COMMENT

You Never Step in the Same River Twice— The Effects of Changes in Supply and Demand in the Colorado River Basin on Wyoming Water Users

*Kevin Carrico**

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I. INTRODUCTION

The Colorado River is a vital water source for seven western states and parts of Mexico, supplying water to nearly forty million people.[1] Twenty-one percent of the State of Wyoming is located within the Colorado River Basin and relies on the River's water.[2] This area in Wyoming includes the streams and rivers that flow into the Green River, the largest tributary of the Colorado River, and the Little Snake River Basin, which drains into the Yampa River and eventually into the Green River in Colorado.[3] Collectively, both basins are referred to as the Green River Basin.[4]

The waters of the Colorado River system are over-allocated.[5] Thus far, the shortfall between supply and demand has been met, largely because of the immense volume of storage in the Colorado River system.[6] However, a recently released study suggests that the gap between supply and demand will increase, eventually causing the water levels in Lakes Powell and Mead to fall to zero around 2030 and rarely rise above this level going forward.[7] Although such an outcome seems unfathomable, studies addressing supply and demand imbalances in the Colorado

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[1] U.S. DEPT. OF THE INTERIOR BUREAU OF RECLAMATION, COLORADO RIVER BASIN WATER SUPPLY AND DEMAND STUDY—EXECUTIVE SUMMARY, ES-1 (2012), *available at* http://www.usbr.gov/lc/region/programs/crbstudy/finalreport/Executive%20Summary/CRBS_Executive_Summary_FINAL.pdf [hereinafter EXECUTIVE SUMMARY].

[2] WYO. WATER DEV. COMM'N., 2010 GREEN RIVER BASIN PLAN, ch. 3-4, (2010), *available at* http://waterplan.state.wy.us/plan/green/2010/finalrept/finalrept.html.

[3] *Id.* at ch. 3-6.

[4] *Id.* For the purposes of the 2010 Green River Basin Plan (2010 GRB Plan) and this comment, the Green River Basin includes both the Green River and the Little Snake River Basins in Wyoming. *Id.*

[5] *See infra* notes 128–30 and accompanying text.

[6] *See infra* notes 133–35 and accompanying text.

[7] *See* Romano Foti et al., *Vulnerability of U.S. Water Supply to Shortage, A Technical Document Supporting the Forest Service 2010 RPA Assessment* (2012), *available at* http://www.treesearch.fs.fed.us/pubs/42363.

River system are unsettling.[8] The United States Bureau of Reclamation (Bureau of Reclamation) recently released the Colorado River Basin Water Supply and Demand Study (Supply and Demand Study).[9] While the results of this study do not predict such dire consequences for water storage in the Colorado River Basin, it does predict a significant shortfall between supply and demand in the future.[10]

This potential for this shortfall establishes the need for Wyoming water users to inform themselves how changes in water supply in the Colorado River Basin as a whole will affect water use and availability in Wyoming. Wyoming has addressed this situation and attempted to limit the impacts on Wyoming water users; however, the discrepancy between supply and demand in the Colorado River Basin presents many issues to Wyoming water users. This comment discusses and critiques various features of Wyoming's position in light of these recent studies to more fully inform Wyoming water users about the state's current and future position in the Colorado River Basin.

To understand Wyoming's position in the Basin, it is important to first explore the rights and obligations Wyoming has to the other states relying on the water of the Colorado River; thus, this comment begins with an overview of the "Law of the River."[11] Second, this comment discusses current and anticipated uses of Colorado River Basin water in Wyoming to determine the availability of water for current and future users.[12] Third, this comment analyzes supply and demand imbalances in the Colorado River Basin, which will determine the amount of water available for current and future uses.[13] Fourth, based on this discussion, this comment details the amount of Colorado River water available for use in Wyoming, the water users at risk in the state, and the likely interpretation of the compacts governing the use of Colorado River water.[14] It concludes by discussing how Wyoming water users can protect their use of Colorado River water.[15]

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[8] *See* U.S. DEP'T OF THE INTERIOR BUREAU OF RECLAMATION, COLORADO RIVER BASIN WATER SUPPLY AND DEMAND STUDY—FINAL STUDY REPORT, (2012) *available at* http://www.usbr.gov/lc/region/programs/crbstudy/finalreport/studyrpt.html [hereinafter FINAL STUDY REPORT].

