Wyoming Demand Management Feasibility Investigation: Stakeholder Engagement Process

July 2019 – December 2020

drawing by Sue Sommers

University of Wyoming | Extension

B-1384
Final report
December 2021

B-1384
December 2021

University of Wyoming Extension — Ginger Paige, Kristi Hansen, and Anne Mackinnon

Designer: Tanya Engel, University of Wyoming Extension

Issued in furtherance of extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Kelly Crane, director, University of Wyoming Extension, University of Wyoming, Laramie, Wyoming 82071.

Internet addresses change and pages can disappear over time. If you find problems with any of the listed web sites in this publication, please contact Ginger Paige, Professor, Ecosystem Science & Management, University of Wyoming, (307) 766-2200, gpaige@uwyo.edu.

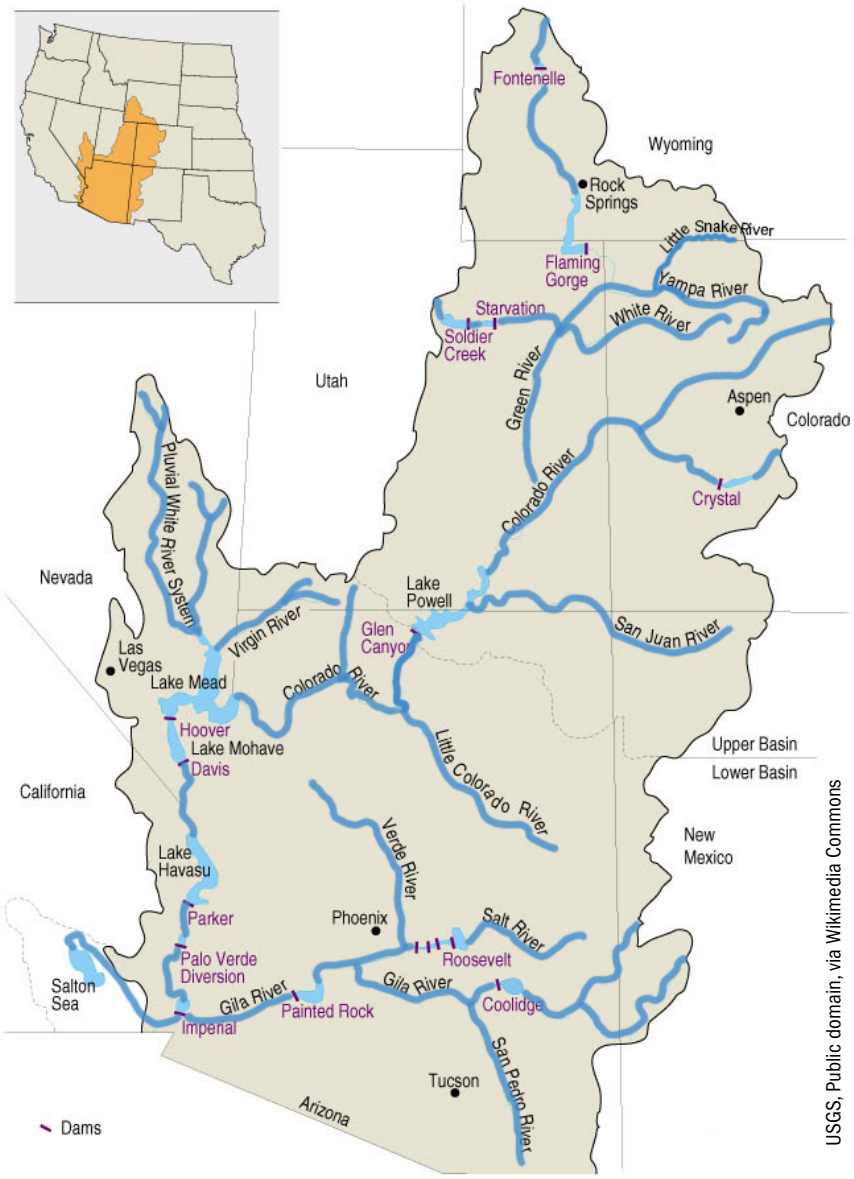
CONTENTS

James R. Campbell, USGS

Fontenelle Creek

EXECUTIVE SUMMARY

Given the drought of over 20 years in the Colorado River Basin, Wyoming and other states in the Upper Colorado River Basin have been exploring how to best minimize and mitigate the risks associated with drought. One concern is that the hydrologic conditions may reach a point where the Upper Division States of Colorado, New Mexico, Utah and Wyoming are at risk of not meeting their legal obligations outlined in the Colorado River Compact of 1922 (1922 Compact). If that happens, Wyoming and the other three states, per the methods outlined in the 1948 Upper Colorado River Compact (1948 Compact), may need to curtail, which means reduce consumptive use of water to the extent that is necessary to comply with the 1922 Compact obligations. Under a curtailment, the Wyoming State Engineer's Office may be required to shutoff water users in reverse order of priority, similar to how priority regulation typically occurs.



USGS, Public domain, via Wikimedia Commons

Wyoming and the other three Upper Division States are working through the Upper Colorado River Commission to examine whether a proactive approach to use less water voluntarily in advance could help minimize or avoid a curtailment situation. This Upper Basin effort is termed the Demand Management Feasibility Investigation, with assessments taking place within each individual state and among all four states jointly. In Wyoming, the Wyoming State Engineer's Office in cooperation with the Attorney General's Office has been investigating the feasibility of a Demand Management program, under guidelines established under the 2019 Colorado River Drought Contingency Plan Authorization Act. Within Wyoming, a crucial part of that investigation is working with Wyoming Colorado River Basin water users and other key stakeholders to learn about their thoughts, concerns and issues related to a potential Demand Management program in Wyoming.

This report outlines the issues discussed by Wyoming water users and other key stakeholders regarding the risks of and possible mitigation for curtailment, and the Demand Management concept, as explored thus far in the investigation. A central focus of Wyoming stakeholders was to compare a possible Demand Management Program with the risks and impacts of curtailment. This report accordingly records stakeholder input assessing both the risks of curtailment and the potential feasibility of a Demand Management program.

INTRODUCTION

What is "Demand Management"?

The Colorado River Basin has been experiencing persistently dry hydrology since the turn of the 21st Century. Given these conditions, all seven states using the river coordinated with the Department of Interior, Mexico, and stakeholders throughout the Colorado River Basin in 2019 to create Drought Contingency Plans to address water supply and demand issues proactively.

For the Upper Division States on the Colorado River - Wyoming, Colorado, New Mexico, and Utah – it is crucial to protect critical water elevations at Lake Powell. Lake Powell is the Upper Basin's primary storage facility to help assure the four states can continue to comply with the foundational multi-state compacts that set basic water allocation rules on the river: the Colorado River Compact of 1922 and the Upper Colorado River Basin Compact of 1948. Lake Powell also supports the continued use and development of Colorado River water by the Upper Division States. If Lake Powell water levels drop so low that Upper Division compliance with the compacts is threatened, Wyoming and the other states could be required to "curtail" their water consumption. In Wyoming that "curtailment" would mean water use being cut back in the reverse order of water right priorities. No curtailment for compact compliance purposes has ever occurred on the Colorado River, but the dry hydrology of this century makes curtailment appear more possible.

As part of the Upper Basin Drought Contingency Plan, Wyoming and the other Upper Division States are examining the feasibility of a possible Demand Management (DM) program. The purpose of an Upper Basin DM program, if implemented, would be to avoid or reduce the risk of curtailment. The idea is to help assure continued compliance with the 1922 Compact without impairing existing Upper Basin water rights. The method used by a DM program would be to pay water users to voluntarily reduce consumptive uses temporarily in the Upper Basin, or to augment supplies with imported water. The water so conserved, or imported, would be stored in federal reservoirs for release only to ensure compact compliance, following a decision of the Upper Colorado River Commission (UCRC).

A DM program in Wyoming would be a state-based effort implemented under state law. The State of Wyoming with input from the water users and stakeholders involved must decide whether Wyoming should work to develop and implement a DM program, and if so, what that program should look like. No DM program will be implemented unless all four Upper Division states and the UCRC determine that a DM program is feasible and consistent with the terms of the Upper Basin Drought Contingency Plan. A DM program can only be implemented if approved independently by each state's Commissioner to the UCRC and by the Commission as a whole. In effect, any one Upper Basin State can veto implementation of a DM program. If, after study, the states collectively agree that a DM program is feasible, consistent with set terms for federal storage of the water conserved or imported (which includes consultation with the Lower Division States of Arizona, California, and Nevada), they may then finalize and implement a program.

To discuss the feasibility of a DM program in Wyoming, in September 2019, the Wyoming State Engineer's Office (SEO) and the Wyoming Attorney General's Office, with assistance from the University of Wyoming, initiated a public stakeholder process in the Green and Little Snake River Basins.

This report outlines the results of that stakeholder engagement process to-date in Wyoming. A central focus of Wyoming stakeholders was to compare a possible DM Program with the risks and impacts of curtailment. This report accordingly records stakeholder input on that issue.

The UCRC has agreed that any DM program must be voluntary, temporary and compensated. If a DM program were implemented, that means water users could individually decide whether to participate and consume less water in their operations. They would be paid for consuming less water but would only use less water temporarily without harming the underlying water right.

Wyoming, the Colorado River, and Twenty Years of Dry Hydrology

In Wyoming, the Colorado River Basin covers the basins of the Little Snake and Green Rivers (Figure 1). Colorado River issues also affect other parts of Wyoming where Colorado River water is used – through trans-basin diversions to the City of Cheyenne from the Little Snake Basin, and smaller agricultural amounts exported into the Bear and North Platte River basins.

