhancing streambles.																										
BCPP-11 Leave Culosado Fore Basin Filed Program	NA Bureau of Reciprosition	Obliquings with tables of projects from each pilot phase	Tellbuogh the Plid Program will be organing until 2010, as of 2015, Salare announcements of handing opportunities and requests for additional properly proposate are not being contemplation. <sup>2</sup>	Notice conserved use measured by Surgium downstrest White and.	Not distanted.	Not necessary as the point of the comments with a the property was to bean water in Late Mead and could be measured entirely by Kengune down store, but habitation.	dissered. Not dissered.		hid discovered.	Not dissipated. Shill diss	niceed. Bid discussed.	Plot documed. Prohipants were just to brings diverting and leading the water to Lake Mead.	Tot decimand.	document. Not document	Stati Participants sweet Stat discussed document. Speed in Sample showing and leasing the walls in Lake Mead.	ed Not decided to	ld discussed. Not di	sussed. But discussed. But discussed.		tol dissipated.	I discoveri. Not discoveri.	Associating the conserved eather is con- by measuring the amount of a timegon	y dime. An solve wan conserved by measuring disminished amount of a fungione-disminion, retiring was not an issue.	Not discussed.	That dissipational	Not dissussed.	hid discound.	No. discounted
System Consensation a cultabilisher age such to dought contingency planning the Upper Colonado Nove Steam	2017 Oxforing SEO Coloning ASMA Impails magazine	Swarphier of Wyoning SCPP, how I works, participation, and falure efforts.	Shellber extensive nor technolog, fact includes some description princes & participation.	of Not decureed.	Not decisional.	Not discussed. Not o	discussed. Standby value is and make any o	s to when to welfy following worth up a whost reposit with p y suggestived changes, as sweeted.	photos Nel discussed	Not discussed. Shorting	ly visits to sites to verify following: "Aid discussed. eried auf	Not discussed: Date disension records to settly.	Set decisions. Set of	Document. Not decreased.	Not Not dissussed. Not dissussed	ed Not decided to	ld discussed. Not di	Not discussed. Not discussed.		to decayed.	d decision.	Not decreased.	Not demand	Mol discounted.	Test dissolvent.	Not discussed.	Not discussed.	Not discussed.
2000A Males Terransus Partholio	2019 Budien Newto Wal	Chapter Surn SNOOK's water plan	Addresses improve supplies initiating different expents of bitectionally Created Surplus, makerye and liserting, OCP, and conservation look.	Mrd decurrent.	Mod discounted.	Not decisioned.	decount. Set decount.		66 discount	Not discussed. Hot disc	NONE has evelant to improve efficiency in addition existing and entirely electronic production of distinct and the control of distinct as affine see fifth.	Port discussed. Fort discussed.	Tool discounter a	SCHOOL SCHOOL	Shift descend. Shift is so with the DO Later Mead	P to	WWW langue stating ("Marking"). Worl of soles in the 1980s. This is consignified by "specificg banked manual Colorabia Nove waiter half the notify groundwater applies in the solesage in assemptioned by notif unique pair remeable groundwater. Solesage is not remeable groundwater.	pel melen. Shruda (1 VVVV), has net up mile pel melen. Shruda (1 VVVV), California southed abserved the mouvey of male souther to be able to have assumed, souther GPCD madings update able.	to banks with Examine to Earnin and Artisma to of a table date. Each Iman annual moovery	for discounted.	d decayed.	All deceased.	SNISK has developed OPCS by 46% belowes 2002 and 2016 older like population has increased by 690,000	Not deceased.	No. distance.	Not distanted.	Ref discussed.	Schoolsen
		This menu evaluates different harmour's concepts in solds up operations of the States Back and provides companion code and other Saless in	Evaluative 4 Sammerculus of a Colorisdo Stauly water bank width to address 200,000 AF of CCU. Armost distribute bank theore, with cleans in collection years, not oppose collection year leaves, and	and field discussed.	Not declared.	Mid discussed. Mid d	danseri. Nel dissant.		tild disserved.	Part dissipated. Part diss	electrolog subto- electric states proceds.	Pol dissand. Pol dissand.	Tot decimand.	DOLAND. No. decimal	Pail Mel dissance. But dissues dissance.	ed. Not departed.	everye is accomplished by not unique poor resociable groundwater glos to acquire starage smalls that of discussed. Not di	Monarate SPCD madings update and page 1940 miles and page 1940 miles and page 1941 decreased.	Par Par	tol distanced. He	I discount. Not discount.	Not decount	Not decisioned.	No decimal.	The Constant	Not dissipated.	hid discount.	Not described
SCPP-32 Connain Work Restriction Francescok & Printersial Analysis	2017 Westfaller Research for TNC	consider in different approaches to developing a scaler bank. The influentation is intended in provide consisple and participany markets for TNC and the Moder Bank Warking Cross-be consider and devices in ongoing Water Bank development of the contract of the contract of the con-	beatens in utilizal paran, non-sipilars selficial peer beaten, and equipment in a 1922 companious. Whether the Presental consequent as control comment of the selficial parameter of the violan of selficial parameters of an excellent parameter of the selficial of selficial parameters of an excellent parameter of there or control to beating widor.	•																								

# Exhibit B-11 Lit (Gen. Literature) Documents with M&V Criteria

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  |  | Necessary Data and Equipm   | meet   |  |   | Manitoring an  | nd Verification   | I  
   |  |  | Program Level Considerations   |  |   
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Title Date Publisher/Author	s Description	Notes	Measurement of water returned to the stream
			inturned to the stream
Service months of the Contraction Toler these engineers of the Contraction Toler and the Contraction Contraction of the Contrac	Analysis of ag impacts from salmon-sociology-related flow alternation in Collection Priors  S  S  Karramon model of water cost provided by above codes or	Investigation and proposed of this mountary resolution for the property of the mountain of the second consistency of the second consistency, and fine as agreemation in a Southern's Development, on the segmentation in a Countern's Development, on the segmentation of the second country of the second country of the state desiration and second second country of the second country of the second country of sections and the second country of the sections country of the second country of sections and the second country of sections and the second country of sections are sections as a section of sections and the second country of sections are sections as a section of the second country of sections are sections as a section of the section of sections are sections as a section of the section of sections are sections as a section of the section of sections are section of sections are section of sections are sections as sections are sections as sections are sections as sections are sections as sections are sections as sections as sections are sections as sections as sections are sections as sections as secti	Not Ciscussed. Not:
Feasibility of water efficiency and reuse schoologies as demand-clos strangles for urban salar management or urban salar management	acconstruct mode of water cost provided by above-code we efficiency and resuse schnologies, including variations & uncertainty analysis.	of 50yr projected needs to the Lower Colorado River Authority service area (central TX)	
  |  |  |  |   |  |  
  |  |   | e e  | Secured.   |   |  |   |  
   |  |  |  | 1  | gion of net-benefit technologies, which produce or<br>ultaneously provide monetary savings to the consu   
  | considerable water savings and sumer.   |  |   |  | impacts study associated with this specific study for the 2612 State Witter Plan for Taxas; includes a high-level assessment of environmental impacts of all socommended and alternate water management strategies for Taxas.  
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| Osegones to valed crisis. How do trained farmers thick should be there in relation to eachering from ricks to less eather dependent croppe?  To eachering from ricks to less eather-dependent croppe?  | Study of farmer exeponse to gov't demand management, switching crops.  | Structural equation modeling showed that farm<br>intention to change from rice cultivation to anoth<br>crop is determined by personal norms, beliefs<br>about their role and emotional considerations.*   | senNot discussed. Not-   | Secured.  
  | Not discussed.   | Not discussed.   | ot discussed   | Not discussed.  | Not discussed.                               | Not discussed. Not discu   
  | vissed. Not discussed.   | Not discussed.  | Not discussed.   | Rot discussed .  | Not discussed. Not discussed.   | Not discussed. Not discu   | Nit discussed.  | Witter managers could place too much relance to<br>on customer water restrictions in coping with<br>drought  
   | ool discussed Mod discussed  | Not decussed   | Not discussed  | Not discussed No.  | discussed   
  | Not   | of discussed.  | NZ discussed.   | Not discussed.   | Not discussed.   