[9] *Id.* In 2012, the U. S. Bureau of Reclamation, in collaboration with representatives of the seven Colorado River Basin States, completed the Colorado River Basin Water Supply and Demand Study. *Id.* A major purpose of the Supply and Demand Study was to define current and future imbalances between water supply and demand in the Colorado River Basin. EXECUTIVE SUMMARY, *supra* note 1, at ES-4.

[10] *See* FINAL STUDY REPORT, *supra* note 8.

[11] *See infra* notes 16–78 and accompanying text.

[12] *See infra* notes 89–108 and accompanying text.

[13] *See infra* notes 112–28 and accompanying text.

[14] *See infra* notes 154–213 and accompanying text.

[15] *See infra* notes 214–55 and accompanying text.

II. BACKGROUND

A. The Law of the River

The complex body of law determining the allocation of the waters of the Colorado River is called the "Law of the River."[16] There is no exact definition of the Law of the River, but it is composed of a myriad of compacts, treaties, statutes, and guidelines governing apportionment and utilization of the waters and tributaries of the Colorado River.[17] The Law of the River determines both the amount of Colorado River water available for consumption in Wyoming and the obligations owed to other states.[18] This comment focuses on the five main aspects of the Law of the River affecting the allocation of water in the Colorado River Basin. These are the 1922 Colorado River Compact, the Mexico Water Treaty of 1944, the Upper Colorado River Basin Compact of 1948, the decree the United States Supreme Court issued in *Arizona v. California*, and the 1968 Colorado River Basin Project Act.[19]

1. 1922 Colorado River Compact

The 1922 Colorado River Compact (1922 Compact) is the original law governing the management of the Colorado River.[20] The primary purpose of the 1922 Compact was to provide for an equitable apportionment of the use of the Colorado River system between the Basin states.[21] To achieve this result, the 1922 Compact first divided the Colorado River Basin into two basins, using Lee Ferry, Arizona as the dividing line.[22] The 1922 Compact defines the Upper Basin as the

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[16] *See* James S. Lochhead, *An Upper Basin Perspective on California's Claims to Water from the Colorado River Part i: The Law of the River*, 4 U. DENV. WATER L. REV. 290, 330 n.5 (2001); W. Patrick Schiffer et al., *From A Colorado River Compact Challenge to the Next Era of Cooperation among the Seven Basin States*, 49 ARIZ. L. REV. 217, 233, n.6 (2007).

[17] U.S. DEP'T OF THE INTERIOR BUREAU OF RECLAMATION: LOWER COLORADO REGION, *The Law of the River* (2008), *available at* http://www.usbr.gov/lc/region/g1000/lawofrvr.html [hereinafter *Law of the River*].

[18] *See* Colorado River Compact of 1922, WYO. STAT. ANN. § 41-12-301(II) (2012) [hereinafter 1922 Compact]; *See* Upper Colorado River Basin Compact of 1948. WYO. STAT. ANN. § 41-12-401(III) (2012) [hereinafter 1948 Compact].

[19] *See infra* notes 20–32 and accompanying text (discussing the 1922 Compact); *see infra* notes 33–39 and accompanying text (discussing the Mexico Water Treaty of 1944); *see infra* notes 40–57 and accompanying text (discussing the 1948 Compact); *see infra* notes 58–68 and accompanying text (discussing *Arizona v. California*); *see infra* notes 70–78 and accompanying text (discussing 1968 Colorado River Basin Act).

[20] John U. Carlson & Alan E. Boles, Jr., *Contrary Views of the Law of The Colorado River: An Examination of Rivalries Between The Upper And Lower Basins,* 32 ROCKY MTN. MIN. L. INST. 21 (1986).

[21] 1922 Compact, *supra* note 18.