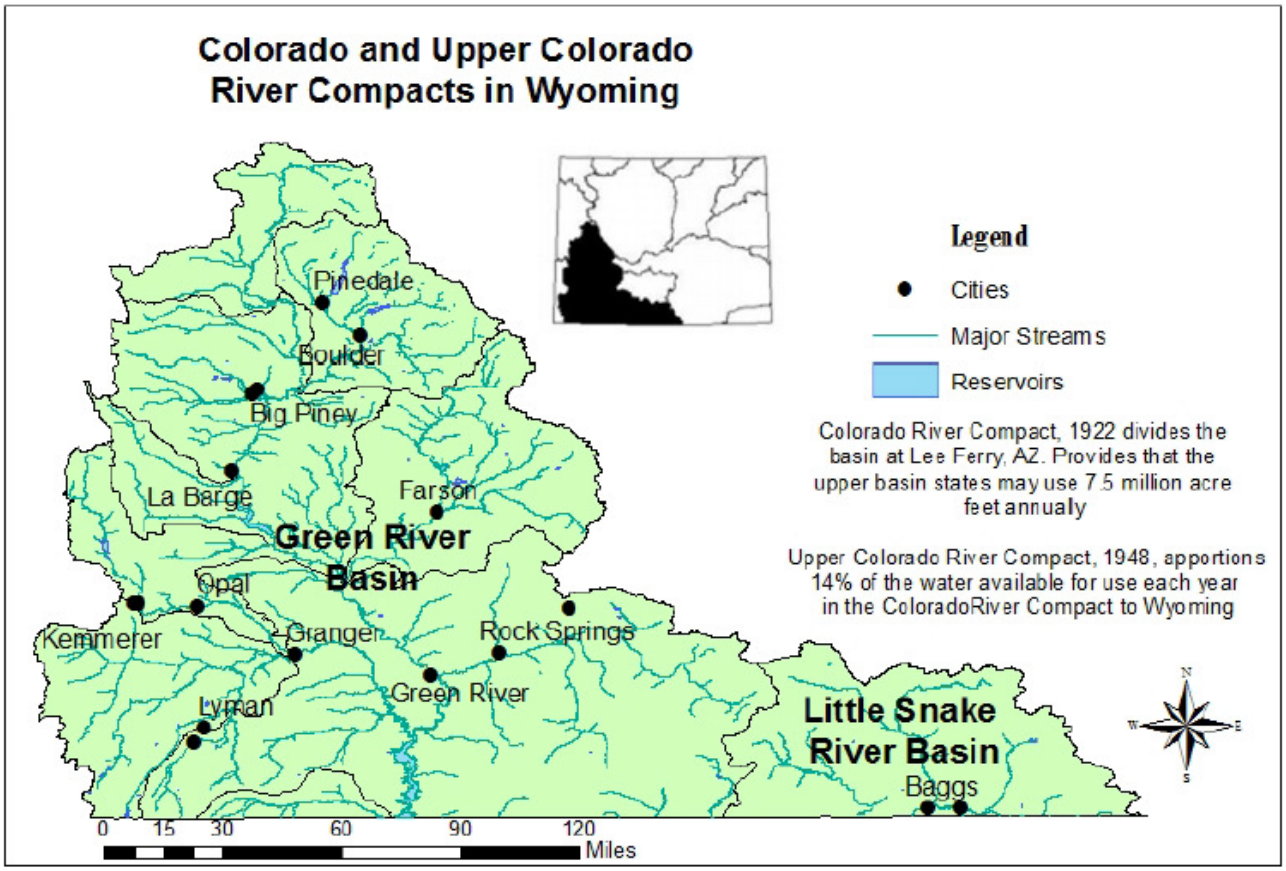


Figure 1. Map of Wyoming portions of the Colorado River Basin.

The entire Colorado River Basin provides water to seven U.S. states and two Mexican states (Figure 2, page 6).

For the last 100 years, the seven basin states and the federal government have produced a large body of existing law affecting the interstate and international use, management, and allocation of water in the Colorado River System. Together, this is known as "the Law of the River." This body of law includes interstate compacts, contracts and agreements, state statutes, federal statutes, an international treaty with Mexico, United States Supreme Court decisions, and federal regulations and decisions. Key elements of the Law of the River include:

- the 1922 Colorado River Compact, which apportions the "exclusive beneficial consumptive use" of Colorado River water between the Upper and Lower Basins of the River (Figure 2).
    - This compact divides the Colorado River into two basins, the Upper and the Lower. It apportions 7.5 million acre-feet (MAF) of beneficial use of water per year to each Basin from the Colorado River and all of its tributaries, with an additional 1 MAF apportioned to the Lower Basin from tributaries. The compact paved the way for the construction of Hoover Dam and Lake Mead, which is the key storage reservoir for water deliveries to the Lower Basin.
    - This compact prohibits the Upper Division States from causing the flow of the river at Lee Ferry to be depleted below an aggregate of 75 MAF for any period of ten consecutive years.
    - Note that this compact does not apportion water, but rather the "exclusive beneficial consumptive use" of water. The significance of this distinction is discussed later in this report.

- the 1944 Mexico Water Treaty, which allocates to Mexico a "guaranteed annual quantity" of 1.5 MAF of water.
- the 1948 Upper Colorado River Basin Compact, which apportions the Upper Basin's allocation of beneficial consumptive use of Colorado River water among the Upper Division States (Wyoming, Colorado, Utah, and New Mexico) (see Table 1, page 7).
    - This compact is administered by the UCRC, consisting of one representative from each of those states and one representative of the United States.
    - Among other things, the UCRC is specifically empowered to make findings on: the quantity of water used each year in the Upper Basin and each state; the quantity of deliveries at Lee Ferry; and the necessity for and extent of any curtailment. Curtailment will be proportioned between the Upper Basin States based upon the previous year's consumptive water use after any previous overuse is repaid. How curtailment will be implemented within an individual state is left up to each state. In Wyoming, implementation would be by the State Engineer and water officials regulating water rights in reverse order by priority date and will not affect pre-1922 Compact water rights.

US Bureau of Reclamation, https://www.usbr.gov/lc/region/programs/crbstudy.html

Figure 2. Map of the Colorado River Basin

- This compact paved the way to build Glen Canyon Dam and Lake Powell, which is a key storage reservoir intended to act as insurance for the Upper Division States so that they can meet the "non-depletion" obligation of the 1922 compact and develop additional uses.

For more information on how these and other features of the Law of the River affect Wyoming, see this 2016 report from the SEO.

Recent developments

Over the past two decades, dry hydrology in the Colorado River Basin (CRB) has increased the risk of reservoirs declining to critically low elevations. Much of the recent research on the future hydrology in the basin suggests that we may continue to see periods equal to or even worse than the current dry conditions. Figure 3, page 9, shows annual average flows in the Colorado River at Lees Ferry, the gaging station between the Upper and Lower Basins. The average flows over the past 30 years (represented by the golden horizontal line) are lower than the running average since the 1920s (represented by the dark green line running across the figure).

A sample of the results from the Bureau of Reclamation's (Reclamation) latest five-year risk assessment is shown in Table 2, page 9. Several times a year, Reclamation presents results from a simulation model indicating probabilities of meeting certain elevation levels in Lakes Powell and Mead for the next five years. Results are presented based on "full hydrology" (assuming the next five years will be similar to the full historical record of natural flows, 1906-2018) and "stress test hydrology" (assuming the next five years

Table 1. Upper Colorado River Basin Compact Apportionment of Full Supply (7.5 MAF) and of Estimated "Available Consumptive Use"

State	Apportionment Percentage	Share of 7.5 MAF (full supply)	Share of 6.01 MAF* (5.96 MAF after AZ)	Share of 5 MAF	Wyoming's Current Estimated Average Use***
Colorado	52	3,855,375	3,084,300	2,561,625	
New Mexico	11	838,125	670,500	556,875	
Utah	23	1,713,500	1,370,800	1,138,500	
Wyoming	14	1,043,000	834,400	693,000	547,000
Arizona	-	50,000	50,000	50,000	
Evaporation**	-	-	-	-	
Total	**100**	**7,500,000**	**6,010,000**	**5,000,000**	

* 6.01 MAF was the amount of water estimated to be available for development at the time identified in the 2007 Hydrologic Determination

** Evaporation of CRSP Initial Units is incorporated into the consumptive use of the Upper Division States and varies depending on the water level elevations. The estimate as of the UCRC's 2016 Depletion Demand Schedule was 520,000 AF

*** Wyoming's estimated consumptive use is subject to change as more accurate methods are adopted. This value does not include the evaporation share of CRSP Initial Units.

will be more similar to the relatively dry period of 1988-2019). Table 2 presents a subset of results from the three most recent simulations in 2020. The first two rows are from April 2020. The first row indicates the probability that Lake Powell elevation will drop below 3,525 ft in each of the next five years, based on full and stress test hydrology. The second row indicates the probability that Lake Powell elevation will drop even lower, to below 3,490 ft in each of the next five years. These probabilities play a significant role in informing Wyoming and the UCRC about whether a curtailment may be needed to ensure the Upper Division States meet their Compact obligations. Results from August 2020 and January 2021 are also included in Table 2. These two simulations indicate a higher risk of reservoirs declining to critically low elevations than results from April 2020 (which are more representative of the probabilities from earlier simulations).

In part due to dry hydrology, the Upper Basin was already facing large drawdowns at Lake Powell in the early 2000s. The Secretary of the Interior examined operations at Lake Mead during shortages and how to better coordinate operations between Lake Powell and Lake Mead. The result, after extensive negotiations with the seven Basin States, was the 2007 Interim Guidelines for Colorado River operations. Among other things, the Guidelines specify coordinated operations of Lakes Powell and Mead in order to operate the reservoirs to avoid the risk of water curtailments in the Upper Basin and minimize shortages in the Lower Basin. Overall, the Guidelines were designed to and have succeeded in avoiding protracted litigation over water allocation from the river in times of drought. The Guidelines expire on December 31, 2025; given continuing dry conditions, re-negotiation will lead up to new operational rules by 2026.

In 2019, the Lower and Upper Basins finalized Drought Contingency Plans to address decreasing supplies, on a temporary basis, until 2026. Congress also approved the Plans in May of 2019. The 2019 temporary plans are designed to help prevent a crash of the Colorado River system if the drought worsens, while allowing each state to control its own destiny and assuring that the 2007 Guidelines can operate until 2026. The 2019 Drought Contingency Plans were intended, once again, to avoid litigation.

The 2019 Upper Basin Drought Contingency plan also provides an opportunity for Upper Division States to identify the best tools and approaches to continue Upper Basin compact compliance and avoid curtailment. Among the tools under consideration is "Demand Management," the prime topic of this report.

Wyoming and Colorado River Issues

Wyoming is involved in a variety of efforts to secure water supply for the region of the state using Colorado River water:

- To improve access to existing storage in Fontenelle Reservoir, the SEO and the Wyoming Water Development Office (WWDO) have been discussing with Reclamation the potential to rip-rap the lower portions of the dam face to increase the usable volume of stored water. Additionally, those discussions have included Wyoming's ability to access other existing storage in the reservoir as well as how Fontenelle might be operated in a curtailment situation.