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Temporary senter transfers for when 1962 Dank, CSU water supply strong thought	PIG dissentation modeling uptions for temporary soler to	continus. This research develops a sealer right option and region of the continue of the cont	Not discussed. Not idea. N	Secured	Not discussed. Not discussed.	Not decimand.	at discussed.	Not discussed. Not discussed.	Not discussed.	Net discussed. Net discu	wined. Not discussed.	Not discussed.	Not discussed.	int Not discussed.	Not discussed. Not discussed.	Not discussed. Not discu	Not discussed.	- 'Stak-adverse' arthode increases cost but may not reduce risk.  - Customer scatification is related directly to reliability but inversely to cost.	Early positions on tens proposites can be find discussed. Department to the case of paint rights. Properly decoprises and released rights there so become of promoting the early streament for party which painting contrastions upon the contrasting will precipite as loss of values to the contrasting will precipitate along the severity and frequency of the obstrage.	The water opinion of the company of	ant of parisa, as a second of the control of the co	Th to the	Colorado Discipli Response Plan uses the 50YEs A Force.  SVISI acts as a triggering mechanism to implementations.  SVISI acts as a triggering mechanism to implementations.  Therefore interest translated enoughly.  Therefore interest or sent fluorisate enoughly.  Therefore interest or sent fluorisate enoughly below and fluorisate enoughly below and fluorisate enoughly and a sent of the implementation of a solice also enoughly obes and fluorisates will asset decision makes or the implementation of a sent of the implementation of a sent of the implementation of the im	nert predetermined levels of the to support triggering mechanisms to support triggering mechanisms to see the total see the total see	coulty based valuer supply formatting and has individually administrating and has individually administrating administration proport implementation of the temporary water south.  The proportion of the temporary water south.  The following contrained were supplementation for the temporary water southers manager and were vest as assurers of performances.  The proportion of the water southers are southers and other vest and assurers of performances.  Description of the southers and administration of the southers are southers and administration of the southers and administr	Where plaveling is a long-tone leave.  Where should be a long-tone and there is a need for surplice.  Consider revisible of designed across settlersheds to infor- sociality.  Lock of ground water data and resources.  Lock of ground water data and resources.  Consider considers which of designed across settlersheds to infor- sociality or considers which cold and resources.  Lock of ground water data and resources.  Lock of ground water data and resources.  Lock of the social considers which cold designed within collect  according to the consideration of the consideration	The temperary transfer of a vater right is experient by the control of the contr	
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Travels agreed nationality  Travels agreed nationality  and travels agreed nationality  and travels agreed nationality  contract, and travels and travels	"His diseasation that admitted Sets (see Year) and colorant and reduced Sets enterance, descripting in Conditional and reduced Sets enterance, descripting in Condition and the Condition and th	augusti irigation varier use could be decrease compared to the wind which is corp regime and nonimal solidity featuring. I allowing.	d.	CO for scenario planning	No discussed.  Not discussed.	Not decomed.	involved generouse gas ensusors ductions with consumptive use and empiring reductions  and decisions  and decisions  and decisions	Contract Strate station    Of discounted    The	Not discussed.	Not discussed. Not discussed.  Not discussed. Not discussed.	word forward.	Not decreased.	Not discussed.	eld Mod decussed.  Not decussed.	Not discussed. Not discussed.  Not discussed.	Not discussed. Not discussed.  Not discussed. Not discussed.	Net discussed.	Produced purpose resided from medical con- signific changes.  Produced integration residued in reduced electricity demand and lowered GHG.		Compact Compact compligations or significance or significance or significance or control of the compact of the	Marchellan  Marche	Controls parently assumed:  1) Changes in total practice among 1) Changes in total practice among 10 Changes in total practice 10 System of grain to 5 years of affaits 10 System of grain to 5 years of affaits 10 System of grain to 5 years of affaits 10 Safationing of 7.006 across of 10 Safationing of 7.000 across of tend 10 Safationing of Tender 11 Safationing of Tender 11 Safationing of Tender 12 Safationing of Tender 12 Safationing of Tender 12 Safationing of Tender 13 Safationing of Tender 13 Safationing of Tender 14 Safationing of T	pervisus sunnary.	Notice	r december (in the control of the co	Local fields to appear control planning of Concarned field and popular spread that sign will posted each of soldies pumping the applic, represe soil for and field, integrated the control of the control of A strong commandly engagement planning. A strong commandly engagement planning for Concollabor company of the control of forestending company of the control of forestending control company of the control of forestending control of	and discussed in the second sec	are previous continues.
Commonic visibility of article integration in 2018 Manning et al.  Applications Whenever GE Management of Manageme		Sanda integration (SII) can also optimal dusing lase growth and pranautions raspect gives introduced or process and produced or compact prices and production cosmit.	aber on					the Standardized Fernman Mortalin equation to calculate reference \$T\$ on an hourly basis. Hourly reference \$T\$ was then roummed by day to create daily settimates of reference \$T\$.						incurred.					conducted throot of an agen-conducted and therefore the defineability is a the imputs and willings also cond-	nomic model he		- 7 - 7 - 90	abler costs could increase as intigation districts impor- ts to acquire and deliver value of an energy costs is to market value of vaster record also likely continue after occase regions takes enviroped and industrial seem may also be an increase in environmental value ducer may realize an increased opportunity cost of	is increase to pump water.  to increase as population growman all willingness to pay for water.  Muses of water was do not be farm.  - Ch  pool  and	mixed of other water conservation options, cluding crop selection and other management stellages such as filiage. Altitiple crops should also be considered as all as the ET target per crop. Dranging planting dates and timing of intigation out also influence the costs and benefits accided with DT.	control for CII to be optimal at any water cost.	Blady exceed historical levels in the US high plains.	se that " I'd it is the seat with makin; it should be dions from it in the last evaporative stage and only within a songle of exists coats.  - Di in the manuscripting filling stage sequires even higher easier coats.
The role of groundstreet rating is spatia. 2014 Management Management Management Communication of Section 1997 Management Communication Commun	Republican River lises assessment of coupling surface- groundwater management.	Vecopatial dataset of F948 rigation wells mode top choice, land, and water use disclininity is "Dar analysis highlights the impropranse of the identification of permits and the institutional costs which studies occurs." Cost weights from study sent to the cost of the cost of the cost permits of the cost of the cost studies with courfest, and groundwater management institutions.	elic Not discussed - all vaells are Not vell metered and annual reporting intelligent pumped volume is oil mandatory, monitoring and g werlf-cration of groundscater and is a telesky a place, with strong enforcement.	Sacusa e4.	Not discussed. Not discussed.	Not discussed. No	of discussed.	Not discussed - used the Manual Rescusse Upperment of Natural Rescusses Will Outstane, sol type, everyorampiration sequentered, and regard and sequentered in digital and published copylatis to inform the manual sequence.	Not discussed.	Not discussed. Not discus	Not discussed.	Not discussed.	Pumping locations further from the river will decrease stream depistion, but it will also decrease the combodies of return flows to shallow subsurface flow and thus to the stream baseflow.	NOT GROUNSED.	Not discussed. Not discussed.	Not discussed. Not discu	hat discussed.	BROGET N	of dacused.  If it analysis we conducted the	was the use imited sights and enforce metaning, metaning, sellone the a function of dates to dislone.	t by water Mot discussed.  Mot discussed.	Pumping locations further from the river of all decrease stream depletion, but it will get also decrease the contribution of return salco decrease the contribution of return foxes to shallow subsurface fice and these to the stream baselfice.	octive trading over a tage area might require a sim- tic in at least some parts of the basin, so that the la digipants were constituted.	multaneous reduction in water lobe lange majority of potential market	te specific data to reflect model outputs.	See Lessons Learned.	Pumping locations further from the river will decrease a baparison, but it will also decrease the contribution of no flows to inhabite subsurface flow and thus to the stream baseflow.	States for white contributed by current regulations. We have given adding incident respects by the trigods reason in these the full confided area, but to apply an amount approaching the optimal depth of water.
Coulosing the patients of cropping adjustment of propping adjustment of propping adjustment of propping adjustment of propping and propping adjustment of proppi	Substation of different congress patterns (including tallows seater supply scientifics.	legi li Pramanoch für using a orup rodel it ingenetion prodes affacts of copyriga adjustments on prodesident austrialisticy it copyriduction prodesident austrialisticy it copyriduction	- There were 3 groundwater sustainability targets and WR.	study used the DOEAT (Sections Region for Memorality Transfel), and dissented model to later companies of the property of the later core growth not agricultural season use based on the divention; soil, ongo cultius and management study.	Not discussed.	The COSAT reside was a reinclassed for all per per period of record (1962-1955) to the period of record (1962-1955) to the period of record of record (1962-1955) to the period of record of record (1962-1955) to the record of record (1962-1955) to the record of record (1962-1955) to the record (1962-1955) to t	scussed the cropping patters, count-deater free targets and influence or production of wheat and maize.	Tutal meleocological data and Post discussed of chamberfolding and processing of the talk cause of the Company of the talk caused by the Company of the Company of Science (ACES).  - Irrigation Water Requirement (MIC) and estimated as the constant of Science (ACES).	Wort discussed.	There is a South-North Not discu- tivizer Trainfer (SAMT). Project that was secured to provide state water soph in meeting two of the groundwater targets (Targets 2 and 2).	ussed Net discussed	Not discussed.	Geroundwater levels (2: exatainability trappet) is seen used to gauge the cropping pattern adjustments.	Bit Montdead.	Not discussed. Not discussed.	Not discussed. Not discu	nerd discussed.	Not discussed.	The modeling frame of the property of the pro	colputs med by summably summably summably sum summably sum summably sum summable summable sum summable sum summable sum	The DERM model used available date to get the copy of	Not discussed	ee shuly provided insights that seeling the copland of in the soil to be reused by wheat in winter. In the commend the seeling of the seeling	fallo red in order to preserve soil water	Consider copiend management during the low period.	See Leasons Leaned.	The concept of "household fool security" makes terms of a fun-bornous commonly the lading explosed to selected accountry could underwise their purchasing part selected accountry, second, they present to gree leverish their fool accountry, second, they present to your bood despite recording subsidies from the governm yearing purchase of food afflorable).	Table Security Learned makes or and a security of the security
