Comments to the Colorado River Operations SEIS

(Prepared and submitted by concerned students at the Colorado School of Mines)

ATTN: Reclamation 2007 Interim Guidelines SEIS Project Manager, Upper Colorado Basin Region, 125 South State Street, Suite 8100, Salt Lake City, Utah 84138

Agency/Docket Number:

RR03010000, 22XR0680A1, RX.18786000.5009000

RE: Request for Comments - Notice of Intent To Prepare a Supplemental Environmental Impact Statement for December 2007 Record of Decision Entitled Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations For Lake Powell and Lake Mead

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Abbreviations

ATM - Alternative Transfer Methods
CRB - Colorado River Basin
CRS - Colorado River Systems
CSM - Colorado School of Mines
CRSP - Colorado River Storage project
FU-CF - Colorado River Facility Use and Water Conservation Fee
MAF - Million Acre Feet
MAF/yr - Million Acre Feet Per Year

I. Introduction

We are twenty-three students from the Colorado School of Mines (CSM) wishing to submit public comments to the open SEIS process for ongoing operation of Colorado River Storage Project facilities. Our names and contact information are listed in **Section IX**.

As a *Water Policy* class at CSM, we have spent the past semester studying the combined crises of drought and overallocation that now gravely impact the CRB. The situation is extremely dynamic, the result of deeply entrenched systemic challenges more than 100 years in the making, and requires novel and comprehensive solutions.

We understand that the current SEIS (Supplemental Environmental Impact Statement) is focused on interim (near-term) operations, which will be followed by a larger and more extensive EIS to determine long-term system operation and water allocation policies for extended Colorado River Compact management.

Our recommendations for how to move towards sustainable CRB management encompass both near and long-term time frames. For this reason, we are submitting these comments to the current SEIS (Docket Number RR03010000) and will resubmit for the long-term EIS decision making process.

II. Colorado River System Operations & Future Allocations

A. Our Observations

1. The Compact erroneously assumed that the Colorado River had a consumable base flow of 20-22 MAF/yr [1].
2. If the best available science had been considered, the consumable flow of the river would have been viewed as 15 MAF/yr, not including imported water and evaporation losses [1].
3. 16.5 MAF/yr was originally allocated to the states in the Upper and Lower Basins, and Mexico, under the Compact and its additions (**Table 1**). The math was wrong from the beginning.
4. The Upper Basin and Lower Basin division and relative water allocations from the Compact were driven by fears, speculation and competitive interests that no longer pertain.
5. The Upper Basin uses less (24-37%) than Compact allocations based on 2020 average consumptions (**Table 1**) [2].
6. The Lower Basin uses ~100% of Compact allocations based on 2020 average consumptions (**Table 1**) [2].

Table 1. Allotted and consumptive use for each state

CRSP Entities	1922 Compact Water Allocations (MAF) For Reference	Average Consumptive Use as of 2020 (MAF)	Percentage Use of 1922 Allocations
WY	1.043	0.71	68%
CO	3.855	2.93	76%
UT	1.714	1.08	63%
NM	0.838	0.63	75%
Total: Upper Basin	**7.45**	**5.35**	-
NV	0.3	0.3	100%
AZ	2.85	2.8	98%
CA	4.4	4.4	100%
Total: Lower Basin	**7.55**	**7.5**	-
MEX	1.5	1.5	100%
Total	**16.5**	**14.35**	**87%**

6. The current average annual flow rate for 2000-2020 is 12.4 MAF/yr [3].
7. The 2021 water year average annual flow rate was 11.4 MAF/yr [4].
8. Climate change forecast will decrease the flow (to ~8.7 MAF/yr) of the Colorado River 20-40% by 2050 [5].

B. Our Recommendations

1. The CRSP should take a holistic basin approach to management. A holistic approach should be taken to address climate change and potential mitigation, like Sustainable Development Goal #6 proposed by the United Nations [6].
2. Acting as a single hydrologic unit will address the unequal water distribution consumption under Prior Appropriation and will better prepare the Basin to address the severity of climate change [6].
3. We suggest making the 2020 net depletion numbers the new baseline for allocation of the Colorado River.
    a. If a curtailment is required, pro-rata reductions against the 2020

consumption baseline is the fairest way to administer the cut. This would not affect the various internal Prior Appropriation legal regimes within Colorado River States. It simply aligns with what has always been true – there is no Federal Prior Appropriation law.