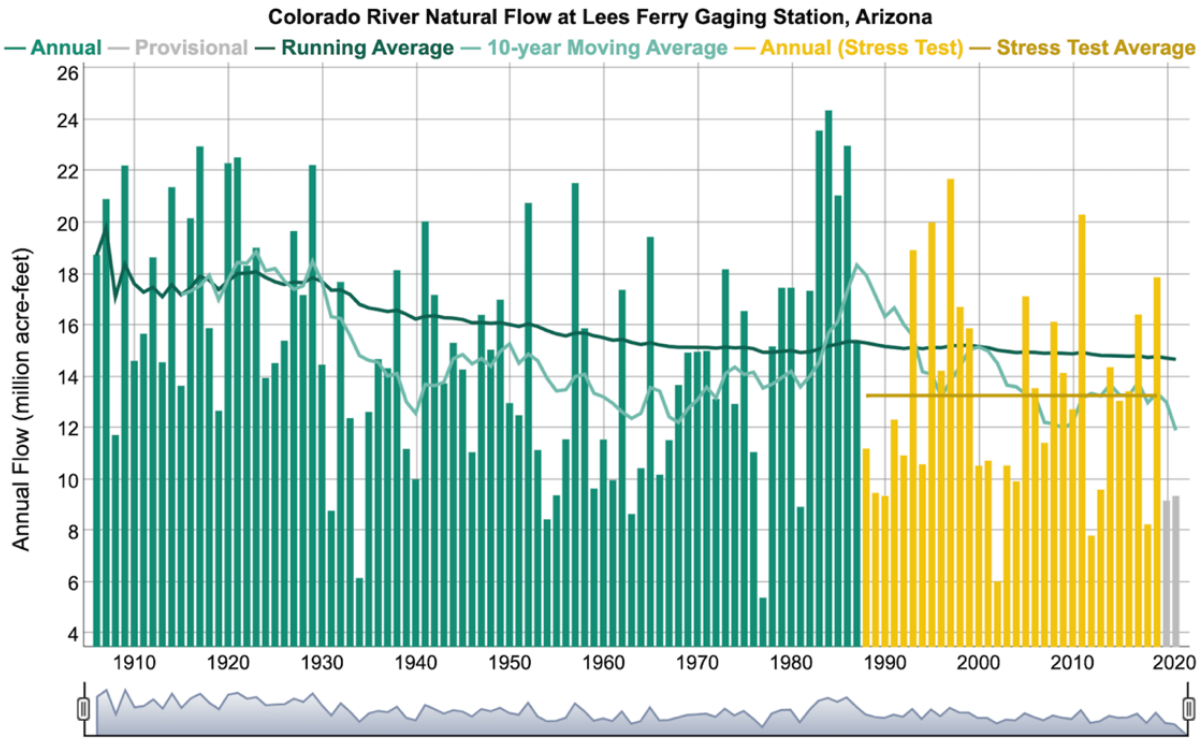


Figure 3. Estimated Colorado River Natural Flow at Lees Ferry, Arizona, 1905-2019.

Table 2. Selected data from Reclamation five-year risk assessment, Aug. 2020

	Full Hydrology					Stress Test Hydrology				
April 2020	2021	2022	2023	2024	2025	2021	2022	2023	2024	2025
Lower Elevation Balancing Tier (Powell < 3,525 ft)	0	0	0	<1	1	0	0	0	<1	6
Below Minimum Power Pool (Powell <3,490 ft)	0	0	0	0	<1	0	0	0	0	<1
August 2020	2021	2022	2023	2024	2025	2021	2022	2023	2024	2025
Lower Elevation Balancing Tier (Powell < 3,525 ft)	0	0	4	4	4	0	0	0	16	23
Below Minimum Power Pool (Powell <3,490 ft)	0	0	0	1	3	0	0	0	6	10
January 2021	2021	2022	2023	2024	2025	2021	2022	2023	2024	2025
Lower Elevation Balancing Tier (Powell < 3,525 ft)	0	6	5	7	8	0	6	3	8	19
Below Minimum Power Pool (Powell <3,490 ft)	0	<1	1	3	4	0	0	<1	6	13

Source: USBR (https://www.usbr.gov/lc/region/g4000/riverops/crss-5year-projections.html)

- Cloud-seeding in the Wind River Range (headwaters to the Green River) is ongoing and directed by the Wyoming Water Development Commission with financial contributions from other Colorado River Basin entities.
- Other opportunities may include constructing new reservoirs or expanding old ones, importing water from other Wyoming basins, or tapping non-tributary groundwater.

Certainly, Wyoming seeks to avoid curtailment of its water uses to comply with its interstate obligations. However, it is only prudent that Wyoming plan for such an event. That requires examining what curtailment would mean for Wyoming. The need for curtailment would be determined by the UCRC, to assure full compliance with the 1922 Compact by the Upper Division States. Specifically, a curtailment would be for the purpose of assuring compliance with the portion of the Compact that states the Upper Division States cannot deplete the flow at Lee Ferry below 75 million acre-feet (MAF) in any running 10-year period. To avoid any violation, the UCRC would make a finding regarding the volume of water each state "owed" to the system. Subsequently, each state would regulate post-compact water users in their state to decrease water uses by each state's assigned volume.

In Wyoming, the primary tool available to achieve curtailment would be regulation by priority date of water rights. If the UCRC found that Wyoming "owed" water under a curtailment, the water rights in Wyoming's Colorado River Basin would be shut off in reverse priority order, starting with latest rights first, until the required amount of consumptive use in Wyoming is curtailed. Water rights that were perfected before the original Colorado River Compact ("pre-compact rights") would not be affected. How many post-compact water rights Wyoming will need to regulate depends upon how much consumptive use occurred in the previous water year. (In addition, exactly what date marks the divide between pre- and post-compact rights is an unsettled question.)

How curtailment would affect users varies. Approximately 80 percent of irrigation water rights in Wyoming's Colorado River Basin have pre-compact priority dates. Yet irrigators with those pre-compact rights may also rely on other water and water rights. One example is "free river" use, generally available in the high flows of spring runoff. Irrigation water users also may rely on "surplus" or "excess" water rights, statutorily added to water rights predating March 1, 1945 and March 1, 1985, respectively, and each being regulated like a water right with that priority date. Irrigators generally call surplus or excess rights their "second foot." "Free river" water use would clearly be shut off in curtailment if the timing of the curtailment precedes spring runoff. The fate of "surplus" or "excess" water rights would depend upon the required curtailment amount. There is little data, meanwhile, on how heavily irrigators in this basin rely on the "second foot" to raise crops.

Municipal and industrial water rights in Wyoming's Colorado River Basin tend to have post-compact priority dates, with the majority dated after the 1940s, as Wyoming cities and industry grew. Of the total annual average water consumption in Wyoming's Colorado River Basin, with the exception of use of free river and the 2nd CFS which are unknown amounts, the portion subject to shut-off due to curtailment (or

due to extreme local drought) is relatively small. However, that portion supports important parts of local communities and economies, whether agricultural, municipal or industrial.

Wyoming portions of Colorado River Basin are located in Carbon, Lincoln, Sublette, Sweetwater, and Uinta counties. The total population of these five counties was 108,870 in 2018, and Gross Domestic Product was approximately $8.5 million.[1] The economy of this region (which notably does not include Cheyenne, with its municipal use of Colorado River water) supported approximately 60,000 jobs in total in 2018, though many of these jobs were not necessarily full-time. Per capita income in these five counties was an average of $45,533 in 2018. This region's economy is driven largely by mining, quarrying, oil and gas extraction, and associated support industries. Mining directly accounts for approximately 30% of economic activity in the region. Manufacturing and construction account for approximately 40% and services (including tourism and support for extractive industries) for 27%. Agriculture accounts for between 1 and 2% of economic activity in the region.[2] Travel, tourism, and recreation are an integral part of the economic fabric of the region and depend on the region's water resources in ways that are difficult to quantify. Agriculture — and agricultural water use — are inextricably linked with the broader economy and community of southwestern Wyoming. For example, although agriculture is a relatively small component of the overall regional economy, it is the economic engine of many smaller communities and a key component of community identity throughout the region.

Investigating "Demand Management"

Due to the potential impact of curtailment, water users and water managers of all Upper Division States are discussing the feasibility of developing a program that could prevent or reduce the risk of curtailment. For Wyoming, the concept behind a DM program would be a proactive approach, conserving over several years some volume of water which is normally consumptively used in the Green River and the Little Snake Basins. Within Wyoming, the water users in the basins involved must decide if they want to see the state work to implement a DM program, and if they do, what that program should look like. Again, however, no DM program can be created and implemented unless and until the four Upper Division States independently, and the UCRC, determine it is feasible and consistent with the terms of the DMSA.

Further, the Upper Colorado River Commission agreed that these minimum requirements, among others, must apply to any DM program:

- Any DM Program would be temporary, voluntary and compensated.
- Water saved each year through a DM program could be stored in certain federal reservoirs (e.g., Flaming Gorge and Lake Powell). To be of use in reducing the risk of curtailment impacts, it is anticipated a DM program would have to operate for multiple years.

1 This is a slight overstatement of population within the Wyoming Colorado River Basin, since portions of these five counties are located in other basins. These economic indicators still provide an approximate indication of the size of the Wyoming Colorado River Basin's economy.

2 Economic data come from the U.S. Bureau of Labor Statistics and IMPLAN (2020).

- The DM water saved and stored could be released only if the UCRC decides the release is necessary to meet compact obligations.
- The water saved and stored each year must be water that would have been consumptively used but for conserving it, as part of a DM program. That means the water stored cannot be the unused part of any state's Colorado River apportionment.

Though Wyoming typically consumes less water than is apportioned to it under the 1948 Upper Colorado River Compact, that "unused apportionment" is not water Wyoming can consider "saved" to store it under a DM program.

If all four Upper Division States and the UCRC finalize an Upper Basin DM program, it is possible that any such program could look different in different states so long as they are not inconsistent. There is even the possibility, if the states and the UCRC agree to it, that a DM program might not operate in one or more Upper Basin states while it does operate in others.

All four Upper Division States and the UCRC are currently investigating DM program feasibility, and the investigation is expected to go on for several years. The many issues that have to be assessed include: (1) consistency with state water law; (2) protection for existing water rights; (3) accounting, management and administration; (4) water user interest; (5) shepherding of saved water to reach storage reservoirs; (6) economic impacts; (7) environmental impacts; and, not least, (8) where the money could come from to pay compensation to water users for their water conservation.