Copyrights 4. Made of extended specific and of the State		require efficiency surrige primarile, galance in substancing and a single galance galance in galance galance galance register (2) and the calling during the principle of 20 and the calling during the substancing galance galance galance to consider galance galance to consider galance	4											Secured.						N. Carlotte			See assume, or a vesse efficiency parameter, in a finite parameter, in a finite parameter, in a finite parameter (assume parameter), and a finite paramete	which searchingly more efficient. So, growing the search of the searching the column of water associated with native available for subsequent search	To the control of the	of earser sealer of in Projection groundwise the even sea and sealer of the extraction of the extracti	ment where one publicly instruction, a prevail continue the recognition of the recognitio	on the second of
Uniform the Market State of the	Disco Materia Times catalographic gapy & savagement actions where CAV dought policies.	dename cutative continue public chainship in the significant continue public chainship in the continue contin	ad Not discussed. Nati	Secured.	Not discussed.	Ned delicionesis.	and the control of th	Not decimand.	Not discussed.	Net declared. Net declar	weed, were decreased.	Not decured.	Not discussed	HE MICHAEL MIC	Not discussed. Not discussed.	Ned discussed. Ned discu	Not discussed.	Command management release on customer productions of the large anticipation value in least considerable and from the state of the control of the large and formation and control of the large and the	of discussed. No discussed.	Not discussed.	No decament	- 5 - 6 - 5	mand management relea on columns participates formed actions regions considerable self-in relia, interferent to Canage Saltanior.  Colorian escale policitario security colorians escale assistante assistante productive colorian productive colorians activated self-investigation to self-investigation according to the colorians according to self-investigation according to the colorians according to the dissipation of the colorians according to self-investigation according to self-invest	gnificant savings to m to report monthly information on nforcement actions of maintained widespread attention	gloring a "you'd of concept" for were marchine design as physical adopting elegation," e.g., empiring and delivering groundwater in files of my proper part delivering groundwater in files of marchine actions where available for smaller market extract water available for smaller	whose the production of the control	or Demand rangement rates to continue participate inductions can be being, extended actions require consistent and an extended actions and an extended actions or consistent see that the section of the section of the section of the section of the section of the section of the section of the sections, although codes are changing to include the participate of the section of the section of the participate of the section of the section of the Proposition 791 requires a water explain not obtain Proposition 791 requires a value require not the continue requires may be solded as the continue of the participate was a section of the section of participate and the section of the section of participate and the section of reinfollowers propositions of the section of participate and the section of the section of participate and the section of participate and participate an	or (in the conservation differently than smaller values of systems who typically have smaller volumes of storage with and are in Need most during
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Detail origination and surface residents considerate consideration and surface residents and surface consideration and surface consideration and surface consideration and surface consideration and surface and surface consideration and surface and	2015-2015 study in Nedcrasks of efforts to decrease ag- groundwater pumping; impacts of water use efficiency and jets.	Pieducing virigation water by 25th caused no crop significant yield reduction and improved irrigation state use efficiency by 25th "Applying 5th Sci- ciant Commission of the Commission of the Commission of the Commission of the Commission of the Commission of science of the Commission of science of the Commission of science of the Commission of science of science scienc		determined corp evapotramphation requirement missel inligation reductions and application as limited to 30° mm every 3 days, the application application as limited to 30° mm every 3 days, and a smolf and simulates a center pivot application system.	Anned to have no runoff to neduce residual field CUI	Not discussed. And The Management of the Control of	tempted to reduce nunoff from the field aspeted growth stages of the crop cross the 9 intigation beatments (See able 2 in study)	- Yes, data from High Plains Not discussed. Conside Center	Bub-eurface drip Intigation was used	Not discussed. 9-different ad engation from 2016	ent deficit noceasion 10-2015	Not discussed.	Not discussed.	Althorwas not facused. pumped	Not discussed. Not discussed.	The study avoided felenaum sunoff systems. pumping surface is Crop yell control for	ed by MRC's timit g and sub- intigation.	invested in soit water monitoring probes (SGS CAN Region potein, CP4 International) MARCV/ more in SSS 8.4 sufficier program used to analyze cats.	or dancesed The measurem pumping export services of frigat export services of frigat export services of frigat export of the services of the s	nert of Reduced pumping ons the could benefit ground stion water weeks, but is not o	g (inigation) The following equipment is needed:	Resulted in retaining of groundwater for depletions in to	ing of intgation relative to the growth of the plant or globo of old western Nichtzeska, it was noted that ET almost old western Nichtzeska, it was noted that ET almost old be helipful in understanding timing and application	could be helpful when timing der High engings engings est always exceeded precipitation at second at the second precipitation at second engineers.	gher elevation snoepack and sming of deficit globin was not applicable as they rely on foot agriculture of the study could be helpful for graph of elevations where different surface globin practices begin	Autiple consocious years across a variety of dydrologic/precipitation seasone	None but study limited to dry beans	Consider deficit inigiation to support critical grown of copy for higher yield
Integration Efficiency and Water Balance of the Little Wind Unit on the Willind River Indian Resensation in Wyoming	Master's thesis on impation system efficiency in Little titre  Desirate of energitis and challenges of easiling legal moch  South ATMs and success-distinct for consolication and  standard station.	nd Unit. Uses agreater balance & geophysical technique to quantify & locate water losses. "Large entral stars gape associated with inflows, unflow, diversions, and pre-lipidation data, [shich] clerified especific needs for better data." Phanism This article will describe the barriers in existing to temporary transfers and the various approval to temporary transfers and the various approval.	No. Paper not found Paper not found Paper not found for found found for found found for found for found for found for found for found for found found for found found for found for found for found for found for found for found found for found for found for found for found found found for found found found for found found found found found found found	er ext found	Paper not found Paper not found Not discussed.	Paper not found Pa Not discussed. Not	oper not found	Paper not found Paper not found  Not discussed. Not discussed.	Paper not found	Paper not found Paper not Post discussed. See Table	Paper not found  Paper not found  for 2 in study Not discussed.	Paper not found  Not discussed.	Paper not found	laper not found p	Paper not found Paper not found  Not discussed. Not discussed.	Paper not found Paper not Not discussed. Not discussed.	ot found Paper not found  Days of found to the found found found found for the found fo	Paper not found  Not discussed	Paper not found Paper not found of decursed	d Paper not found	Paper not found  Not discussed	Paper not Sound Pa Not discussed Not discussed	er not found	Pap Not	oper not found	Paper out Sound  Not discussed	Paper cot found  Not decussed	Paper not found  Not discussed
Standarding Tengony Water Tansle Standarding Tengony Water Tansle Procedure in Colorado Mater Law Review	personal POSITION.	chainse This article will describe the barriers in existing to temporary transfers and the various approval mechanisms available under existing Colonolis it will provide an assessment of the inengith as inhalations of the existing barrier reshoots and make a recommendation for consolidation and transfer details.	nd																									
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## Exhibit B-12 ATM Documents with M&V Criteria

									-14-14-1								Monitoring and Verification	F84											
			Methodologies and in Processes												d Equipment Municipal Participants							Program Levit Considerations Manadering & Verification Workgroup dealing Principles				Ney Tahanesys			
Title Di	te Publisher/Authors Description	Notes	Measurement of water returned to the stream	Consumptive use analysis	Extinated residual field consumptive use	Return flow maintenance V	Verify conserved consumptive use	Coordination of Benefits	Representative Crop ET Data	Verification of conserved Sub- consumptive use	Reservoir operations	River diversions & foregone or bypassed diversions	Lateral delivery and ditch loss	trigation and non- irrigation season return flows	ting River Forego	ne or Reservoir sed operations	Ditch or pipeline Overall code delivery system	Monitor system- wide operations system- to werly account conserved record	Tradeoffs - Value and/or cost wide implications for more precise data its	Proportionality	detecation			Resulted in added water, rather than a retiming of depletions	Lessons tramed	Clata gape	Keys to success	Identified challenges	Overall findings and recommendations
				e g analytical proces	esses and whether or not MEV ac	chides were measured; estimated	nd or not considered	D/ ADV.2324	e.g. feld specific data or regional data?	g visual verification, regional date, e.g. w respectfic date? should slead	eets e.g. staffgauge tored or reading or outlet reading traubet	e g flume or pump, regular e g or continuous readings? - rea	g, regular or continuous flume leadings?	e.g. measured and e.g. availa returned via aug streamfour station? freaturent	e eg fune or eg estin punp, fon strea rist? regular or measured	eg staffgauge inflow leading or outlet leats or leater?	e g flune or pump, e legular or continuous divenion from leadings? same basis?	er eg compare eg are zy tre overall basin ende diversions to eccounting	ation is g. value between estimating a towery vs. obtaining measurements to increase parts?	e g geographic diversity?	e.g. accuracy of economic and/or data solected?	op. consideration of equicers and/or fownstream water users?	g amount of effort required to equip farm indicr implement project?	e.g. activity resulted in a net increase in water in the stream?	e.g. critical bans, or considerations for future projects?	e.g. date and/or information necessary for future projects?	e g. crucial paths and/or processes that should be replicated?	e.g. missees that should be aucided?	e g. comments on the featibility of DM activities?