[22] *Id.* art. II.

parts of Arizona, Colorado, New Mexico, Utah, and Wyoming located within the Colorado River system, and from which waters naturally drain into the Colorado River System above Lee Ferry.[23] The Lower Basin includes the parts of Arizona, California, Nevada, New Mexico, and Utah located within the system, and from which waters naturally drain into the Colorado River System below Lee Ferry.[24]

Article III of the 1922 Compact describes how water is apportioned in the Colorado River Basin.[25] First, the Compact allocates consumptive use of 7.5 million acre-feet (maf) per year to both the Lower and Upper Basins in perpetuity.[26] Additionally, the 1922 Compact gives the Lower Basin the right to increase its beneficial consumptive use by 1 maf per year.[27] Thus, the 1922 Compact allocates 16 maf of water on a yearly basis: 7.5 maf to the Upper Basin and 8.5 maf to the Lower Basin.[28] Next, Article III(c) provides that if a right is recognized for Mexico to receive Colorado River water, it will first come from the aggregate over and above any surplus of the 16 maf allocated to the Upper and Lower Basins.[29] However, if there is no surplus, the obligation to Mexico is shared equally between the two basins.[30] Finally, Article III(d) requires the Upper Basin states to "not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75 maf for any consecutive ten year period."[31] The 1922 Compact further provides protection to perfected rights in use prior to its enactment, making clear they would be unimpaired.[32]

2. *Mexico Water Treaty of 1944*[33]

As allowed under Article III(c) of the 1922 Compact, the United States signed a treaty with Mexico in 1944, apportioning 1.5 maf of Colorado River Basin water to Mexico annually.[34] Because this delivery obligation comes from an international

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[23] *Id.*

[24] *Id.*

[25] *Id.* art. III.

[26] *Id.* art. III(a).

[27] *Id.* art. III(b). "Beneficial use: The application of water necessary to accomplish the pur-pose of the appropriation, without waste. . . . Consumptive use: Any use of water that permanently removes water from the natural stream system." R. Waskom and M. Neibauer, *Glossary of Water Terminology*, COLO. ST. U. (2012) *available at* http://www.ext.colostate.edu/pubs/crops/04717.html.

[28] *Id.* art. III(a), (b).

[29] 1922 Compact, *supra* note 18, art. III(c).

[30] *Id.*

[31] *Id.* art. III(d).

[32] *Id.* art. VIII.

[33] Treaty between the United States of America and Mexico Respecting Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande, U.S.-Mex., Feb. 3, 1944, T.S. No. 994, 59 Stat. 1219 [hereinafter Treaty].

[34] Treaty, *supra* note 33.

treaty—the Mexico Water Treaty of 1944, this allocation has the highest priority on the river.[35] The Treaty also determines how water surpluses and shortages will be handled between the two nations.[36] The treaty provides that Mexico will share in any surplus or shortage of water in any given year.[37] Therefore, if the United States declares a surplus in addition to the amount needed to supply uses in the United States as well as the guaranteed delivery to Mexico, the United States can deliver up to 200,000 acre-feet of additional water to Mexico.[38] This treaty also declares that in the event of "extraordinary drought or serious accident" to the United States' irrigation system, the quantity of water delivered to Mexico will be reduced proportionately to the United States' decreased consumptive uses.[39]

3. *Upper Colorado River Basin Compact of 1948*

In 1948, the states of the Upper Basin negotiated the apportionment of water the Upper Basin received under the 1922 Compact.[40] The two major purposes of the Upper Colorado River Basin Compact of 1948 (1948 Compact) were: (1) to provide equitable apportionment of the Colorado River System waters allocated to the Upper Basin under the 1922 Compact and (2) to establish the obligations of each state in the Upper Basin with respect to the flows required at Lee Ferry under the 1922 Compact.[41] Unfortunately, the negotiators of the 1922 Compact vastly overestimated the average annual flows of the Colorado River system.[42] Realizing these estimates were much higher than average, the Upper Basin states allocated consumptive use of the waters of the Colorado River system on a percentage basis because it was becoming apparent the Upper Basin might be able to consume

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[35] 43 U.S.C. § 1552(a)(1) (2012).

[36] Treaty, *supra* note 33, art. X.