4. A 4 MAF Pro-Rate Curtailment Proposal (4MAF-Plan), the most aggressive targets being suggested by the Secretary of Interior and Bureau of Reclamation, should be used by all parties for operations and planning purposes (**Table 2**) [3].
    a. The science indicates that this more conservative reduction will be needed to stabilize the system and preserve the ecology of the river.
    b. If applied pro-rata to the States relative depletions as of 2020, the 4 MAF reduction results in a 27.1% reduction from 2020 consumptive uses by all and a consumable river flow of 10.35 MAF/yr.
    c. The 2 MAF curtailment, also proposed by the Interior, would not be sufficient to deal with the current climate situation.

Table 2. Total allocations from a 4 MAF Pro-Rate Curtailment Proposal (4MAF-Plan)

CRSP Entities	Average Consumptive Use as of 2020 (MAF)	4 MAF (72.1%) Cut to 2020 Uses Applied Pro-rate
WY	0.71	0.51
CO	2.93	2.11
UT	1.08	0.78
NM	0.63	0.45
Total: Upper Basin	**5.35**	**3.86**
NV	0.3	0.22
AZ	2.8	2.02
CA	4.4	3.17
Total: Lower Basin	**7.5**	**5.41**
MEX	1.5	1.08
Total	**14.35**	**10.35**

5. Tribal water rights can and should be honored as senior federal reserved water rights.
6. We assumed tribes currently receive and use approximately one-third of their water rights. The two-thirds remainder of recognized tribal water rights could be characterized as “on loan” tribal water to the recipients. This concept is explained in **Section IV**.
7. The table below identifies the percent of water allocations, in the context of a 4 MAF curtailment scenario (discussed above as *Recommendation 6*) that would be deemed as tribal water on-loan (**Table 3**).

Table 3. The "on loan" tribal water owed by the recipients

CRSP Entities	Tribal Water: Overlayed Assignment (MAF) 2.11/10.35 = ~20%
WY	-
CO	0.42
UT	0.16
NM	0.09
Total: Upper Basin	
NV	0.04
AZ	0.40
CA	0.63
Total: Lower Basin	
MEX	

C. Compared Scenarios

Two scenarios were investigated for further consideration: 1) A concept proposed by Scientist Brad Udall et. al. in a published journal article titled "What will it take to stabilize the Colorado River?," and 2) a scenario impacted by climate change. Brad Udall et. al. suggested that each basin receive 3 MAF cuts (6 MAF total), including Mexico in the Lower Basin, because such a scenario stabilizes current reservoir levels if consumptive uses decrease [3]. **Table 4** below shows that these curtailments would result in a total flow rate of 8.35 MAF/yr if such cuts were to be made based on entities' average consumptive uses in 2020.

Moreover, studies indicate that the average flow rate in the Colorado River will decrease by 20-40% by 2050 due to climate change [5]. Also shown in **Table 4** is a scenario where there is a 30% decrease in the 2000-2020 average flow rate of 12.4 MAF/yr. This would result in a 39.5% curtailment from the 2020 consumptive uses to divide a consumable river flow of 8.67 MAF/yr between all entities of the Colorado River Storage Project (CRSP).

Table 4. Comparison of allocations from Udall's scenario and Climate Change

CRSP Entities	Average Consumptive Use as of 2020 (MAF)	Udall Scenario 3 MAF Cut per Basin based on Consumptive Uses	Climate Change Scenario 30% Drop from 2000-2020 Avg Flow (12.4 MAF)
WY	0.71	0.31	0.42
CO	2.93	1.29	1.78
UT	1.08	0.47	0.65
NM	0.63	0.28	0.38
Total: Upper Basin	**5.35**	**2.35**	**3.23**
NV	0.3	0.2	0.18
AZ	2.8	1.87	1.69
CA	4.4	2.93	2.66
Total: Lower Basin	**7.5**	**5**	**4.53**
MEX	1.5	1	0.91
Total	**14.35**	**8.35**	**8.67**

The demands of climate change are met through Udall's proposition of greater (6 MAF versus the suggested 4 MAF by Reclamation) and equal water use curtailments to the Lower and Upper Basin entities' consumptive uses. Udall's scenario could provide a template for how to effectively manage water cuts across the board with future projected flows of the Colorado River. With these scenarios in mind, it is suggested that all entities of the CRSP take equal responsibility for the curtailments in consumptive uses to meet the threatening demands of climate change.