This report summarizes what Wyoming water users and stakeholders have said, in discussions held in 2019 and 2020, about the feasibility of a DM program for Wyoming, touching on a number of these issues. The report does not contain a conclusion on DM feasibility, or recommendations on whether to proceed with DM. This report does contain recommendations on next steps in Wyoming's DM feasibility investigation.

Understanding Consumptive Use

Generally, consumptive use of water is the portion of water that is removed or withdrawn from a system for a specific use that does not return to the system. Understanding consumptive use is crucial to thinking about the development of a DM program and risks of curtailment for the Upper Colorado River Basin (UCRB). The Colorado River compacts' metric for water use is "consumptive use". As part of a potential DM program, the water that could be voluntarily "conserved" and stored in one of the Initial Units is water that has been historically, consumptively used. Therefore, understanding the overall complexities of CONSUMPTIVE USE, how it is measured or estimated, and how it relates to specific water rights in Wyoming is important for assessing the feasibility of a DM program and effects of a curtailment.

The largest consumptive use in Wyoming is in irrigated agriculture, water that is specifically used or consumed by agricultural plants in the evaporation and transpiration processes. Municipal and industrial are also major users (USBR, 2012). The annual average consumptive use estimates by sector in the UCRB of Wyoming for the period of 2011–2020 are shown in Table 3.

Table 3. Average annual consumptive use by sector for the Wyoming portion of the UCRB (2011-2020). (Source: Wyoming SEO, 2021).

Average Annual Consumptive Use by Sector	
Use Sector	**Consumptive Use (AF)**
Agriculture	448,680
Municipal & Industrial	62,440
Reservoir Evaporation	27,000
Diversions	9,314
Total	547,433

The SEO uses a combination of methods to calculate and estimate consumptive use associated with irrigated agriculture. One method is the standardized Penman-Monteith reference ET equation, described in Jensen et al. (1990), using data from 10 weather stations that the SEO operates across the basin. The SEO has also been estimating ET using a remote sensing method called METRIC (Mapping Evapo Transpiration using high Resolution and Internalized Calibration) (https://idwr.idaho.gov/GIS/mapping-evapotranspiration/). The SEO is currently working with Reclamation and a contractor to collect two additional years of METRIC ET data for years of 2001 and 2016. The consumptive use values presented in Table 3 have changed moderately due to incorporating more METRIC data, which is more accurate than relying only on the Penman-Monteith method.

Comparing the benefits of a DM Program to the effects of a curtailment requires an understanding of consumptive use. For clarity, the consumptive use of a DM Program is referred to here as "conserved consumptive use;" "curtailed consumptive use" is used when discussing curtailment. In a DM program, the total conserved consumptive use on a parcel of land due to fallowing can likely be considered for the program. The UCRC is currently investigating the potential conserved consumptive use for various scenarios, which should allow the states to better understand the potential conservation of a DM Program.

For understanding the effects of curtailment, one might want to know the risk of whether their water right will be shutoff to reach a given curtailment volume. To know this, the curtailed consumptive use must be split into each water right. The complicating factor is that in most irrigation cases there is more than one priority date on the same field, as discussed above (free river, surplus/excess right, original water right, and at times a reservoir water right).

The SEO presented a conceptual model at the stakeholder meeting that examines the theoretical curtailed consumptive use of regulating agricultural use by priority date (Figure 4, page 14). The conceptual model shows the effect of the regulation of the excess (3/1/1985), surplus (3/1/1945), and original rights. Through the process, it became clear how many significant variables were present, how many had to be assumed, and how much missing data there were. Data missing include information as to what extent irrigation rights are dependent on the use of the surplus/excess right vs. the original right, and to a lesser extent, how important reservoir water is relative to surface water. These data are missing because many diversions are generally not gauged. It also demonstrated the limitations that the SEO's online water right database, "e-Permit," has

in mapping water rights. In addition, it became clear that due to the large number of water rights, it would require large resources to expand into a full-scale model. While the originally presented model did link curtailed consumptive use to the priority date, the SEO decided that the use of such a model could be very misleading and made it more conceptual by removing the link to the curtailed consumptive use numbers.

The results of the conceptual model, as shown in Figure 5, page 14, assume a significant use of the 1985 excess "second foot" and 1945 surplus "second foot", as indicated by the large increase in curtailed consumptive use at those dates. Under a different scenario where the "second foot" is not used as much, the increase in curtailed consumptive use at those dates would be smaller, and the curtailment would reach further into pre-1945 rights. Because of this lack of data, the safest determination at this time for assessing the risk and effects of a curtailment is to assume that all water rights post 1922 Compact could be curtailed, and that the "second foot" would be shutoff.

It is important to point out that this irrigation conceptual model does not include municipal and industrial rights. Consumptive use from these other uses is easier to assess.

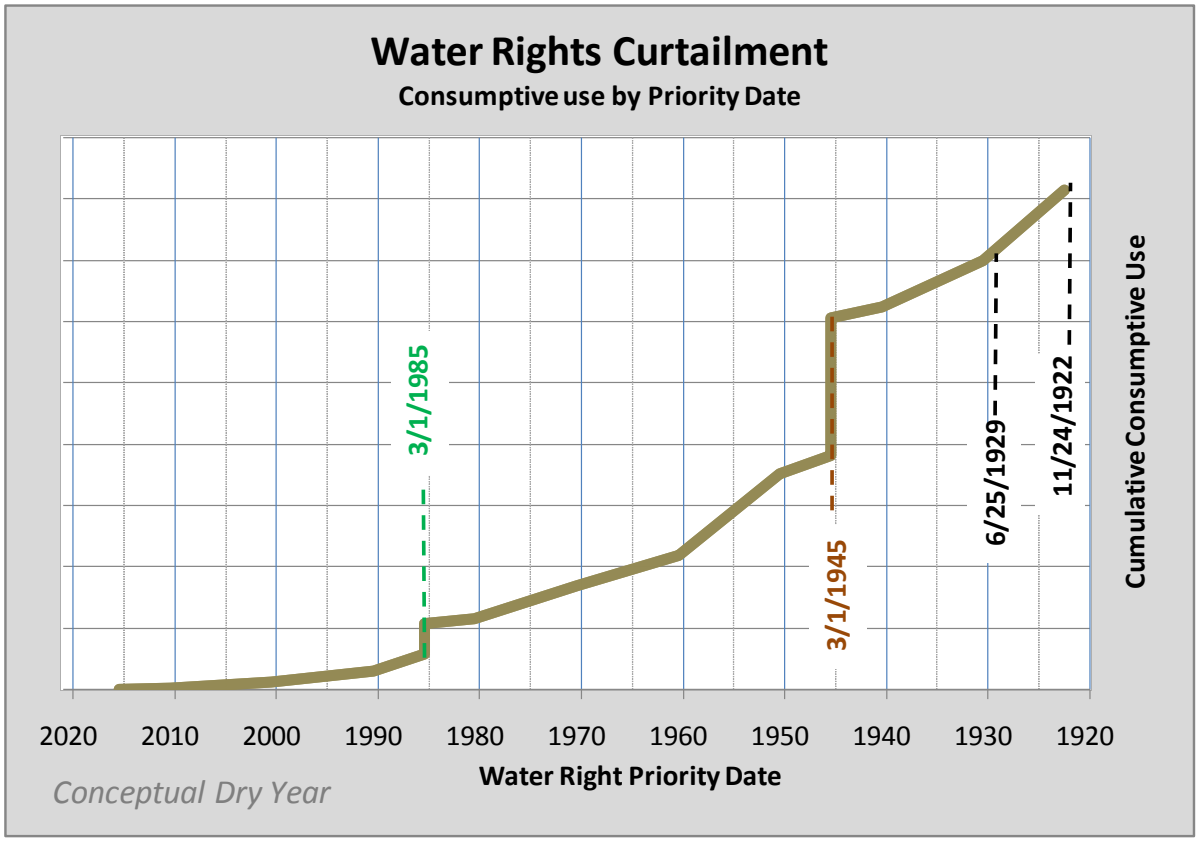


Figure 4. Irrigation conceptual model illustrating potential curtailed consumptive use associated with priority dates for a dry year assuming no free river, and significant use of the excess and surplus "second" foot.

STAKEHOLDER AND COMMUNITY ENGAGEMENT PROCESS

The overarching, foundational question that each state in the Upper Basin must consider with its own stakeholders is whether a DM program is feasible and should be developed. The specific questions surrounding the feasibility of program development include: (1) whether a DM program is possible given the technical, legal, and policy challenges to address in each State and within the Basin; and (2) if possible, what would be the best way to implement, operate, and administer such a program in the Upper Basin?

Outreach to and input from interested water users and stakeholders is essential to helping Wyoming understand and answer these questions considering the impacts, opportunities, options, and concerns regarding any DM program.

Accordingly, the SEO and the University of Wyoming Extension developed a multi-tiered approach with three overarching objectives:

- to share information regarding the state of the UCRB with water users and other key stakeholders;
- to begin discussions with stakeholders on DM and seek their input regarding a DM program in Wyoming; and
- to identify information needs and next steps in assessing DM and curtailment risks.

The multi-tiered engagement approach included: identifying and working with Key Stakeholders in the Wyoming portions of the UCRB; outreach to communities and interested parties; and a series of focus groups with stakeholder groups from both agriculture and M&I to directly discuss issues and information needs regarding assessment of a potential DM program and curtailment risk and mitigation. Discussions regarding curtailment risk and mitigation were included in the focus group meetings as the Key Stakeholders in WY's UCRB were interested in assessing a potential DM program relative to the risks associated with curtailment. This was an important addition to our discussions.

The details of the meetings and the engagement process undertaken between July 2019 and December 2020 are set forth below. The issues and ideas shared by stakeholders in the focus group meetings are discussed fully in the next chapter. It should be noted that the original engagement process included a plan to share the "findings" of the meetings and focus groups with communities and stakeholders in the Wyoming UCRB in the fall of 2020. However, due to COVID many of the "in person" focus group meetings were delayed and moved on-line. We hope to share the results, ideas and suggestions with stakeholders and communities safely in person sometime in 2022.

Details of the Engagement Process

Meeting with Key Stakeholders in the Wyoming portion of the UCRB; Green River Basin, Little Snake Basin, and City of Cheyenne.