[37] *Id.*

[38] *Id.*

[39] *Id.* The terms "extraordinary drought" and "serious accident" are not defined by the treaty. *See id.* This treaty has been amended repeatedly; over 300 minutes have been added to the Treaty since it was originally signed. Interim International Cooperative Measures in the Colorado River Basin through 2017, Minutes between the United States and Mexican Sections of the IBWC (2012), http://www.ibwc.gov/Treaties_Minutes/Minutes.html (last visited May, 1, 2013). A minute is a subsequent development to the treaty. Damien M. Schiff, *Rollin', Rollin', Rollin' on the River: A Story of Drought, Treaty Interpretation, and Other Rio Grande Problems*, 14 IND. INT'L & COMP. L. REV. 117, 118 (2003). Minute 319, passed in 2012, allows for greater flexibility regarding water delivery to Mexico—such as allowing Mexico to store water in Lake Mead to be available in future years—and establishes operation measures which reduce water delivery when Lake Mead levels are low to deter more severe reductions in the future. International Boundary and Water Commission, Minute 319, *Interim International Cooperative Measures in the Colorado River Basin Through 2017 and Extension of Minute 318 Cooperative Measures to Address the Continued Effects of the April 2010 Earthquake in the Mexicali Valley, Baja California* (2012) *available at* http://ibwc.state.gov/Files/Minutes/Minute_319.pdf.

[40] *See* 1948 Compact, *supra* note 18.

[41] *Id.* art. I.

[42] *See* Lochhead, *supra* note 16, at 317.

the 7.5 maf allocated to it in the 1922 Compact.[43] The 1948 Compact first gives Arizona 50,000 acre-feet per year for its small area in the Upper Basin and then allocates the remaining Upper Basin share on a percentage basis: 51.75% to Colorado, 11.25% to New Mexico, 23.00% to Utah, and 14.00% to Wyoming.[44]

The 1948 Compact describes how curtailment among the Upper Basin states will occur in the event the Upper Basin is unable to supply the 75 maf over a ten year period as required under Article III(d) of the 1922 Compact.[45] If the Upper Basin has failed to meet this obligation, the Lower Basin can "call" on the Upper Basin to provide the under-supplied water at Lee Ferry.[46] In this situation, the Upper Basin states will determine the extent of the curtailment for each state based on the following predetermined principles: first, the extent and timing of the curtailment are to assure Upper Basin compliance with Article III of the 1922 Compact.[47] Second, if one Upper Basin state has used more than its share in the ten year period immediately preceding the year in which curtailment is necessary, then that state must supply at Lee Ferry the amount of the overdraft during this period before any demand will be made upon the other states of the Upper Basin.[48] Third, in the event curtailment is necessary to satisfy the flow obligation to the Lower Basin, and no state has used more than its allocated share, each Upper Basin state must deliver to Lee Ferry a portion of the total curtailment based on the consumptive use of each state during the immediately preceding water year.[49] For example, in a situation where no state consumed more than its allocated share, and Wyoming consumed fourteen percent of the total consumptive use of the Upper Basin in the year prior to curtailment, Wyoming would be required to supply fourteen percent of the curtailment.[50] Finally, the 1948 Compact specifically notes rights perfected prior to November 24, 1922 shall be excluded from curtailment.[51]

The 1948 Compact also provides for how losses due to evaporation in storage reservoirs are divided among the Upper Basin states.[52] The losses from reservoirs

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[43] *Id.* art. III; Hon. Greg Hobbs, *Upper Colorado River Basin Compact Sharing the Shortage*, 32 WYO. LAWYER, Oct. 2009 at 20, 23.

[44] *Id.* art. III(a).

[45] This is a legal requirement that the Upper Basin will not cause the river to be depleted to an extent that the obligations in the treaty are violated. *Id.* art. IV.

[46] *See* 1922 Compact, *supra* note 18, art. III(d).

[47] 1948 Compact, *supra* note 18, art. IV.

[48] *Id.*

[49] *Id.* A water year is defined as the twelve-month period from Oct. 1, for any given year through Sept. 30, of the following year. *Explanations for the National Water Conditions* U.S. GEOLOGICAL SURVEY, HTTP://WATER.USGS.GOV/NWC/EXPLAIN_DATA.HTML (last visited Mar. 17, 2014).

[50] *See* 1948 Compact, *supra* note 18, art. IV.