The great benefit of this policy recommendation is that it will allow all CRSP entities to move away from operating under the premise that the Upper and Lower Basin have rigid water allocations that need to be met. There is no longer enough water to ensure that original allocations can be fulfilled. Continuing to impose drastic cuts on junior water rights users before states with much larger shares is not a long-term solution. The flow of the river is constantly changing due to many factors, and a policy that responds fast to changing flows is necessary.

The **4 MAF Pro-Rate Curtailment Proposal (4MAF-Plan)** makes the response to the current water crisis more efficient. It requires every member of the basin to begin conserving immediately after reductions are imposed, and it allows for the curtailment amount to change situationally. The 4 MAF cut is a conservative, minimum suggestion, given that Udall's and the climate change scenario pose more substantial curtailments (6 and 3.7 MAF, respectively) in order to stabilize the Colorado River. Both scenarios above are more difficult and painful than the 4MAF-Plan discussed above. Thus, we see the 4MAF-Plan as the minimum prudent place to start. If it is not enough, more aggressive pro-rata curtailments can be added as we continue to see significant impacts on the water supply.

III. Urban Conservation: A Drop in the Bucket

A. Our Observations

1. Most urban areas within the United States tend to have inadequate and inconsistent water conservation policies. Our assumptions for urban water waste and conservation in the CRB are as follows:
    a. Urban conservation measures include indoor water for reuse, xeriscape, following strict irrigation schedules, progressive pricing, and high water-efficiency home appliances.
    b. Turf requires approximately 73 gallons per square foot per year in the dry, arid conditions [7] and one of the largest sources of water waste.
    c. Around 2.1 trillion gallons of water are lost in the United States due to leaky pipes, broken water mains, and faulty water meters each year [8].
    d. Urban centers that are identified as leaders in water conservation include Las Vegas, Amsterdam, and Singapore
    e. Removing nonfunctional grass on the Las Vegas Strip alone conserves 9.5 billion gallons of water per year [9], which is roughly 10% of Southern Nevada's water supply. Therefore, the best case-study for urban water conservation for our purposes is Las Vegas, NV due to its documented efforts and location within the CRB (**Figure 1**).
2. Population growth in the CRB is undoubtedly related to the issue. According to these observations, we have assumed:
    a. Much of the growing U.S. population is moving to Western and Southern cities, including several in the CRB [10].
    b. Water conservation will reach a maximum level of efficiency, after which further population growth will not be sustainable [10].
    c. Population growth in the CRB at its current rate is not sustainable without significant measures to increase conservation in both urban and agricultural areas.