- In July and August 2019: the outreach team conducted "In-person Extension & Outreach" working with state agencies and water user groups to identify Key Stakeholders.
- September 9, 2019: an in-person Key Stakeholder meeting in Rock Springs, WY, at Western Wyoming College, in Rock Springs, WY.
- Key Stakeholders from across the state were invited; 29 were able to attend the meeting. The invitees list included agriculture and M&I water users, state agencies, conservation districts, county commissioners, NGOs, and other interested parties. A list of the Key Stakeholders invited and those who attended is presented in Appendix A along with a copy of the meeting agenda.

Presentations:

- Introduction
- Wyoming's Colorado River Basin – Water & People
- The "Law of the River"
- Demand Management Feasibility Investigation
- Lower Basin
- Related Investigations – Economic Assessment
- The Stakeholder Engagement Process

Major topic areas discussed were:

- Compact Curtailment risk assessment
- Consumptive Use Measurement: a major issue for Colorado River management going forward
- Credit for savings in a DM program
- Existing water transfer tools in Wyoming
- Augmentation needs exploration
- Funding

Please see Appendix A for a detailed account of the issues and suggestions. The presentations and the comments and suggestions from the Key Stakeholders at the meeting are also posted on the project website.

Community –public meetings in 4 communities in the Wyoming portion of the UCRB in fall 2019.
The objectives of the community meetings were to: 1) inform communities, water users and other stakeholders about the initiation of the Demand Management Feasibility Investigation, 2) present the current status and issues regarding water resources in the UCRB, and 3) answer any questions about a potential DM program, risks of curtailment, curtailment mitigation and the engagement process.

To promote the meetings both UW Extension and the SEO office sent out press releases (SEO & Extension press releases are presented in the Appendix A). The meeting locations, dates, and numbers of attendees:

- Pinedale, WY: November 4, 2019, 13 participants
- Green River, WY: November 5, 2019, 20 participants
- Baggs, WY: November 6, 2019, 28 participants
- Cheyenne, WY: November 7, 2019, 23 participants

The presentations are posted on the project website.

Focus Group meetings on-line (via zoom) in September 2020.
Focus groups were formed to allow for detailed and in-depth conversations regarding both curtailment risk and DM issues. The focus group meetings were originally planned for Spring of 2020; however, they were delayed due to COVID. The outreach team would have preferred in-person meetings, and waited several months hoping for a safe time, but finally held on-line focus group meetings in September 2020.

A draft of potential topics and issues to be covered in the focus groups was compiled based on issues raised during the Key Stakeholder and community meetings and input requested by the state. The issues were divided into four specific focus areas to be addressed by four different focus groups. The draft focus group topics were vetted and refined by Key Stakeholders in December 2019. Just as with the focus group topics, the focus group participants were nominated and vetted by Key Stakeholders (May 2020).

The topic areas for the four focus groups were:

- Assessing Curtailment
- Curtailment Mitigation
- Demand Management conserved consumptive use: Irrigation
- Demand Management conserved consumptive use: Municipalities & Industry

Focus Groups

The focus groups were held on-line, over Zoom, in September 2020. Each focus group was comprised of 12 invited members and met for a total of 4 hours (2-hour meeting one day followed by a 2-hour meeting one week later). The focus groups were facilitated by Anne MacKinnon from the UW portion of the outreach team. The focus group questions and issues along with background materials were sent to the focus group members ahead of time. The focus group invitees are presented in the 4 tables below. Due to scheduling issues and conflicts, some invitees were not able to attend both or either meeting. However, all information was shared with all invitees.

Focus Group Invited Participants	
Focus Group 1	
Jim Magagna	Wyoming Stockgrowers Association
*Don Lamborn	Hams Fork Water Users
*Randy Bolgiano	UCRC – Alternate for Wyoming
*Joe Gillis	Boulder Irrigation District
*Del Lobb	Wyoming Game & Fish
Stan Blake	Legislator (SWC)
*Ed Burton	Eden Valley Irrigation District
Ken Fackrell	Bridger Valley WCD
*Pat O'Toole/Eamon O'Toole	Rancher/Family Farm Alliance
Ron Kailey	WWDC
*Bob Davis	Savery - Little Snake River Water Conservancy
*Chris Lidstone	Consultant
Focus Group 2	
*Randy "Doc" Wendling	Sweetwater County Commission
*Bryan Seppie	Sweetwater County JPWB
Amy Butler	County Engineer, Lincoln County
*Aaron Reichl	Genesis – Trona Industry
*Cody Allred	PacifiCorp
Robb Keith	Wyoming Game & Fish
Evan Simpson	Consultant/Legislator (SWC)
Larry Hicks	LSRCD/Legislator (SWC)
*Mike Purcell	WWDC
*Brad Brooks	Cheyenne BOPU
*Keith Burron	UCRC - Alternate for Wyoming
*Rick Baxter	Bureau of Reclamation
** Able to attend one or both meetings*	

Focus Group Invited Participants	
Focus Group 3	
*Zach Schofield	Lonetree Ranch (SCPP)
George Kahrl	Irrigator (SCPP)
Ken Hamilton	Wyoming Farm Bureau
*Chad Espenscheid	Irrigator (SCPP)/Consultant
Tom Noble	Sublette County Commission
*Cory Toye	Trout Unlimited
Bill Taliaferro	Irrigator
Jerry Paxton	Legislator (SWC)
*Jen Lamb	TNC
*Kellen Lancaster	WWDC
*Albert Sommers	Irrigator/Legislator
*Eamon O'Toole/Pat O'Toole	Savery - Little Snake River Water Conservancy
Focus Group 4	
*Paul Fahlsing	PacifiCorp – Jim Bridger Plant
Craig Rood	Ciner - Trona Industry
*Danielle Mathey	Former Council - Sweetwater County JPWB
Brent McClarnon	Kemmerer-Diamondvillle JBP
*Ben Bracken	UCRC – Alternate for Wyoming
*Abram Pearce	Consultant/Town of Pinedale
*Michelle Christopher	Wyoming Association Rural Water
Troy Andersen	Bridger Valley JPB
*Bruce Hattig	Cheyenne BOPU
Liisa Anselmi-Dalton	Legislator (SWC)
Bob Davis	LSRWCD
*Mark Kott	WWDC
Other Focus Group Participants	
UW Extension Team	Ginger Paige, Kristi Hansen, Anne MacKinnon
Wyoming State Engineer's Office	Steve Wolff, Charlie Ferrantelli
	Brian Pugsley, Superintendent of Division I
	Kevin Payne, Superintendent of Division IV
Wyoming Attorney General's Office	Chris Brown
Wyoming Water Development Office	Barry Lawrence, Jason Mead
UCRC	Pat Tyrrell
Governor's Office	Beth Callaway (invited)
** Able to attend one or both meetings*	

The questions and issues addressed by each focus group were vetted by the Key Stakeholders. The focus group questions for the first 2-hour session (round 1) and any additional questions and issues developed for "round 2" are found in Appendix A, page 37. The background materials shared with the focus groups are also in Appendix A. The next section discusses the outcomes and issues raised in the focus groups.

Questions, materials, and summaries of discussions are posted on the project website.

All the letters and communications (cover notes and pdfs) sent out to officially launch the stakeholder meetings, public meetings, and focus groups are included in Appendix A.

PLANNING FOR WYOMING'S COLORADO RIVER BASIN: ISSUES AND VIEWS FROM WYOMING STAKEHOLDERS

Stakeholder and community meetings, as well as focus groups, contributed a wide range of comments, captured here. A summary of the topics and issues raised regarding curtailment and DM are presented first, followed by more detailed discussion of the comments and issues from the focus groups. We present both the summary issues and detailed comments and issues by stakeholder group (e.g., Irrigators and Municipality and industry views).

Summary

Curtailment

1. Irrigator views

There are several issues and factors that were identified as important by irrigators in assessing curtailment risk. These include a) relationship between water rights and consumptive use; b) impacts on soils and plant communities, and c) curtailment mitigation strategies (e.g., storage). Many of the issues discussed need additional investigation.

A. Relationship between water right priority date and consumptive use
   1. A curtailment could be a disaster for some irrigators
   2. A detailed model of which priority dates that would be impacted would be helpful

B. Impacts of curtailment on soil and plant communities
   1. Curtailment could cause long term damage to fields of those that use flood irrigation
   2. Impacts to soil and plants could adversely affect ranches and community economies into the future
   3. Curtailment of free river could cause flooding in towns downstream

C. Curtailment mitigation strategies: storage
   1. The use of Fontenelle Reservoir's storage to mitigate curtailment is seen by many as a hopeful strategy
   2. Some may be willing to pay for storage in a similar way to crop insurance
   3. With Fontenelle storage mitigation, some would rather risk a curtailment than have a DM program

2. Municipality and industry views

Most of the towns and industrial operations in Wyoming's CRB have later-date water rights that make many of them vulnerable to potential impacts of a curtailment. The inability to access water would be disastrous for town citizens, for industry operations, and for employment. The economic and social

impact of curtailment could be extensive if towns and industries in Wyoming's UCRB do not take measures to minimize the potential impacts.

Further, the people responsible for these operations see the risk of curtailment as very real. That is based on their reviews of the water flow data for the entire CRB over the last 20 years. Stakeholders interviewed agreed they must strive to maintain at least minimum water supply to keep their operations going in any situation. Accordingly, they are looking very seriously at options for mitigating the impacts of curtailment, to protect a minimum water supply for their operations. The main issues that arose were a) mitigation tools and b) developing a clearinghouse of temporary water rights for transfers.

- Mitigation tools
  - Municipalities are looking into all options including Fontenelle storage, accessing other supplies, and a DM program
  - Some may consider potential readiness to serve contracts
  - M&I users are only suggesting temporary changes in use (not permanent water right changes)
- Clearinghouse of temporary water rights for transfers
  - Some suggested a clearing house to provide information on the small municipalities, industries, and irrigation water right holders interested in temporary transfers; voluntary noting of temporary transfers in county records could also be helpful
  - A number suggested the refinement of a model to provide the priority date impacted by curtailing a given consumptive use

Demand management

1. Irrigator views

In these first steps of assessing the feasibility of developing a DM program, irrigators identified several issues that need further investigation. These issues include: a) ensuring equity among the Upper Division states; b) increasing storage; c) methods for water conservation and reducing consumptive use; d) the potential negative impacts on soils, plant communities and ecosystems; e) payment for consumptive use savings; and f) the potential impact on existing water rights.