[51] *Id.*

[52] *Id.* art. V.

that are used to assist the Upper Basin states in meeting the delivery requirements of Article III(c) and (d) of the 1922 Compact are charged to an individual state in proportion to the amount of total water that the states in the Upper Basin used.[53] Thus, if Wyoming consumed fourteen percent of the total water consumed in the Upper Basin, Wyoming would be charged fourteen percent of the total evaporation losses.[54]

The 1948 Compact addresses the consumptive use of water by the United States of America or any of its "agencies, instrumentalities, or wards" and requires the use to be charged to the state in which the water is used.[55] Finally, the 1948 Compact protects the unused portions of the water allocated to the individual states in the Upper Basin.[56] Under Article XVI of the Compact, a failure of any state to use water apportioned to it will not constitute abandonment, forfeiture, or a relinquishment to the Lower Basin or any other state of the right to use the water.[57]

4. Arizona v. California

The United States Supreme Court's decision in *Arizona v. California* focused mainly on water allocations in the Lower Basin; however, it is important to this discussion.[58] This decision results in the Upper Basin having increased pressure to deliver water to the Lower Basin in two ways. First, the Court held that "the tributaries [of the Colorado River] are not included in the waters to be divided, but remain for the exclusive use of each state."[59] Thus, the Court held the Lower Basin was entitled to 7.5 maf of main stem Colorado River water, of which tributaries within each state would not be included.[60] This puts more pressure on the Upper Basin to assure enough water reaches Lee Ferry than if the tributary flows were counted as part of the 7.5 maf allocated to the Lower Basin in the 1922 Compact because all of the 7.5 maf allocated to the Lower Basin must come from the Upper Basin.[61]

Second, *Arizona* reaffirmed a prior United States Supreme Court decision by holding that the United States reserved water rights for the Indian tribes of the

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[53] *Id.*

[54] *See id.*

[55] *Id.*

[56] *Id.* art. XVI.

[57] *Id.*

[58] *See* Arizona v. California, 373 U.S. 546 (1963).

[59] *Id.* at 567.

[60] *Id.*

[61] *See generally* Lawrence J. MacDonnell, *Arizona v. California Revisited*, 52 NAT. RESOURCES J. 364 (2012).

Basin effective from the date the Indian reservations were created.[62] The Court in *Arizona* went one step further by quantifying the amount of water intended to be reserved.[63] The quantity of water reserved was the amount intended to satisfy the future as well as the present needs contemplated for the Indian reservations.[64] The Court ruled the standard employed in quantifying the right associated with the reservations was whether enough water was reserved to irrigate all the practicably irrigable acreage on the reservations.[65] The Court further determined the principle underlying the reservation of water rights for Indian reservations is equally applicable to other federal establishments, such as national recreation areas and national forests.[66] The Court held "that all uses of mainstream water within a State are to be charged against that State's apportionment, which of course includes uses by the United States."[67] This means the main stem Colorado River water used to serve all federal reserved rights within a state is charged against that state's allocation.[68] The amount of water that must come from the individual state's allocation is substantial to satisfy the federal reserved rights. The Bureau of Reclamation estimates that Indian tribes already hold quantified water rights to 2.9 maf of Colorado River water with substantial rights remaining to be quantified.[69]

5. *1968 Colorado River Basin Project Act*[70]

The 1968 Colorado River Basin Project Act (1968 Act) directed the Secretary of the Interior to prepare, in consultation with the states of the Colorado River Basin, a Long-Range Operating Criteria (LROC) for the Colorado River reservoir system.[71] Pursuant to the 1968 Act, the Secretary prepared and adopted the criteria for the first LROC in 1970.[72] These criteria provide for the coordinated operation of reservoirs in the Upper and Lower Basins and also set conditions for releases

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[62] *Arizona*, 373 U.S. at 600; *see* Winters v. United States, 207 U.S. 564 (1908).

[63] *Arizona*, 373 U.S. at 600.

[64] *Id.*

[65] *Id.*

[66] *Id.* at 601.

[67] *Id.*

[68] *Id.*

[69] U.S. DEP'T OF THE INTERIOR BUREAU OF RECLAMATION, COLORADO RIVER BASIN WATER SUPPLY AND DEMAND STUDY: TECHNICAL REPORT C– WATER DEMAND ASSESSMENT, ch. C-38 (2012), *available at* http://www.usbr.gov/lc/region/programs/crbstudy/finalreport/Technical%20Report%20C%20-%20Water%20Demand%20Assessment/TR-C_Water_Demand_Assesmemt_FINAL_Dec2012 [hereinafter WATER DEMAND ASSESSMENT].

[70] Colorado River Basin Project Act, 43 U.S.C. §§ 1501–1556 (1968).

[71] *Law of the River*, *supra* note 17.