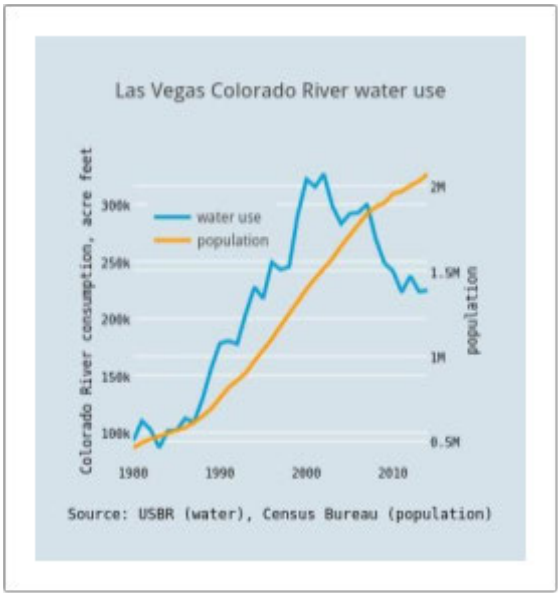

Figure 1. Colorado River Water Use in Las Vegas

B. Our Recommendations

1. **Standardize Urban Water Demand Management Practices.** There is currently no standardized method for determining water consumption, making conservation evaluation efforts and comparison difficult or impossible [11]. Standardizing water consumption across all CRB states will help to better account for current and future urban water demand, forecasting new development and population growth impacts, improve water efficiency, and evaluate the success of water conservation policy. In addition, standardizing urban water consumption can help identify which municipalities and states lack adequate water conservation through insufficient policy practices or through aging infrastructure. The following should be considered and included:
    a. Climate impacts (i.e. evapotranspiration)
    b. Return flows to the CRB through reclamation of wastewater
    c. Return flows to the CRB through surface runoff
    d. Commercial and industrial use
    e. Open space irrigation
    f. Annual reporting of demand to state reporting agencies
    g. Statewide evaluations of individual water provider conservation efforts
    h. Loan or grant consideration based on evaluations to promote water conservation efforts
2. **Standardize Threshold Water Use Limits.** We considered Denver Water, Salt Lake City Public Utilities, Las Vegas Water District, City of Phoenix, and the Metropolitan Water District of Southern California for comparison between water tier rates, excessive use limits, and other related billing reporting standards. Simplifying the comparison between municipalities drawing water from the CRB will allow for easier reporting of urban conservation efforts and growth across the entire CRB. Our specific recommendations for this are as follows:
    a. Standardized units for water use billing across all municipalities drawing water from the Colorado River and its tributaries.
    b. The same tier structure and naming conventions should be enforced and used at all municipalities that treat and distribute potable water from Colorado River and its tributaries. Billing standards should remain up to the discretion of the individual municipalities, but consistent naming of billing tiers will allow for simplified comparison of water consumption, conservation, and efficiency to track progress across the CRB.
    c. Several ways of water billing are used, including uniform rates, increasing and decreasing block rates, seasonal, drought, and water budget based [12]. Implementing standard assessments for billing across all municipalities in the CRB, or simply refining the different billing methods for easy conversion and comparison, can provide a better tool for assessment and synthesization.
3. **Conservation fees.** Cost is the most useful and important tool. As the cost of water moves towards the true value of water, in other words, the cost of returning water to the CRB, other water sources become more lucrative, as described in **Section IV**. Water conservation efforts can be encouraged monetarily through implementation of a program that funds efforts accordingly. For example, fees may be collected into a

state fund and allocated for the assistance of retrofitting older housing with modern water-smart technology and prioritizing low-income and multi-family housing. A small percentage of collected tap fees could also be awarded in grants to Water-Conservation Research, with the goal of improving water efficiency for urban uses. The following are suggested ways of fee implementation for related programs:

a. ***State Conservation Tariffs:*** Tariff(s) can be implemented federally and taken from all states within the CRB. Funds could be distributed to the same States in full or increased amounts depending on their water conservation successes, as described in **Section V**.
b. ***New Development Fees:*** To encourage developers to adopt conservation-minded building practices, like low water-use fixtures and drought tolerant landscaping, state water agencies may implement sliding-rate tap-fees, or connection fees. These fees may be determined using a proportional rate of the number of approved new developments and inversely proportional to unallocated Colorado River water at the state level. For example, as the number of new developments increases, tap-fees may increase. If developers comply with state approved conservation practices, fees may be adjusted as a credit. Using an inversely proportional rate model can incentivize states to consider water allocations and conservation on a holistic basis to include agricultural users.

C. Conceptual Scenario

1. Intensive urban water conservation should be aggressively implemented throughout the CRB with consistent standards and a coordinated systematic approach. However, compared to our recommendations described in **Sections IV & V**, the potential water savings from urban conservation programs are relatively small. Essentially, it's "a drop in the bucket" given the scope and scale of the problem. Our observations demonstrate that water conservation from the urban sector alone is insufficient to keep pace with the increasing rates of urban growth across the region.

IV. Agricultural Water Reduction Programs

A. Our Observations

1. Farmers and ranchers utilize nearly 80% of available water in the CRB [13].
2. Uncompensated cuts to these landowners' water access would have adverse effects on their livelihoods, with cascading impacts on their local communities.
3. To achieve our 3.2 MAF depletion goal (80% of 4 MAF) from this sector, we have devised five voluntary programs that seek to revitalize agricultural communities with new incentive models that significantly benefit landowners financially, while simultaneously addressing the necessary water reductions from rural lands.