Use of Attenuative Transfer Methods to increase Water Supplies for 20	Trujulo Minadown Reservoir ATM struly (1984 s.)  plensky objective of the TMR Starty is to invest on  https://doi.org/10.1006/	page the benefit for municipal augmentation of Trijits electoryment of Trijits Meadows Reserve or supplies. Statemation meetings for federal & state.	basin with steam measurement – Conejos River basin wheched	2002 for districts 20-02, 24-07, and 35	Account.	tion Platers Reservoir and Trujito Meadows		an unicons		rependent upon proposed reargement of storage and/or vice- ersa	outline measurement would be needed to monitor	ent on the second	nd inigation efficiency for demand dimates	ander stre	in gage lates, irrigation in page lates, irrigation to amount reporting to atlonge process.	stated selecte need to be of coordinated sposed through other	be conveyance from Conejos River to San Antonio River	records an augmenta requirement	d requirements for Yourse outseighs cost for expansion of existing reservoir and/or no additional reservoir construction	of and distribute curtainments throughout ber		digations are big driver or feasibility study, as well is in-state water right.	II, III, SIIS BINAS	of depletions and/or augmentation	anagemen was ar maked a rep i sensouropalen was augminator	neasurement on Trujilo Meadows	No. Concession	No. Security	reaction that produce the second section is a particular transfer to the second section in the second section is a second section of the second section in the second section is a second section of the second section in the second section is a second section of the second section in the second section is a second section of the second section of the second section is a second section of the second section of the second section is a second section of the second section of the second section is a second section of the second section of the second section is a second section of the section
to transasa Wagnatura, Huminipal, Consepte Basin Agricatura, Huminipal, and Environmental Purposes	17 e.o.ukicealitiiseoon luotudeg dieut tuv storage and storage of oth ISPB aggressionomia S303&did=0 and augmentation-water rights for agricultural or from the Start Arthonic.	AND WE remainded about an amountment of page to a page to a page to a page to a well-stagement of finglish Massbow Reservi- er explain. So well as a page to the same a approximate approximate approximate page to the same and the same and and approximate approximate approximate page to the same approximate page to the same approximate page to the same approximate approximate approximate approximate approximate page to the same approximate of the same page to the same approximate of the same page to the same approximate approximate page to the same approximate approximate page to the same approximate approximate page to the same approximate p	n us to ued ng																										
Allmon Development of Land Fallowing-Motor Leasing in the Lower Arbanisas Valley	The goal of this report is to "report on the devel https://drive.bisk.stat leasing fillhowing-leasing in the Lover Alkania occurrent/likectors (Lordon John Stating) at the Lover Alkania to Askindering Stating (Lordon John Stating) at the Lover Alkania to File askindood Stating Commission (Device Alk District) and to \$7558,6600			Hydrologic-Institutional (H+I) Model, Groundwater Accounting Model (GRINN)	Non-discussed.	Not decreased. Not di	discussed. No	iot discussed	Not decussed.	Not discussed. Not di	iscussed. Most storage include at Puebla Reservoir and conveyed to reunis through SDS	Sed Not decussed. As- ir to the	8-or-none approach with Super Ditch C lateral users will have to follow Super lbds.	s -Not decussed. Not decus	ed. Not Nondeau discussed.	sed. Not discussed.	Not discussed. Not discussed.	Not discussed. Not discus	Munic were worsed about another ently buying up water rights during lease and severing Munichigh-and-dry after lease to expires.	y Munic want-protections, tease-fallow is get attractive to farmers em	merally Yes	1946	ic, no, and kind of	No this would only result in re-timing to depletions and/or augmentation	Not discussed	Not decorated	Increasing storage for farmers to use as lease water, simple tools and admin process to help farmers balance economic obsides	Not decused	Continue developing and piloting lease-fallow programs
Leasing in the Lower Arkansas Valley	STOREGUE O ANAMAS Valley Super DICK Company, Inc. Sk	Valley of uninecessary it times due to trans-basis     Lower august considers monthly search four facts     tower analysis by Leonard Ros Engineers found y     epicolitis by Leonard Ros Engineers found in     epicolitis analysis of the registed in the so     engineers water will be required in the so     engineers water will be required in the so     engineers water will be required in the so	and the same of the fire and the same	Integrated Decision Support Consumptiv Use model (IDSCU)			downer of the same		r los montos sos ET	Professional Services			tich loss was calculated as 10% provipance, 63% prigation efficiency			and the consequence	Art come	No decreed the control		No de casa						No. of Concession			
	Thumpeon Farm receives supply from Handy D Reservoir Company shares and 240 Celf units consultant ream found that it was feasible for L County to afford, from a water supply perspecti	The Libert Section of the Control of	intigation, Ditch company rules dictare sito, when/amount of different water types for a linigation (direct, storage, C-BIT)	Use model (DSCU)		conditions, when C-RT Not di condits not bandlened to Broanfield	5	armhaeps irrigating most years (it or 0 out of 11) and gets cash for sold redits	r Sool mostare and sit monitoring station recommended, not implemented			ofi All	ny Creek Laterat of the Handy Ditch, en Falloth users sould lose out if the much Thit water transferred out. Itch loss was calculated as 25-50% procyance	Little Thompson River Little Thom as a result of ATM as a result	tun flow to Handy Ditth Not deco- pion River Company of ATM dockly socks water st-dish	holds shares in reservoirs and delivers them to members through	Note, existing Accounting in inflaetructure on Farm secencials whe Data Company shales	place at D cens Co.	ia						endugh for farmers is an issue for this ATM, Working with DNth company to maintain orbital mass of flows in Mandy District was important for buy-in public proceptors was outsid and political engagement from County was essential; Dollay-Rocked, in- person, Socie-to-floor, talkned to munic concerns; develop-clear goals, but stay willing		Keeping critical mass in ditch for Ditch Company Suy-in; work with water conservancy district closely; limbed legal machanisms through water court make it tricky; be conservative in ditch	best fit for municipal partner to self-lease shares	Through plot demonstrations, the State can help encourage "timoustion" and "waity stationer" such as Earliner County and Brooffeld to consider adopting ATMs to reset their goals.
	some cell units (111) and share some other or some years, while still having sufficient water or som and sugar beets, as well as crops that my water." The study looks at aspects of feedbling forcessing them forces of shallower.	life (IDI) in Control weeds whethcode of thinge pringer the farm for including modification); Class II and III solls, including the control including the control control in control in control in control control in control in control in control control in control in control in control in control control in contr											inveyorus			Hany Distri									сопроснике, версияе комт то упореку ехексаве от тhe упорест долок, паче а укол вг		efficiency to keep downstream users whose identify clear goals with establish as ATM but stay flexible about details.		
Little Thompson Fami ATM Grant 20 Completion Report	high name and an interest of pathwellers and interest of pathwellers and interest of the cade 27 till favore _ of the cade 27 till favore _ of the cade _ of	sport also secommended to reduce direct evap, impro- te final 115 C-BIT efficiency also contour farming, dop intgation distall to SMT & ET monitoring, drought stateast crops																											
	lease back these units for assessment coor plus available. "The report also discusses Lescons: Future Considerations: Legal Hundles Blankes to (Northern Rusenaking, Direct Flow Rights, Deli	10% when SPE impation patience, no secun-flow equirements due to CRT water, so no effor experiments way Efficiency 4 Employers	19																										
	Will (Educating and Obtaining Support of Leade Support, Out of County Pattners, Continued Ed Neightlanding an ATM, Succeedal Tipe, Trust (Scradinis and Pursua Couls with an Open Min.	ratio, Public carrierd d Tools About																											
HR13-1200 Catin Canal Company Street Catin Canal Company	Opportunities and Personal Color Personal Color with the City Color Colo	coor Reason not Satissing—leage emphasis on return flows; using Lease is imigation. Satissis Tool from DWR to calc available war ject airms to discussed returns; Pay As You So? target reases to deliveries for return flow use of rechance.	Fingas Creek augmentation station or	UT .	Non-discussed.	FT and coordinated Accountry and Changes Creek Augmentation Station and nearby rechange	ounting for exchanges and water deliveries. No marks	lot discussed	Non-discussed.	occurring for exchanges and water. Not di adventes to munis.	Not decused.	Field visits to track oundition of fallowed areas	tz discussed.	Accounting for Not discus eachanges and deliveries to Timpas Creek Aug Station	ed. Existing Existing directions, directions diversion diversion.	LAWCD coordinates ecords selectes from Pueblo Reservoir	Sidesting structures, Silvinting structs diversion records diversion records	ne, Not decused. Yes very be detailed	CU Water estimates based on LFT and models offer dramatically and may limit water available to munic excessively	Het Not discussed	Yes		to, yes, and yes	No.	Largery exceessful project water deliveries were made, return flow obligations met, farmers gut paid, murins gut water at reduced rate, fallowed areas were able to bounce black with re-imigation, no issues with encion or nocious weeds.	None identified or stated in report	Cooperation and communication among enter(s), denium, munic, SEC; recommend as "one-the-rive" storage account at participating near-voin to allow for more precise exchange constraint and precise accounts.	Conservative exchange rates for deliveries meant that munis had reduced CU credits available	Successful operation of plot project COMMENT: no decursion of public engagement or perceptions, so more research into public take on plot project
HR13-rdell Cetter Canal Company Rosedonal Land Fallowing Municipal Leasing Plot Project	the municipal water providers — the Yours of 6 (xiOCximin209 listinitizing of Founties, and the Security Water District (Project/200 PALL polity Practicipants) - from notinized thindusing of stand (Nearthird-3856ct20 - lax films irrigated under the Catin Canal in the	owier, the idructures supported well-timed natura Stave (Municipal supported on station used for factor return located on Sows and consumptive use water delivered Arkansas. Inunicipal participants; ecosion & weed con-	to a			and nearby recharge ponds																					allow for more precise exchange accounting and less excess storage of CII credits		
	The annual of a difficulty of the control of the co	nded by Standard delay table to estimate this for isolators with the standard delay table to estimate this to be standard delay table to estimate this standard by the standard return to stater quality by lowering return to stater quality by lowering return to the standard of the standard return to the standard of the standard return to the standard of the standard return to the standard return to the the standard return to the the standard return to the the the the the the the the	Not discussed.	Not discussed	Not decused.	Not decreased. Not di	discussed. N	lot decussed	Not decursed.	or discussed. Not d	Not decreased.	Not decused. Not	of decused.	Not decussed. Not decus	ed. Not Not dead	sel Notdiscasel	Not decreased. Not decreased.	Not discussed. Not discus	med. Not discussed	Not decreased	Not discussed	est decimand	tot decisted	Not discussed	CVCR OF could be a very walful but for paraming increase flows for discretization seams but cannot growed against intervening earlier discretizing state data is useful to the initiation, and proposed data will be executed, shapherding is very challenging; collaboration among all water users will be key.	Not explicitly, just that stateMod can only do so much, need to get in abouldta	Local participation through ag deganizations, roundables, conservancy districts, etc.	Not decussed	Not decided