A. Ensuring equity among the Upper Division States
   1. Some were concerned with the concept that Wyoming would conserve water just to see other Upper Division states use more

B. Increasing Storage
    1. Some suggested using more of Wyoming's allocation of UCRB water by increasing our water storage in order for the Upper Division to comply with the 1922 Compact (an idea that would require a change in Wyoming water law)

C. Methods for water conservation and reducing consumptive use
    1. Some preferred to be compensated for changes to pivot sprinklers, better headgates, more efficient transmission of water, rather than be paid not to irrigate - due to the potential impact on soils, vegetation and overall ecosystem of shutting off irrigation
    2. Some see irrigation with reduced consumptive use as the coming reality, and that DM program would at least generate income

D. Potential impacts on soils and vegetation, ecosystems (Partial vs Full season fallow)
    1. Payment to start fallowing in mid-season is not preferable and would not generate much consumptive use savings
    2. In addition, late season irrigation is crucial for fall grazing and spring green-up
    3. Full season fallowing is only acceptable for marginal fields because there are many concerns over the health of soil and plants
    4. Just wetting a field once can protect against cheat-grass and other deterioration
    5. Administrators should consider allowing short use of free river as an option
    6. Fallowing in one field can directly affect the neighbor's field due to runoff affecting water tables and streamflow
    7. Irrigators and administrators should consider entering an entire small watershed for partial-season fallow
    8. Ranchers are unlikely to enter their most productive fields into a DM program
    9. The willingness to participate for an entire season would depend on the amount of the payment

E. Compensation: equity among participants
    1. Some prefer group negotiations, to promote equity among participants
    2. Other prefer negotiating privately to allow each person to benefit from their own negotiating skills
    3. Price definitely needs to cover the loss of the field, damage to forage, and a major premium, or margin, to cover all unanticipated impacts
    4. Some considered DM acting as a new free market providing new income for Wyoming ranchers
    5. Others recommended a market regulated by the state to ensure consistency in pricing

F. Potential impact on existing water rights
    1. Statutes might need to be changed to ensure that a water right entered into a DM Program would be protected from abandonment

2. Municipality and industry views

Similar to the irrigators, municipal and industrial stakeholders are looking at the trade-offs between curtailment risk and the potential implications and benefits of a DM program in Wyoming. To avoid the impacts of curtailment, industrial users said, they would prefer to rely on market forces, using tools like temporary water agreements. But, they said, a DM Program is also worth considering, if it would not compete with a market in temporary water agreements.

Municipalities in the Green River and Little Snake River Basins believe there is potential for their operations to conserve some water, but the bigger problem for municipalities is education to persuade their customers that water conservation for a DM program is necessary. The municipal and industry water users identified several issues that need further investigation. These issues include: a) Perception and education; b) the value of water in industry; and c) conservation measures and compensation.

A. Perception and education
    1. Important to explain why to conserve when lower basin states will get to use more water
    2. Municipalities need to convince people there really is a risk of curtailment
    3. There is a popular tendency to believe the State won't let towns dry up
    4. People wonder why they should conserve if the cities and towns aren't using all their water rights
    5. Storing the conserved water in Flaming Gorge Reservoir might soften resistance to a DM program
    6. Leaders in certain towns believe curtailment risk to be real and recommend educational task forces
    7. It is better to have a DM plan than to send staff out to turn off people's water
    8. Cheyenne water customers are accustomed to pressure to conserve water
    9. There is resistance to DM projects in towns located in areas where having less water would impact the agricultural economy

B. DM Programs: Industry Participation
    1. Conserving industrial water not likely feasible due to its high cost per acre-foot
    2. For trona, most possible water conservation has already been done
    3. Industrial representatives support a DM program and are looking for curtailment mitigation supply in Fontenelle Reservoir, and for temporary water use arrangements
    4. Others felt that it would be politically good for municipal and industrial users to participate (even minimally) in a DM program so that everyone has "skin in the game"

C. DM Programs: Municipal Participation
    1. Depending on municipality size, estimates of conservation range from 300 acre-feet to 1000 acre-feet

2. Most conservation efforts would be permanent
3. Water savings from not watering lawns or parks, for instance, could have major impact on community quality of life and tourism
4. Conservation should be based on measured amounts, not proposed amounts
5. Some municipal representatives are uncertain whether it had been legally determined what percent of oversupply a Wyoming city can hold in unused water rights without being subject to abandonment

Detailed Discussion of Issues

Curtailment

Irrigator views

Relationship between water right priority date and consumptive use

A curtailment could be a disaster for some Wyoming irrigators in the CRB. The specific impact would depend on each operation's water rights and which priority dates would be affected by a curtailment. For many irrigators, the amount of impact on consumptive use of the original water right may also depend on the availability of their surplus or excess rights.

Determining whether it is worth risking curtailment, without undertaking special efforts such as a DM program, is a real question for irrigators. A more detailed model of which priority dates would be impacted by curtailments of different amounts would help them assess the potential risk.

Impacts of curtailment on soil and plant communities

Assessing the potential impact of curtailment is difficult for irrigators for many reasons. Impacts could vary with what time of year the curtailment is declared; aquifers recharged by flood irrigation could suffer long-term damage; inability to tap into "free river" extra water in high runoff could then mean uncontrolled flooding further down in a watershed, including in towns below. Many irrigators think that the impacts of using less irrigation water (due to curtailment) on soils and plant communities could affect ranch and community economies far into the future.

Some irrigators pointed to a need to increase our understanding of the relationship between current irrigation patterns of use and the entire ecosystem in which ranchers work. Climate change is apparent, and some irrigators suggested that increasing storage of water high in the watersheds of the entire Colorado River Basin would make the most sense to be able to maintain current water use patterns and minimize impact to the ecosystems.

In the end, some feel that more water, not less, needs to be put to beneficial consumptive use in Wyoming, to meet needs here that may increase.

Curtailment mitigation strategies: storage
Fontenelle Reservoir could help mitigate the unknown curtailment impacts. Irrigators would like to know more, as the State Engineer's Office negotiates with the Bureau of Reclamation, about how Fontenelle might operate in a curtailment situation. It is understood that Fontenelle could likely not refill during curtailment. However, irrigators see potential water releases from Fontenelle, which might make priority regulation due to curtailment cut less deeply into water rights, as a form of insurance against the worst hydrologic and economic impacts. Similar to paying for crop insurance, irrigators may be willing to pay for Fontenelle being used this way.

The potential immediate and long-term impacts of curtailment are of concern to irrigators. Some irrigators are clear that they would prefer to risk curtailment and rely on the state to deploy existing water storage (as at Fontenelle Reservoir) to mitigate the impacts of curtailment to some extent. They would prefer taking that risk rather than undertaking a DM program. Other irrigators, however, wonder whether it is even possible to avoid curtailment and meanwhile maintain status quo for their communities. A DM program, some said, might be the lesser of two evils, compared to curtailment; at least it would mean receiving payment for using less water. Perhaps, they said, if there is ever a 50% chance of curtailment, the State could institute a DM program. Some proposed that perhaps the State could start a very small trial - taking maybe 10 years to conserve 70,000 acre-feet of water; some suggested Wyoming could agree with the other Upper Basin states that they would start a DM program, but Wyoming would not actively participate.

Municipality and industry views

Mitigation Tools
Municipality and industry are looking at a variety of options: using tools available in Wyoming water law to access other supplies; deploying water from Fontenelle Reservoir; and looking into the feasibility of a DM Program.

There are tools and mitigation strategies that could allow towns and industry to contract with holders of earlier-date water rights to change the use of those rights and mitigate potential adverse impacts from a curtailment. Municipality and industry stakeholders suggested that a combination of temporary changes in water use and exchanges of water rights could be very useful.

Stakeholders indicated that the municipality or industry planning to use any of these tools would have to be very diligent in making sure the water right in question has been actively used and will continue to be used and the contract with the water right holder should be structured to ensure that. "Readiness to serve" contracts could involve annual payments for the water to be available, and higher payments when the water is actually used by the municipality or industry. Once approved by the State Engineer, the temporary change does not have to be implemented until the water is needed, and the temporary change may be regularly renewed until the need arises – a very important feature in preparing for a possible curtailment at an unknown date. Significantly, such tools would provide for only temporary change in where and how water is used in Wyoming's Colorado River Basin. Municipal and industrial users indicated they had no

interest in permanent water right changes, though those are allowed under Wyoming water law. See "Wyoming Water Law Background Information."

A municipality or industry with late-date water rights could contract for temporary change in the use of early-date water rights, rights which would not be subject to shut-down under curtailment. A temporary change contract for those rights would mean water would not be used in its usual manner under those rights. Instead, it would flow unconsumed and allow for continued water use in municipal and industrial operations that made the contract. The municipal or industrial operation with rights ordinarily subject to curtailment regulation could continue consuming water without being cut back. Such an approach could be applied anywhere in the Green River-Little Snake basins, without requiring the water unconsumed in one place to be physically delivered to a facility on a completely different stream as long as the correct amount of water is not consumed in the basin and gets to the state line, which is all that will be required under curtailment. Exchanges combined with temporary transfers could help in that process. In such a case, Wyoming would be able to meet its curtailment obligation by regulating off water rights in reverse priority.

Clearinghouse of temporary water rights for transfers
The State Engineer's Office Water Right Tabulation books list existing rights and priority dates.

Records of approved temporary use agreements and exchange agreements are also kept on file at the State Engineer's Office. These agreements are not legally required to be on record at the county clerks' offices but making such recording would let others know what contracts have already been made on water rights in a county. Municipal and industrial stakeholders also indicated it could be very helpful to build an informational clearinghouse so people potentially interested in joining into a temporary water use agreement and/or an exchange agreement could find each other, and then make their transactions (privately). A clearinghouse might particularly help small

WYOMING WATER — LAW BACKGROUND INFORMATION

Wyoming water law provides several tools that could be useful to mitigate curtailment impacts for municipalities and industry:

- Temporary change in use (to a new use or new place of use). Two-year changes that can be renewed. Straightforward process, not data intensive. Must be approved by State Engineer, who examines water right being changed to ensure it is in good standing and ensures no injury to other users. Often only half the water may be changed to the new use. (Wyoming Statutes §41-3-110: see Appendix B).

- Permanent change in use (to a new use or new place of use). Data-intensive: proof of historic consumptive use; consumptive use study may be required. Board of Control approval required. Board scrutiny for injury to other users: hearings, public controversy possible. Original water right typically reduced in transfer (due to return flow and other considerations). (Wyoming Statutes §41-3-104: see Appendix B).

- Exchange. A water right holder takes water out of priority, with water from exchange source as "make-up" water to earlier-priority rights that would otherwise be injured. Exchanges are favored by statutory policy. State Engineer approval required, examines to ensure no expansion of historic use. (Wyoming Statutes §41-3-106: see Appendix B)

municipalities and industry find water right holders. The details of how such a clearing house could be developed and implemented needs further investigation.