B. Our Recommendations

1. Expansion of the price per acre-foot model established by the Department of the Interior in the LC Conservation Program [14].
    a. We recommend incorporating a five-year agreement: $900 per acre-foot, as well as a ten-year agreement: $1200 per acre-foot.
    b. We believe extended multi-year agreements will provide landowners with longer term options that deliver the type of financial security they can depend on to sustain them during their water reduction period.
2. Creation of an energy production tax credit that reduces agricultural water usage while concurrently encouraging solar generation.
    a. Landowners who qualify will agree to decrease their water usage by 10 acre-feet per year for the duration of their contracted land lease to a solar developer.
    b. In doing so, they will be eligible to receive a $0.02 per kilowatt-hour (kWh) credit towards their annual property tax.
3. Development of alternative transfer methods (ATMs) between landowners and municipalities through lease agreements.
    a. We recommend leasing options to municipalities based on five-year lease terms at $900 per acre-foot, as well as ten-year terms at $1200 per acre-foot.
    b. By allowing a per acre-foot payment, smaller water rights holders will be able to benefit from this leasing opportunity alongside larger rights holders.
4. The expansion of sustainable agriculture in the CRB.
    a. We recommend incentivizing the implementation of multi-year crop rotations, permaculture, intercropping, and the planting of cover crops.
    b. The adoption of agroforestry practices, including implementing windbreaks, as well as riparian forest buffers, alley cropping and silvopasture are additional practices that will reduce rural water consumption.
5. The establishment of a CRB water bank(s) to facilitate the transfer of excess water generated from the aforementioned programs.
    a. A water right holder will be able to deposit a portion of their right for a contracted period of time in exchange for compensation by the bank. The bank would loan the use of that water to a higher priority user willing to pay for access.
    b. The leasee's water right will not be in danger of forfeiture due to abandonment as the deposit will be considered a beneficial use.

c. Farmers could benefit through an exemption from the fees charged for the use of federally built infrastructure as compensation for participation in the water bank. This exemption would be evaluated on the state level. These fees and exemption requirements will be discussed further in **Section VI**.
d. Water banking institutions need to be streamlined. The institution could be managed most effectively by a coalition of the Native American tribes who are best positioned to coordinate an interstate water bank as they are not bound by individual state appropriation laws. Native American water rights will be discussed further in **Section VII**.
e. By linking the previous four programs to the water bank, farmers could use the institution as an intermediary to manage the transaction.

C. Conceptual Scenario

Collectively, these programs create a menu of options for farmers and ranchers, allowing them to customize and adopt a water reduction strategy which best suits their unique circumstance. For instance, if an Arizona landowner reduced their water consumption by ten acre-feet per year for the duration of their standard twenty year lease agreement with a solar developer, they would qualify for programs 1 & 2.

Table 5. Projected annual returns (programs 1 & 2)

10 acre-foot annual reduction plan	**Annual revenue**
Ten-year agreement: $1200 per acre-foot	$12,000
$0.02 per kWh for a 1 MW solar garden	$42,920
10 acre land lease for 1 MW solar garden [15]	$42,000
Total:	$96,920

Using this combination of programs, it would require 320,000 landowners to achieve our 3.2 million acre-feet depletion goal from this sector. In doing so, these landowners 1 MW solar gardens would simultaneously generate 600 billion kWh of electricity a year.

V. Desalination for California's Water Future

A. Our Observations

1. The US Bureau of Reclamation's call for reductions of Colorado River water by 4 MAF results in 1.75 MAF being levied across the state of California indiscriminate of priority water rights.
2. The majority of California's Reservoirs are below CRS with more strain on water resources expected in the future.
3. Desalination is an increasingly viable solution globally for making fresh water. Applying this in California would reduce stress on the Colorado River.
4. Israel is the world leader in the implementation of desalination, making for a perfect case study for implementing such systems. California is the most capable to copy this system since the coastal geography of California mimics the coast of Israel making ease of implementation feasible in California's water structure. Whereas other landlocked states would struggle to pipe water across state lines in a cost-effective manner.

B. Our Recommendations

1. Implement fast-tracked desalination plants for 2-million-acre ft of water.
2. Implement water reuse infrastructure to maximize the potential of water gained through seawater desalination.
3. Use the California Aqueduct as a central water carrier in order to transport desalinated and reused water throughout California.
4. Development of Aqueduct from southernmost end of California Aqueduct to start of Coachella Canal in order to transport desalination water to the Imperial Valley.
5. Construct desalination plants along the California Coast at industrial areas, using connections to the California Aqueduct as water carriers. These plants can be funded by offering long term take or pay water contracts with private companies.