	https://downeblek.stat e.co.un/ows/tribadour 169 to meet multiple uses /nonconsumption to signouthurs shortages; and identify types of AT 1009103/tumpak20 https://do.unel.200 tumsections most subside for meeting multiple	clone could commitment transport, fewer excess native data and due to fertigation in drip systems; TNOTIU of patreenthy to support instream flows for supposes. Tablist wWTM listers used when downsteen																							collaboration among all water users will be key				
ATMOS Yanga Rein ATM Study 20	HAZIA TRINI-000/AUDM TINC and be patners, would involve the following organization and programs agrouphize water user with full or a incomprisor to the program applies and transferable CD water follows the program applies and transferable of the water of the program applies and transferable with reason with an in	somation such without DF right spins out to the such without DF right spins CU																											
	A characteristic state of the control of the contro	over flows for neather flat						DV ADVISOR												67.00/1464			WALLEY .	6770004461		67 00/0160			SSV ALCOHAGE
ATMOS Grand Valley Male: Users Asso	The Comments Comments for Project intended to 1 to characteristics receiving for a Western Stope in the Comments receiving for a Western Stope in the Comments of the Comments for a compensated teacher. This report years were consulps voluntary and compensated teacher. This report	COUNTY is a large demandance annihal, manage week det the county of the	M. MARINE	No. Gallouses	No. o no o no	NA SHEETE SALE		an annual and		an uniconsta			a sousee.		discussed.		, , , , , , , , , , , , , , , , , , ,	NO. GREATER. 1904 GREAT	MAL SINGSON	NO. UNICORNIC			n. unusunu	No. of Concession	der wick inflamment ails medical interest and an analysis of an analysis of a made only open cut from any electronic process. The analysis of a made only open cut from any electronic or electronic or experience, broadched and open contained or contained in a condition find participation, dissolidations in regulative impusors of electronic prolification and the Westerlan Stoppes of electronic prolification and the Westerlan Stoppes of electronic prolification and the electronic contained and contained and the electronic prolification and the electronic contained and electronic prolification are not with an absorbing of participation; electronic prolification and participation are engage as produced such and and electronic prolification and provided and participation are engage as produced such and and electronic prolification are contained as the electronic prolification and electronic prolification are contained as the electronic prolification and electronic prolification are contained as the electronic prolification are contained as the electronic prolification and electronic prolification are contained as the electronic prolification are contained as t	y -	No. Company	No. Security	NAS WINAMANNA
ATM-66 Grand Valley Water User Asson Conserved Consumptive User Pack Project Development Process, Procedury, and Exercise Learned. Water Banking Nick Steps Part II	86 ADMICSROWING THE the process of developing the CCLSPP, the pro- sing linearing learned. 17 Coupp projection economic final pdf	induse used, inchemibles including local economy & sectivation (COL withouting produces (Subtlet 8) cost specify methods to verify C on fallowed land, but does include sizes visit to wattri local month and explorer probability.	u a																						pericipation as much as benefits of participation; engage ag producers early and other in program process.				
Grand Valley States Users Asso 2017 20 CCLSP In-Season Verification	topic/formeblink.com  Press complained and payment element for each participation Science Security in adding well-cation Science for each participate of an adding another adding an addin	active plant grawth on fallowed land 2017 Includes 2017 ventrament Social editions ogram commentations, commentationies	No decorated	Not decounsed	No Pacients.	Araulus Ara	Second 6	ECT CHICAGE	Not decorated.	or decimal.	MARKET BUT SECURED	Not decorated.	of Secondary	Not decided. Not decid	as for Mindels	H1 807 0103.4001	Not declared. Not declared	Ser decusing . Not decu	MT NO GROUND	NX DECLESES	Not discussed	est decorated	NI SHIFTING	Not concessed	NOT DROUGHE	NX DECISION	Rot discussed	Not decurate	for decision
CCUPP In-Season Verification	very true report on "one potential mechanism"	yough which. I'very onet report on "one potential medians	an Maranasana	NOT DECLEME	NZ FEGURE	NAX GALLALIAN SAX G	decess	EST GRECULENCE	AZ SICURIA	ext discussed.	NAME AND DESCRIPTIONS	Not decourse. Not	or decursed	Not decorated. Not decor	AL NO ACCESS	INI BOLDANI	Mar discussed. Mar discussed	NOT GROWING - NOT GROW	MAT AND GROUNDS	NOT DECLERA	Not discussed	ez seculus	DX GELIUMS	NOT DISCUSSED	NV discussed	63 SECENS	ROZ GROJANIA	Not decorated	SUI decusion
ATM-08 Power Canal Capacity Report, Grand 12/1 Valley Water Users Assa	Mope inderwebbis, and the Colorado River under a plate project was classed and account Sectors of the Colorado River under a plate project was classed. Sectors of the Colorado River under a plate project with the Colorado River under a plate project to the sector of the Colorado River under the generate by scored.	vocage admits - to you clear report on this potential institution of inflamed in though which water associated with OCU - bases? to could be proceeded and institute of the could be proceeded and institute of the fact these bed counted personal for improving voluntary, and the lates? Compensated, temporary, voluntary, and the processing of the processing of the processing of processing of the processing of processing of processing processi																											
	the potential for additional water to generate by power.  An extensive evaluation for 1) To identify transers to implementation of after	As coulding becomputed this in inci, manipal with 2017 by War II to consciously. War II was to A THE investigations of the consciously post of the consciously post of the consciously post of calculations post of principle, loss of supply, and consciously post of principle, loss of supply, consciously post of principle, loss of supply, and consciously post of principle, loss of supply, loss of supply and principles of supply and post o	Potentially new flumes in tallwater laberals; measurement devices at laberals and the forms of the forms	Standard methods	Not decused.	Accounting at recharge Depart stations prenantly, or deficit	sends on the ATM program: fallowing vs. No of irrigation, etc.	lot decussed	Standard methods	or fallowing: SSIO werifies by Not di necking field in not intigated. For should be supported to the solid be oparatily aspects of CU but have of been sealed in Water Court!	Not decided	coss Na	of decused.	Depends on which Not discus portions of land are	ed. Not These for discussed included the available apply for	es are Not discussed.	Common crux of issue Not discussed. for potential ATMs.—	Not discussed. Not discus	ned Potential injury to senior water rights to based on historical consumptive use	iden: Concern of agrueers that benefits outweep the pain of inglementation, reporting, inc.	pad by Not discussed of	est decimand	to decision	Not discussed	Legal mechanism is crucial to get buy-in on both sides: 1) protections for agusers from divinishment of rights, or risk of abandonment, 2) Munic know buy-and-dry and	Most decusion relied on CDSG data that is jublicly available and leverage existing	Programs that can address the barriers local in the next cell —>	Five barriers identified from interviews with MMI and ag- users: 1) High transactional cost, equal to or greater	Not discussed
Companion Report Development of Practical Absensive Agicultural Water Transfer Meleures for Preservation of Colonols Intigened Agiculture	transfers and to describe potential disabages to barriers.  2) To develop tools for agricultural producers to validity of potential abstractive transfers.  4 co. subcedit Electron.  10 S. States and authorized transfers to see	poet, reacurourantly, lack of eappy, selectance, power dynamics, needs and me evaluate the to address burriers, Lease Sushadon Tool (AgCST) agleomorrics evaluator, eachange control trees.	sectors of setterosporos			efficiencies and diversion records (with dish losses)				and impator sectioning assistant quantity aspects of CU but have of been tested in Water Court				Depends on which por discourage parties of faind are fallowed, may need additional pipeline-distance or purpose to the faint-faint faint faint-faint faint-f	supply for	tander	Man is updream of the inigation point of one so actually concluding author,		(\$5.13) "his associated with any proce (\$5.13) "his associated with any proce that quantifies a service right based on that countries a right of recent decision (actually) use, in hight of recent decision	dates. Concern of ay users that benefits outweight the pain of implementation, seporting, or new seasons and only on the season, butter, or change the program that instruments, butter, or change the paid dry. 6 de 6.	or than				Larger mechanisms in concert to get from you not belt related by protections for agreement production of the control of the c	processory analysis and anomaly extensive a program of the control of the control of Limbed discussion of equipment and editactuature needs for 11 delivery of transferred water (usually upsteam to All land 2) measurement of Collegeum Sowiesc.		Five Turniers identified from interviews with MML and ag- iestic: "1) Fight branchication (cut, equal to or greater than typical buy and day process; 1) Risk and Uncertainty, for agine early the state of the control of the con- trol of the control of the control of the con- trol of the control of the control of the con- trol of the control of the control of the con- cernation of the control of the control of the ATBNs is not not put to due of Capitalities for Delivery, suc- of influence-time can be a respiration of the con- trol of the control of the control of the control of the control of the control of the control of the con- putations to the control of the control of the con- trol of the control of the control of the con- trol of the control of the control of the con- trol of the control of the control of the con- trol of the control of the control of the con- trol of the control of the control of the con- trol of the control of the control of the con- trol of the control of the control of the con- trol of the control of the control of the con- trol of the control of the control of the con- trol of the control of the control of the con- trol of the control of the control of the con- trol of the control of the control of the con- trol of the control of the control of the con- trol of the control of the control of the con- trol of the control of the control of the con- trol of the control of the control of the control of the con- trol of the control of the control of the control of the con- trol of the control of the control of the control of the con- trol of the control of the control of the control of the con- trol of the control of the control of the control of the con- trol of the control of the control of the control of the con- trol of the control of the con- trol of the control of	
Preservation of Colorado Intigated Agliculture	and out-of-members and security of government absorative transfers.  a co. sectorate Silence or Section of Section and an advanced transfers by event of Section and Section of Section	gloubusi osally												patterns, may need multiple inflastructure changes to re- establish timing			minimizing exchange drysp, etc. can be challenging and norw as the further the original land is from the Muni		on Sandal serious Sarbandul historical un	a.*					recommendation that SEO should have more authority regarding relembing for temporary water transfers under the undersite of ATMs.			year, respectively; 5) Power Indiatance, related to access	