Some municipal and industrial representatives suggested that the SEO conceptual model of curtailment impacts could, particularly if refined, give their entities a better idea of how to find water rights with high consumptive use and a sufficiently early date to avoid curtailment.

Permanent change, allowed under Wyoming water law, was not a focus of the stakeholder discussions. None of the municipalities or industries represented in discussions held in 2020 expressed any interest in permanently acquiring water rights now being used for other purposes.

Fontenelle Reservoir. There was very strong interest in potentially using Fontenelle Reservoir water to mitigate curtailment impacts. Four industrial users in the Rock Springs-Green River area currently have contracts for Fontenelle water. These are back-up contracts for stored water that they have not had to use. How useful those contracts could be in curtailment, and for how long, depends upon several factors. Those include when and how long curtailment is declared and, what new contracts other users might take out in anticipation of curtailment needs.

The SEO and Reclamation are discussing how Fontenelle water could potentially be used during a curtailment. (An additional issue raised was if the reservoir could be operated for water supply during a curtailment, rather than the usual operating focus on hydropower production.) See "Curtailment Background Information," page 29.

Demand Management

Irrigator views

Conserving water via a DM program would mean drying up some agricultural land temporarily but possibly for a number of years. Some irrigators are interested in investigating other approaches and alternatives including more investment in cloud-seeding, negotiating other arrangements with the other states, or new storage. Already, in dry years, Wyoming irrigators are not able irrigate all their fields; new storage could catch spring high flows and allow more water to fill the "big sponge" of river valleys, as well as releasing water, if necessary, to go downstream to meet compact obligations.

Irrigators said the factors that affect irrigator decisions to participate in a DM program include the length of time a field would need to be enrolled, potential impact to fields and operations, climatic conditions (wet and dry years), how compensation rates are determined, and who assumes the risk of how much consumptive use reduction will actually be achieved. A DM program could act as a buffer, some said, to help hold off "something worse" – curtailment.

CURTAILMENT — BACKGROUND INFORMATION

Curtailment could last longer than a year, and that could ultimately exhaust the capacity of Fontenelle Reservoir to mitigate the impacts of curtailment.

Water stored in a reservoir in priority, before a curtailment, can be used out of priority as curtailment mitigation tool. If a multi-year curtailment occurs, however, basin reservoirs with late priority dates – like Fontenelle - cannot store water again, once they have come under curtailment.

The volume of water carried over, as well as the number and size of user contracts, may affect how much water remains available in each year of a multi-year curtailment.

- Wyoming has rights to 120,000 acre-feet.
- 46,550 acre-feet of that currently is contracted, on a "readiness to serve" basis, to 4 industrial users in Rock Springs-Green River area. A contract for another 6,000 acre-feet is pending.
- Wyoming has first right of refusal to another 140,000 acre-feet of currently uncommitted storage.
- Wyoming law requires that the state be paid for use of any water stored in Fontenelle to which Wyoming acquires rights (Wyoming Statute § 9-2-211); water releases for curtailment mitigation purposes therefore may require statutory change
- Another 80,000 acre-feet could be available to Wyoming depending on ongoing work with the Bureau of Reclamation and a possible rip-rap project (see below)
- Other existing reservoirs in the Green River and Little Snake Basins are all potential tools to mitigate curtailment, each with its own limitation of its priority date, how much it has stored before a curtailment is declared, and how useful it could be in a multi-year curtailment.

The Wyoming Water Development Office (WWDO) has, with the backing of the legislature, been exploring the possibility of rip-rapping the lower reaches of Fontenelle Reservoir to make water accessible that currently cannot be safely released from the dam.

Studies by the WWDO and Reclamation thus far suggest:

- Under its current structure and management plan, Fontenelle could supply curtailment mitigation water over two years of curtailment
- There is some uncertainty however for current Wyoming industries that hold contracts on Fontenelle water, over whether water will be available to meet their contracts fully, particularly after the first year of curtailment
- Financially, it might make the most sense for Wyoming not to decide immediately on whether to invest in the rip-rap project. Rather, the state could decide in the midst of a multi-year curtailment – if such an event occurs - whether to invest in the rip-rap project, to make another 80,000 acre-feet of stored water accessible.

See Appendix B for more detail

PERCENTAGE OF FLOWS — BACKGROUND INFORMATION

Wyoming's share of the Colorado River under the Colorado River Compact is a percentage of flows, so in dry years with less water, the volume available to Wyoming is smaller. In dry years Wyoming users may already be close to using Wyoming's entire share of the river.

Declaring storage alone to be a beneficial use could be echoed in other Colorado River states, to Wyoming's disadvantage.

New storage or no, the compact obligation remains; not to deplete flows at Lee Ferry below a certain level. Curtailment of Wyoming's water use could be required to avoid depletion that violates the compact, and such a curtailment would undoubtedly prohibit further water storage in new reservoirs.

But new storage in Wyoming that provides supplemental water for existing irrigation users might nonetheless be valuable in a curtailment situation, via water stored in new reservoirs before a curtailment is declared. If curtailment is required to meet the compact obligation, that water could help mitigate the impact of curtailment. It could do so by making more exchange transactions possible. Junior water users like towns and industry seeking to avoid shut-off could pay irrigators to forego use, temporarily, of their supplemental water stored before curtailment.

The WWDO is currently working on five storage projects in the Green River and Little Snake River Basins: riprap of Fontenelle, discussed above; the proposed West Fork reservoir in Carbon County for supplemental irrigation water there; and restoration of Middle Piney Reservoir, and enlargement of Big Sandy and New Fork reservoirs, for supplemental irrigation water for existing users in the Green River Basin.

Ensuring Equity among the Upper Division States

A concern that was shared is how to maintain and guarantee Wyoming's portion of CRB water. Irrigators objected to any DM program that would have Wyoming use less water just to see other Upper Basin states use more (e.g., Utah's proposed Lake Powell Pipeline to take water to the southwestern part of that state.)

Increasing Storage

Irrigators wondered whether Wyoming should try to use more of Wyoming's share of the UCRB water rather than less, by increasing water storage. They proposed that new reservoirs could be built to store water in Wyoming that could be released to help the Upper Basin comply with the compact. Such a plan would require a change in Wyoming water law so storage of water for the purpose of compact compliance could be legally considered a beneficial use. New water storage also must pass a federal permitting test of sufficient "purpose and need" for a project. Water could not be stored in new reservoirs after a curtailment is declared.

Some suggested that irrigators should not think of the question facing the state as a choice between building new storage or undertaking DM: the state should pursue both. See "Percentage of Flows Background Information."

Methods for water conservation and reducing consumptive use

If a DM program were to be implemented in Wyoming, irrigators had very clear preferences on what methods for reducing consumptive use should be compensated by the program.

Irrigators most preferred payment for infrastructure changes like installation of pivot sprinklers, better headgates, or rerouting of water flows through an operation in ways that could avoid water going to

waste. Consumptive use savings that are available through such means may be underestimated by water experts, irrigators said. There was less interest in simply not irrigating certain lands for a set period, due to the potential impacts on soils, vegetation, and overall ecosystems.

Some irrigators pointed out that cutting the consumptive use of water in irrigation may be the coming reality. And in that context, an important feature of DM is that irrigators could be paid to conserve water. That could be an important additional tool for ranchers to generate income to keep their operations going while they find ways to use less water. Ranchers would have to consider possible impacts, in deciding whether to participate in DM and how much compensation to require for their participation. Those impacts include long-term changes in plant communities, particularly in areas that are now water rich.

Potential impacts on soils and vegetation, ecosystems (Partial vs Full season fallow)
Payment to stop irrigating and dry up a field in the middle of a growing season is not preferable, irrigators said. Such an approach may not provide as much consumptive use savings, and late season irrigation is crucial to support fall grazing in some areas, particularly in the Little Snake basin. Late season irrigation also provides early green-up in the spring which is valuable for ranchers.

Payment for irrigators to dry up a field for an entire season should only be acceptable for marginal fields, irrigators said. For prime fields, there are too many concerns over the health of the soil and plant communities if a field is left dry for an entire growing season, they said. Even in an area where water is usually scarce, wetting a field just once helps protect against cheat-grass growth and other deterioration. Perhaps a DM program seeking to pay for fields dried up for an entire season could allow irrigators to take water in the "free river" period of high run-off, and then not irrigate afterwards. Climate and economic circumstances will also affect participation in such a program – some might participate in good times, or, by contrast, in bad times after a twenty-year drought.

Irrigation in one location can directly affect a neighbor, due to return flow affecting water tables and streamflow between neighbors. A DM program should not encourage a careless operator to dry up a field at the expense of his neighbors, irrigators said. Irrigators could perhaps agree to rotate who turns off irrigation of what field and when. It was suggested that an approach might be for an entire small watershed, tributary to the main rivers, to collaborate and partially dry up their fields in rotation with each other, some irrigators said. They said that would be better than a program that, by paying ranchers not to use water, allows them to "decimate their property," and adversely affect their neighbors.

Ranchers are overall unlikely to enter their most-productive fields into a DM program, irrigators said. For some people, that means their bench lands, for others, their bottom lands. Much may depend, irrigators said, upon what is paid for different types of fields, and upon whether ranchers in small watersheds can work together. It could potentially be beneficial to work on having entire watersheds participate in a DM program.

The willingness of irrigators to participate in a DM program that paid for leaving a field dry for an entire season could depend on such things as the amount of the payment.

Compensation: equity among participants

Irrigator views varied on how a compensation price should be set if a DM program were to be implemented in Wyoming. Suggestions included "group negotiations" to promote equity among participants or negotiating privately to allow each person to benefit from their own negotiating skills. Some thought the price of water in Las Vegas or California should be a starting point, even though DM conservation would be for Wyoming's benefit. But irrigators said the price paid definitely needs to cover the loss of the field, the damage to forage, and a major premium, or margin, to cover all the unanticipated impacts.

Some irrigators thought that there could be an advantage in creating a new free market providing potential for new income for Wyoming ranchers in the Green River and Little Snake River Basins. Or perhaps it is better for it to be a market regulated by the state, to ensure consistency in pricing, not money just going to the low bidder, who doesn't intend to stay in agriculture anyway, others said. "The market shouldn't be driven by the guy who's broke."