Figure 2: *Bay-Delta Watershed and other Major Water Projects Map [16].*

C. Conceptual Scenario

The implementation of these 22 additional plants, along with a water reuse policy of at least 35%, will allow for the generation of 2-million-acre ft of water for California each year. It is suggested that the state of California partners with private companies in the form of a long-term contract such as a take or pay contract. This will allow private companies to manage the logistics of construction and the production of desalination, while providing a long-term agreement to ensure that the upfront costs are justified and that the water produced by desalination plants are distributed and utilized throughout California. If needed, a state of emergency should be called in California to expedite the construction schedules of these additional desalination plants [17]. If reuse measures are similarly effective to those established in Israel, which reuses approximately 87% of the water generated through desalination, additional water can be utilized throughout California through this reuse process [18]. A reuse of 87% of the water generated from 22 plants will produce up to 640,000-acre ft of additional water for the state. California's existing water transportation network, with slight modification, will allow water produced by desalination to be transported as far as the agricultural hub of the Imperial Valley. This will put California on a path towards water independence, which will produce a water supply and water liberty more sustainable and reliable than the existing water supply from the Colorado River.

As these desalination plants and the required infrastructure are implemented, additional measures can be taken to improve the efficiency and environmental friendliness of desalination plants in California. For example, one main environmental concern of California is the brine produced by desalination. Without diluting the brine, the excess salt within the brine causes lower oxygen levels in the seawater, causing it to suffocate marine life. California is also concerned with the impacts of dumping brine near the coral on the coast because it causes damage to marine life like coral. However, having a deep-water system that pumps the diluted brine solution back into the sea at a deeper depth than the coral grows would fix this issue. California could also require a deep injection well or underground aquifer where the input of brine is carefully measured, and the wellhead pressure is also constantly measured to ensure the brine is not seeping out of the well. Additionally, studies have indicated that the brine may be able to be recycled within the desalination plant, further improving the efficiency of the plant in the process. To address concerns of harming marine life, the intake pumps for the desalination plants could be required to be installed deeper into the ocean with additional marine life safety measures.

In terms of cost of water produced from desalination, water produced by the Carlsbad desalination plant is sold to the state from $2,513 to $2,796 per acre-foot that's less than 1 cent per gallon or $6.42/ hundred cubic feet [19]. It's estimated that water produced by desalination plants will be sold to the state of California at a comparable rate.

California now has access to a technology that was not available 100 years ago when the Colorado River Compact was first established. This new desalination technology would allow California to effectively manage their own water supply and to produce an unlimited supply of fresh water within their state. If this technology had been available at the time of the initial compact, California would have no reason not to choose desalination and would no longer depend on shares of a river now in rapid decline. Now is the time to implement these new technologies in California, allowing

the state to distance itself from the problems and conflicts surrounding the Colorado River Basin and establish a new path of water independence.

Short term contributions to the preservation of the Colorado River Basin are the return of 2 mil acre-ft to the Colorado River within the next decade. Long term, it is desired that all of California's current Colorado River water allocation will be returned to the river basin as California transitions to water security and independence through desalination.

VI. Instituting True Value Water Costs

A. Our Observations

1. The Colorado River has been providing below-cost water to the seven basin states for over a hundred years. While this system made sense when the Colorado River Compact was created in 1922, rising population and severe drought mean that undervaluing water is becoming a pressing issue.
2. All CRSP projects are owned by the federal government, were subsidized by federal taxpayers, and are currently used by various interests free of charge.
3. There are currently 22 dams along the Colorado River that store water for dry-season and thus greatly enhances the value of associated private water rights [20].
4. The federal government has made immense investments in hydroelectric power which is distributed preferentially at below market prices (**Table 6**).

B. Primary Recommendations

Establish a *Colorado River Facility Use and Water Conservation Fee* (CRFUWCF)

1. The portion of the water rights that are substantially dependent (or have a substantial value added component) on federal facilities need to be subject to an overarching federal fee system, called a CRFUWCF.
2. In broad terms, and by indirect means, that do not offend state water laws, it is hoped that state authorities will attach a CRS Facility Use and Water Conservation Fee to the use of Colorado River water within their state. When the cost of Colorado River water increases, water conservation will be incentivized. And, California will have greater reason to consider drought proof and unlimited alternative water supplies, such as desalination.
3. Lastly, to improve political acceptance, provisions should be made to return all funds collected to the States from which they were collected through programs designed to move the CRSP towards long-term sustainability. Examples of just uses include:
    a. Infrastructure adaptation for California. A kind of "hold harmless" for conversion
    b. CRSP water conservation programs
    c. CRSP conservation infrastructure
    d. A just transition fund to aid hard hit communities in meeting the new costs.
    e. To develop and facilitate CRSP water market and water banking
    f. Create social safety net programs to assist the people hurt most by rising water costs.