ATM-10	avanuation of determin membras of monitoring or stores and consumptive use (CU) under defact. Index (introvenies and	op water Steno project to available different methods regation, enabling crop water stenes and CU under ch or crop stenes monitoring.	or branches methodologies	Study tocused on comparing measurement techniques to estimate cro coefficients (and therefore ET and	Not decided.	Alfantina Acra	decimal	ROT CHICLEGARD	sol mosture sensors, intrared for thermometers (RTs), landsuit images	ex decused fex d	MARKET NO SECURED	Not decursed.	of decused.	Not decursed. Not decur	ed Fox Northead decused.	101 NO CHILADO	NO GROUND NO GROUND	Six decision Six decis	ned Concusion is that Landian Notifi based coefficient estimates are just as accurate expensive and labor intensive ground to	cop for decision	Ton	ez decuesa	Statively, is all open-source data and disease provided by USrSS from Landsat attellies	Not decided	IRT; require castration and research-pade instruments can be several founded to several flowand distant; commercial handheld RTs require extensive calibration and separate instrumentation to propely measure cancey temperatures; CHSI tend	NEXY is a useful Scotts extinute cop- coefficients and ET for targe, distri-scale analysis; SWR could be a good atternative for small applications.	Not discussed	to incomplicate and segal exercises to incomplicates introduces (1,000, Medical) flants contact of warner accuracy companied to satellite hashed subchrispant for existinging Sept?. Ground based shortwispant are lated interesting and requires investioned in measurin-grade equipment. Landow NEVE Sizes LESGS in PRESEDENCE SERVICES.	Estuario based sectiniques (s.VVIII, Heidel ) have sinter or works accuracy companied to unitritite-based sectiniques for estimating NDVII. (Issued based sections are taken temperature and require investment in research-grade equipment. Landaut NDVIII from
Final Project Report Implementation of Defact Implems Regimes: Demonstration & Outreach	+ 56 ACA ACCORD. MINISTRAN ACCORD. ACC	on arap stress monitoring		hassumment techniques to estimate or coefficients (and therefore ET and therefore CU; Cop coefficient (KU; soil sales balance, inflaved thereforestee, Crop Water Stress Index, Landaut NDVII ground based NDVII and RadisT method pound based NDVII and RadisT method	e e, de														Industrial IS						In the depart count about any terminal originate relativistics, but an elevative and inclined a lowered Trichand admits, commended installed PTR require extension cultivation and requires installmentation to propely resource couply serperatures, CMR and to underestimate ETR resource background temperature resourcements can communicate PTR resourcement, CMR with not except as installed properties of commission and country of the service and the service properties of commission and country of the service proportion of the service and country of the service proportion of the service and country of the service provided proportion of the service ground channel STVIC.	tor email applications.		Nonelive and require investment in research-grade equipment. Landuist NSVI from USSSS is PRESERVEDENCESSES.	prop a Presentation .
	Final report of Poudre Water Sharing Working of scrotogie ATM water sharing group between ay users ploom Poudre in Cu., Water Supply & So (Sache in Poudre in Cu., and Larines What is Cache in Poudre in Cu. and Larines What In (Sache in Poudre in Cu.) and Cu.) and (Sache in Poudre in Cu.) and (Sache in Poudre in Cu.) and (Sache in	Iroup - a Pinat report of prombype ATM water sharing ricultural group between ag (North Pouder for Co. Wat large Co. New Supply & Storage Co. New Cache is Poude () and Co., and Latimer/Weld for Co) and main (Fu	Standard methodologies der s sir 1	Not discussed.	Not discussed.	Not decisioned. Not di	decused.	or decused.	Not decussed.	or discussed. Not d	Not decreased.	Not decussed. Not	of decused.	Not decussed. Not decus	ed. Not Not discussed.	sed Not discussed	Not discussed. Not discussed.	Not discussed. Not discus	Met discussed	Not decuseed.	Not discussed.	ez decuesad.	to decision	Not discussed	Not discussed	Not decused	Personalized approach to ag about alternative options.	Not decuseed	Proposed buy and supply hybrid ATM: "3" sheet send and water that a farmer securisation to see it is purchased by a conservation entity (spicarly with numbble sections) that places a conservation essented or the farm and leases or sells back to an applications producer. A portion of the water is reserved for hause to domestic users
ATM-11 The Poudre Water Stading Working Group: A Report to the CWCR	So autowalt Silection   Memoral users (Foot Califers, Greenley, and Tith's Gife augustacion 19     Honor Review (Service Silection 19)   Memoral users (Service Silection 19)       Solidation (Service Silection 19)   Memoral users (Service Silection 19)       Solidation (Service Silection 19)   Memoral users (Service Silection 19)       Solidation (Service Silection 19)   Memoral users (Service Silection 19)       Solidation (Service Sile	ciudinatal group-between ag (North Peads in Co., Village Co., New James 19 Co.)  (and Log Co.)  Co., And Lainmen/Weld in Co.) and must offer between technical on the less facilities of the less facilities (Northey, and T-6 Calcassing on the less facilities (Northey and T-6 Calcassing on the less facilities of the less facilities on the less f																											provides for drought finning, recover 2 years in 11, or even for base supply where possible.
ATM-12	sozned, survey of ag ulens, development of pro- agreements, and regional cooperation stategic tree-digation of PLEX water market explanement independent and recognition of PLEX water market explanements independent and recognition of the companies of the companies of the independent of the companies of the comp		Standard methodologies	Standard methodologies	Not discussed.	Not decisised. Not di	discussed.	ox decused	Nor decused.	or discussed. Not d	lacused. Not decreased.	Not decussed. Not	oz discussed.	Not decused. Not decus	ed. Not Not dead decreased.	sed Not discussed	Not discussed. Not discussed.	Not discussed. Not discus	med. Not discussed	Not discussed	Not discussed	nz decused	lot decisioned	Not discussed	Not discussed	Not decreased	Not discussed	Market volatility and changing priorities for private industry make it toogh to work out deals; customized approach for inflastructure needs on a case-for-case	Consumptive use-quantification could gateritially be used to substitute the need for a change-in-use with end-users to be determined — Earnework for Water Court case(r)
PLEX Water Market Education and Implementation Phase	# 40 AND AND THE PROPERTY OF T	tion: Investigation of FLEX water marker to large-scale implementation; regispersers, index based shotsters. The pricing merciting on large-scale or the FLEX in plementation, meetings between willing stora, and LEX markers.																										educity make it hogh to work our dealer, combinised approach for inflationates reads on a case-by-case back to assess needed inflationation (Ppelies to deliver downteesen ag water upsteam to MMI sould have the unintended consequence that intensities that of you've our pible to access the pibeline. Then your water will be	
	dry that maintain some continued level of agrics production: 1) Dry land farming, and 2) limited is	thanse and attenuatives. Properties for conversion of rigation. Send to dry tand or deficit-integration, economic is maintenance issues withy land it deficit.	ag .	anau mounge.	No. o account.	ig is i	is sibe visits to verify no intigation and reveg cess in underway. Limited trigation is more splicated to track amount of water being seed to land juhanis partial CU for a crop?)	ingation could benefit both M&I and g case: when there are surplus water i their supply portiate that cannot be iredly used or stored, as this can be	methodologies applied	pantly using standard settodologies (i.e. court-accepted)			a accusatio.	during limited intigation	discussed.		94.04444	accounting any recha stations w see Ney 1s.	g at inigation of crops gar outd lay	No. Security				increased water in streams rather than just a retiring but it would beyond on the crop type	are the quipped to handle poor solls (high compaction, poor structure, time organic matter, and possible high nutrient residuals;)	content (also helps indicate infiltration and counting issues), and soll texture analysis can help determine best path to revegetation strategies.	up can improve outcomes for establishment of native non-insigated segetation. Minimize carryover of Wittinger. Weed united continued for 3-	our able to access the closeline. Then your water will be bad, the needs upontic species, equipment, things produces, and filling to achieve beet results. Long-term project timeline of 5 y seas to active or good results. Registrated count framer i'll only resultance or sessitance available for finished imparion. I spicately a Stituce of water is more valuable than timeled imparion.	restriction of leased in any case yet/
Attendives to Permanent Cry Up of Jun Formerly Irrigated Lands	+10 ANOVAN SINCON  13 ANOVAN SINCON  1008& ANOVAN S							sated back to irrigators, which are consumed for in the form of recharge tations and any surplus credits. The scharge credit Samework takes care scharge credit form form to take care										eon of the religation of lease can agreemen between t	ted f k								5 after planting/seeding rative seg	<ol> <li>Sittacire of water is more valuable than limbed intgation- yield (payout from limbed intigation-farming unlikely to pastly cost of continued farming efforts)</li> </ol>	
	Native market experiment, survey of municipal is	industrial Rister market experiment, survey of municipalities	of Not discussed.	Not discussed	No decused.	Not discussed. Not di	ands or farming produce. Permanent dry, to she wish to verify no insignation and every cases in useful more insignation and every cases in useful more limited in the contract of the contract of the contract of their training in the contract to the contract of their training in the contract to the contract of their training in the contract to the contract CLI for a cought of the contract to the contract CLI for a cought of the	lous better coordination between till and ag legot details an economic	No decised	for discussed. Not di	located NZ decused	Not decused.	or decuseed.	Not decursed. Not decur	ed Not Notdeau	sei Notdiscussei	Not discussed. Not discussed	and ag Not decused. Not decu	med. Not discussed	Economic Siburatory experiment to Server	uter Not discussed to	94	ins - hearing markets allow MMF to Suy	Not discussed	Lots of Ag and Mills survey results about willingness to participate in ATMs/Water	None identified or stated in report. The	shoentives that assuage concerns of	Inherently apposing goals of individual irrigators and MBI	Findings
	earte bank cenanics on South Poths, Sociaed shareholders.	industrial transfer experiment, survey of municipal strated is industrial providers on ATM practices, to FRICO season, evaluation of charmed water bank sciences on South Platte					14 14 14	seport details an economic speciment where volunteers glayed a area to text our economics of a shared water bank? To see whether fill or Ag users benefit the most by society who gets more water under diverse market conditions and												Economic biboratory experiment to test w leading market results: -Ay users will release more water rights an water then in typical buy-and-dry practices thus add benefit to rural communities one and-dry.	id more 6 and 6 buy-		we - teasing markets allow filld to buy sakes from tarmers during dry years without up-and-dry impacts but there's not much enefit to farmers in well years.		Cold of Alg. and filter survey results about entingleses to participate in ATMINIVESHIP COLD of ALG. A COLD of	eried on publicly available data from the basis.	tricentives that assuage concerns of 6 both farmers and MMs, but primarily MMs needs. Not putting cost burden entirely circs ag- and MMI but perhaps State sharing some cost.		In linguistic axio inductant of ATMs due to 1) concerns over ability to self-their water rights in the Subset, 3) relatation to go through water court for feer of consequences entitle to Case Sold SCH SMS .  ABIlitiasers plan to acquire agreement rights as part of their long-term supply planning &
When Partnerships as evaluation of absentative agricultural water banefur methods in the South Plate basis.	https://downlook.est e.co.actows/fileston pt-12: CFR agar/fooder19 1715/actor/							Merent market conditions and egulations												and dry	to Suction of In				dry but the rist their trial choice				development  - Mill users are reluctant of any ATM method unless they can be assured 1) permanent supply. 2) conventing of eather rights used in their supply. 3) certainty it initiatility, 4) their can have a seminant supply at the end for a prevenient sector for an ATM.