Payment to irrigators would have to be based on estimates of what consumptive use savings will be produced by whatever practice the irrigator takes on that the DM program will pay for, irrigators said. It would not work for irrigators to have the payment based on measurement of the consumptive use actually saved. Putting the risk of unexpectedly low savings on the irrigators would be unacceptable.

Potential impact on existing water rights

The fact that a DM program would require that reduction in the water consumptively used be temporary, as well as compensated, may suggest protection from abandonment of the water right involved, irrigators agreed. That is because a water right is not abandoned under Wyoming water law unless it has been left unused for five years. But one irrigator speculated on whether state endorsement of a DM program would perhaps commit state government to defend participants against any abandonment claim. Perhaps if a DM program were adopted, statutes might need to be changed to make clear that a water right participating in a DM program could not be declared abandoned, the irrigator suggested.

Municipality and industry views

Perception and education

The general public belief is that using less water in Wyoming just means states like Arizona and California will get to use more – so people question why they should conserve, municipal representatives said.

On the mainstem of the Green River, for instance, water use has never been regulated. People in Rock Springs and Green River will need to be convinced that there is a genuine risk of curtailment. People tend to think that Wyoming will not let the towns and cities dry up and people in municipalities know that the towns "aren't using all the water rights" they have — so "why conserve?" The fact that water conserved

in a DM program might be stored in Flaming Gorge reservoir, with its many recreation and economic benefits for the nearby area, might soften initial resistance to a DM program, representatives for those towns said.

Representatives of towns in both the Green River and Little Snake River Basins personally believe the risk of curtailment is very real. They offered to form educational task forces to go to local meetings of all kinds to help people see that. "It's better to have a plan for DM than to have to send staff out to go turn off people's water," one representative of small water systems said.

Cheyenne is an exception to resistance to conservation, that city's representatives said. Cheyenne water customers are accustomed to pressure to conserve water, they said.

Others, from small towns in rural areas that already have low water supply, suggested that perhaps any DM program established in Wyoming should not enroll participants in places where less water consumption, especially for irrigation, could have a high impact on a local economy dependent on agricultural production.

DM programs: industry participation

Representatives of industry, by contrast, said it was unlikely any water could be conserved by their operations under a DM program in Wyoming, because the value of water to their operations is so high - $15,000 or more per acre-foot – that a DM program could not possibly pay for it. Further, water remaining after processing trona, for instance, is never returned to the river: the cost of handling that water is so high that trona plants already have considerable incentive to conserve and have already done so. (One plant cut its water use by 50 percent over 25 years.)

A DM program in Wyoming would therefore have no real effect on industry plans to expand or contract their operations in Wyoming. One trona operation is hoping to expand, while minimizing its use of water.

On the other hand, industry does support adoption of a DM program in Wyoming, spokespeople said. Their own operations hope to rely on Fontenelle water and on arrangements for temporarily using others' water rights, as was discussed relative to curtailment. But they feel it would be good to know that a DM program is in place in Wyoming. Some stakeholders pointed out that it could be politically important for industry and municipalities to conserve some use under a DM program so that participants with major conservation potential (likely to be irrigators) would feel that everyone in the basin has "skin in the game." See "Closed Power Plants Background Information."

CLOSED POWER PLANTS — BACKGROUND INFORMATION

The projected closure of Rocky Mountain Power units in southwestern Wyoming would not make any water consumptive use available to be conserved under a DM program.

The requirement that consumptive use conservation in a DM program be "temporary" – as agreed to already by all four Upper Basin states – means that water once used in closed power plant units would not qualify under a DM program.

The water conserved under a DM program must be water

- that would otherwise be used, and
- that the water right holder plans to use in the future.

TEMPORARY MEASURES — BACKGROUND INFORMATION
In the overall CRB, where large cities in the Southwest have pledged water conservation, there is some precedent for permanent conservation measures qualifying as "temporary" in the sense that is contemplated by any DM program.

DM Programs: Municipal Participation
Municipalities estimate they could conserve water under a DM program, in amounts that vary by their size. For small towns, they might fix leaks and discourage lawn watering, and save perhaps 300 acre-feet. Rock Springs and Green River water service is under a joint powers board, which makes decision-making complex and difficult, though they might be able to conserve 800 acre-feet. State loans connected to water utility income and rate schedules could present problems for that board and for the smaller towns. Cheyenne might be able to replace as much as 1,000 acre-feet of Colorado River (Little Snake) water use with conservation, groundwater, and non-Colorado Basin surface water.

But for municipalities, in addition to the hurdle of public opinion buy-in, there is another problem for taking on conservation under a DM program. Municipal representatives asked what the DM program requirement that water conservation be "temporary" would mean in the case of a municipality. Municipal representatives pointed out that most conservation measures they could undertake would likely be permanent, just by the nature of what they could do. See "Temporary Background Measures Background Information."

There is also a possibility that conservation education programs undertaken by municipalities might qualify as measures that could be compensated by a DM program.

COMPENSATION — BACKGROUND INFORMATION
How accounting and administration of any DM program will be done – by a public entity, or perhaps a public-private partnership – is one of many DM issues yet to be determined if any DM program is pursued.

How a DM program would be funded, to provide compensation for the water temporarily and voluntarily conserved, is another major question yet to be determined.

Municipal and industrial representatives agreed that compensation for any conservation under a DM program would have to go beyond just reimbursing the capital costs of a conservation project, to include compensation to their operations and their communities for using less water. Water savings from not watering lawns or parks, for instance, could have major impact on community quality of life and tourism.

It was also agreed that compensation should be tied to the amount of water measured as actually conserved, not an estimate of the amount that would be saved by proposed conservation measures. In addition, in the case of cities and towns, care must be taken to select the benchmark for measuring the amount of water conserved under DM. Annual variations in water use can be considerable in cities and towns. See "Compensation Background Information."

The DM requirement that conservation must be temporary is regarded as sufficient to protect municipal water rights from abandonment, municipal representatives said. Under Wyoming water law cities can

acquire rights to water they may not immediately use, to prepare for future growth. But one municipal representative pointed out that it has never been legally determined what percent of oversupply a Wyoming city can hold in unused water rights without being subject to abandonment.

NEXT STEPS

The Wyoming State Engineer's Office and the water users and stakeholders in the Green River and Little Snake River Basins have all learned from the exploration thus far of the DM concept.

The outreach effort for 2019-2020 had the following goals, which have been accomplished:

- Increased understanding among diverse stakeholder groups in Wyoming regarding the trade-offs (advantages and disadvantages) of a potential DM program.
- Documentation of stakeholders' views on the feasibility of a DM program in Wyoming's Colorado River Basin, including potential approaches and considerations regarding a potential DM program in Wyoming.

There is more to do to investigate the feasibility of a DM Program for Wyoming and for all the states in the Upper Colorado River Basin. As the regional discussion evolves, continued input from stakeholders in Wyoming will be important.

All four states are conducting their own investigations. The UCRC has also undertaken, through consultants, an investigation of technical issues involved in a potential DM Program.

One major outcome of all the work the states and the UCRC are doing might be agreement on a consistent way to measure consumptive use, applicable in any of the Upper Basin States. That alone will be of great value as the Upper Basin states continue to work with Lower Basin States and the federal government in management of the Colorado River for years to come.

The Wyoming SEO is meanwhile continuing its work investigating the feasibility of a DM Program for Wyoming through the following avenues:

- Ongoing negotiations with Reclamation regarding the operation of Fontenelle Reservoir, and how it could be used in a curtailment situation
- Ongoing discussions with the Upper Basin States and the Reclamation regarding assessment of consumptive use
- Renegotiation of the 2007 Interim Guidelines: with a 2026 target date for issuing new guidelines.

University of Wyoming faculty have completed a study estimating the economic impacts of DM if consumptive use reductions came from the agricultural sector. An additional study to compare the economic impact of curtailment to that of DM is underway. This study will include review of how municipalities and industry might use available tools to mitigate the impact of curtailment on their

operation. The study will also assess the impacts of curtailment and DM in scenarios involving different types of water years.

The condition of Wyoming state finances at present precludes the SEO from further refining its conceptual model of what water rights would be affected by what level of curtailment, though both irrigator and municipal-industrial stakeholders have emphasized the value of refining the model. The SEO has however invited water right holders to provide information on their use of excess and surplus rights, which could help further inform the conceptual model.

Continued public input and involvement in the investigation of the feasibility of a DM Program for Wyoming is crucial to the progress of the investigation.

Continued public outreach will include:

- Updating the existing website on the investigation, as more information is available
- Continued contact with water users, stakeholders, and the general public
- Possibility of more public meetings

A decision on **whether to move ahead** to implement a DM program is years away. Any such decision will be preceded by negotiations within the UCRC between Wyoming's representatives (appointed by the Governor) and the representatives of the other states.

Ultimately, the Governor of Wyoming, advised by many different people, will make the decision on whether to move ahead in favor of a DM Program, and the state's representatives on the commission will act to establish such a program only with the Governor's approval.

REFERENCES

Jensen, M.E., R.D Burman, R.G. Allen, 1990. Evapotranspiration and Irrigation Water Requirements (Manual No. 70), Committee on Irrigation Water Requirements of the Irrigation and Drainage Division of the American Society of Civil Engineers. American Society of Civil Engineers, New York, NY.

U.S. Bureau of Reclamation (USBR). 2012. Colorado River basin water supply and demand study. Study report. Washington D.C.: Department of the Interior, Bureau of Reclamation. Retrieved from http://www.usbr.gov/lc/region/programs/crbstudy.html

Wyoming SEO, 2021. Green River Basin Annual Consumptive Use Report, Water Year 2020. Wyoming State Engineer's Office, Cheyenne, WY.

APPENDICES

Appendix A: Community Meetings & Focus Groups — https://www.uwyo.edu/uwe/wy-dm-ucrb/final-project-report/wy-dm-ucrb-final-report-appendix-a.pdf

Appendix B: Relevant Wyoming Statutes and Fontenelle Options — https://www.uwyo.edu/uwe/wy-dm-ucrb/final-project-report/wy-dm-ucrb-final-report-appendix-b.pdf

Appendix C: Wyoming Demand Management Feasibility FAQ — https://www.uwyo.edu/uwe/wy-dm-ucrb/final-project-report/wy-dm-ucrb-final-report-faq.pdf

Final Report: https://www.uwyo.edu/uwe/wy-dm-ucrb/final-project-report/wy-dm-ucrb-final-report.pdf

B-1384
Wyoming Demand Management Feasibility Investigation: Stakeholder Engagement Process
December 2021