C. Conceptual Scenario

The following table uses the 2020 average consumptive water use for each state described in **Section I**. We used a $10.00 fee per acre-foot for convenience. This is most likely too high, and the specific fee should be reevaluated later.

Colorado River States	Average Consumptive Use as of 2020 (MAC)	Estimated Revenue from FU-CF ($)
WY	1.043	10,430,000
CO	3.855	38,550,000
NM	0.838	8,380,000
UT	1.714	17,140,000
AZ	2.85	28,250,000
CA	4.4	44,000,000
NV	0.3	3,000,000

[1] **Secondary Recommendation**

1. Creating a Free Market System For Hydropower:
    a. The sale of federally produced hydropower needs to be based on a free market. Selling at a rate similar to market rates in the area would create added revenue in the basin, as well as force the users of this power to consider ways to be more efficient with their power use.
    b. Create multidisciplinary teams to further study how to best allocate the Just Purpose Fund, what the increased prices for water and power should be, and how make these suggestions politically feasible.

Table 7. Current wholesale rates and federal revenue lost

CRSP Rate ($/MW-hr) [20]	29.62
Non-CRSP ($/MW-hr) [21]	100
Hydroelectric power produced (MW-hr) [22]	25,000,000
Revenue lost per year ($)	1,759,500,000

Short Overview

By building a conservation fee, we hope to enact a fund that allows our water infrastructures to be supported. The evaluation of the price of water will lead to the creation of this fee. We will do this conceptually by assessing the depletion rates of the dams involved in the CRSP.

VII. Native Water Rights Can and Should be Fully Respected

A. Our Observations

1. Despite Native Americans having senior sovereignty in the Colorado River Basin, tribes lack legislation and infrastructure. As a result, 45% of Native American homes do not have access to clean water. Most individuals are forced to transport water into their communities to gain access to drinkable water[1] [25].

2. Basin Tribes are legally entitled to somewhere between 3.2 - 3.8 MAF, approximately 25% of the river's allocation [26]. Though difficult to estimate total tribal water use, we approximate only 33% of the current 3.2 MAF quantified water right is being used[2] [27] [28].

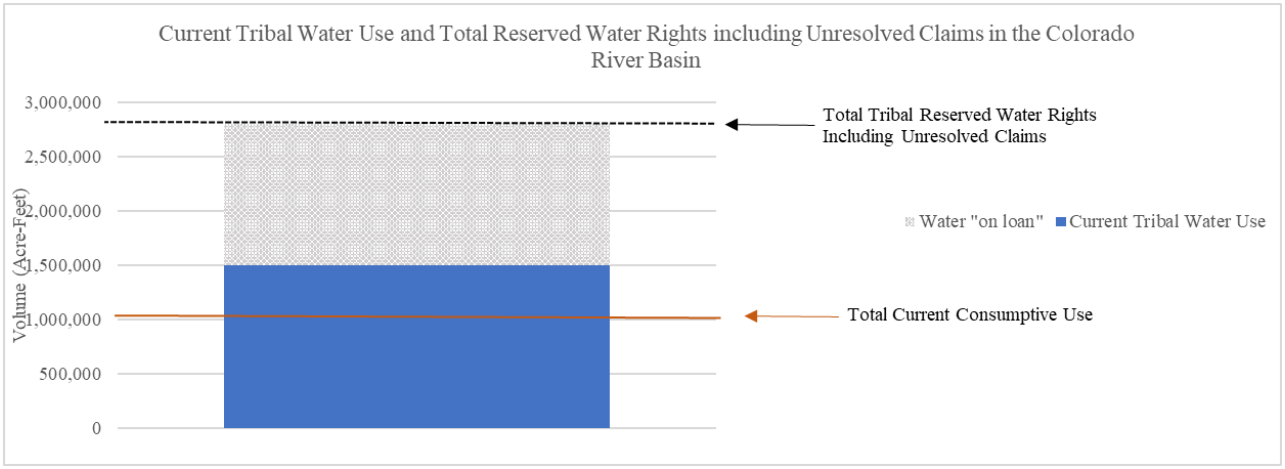

***Figure 3**: Visual schematic of the assessment of current tribal water use in the upper and lower Colorado River Basin performed by the United States Bureau of Reclamation [27]. The quantity of water in each instance is measured by (i) diversions or (ii) consumptive use required for irrigation of the respective acreage and for satisfaction of related uses, whichever of (i) or (ii) is less.*