methods in the South Platte basis.	NOTSBARGED																			decrease with introduction of water leading	g market								Recommendations
			<u> </u>	<u></u>																						<u> </u>			Service pose accessorable to consider the service present consistence in Planta service. In Planta service processors of the Continue to the C
	Proced or coloning or symbol primaring for Antoline's Law Carolla Monotering-production based on a further returns, inflant to exchange plus, and soll sensors to verify ment the loss by produptionation solvenment below the rest Zone. Project was no due to company water sensory at the time (2015) duality to righter on a price. Describbe extension and the company of the control of southing to righter on a price. Describbe extension and the company of the control of the control control	registration of Laboratory proposal patients gas A Taltic limitation of Laboratory and A Taltic programs on Laboratory with the programs of Laboratory with the programs of Laboratory with the programs of the Company of the single work the laboratory of the Laboratory of the programs of the programs of the Laboratory of the programs of programs of	This project was not achievy tion implemented to - By-gass of disentions from the Lake Canal headgate on the Cache La	Fig. to quantify water right, and another I constitute CU analysis based on crops used for deficit impation.  This project was not actually implemente	(i.e. HCU) and measured CU by only deficit intigating a partion of each participating and	This project was not state actually implemented second	project was that allustry regenerated by the project was the allustry regenerated by the project of the project	ggoth-locally yes, engative get-paid or conserving water (fallowing or effect ingation) and the MBI interest incoming environmental flows for incoming the proper for interests.	calibrated for periods where data for ASICS-PM was a multident	pgrax \$23 socials investment in social instrumentation on existing flumes, social orient institute sensor arrays, and down too and \$0.000 augments.	conduct stage upporty curve or vertically—and water level and analy resourcements to 7-feet y surface. This remark ar-	pressure transducers for in- situ flow data togging our or. This project was not	exiting flumes at dish furnous wintained and recorded by dish impany need to be outlined with resource transducers for continuous expurements	Proposed Sumes to be instituted installed strategically at collected in surface runoff outliets, outlieted with continuous data. This project extuatly instituted in actually instituted in actually	on data Fox Nor-Security SCADA discussed.	sed Rot decided	that discussed. Heat discussed.	NOT DECLERAD. NOT DECLE	seal. Seamaned \$50,000 per property for instrumentation and equipment required set up integrated SCASA. This project was not actually implement	between impator and trital	out of water lease rates, a agricultural production opportunity use tould feel even the obvino	-	se, strait above to deted for credit to e counted beards conservation posts as ell as little eason storage releases, rough the Storawer's (Nature Consensancy of City of Fort Californy valued blase associa- ows many that especia peak flows for	Hypothebically, yes, this project was not actually implemented	This project was not actually engineered but some exponent seasons were identifi- from the progress that the project made:  An established and agreed upon lease rate structure is crucial at the beginning of a project.		whater trace rate man the most difficult - point of discussion for the project - opportunity used to farmers faregoing sales of purificials crops was a hundle and oil & use sector was willing to our	Date Leading Learned	Production by pricer recognition and approximate of preparation of the control of
		programmon on youngerfalled of final 2013) and investment before the not Jame. Project was registered due to ongoing water exactly the time (2013-0013) and invalid to agree a price. Executions extension legal such to	time Cantal headgable on the Cache La Local Poudre River of — Storage water conserved would remain on Storage at S. Gray Res or Timosth Res.	And the second second second	This project was not actually implemented	y Davis Chie mans as ind Starts	version Fitnes: in-situ mat-time soumments at existing Parshall furnes into neguzed SCADA system afface Return Fitnes: in-situ mat-time	ould've been achieved his project was not actually replemented	This project was not actually implemented	his project was not actually this project and out actually not as	project was dually implemented dually mented	ed actually inglemented The	his project was not actually implemente	logging and integration to SICADA This project was not					proper was not accounty inguisment	This project was not actually implemented	feld for negotiations between ingetur and MMI		nd City of Polt Colone; valued labelesson own name than excess peak flows for invisormental goals. his project was not actually implemented.		project.  "Commission are independent appraised of the value of conserved water at the color of projects in solve form justice are the equationing a good wife and of a project in solve form justice are required in the project of the project of a project of the project of a proj	between the timing of the conserved consumptive use and the delivery of water to the river?  Does CU need to be "saved" betweet can	ages of purificative copy was a hundle and oil 8-gas sector was willing to pay shore than Marill in the end.  - DMN was a willing participant in planning the implementation of the project with respect to level management, instrumentation, and how		-Countration the spotential expept for the Cache La Process (New thr a reach including for CachesDemonstrate used in thick has producing water contriber of a dath service areaExercise countributes used in the Armandering water contriber of a dath service areaExercise countributes used in the Cache of the Armandering of the Armandering that Cache or produces to the contribute of the Armandering of th
ATM-15 Project Report Late Caral atternative agricultural practices and in-stream flow demonstration project	https://downeblek.atal h-13 offenseth/fesseton schie.aspir/secd-20 10658-86-90	where at proof of concept.		,		eurlac (numb	tace runoff outlate at partipicating farms when and placement dependent on site ographythydralogy							adually inperiorise							actually implemented				- Presidity in the terring of determines is cluster.  Needs, values, and preferences need to be established early and communicated clearly thin both sides.  That building to oversime social and political barriers was time consuming and conveniences.	te "spect"/  - Could an unintended consequence of this type of ATM be that this is another tool to ge eater out of the river and into the treatment dark thereby decreasing over flows in the tender.	thanagement, inclumentation, and how to monitor and report on return flows it - Some project participants had begative internations and the social/portlessional history was difficult		
			only be directly accompanied to in- priority diventions from Cache La Poude into Lake Carell, stoned conserved use had to be exchanged agreement with VMC and Lake Canal Co superiorities of the Carel Case Canal Co superiorities of the Carel Case Canal Co			Place in soci person Place	grated into CADA to monitor soli modure bot zone and below, taking difference ween two to estimate subsurface return flow echange pits maintained with long-throated																		companies; secessary.  "Other industries sections can influence perceived price of water and thut needs to be considered in approximate, particularly any demand from all & gas.  "Characteristics of the physical river disentions are important to ensure honest tracking of conserved water.	end?  Does it make sense to by and limit the suntier of agreements or does this kind of IRISA make this too complicated to be a viable option in utther processor.	to overcome		
						Suner - Vise partiq Deal's	nes easity aerial imagery captured for siqueting fames to include RSSR, NIR, and it signature (IR)																						
	Technical meaning pages with their bottle. Fair services, the control of the cont	Develop Boals were 1. Develop calculation 8 are and water seeffication of calculations water use and the state court seems, such that water court name to be stated on the seeffication of the seefficati	Assumption is that return flow obligations are met through sugmentation so reservoir interacts of started water are applied to sover CCU and floating flows (i.e. no such	Not zone water balance (RZWE) to get estimates of stress coefficient (Ks) and 6T for corn in web-inigated vs. defici- inigated plots.	c LimberDefort Intgating ET estimates were compared in actual test place : Street coefficient - Crop Water Streets Index (CWSI) - RedSET mode (satellite based method)	Water allocation - Street approach - diversions used to see timbed to what is the improveded for other and the second for the	ress coefficient - neutron probe readings to discentinate initial soll molecule conditions input into the FAC-58 model, which could neutrons changes in stress coefficient a FT) over time.	or decused	A control field, ideatly in the same property or proximal to project elle would need to be fully irrigated and measured in the same method used to	repends on the ET estimation. Net dis- influenciality.  The conditional public instruction of the conditional public instructions and solid study to clinical water control parameters and control parameters and solid study to clinical water control parameters instructionare and solid considerations in background respensable makings and local clinicals state predict — on expensable makings and solid clinical state products to expensional analyses assistation transports.	soused. Not decused.	Aboustion approach to near flow maintenance some normal river disension measurements: - Return flows are not by a court- approach augmentation plan as opposed to project apecific measurements of soil moisture	of decussed.	