3. Under *Sporhase v. Nebraska*, 458 U.S. 941 (1982), water developed under tribal entitlements may be marketed without regard to state and reservation boundaries [29].
4. The United States acts as a Trustee for Native American Tribes
    a. Federal Indian policy is to settle Indian water claims by negotiation and to promote Indian self-determination through the development of diversified

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[1] *Winters v. The United States*, 207 U.S. 564 (1908), established the Winter's Doctrine. This doctrine ascertained tribal water rights by quantifying water allocations to Native American reservations, especially where rights were not yet clear. The Winter's doctrine was approved in anticipation that water allocations would transform traditional nomadic tribes into agrarians. This anticipation, paired with the confinement of reservations, meant that Native Americans were more reliant on water from the Colorado River than ever. [24]

[2] This 33% water use estimation is based on a study completed by the Ten Tribes Initiative, demonstrated in figure 3, shown below.

reservation economies. [30]

b. This grants tribes the utilization of federal resources through the Bureau of Reclamation.

B. Our Recommendations

1. **Establish a pan-basin tribal water bank.**
    a. A pan-basin water bank would permit and expedite the process of transfer between on and off reservation users. A Native-run water bank would allow tribal governments to loan or lease their water rights and thus, have the opportunity to benefit from their full rights to the water. Since tribal water rights are federally recognized, these water transactions have the ability to surpass state lines and be applied to anywhere in the Colorado River Basin. This means that those who use this tribal water bank can sell or lease their water across the basin to cities or states experiencing severe water shortages. While this is not a solution that will waive the need for conservation, it has the potential to reduce strain on struggling cities or ecosystems.
2. **Interstate tribal water bank.**
    a. While a basin-wide water bank would be ideal, large-scale cooperation and negotiations likely exceed the amount of crucial time available to reduce water consumption. A simpler solution could rely on water banking agreements between a state and tribe. Experts have suggested the possibility of states initializing arrangements with reservations involving infrastructural investment in exchange for excess tribal water right usage [31]. This settlement would provide the state with the incentive to construct efficient plumbing and irrigation systems to maximize unutilized tribal water rights, while providing native communities with the opportunity to flourish towards self-sufficiency.
3. **Separate drinking water from water allocations.**
    a. It is universally agreed upon that every individual should have access to clean drinking water. Drinking water constitutes a miniscule percentage of Colorado River water consumption. Separating drinking water from quantified water rights could be the immediate solution tribes need to access water while settlements are still being resolved. Tribes must receive access to clean drinking water, regardless of the status of their water settlements.

C. Conceptual Scenario

We can envision with the genuine assurance of the federal government, the formation of a pan-basin native water bank. All recognized native water not currently being made available for native use could be sold or leased by the appropriate owners to water users actually receiving/directing the wet water. Starting in 2026, all Colorado river water users would be obligated to pay water rents for that partition of native water received as a loan from the native water bank.

Table 9 below, described in **Section I**, demonstrates how the native water right ‘water on loan’ percentages would apply after a 4 MAF curtailment scenario.

Table 9. The estimated MAF to be used as 'water on loan'

CRSP Entities	Tribal Water: Overlayed Assignment (MAF) 2.11/10.35 = ~20%
WY	-
CO	0.42
UT	0.16
NM	0.09
Total: Upper Basin	
NV	0.04
AZ	0.40
CA	0.63
Total: Lower Basin	
MEX	

The federal government could assist the CRB Tribal water bank in determining appropriate initial water rental prices, tribal representation within the banks, and the point at which loan terms with the various water borrowers should be re-evaluated.

As we begin the arduous task of re-structuring the Colorado River Compact, the consideration of tribal water rights—that were previously omitted—is vital to creating an equitable solution. Reaching this solution will require inclusion of Native Americans people in the discussion and subsequent revisions to the compact so they may finally obtain their legal water right.

VIII. References

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