Aboution approach to Potentially intuit flow CCU is un transferance uses on ET call normal riser diversion (methods of	igher, if you Non-decur energinated discussed. Jations valuated all wardware.	and. Yes potentially seed to linitial additional schooling for the schooling schoolings and schoolings and schoolings and schoolings and schoolings to tendors out differencies between schooling pumping rates as existing pumping rates as existing populars.	Yes the report evaluated installation of a new pipeline to bring exchange water for a personnel or a series of the control o	Not decused. Not discur	ted. Depends on the ET methodology:  - Stress coefficient — detailed  measurements are needed at the begin of intigation season (soil study and resul- portion are successfully in entitles in the	Allocation method for maintaining return to require the availability of credits through a ning approved augmentation plan or willingness run establish a court-approved augmentation	Sout Fet all time ST or sectionate are peer or sectionates are peer or sectionated science-based to plan. Inethodologies	tes, allocation method for etters flow maintenance is mitted to projects that can slibbe augmentation ources or have willingness a invest in establish an	ies, the stress coefficient method is bentified in report as being the economic and approach for property when involved in deficit impation projects.	tres, less water is diverted from the flow and consumed by crops	6T and CU can be estimated by the stress coefficient method (FAO 58) and develops at the headgate can be reduced in unquinction with deficient gated 6T states.  A baseline pict in the project zero receives to allow be evaluated during the project to another. See the project area received to allow the evaluated during the project to another. Second Till by deficient.	tione identified in this report — It was science based and relied heavily on actual climate and project-site data for comparing three offerent ET estimation methods	<ul> <li>Reducing administrative burden on verifying return flow maintenance by implementing the abocation method, which can be summarized as: 11 client the minimum consisted solution.</li> </ul>	at retination methods can have accuracy insues and are highly dependent upon the accuracy of the data being input into the models gartage in + gastage out. The report identifies the stress coefficient method (FAD 66) as the mount affective method for any other as the mount affective method for any other.	If estimation methods can have accuracy issues and are highly dependent upon the occuracy of the data being input into the modes (gastage in + gastage aug. The proprisenties he dress coefficient method (FAX) so the most converted to earthod for estimating ET and COU in deficil registers properly with accuracy similar to make one properly and interesting etc. (In our Other Service Index Ind
Final Report of the Lower South Platte Intigation Research and Democration Project	Accuracy of 20-99% for facilities and control of the control of th	and the Reddil'T model of minute sensing growing Reddil'T showed accuracy of 50-48% for fail fast 2 under normal grawing conditions and accessfully detected absorbed grawing	flow from defect impated fields) as		(CWS) - RedST made (spelite based method)	ther augmentation Crop Sizes are used to other maintain return flows damage stress	up those Stress Index – research-grade and thermometer used to measure crop opy temperature changes over time and so index and thus ET are estimated, with		quarity CCU (diress coefficient, CWSI, or ReSST).	Citris - recently-grade infrared nemoment and lots of corrections or background temperature seeings and local climate data		approved augmentation plan as opposed to project specific measurements of eat mosture		maintenance uses in ST call ST call stream remembers: - Redum tions are met By a Cost-happroved augmentation plan as opposed to project specific measurements of all moleture.	-	pipelines and surface storage to smooth out differences	100		conditions for FAC-66 model  - Crop Water Stress Index – More use of specialized equipment (influend thermometer) deployed to the project of	CCU depends on ET methodologic of Street coefficient – one-time measurem needed at project site prior to insigation se to — Coop Water Street Index – continual	mental cascon	sinvest in establish an agreeration structures			irigation  Association method for return flow maintenance altimes for simple conservative extension profits of times that are activised through augmentation and if the \$17 sections of the simple conservative extension profit CCU, therein a not benefit to the streamflow and downstream		of the headpate to meet estimated defect inigation target 2) assume that no flow from the project little is incurred to the stream.	CCU in deficit irrigation projects with accuracy similar to more immediate methodologies like Crop Water Stress Index (CWSR) and RedSIT model.	econology of the delict beneg upon data for molecus galaxies on "produces on", "the separate of the delict beneg upon data for molecus galaxies on "produces on", "the separate of the delict benegation cannot galaxies a part a most can another sections for the delict benefit of the delict benefit of the delict benefit of the delict for molecus reserves membracisegas das Crop Vitaer Stress false (CMSS) and RedST moute.
Demonstration Project	IGTSBullid=0  Street: Task 3: Institute supply delivery potential Lower South Platte Intigation Research Fairs no	Trayers or or BIT. 2. Simplify the administrative burden of maintaining return flows, and 3. Settinate supply delivery potential. Project on Lower South Platter bitsation Research Firm new				Special Events - Parki down is annie	of the external initial and modelmus conditions upon into the FAC-Si model, which could external colleges in times coefficient (ET) over time. (ET) over ti			reven — so equipment but specific echnical incretedge and computers o analyse satelite imagery		Cheesions are limited to the target defect irrigation amount and the remainder		of sall molecure		pumping rates an existing pipeline capacities			reveglocal ingatos season for no significant improvement in ET estimate - RedET — Requires specialized analysi in major investment in project-specific observables.	plane to availability of condit trough; and papersed apprentation plane is willing personal papersed apprentation plane is willing personal papersed apprentation. Control of the condition of th	principal principal cont				deversions after the headings are in resolution in compression with self-devilent regime ET.  A stateming of the trop large care severals busines for section of the sectio		b) measure CCU at the project site to weetly ET and adjust diversions accordingly (daily or weetly), etc.) () augment required return flows from an approved (presumably existing) augmentation source		
							er than using meter and diversion records.	estated accounting of groundwater	Not decused.	sot discussed. Not di	No.wed No decused.	stays in the river, return flows are maintained through augmentation Not discussed. Not	of decussed.	Not decussed. Not decus	ed. Not Nodeda	sed Not discussed	Not discussed. Not discussed.	Ortalised Not discus	sed. NA presumpth trainsf water meters we	overtheen in inflastructure or equipment other than local weather data-jourist be for existing climate stational way Various farms, ditth companies, etc. are just the project on local of September 1	needed on otsting fire	Net, a big reason for the	W.	Tes.	Significant gains wit have to be made in order to much program goals by 2000	No. of decisioned	augmentation source		Not discussed
Repor	No. Grande Heart Consensance (Statistic person between Consensance) Statistic person between Consensance (Statistic person of the Consensance) Statistic person of the Consensance of th	is temporary agreements, bases for exchanges to need treamflow criteria, temporary following agreements, etc.		rigation with an 80% efficiency for spiritdens and 60% for flood.	otherwise it's forbearance on pumping/diversing	n 'augmention' and its no selease trun upstream sesencis (fo Grande Reservoir)	and the second s	ithdownis to assess the storage yet of the aquifer and track it over me										groundwater pump reeter data analysis.	used, possibly with SICADA to coordinat measurements	The see property 60 100s of Telemode's		roject is to meet interstate ompact obligations						Not enough curtainentifobearance/fallowing to reads program grain, eignificant pains will be needed to meet 2000 tagets	
RSWCD Net Annual Replacement Real replacement April Ap	w. https://tgwod.org/ub - https://tgwod.org/ub - ters.org/ub/ub/ub/ub/ub/ub/ub/ub/ub/ub/ub/ub/ub/	men toos.  In a plant to  In withdrawal  Faculties a  Each the																											
*	replace such stream depletions.																												
	Review of ATMs in Colorada for Front Range to	unsignation. Soview of ATMs in Colorado for Front Rang Municipalities. The report conducted a is of ATMs. services and application cases at color a more detailed analysis of ATM	Mit discussed	Not discussed	Nondiscussed	Not discussed Not di	discussed	ACT discussed	Not decussed.	for discussed.	lacussed. Not decussed.	Not discussed. Not	of decussed.	Not decused. Not decus	ed. Not Nondeau decused.	sed Not discussed	Not discussed. Not discussed.	Not decused. Not decu	net Not discussed	Not discussed	Not discussed	nt decused	ix decread	Not discussed	Not discussed	NAT discussed	Not discussed	Not decussed	Not discussed
Alternative floater Transfers in Colorado: A Review of Attentable Transfer Mechanisms for Front Range Municipalities	https://www.ad.cogist and demand size criteria. Two case study parts to exact control	Introcupation. The report conducted a six of ATMs, someoning analysis to identify operating cases after course between the course of the cours	a d																										
	Anna prosessors se suo escolo fissiscipalità	is. Conducted a francis analysis of visitor supply alternations for the feet case studies; finding sociate recommendations for sext ATM practices to suit those municipalities.	pi .																							1			