[72] *Id.*

of water from Lake Powell and Lake Mead.[73] The 1968 Act gave the Secretary of the Interior several directives for the coordinated operation of many federal reservoirs on the Colorado River.[74] For example, the original LROC of 1970 directs the Bureau of Reclamation to release a minimum of 8.23 maf per year from Lake Powell.[75]

In December 2007, facing the eighth year of the worst drought in more than a century of recordkeeping in the Colorado River Basin, the Secretary of the Interior adopted the "Colorado River Interim Guidelines" to manage Lower Basin shortages through the coordinated operations of Lake Powell and Lake Mead.[76] These interim guidelines, which will remain in effect through 2026, enable the Bureau of Reclamation to manage water to prevent shortages in the Lower Basin while assuring the Upper Basin meets its ten-year flow obligation.[77] The guide-

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[73] *Id.* These reservoirs provide a buffer to shortages in the Colorado River system. David E. Lindgren, *Colorado River Shortages—Crisis or Just A Serious Problem?*, 11 ABA WATER RESOURCES COMM. NEWSLETTER, AUGUST 2004. Lake Powell, located in the Upper Basin accounts for 26.0 maf (or 43% of system storage). *Id.* Lake Mead, located in the Lower Basin has a total capacity is 27.4 maf (or 46% of system storage). *Id.*

[74] 43 U.S.C. § 1552 (2012). This act requires the Secretary to propose criteria for the coordinated long-range operation of federal reservoirs to comply with and carry out the provisions of the Colorado River Compact, the Upper Colorado River Basin Compact, and the Mexican Water Treaty of 1944. *Id.* The 1968 Act requires the Secretary to store water in the federal reservoirs and to make release from Lake Powell in a listed order of priority; first, the Secretary must release water from Lake Powell to supply one-half of any deficiency in delivery to Mexico under Article III(c) of the 1922 Compact. *Id.* Second, the Secretary must release water required to comply with Article III(d) of the 1922 Compact (75 maf over ten years). *Id.* Finally, the act requires the Secretary to release storage water from Lake Powell, which will not be required and not reasonably necessary to supply the first two requirements for the following purposes: (i) to the extent it can be reasonably applied in the states of the Lower Basin, but no such releases shall be made when the active storage in Lake Powell is less than the active storage in Lake Mead, (ii) to maintain, to the extent possible, the equalization of active storage in Lake Mead and Lake Powell, and (iii) to avoid spills from Lake Powell. *Id.*

[75] CRITERIA FOR COORDINATED LONG-RANGE OPERATION OF COLORADO RIVER RESERVOIRS PURSUANT TO THE COLORADO RIVER BASIN PROJECT ACT OF SEPTEMBER 30, 1968, Pub. L. No. 90-537 (1970) *available at* http://www.usbr.gov/lc/region/pao/pdfiles/opcriter.pdf. Most agree that the 8.23 maf figure was arrived at by adding two numbers: first, one-half the 1.5 maf Mexican Treaty obligation (0.75 maf), plus the average annual Upper Division obligation under Article III(d) (7.5 maf). *See* Schiffer et al., *From A Colorado River Compact Challenge to the Next Era of Cooperation Among the Seven Basin States*, 49 ARIZ. L. REV. 217, 223–25 (2007). From this figure, 8.25 maf, the expected annual tributary flow of the Paria River, which flows into the Colorado River below Lake Powell and above Lee Ferry (0.02 maf), is deducted. *Id.*

[76] U.S. DEP'T OF THE INTERIOR BUREAU OF RECLAMATION, LAKE POWELL OPERATIONS, EQUALIZATION AND THE INTERIM GUIDELINES, 2008, *available at* http://www.usbr.gov/uc/rm/crsp/gc/Eq-IntGuide/Eq-IntGuidelines-Fact.pdf.

[77] "The objectives of the coordinated operations are: to avoid curtailment of uses in Upper Basin; minimize shortages in Lower Basin; and to not adversely affect yield for development in the Upper Basin through attempting to 'equalize' or balance the contents of Lakes Powell and Mead as nearly as practicable." *Id.*

lines reduce the risk of interstate river litigation as well as the risk of Upper Basin water users needing to curtail use during this interim period.[78]

B. *State Preparations for a Possible Curtailment: Determining Consumptive Uses in the Green River Basin of Wyoming*

The State of Wyoming is well-informed on the issues Wyoming users of Colorado River Basin water currently face.[79] In 2005, following the lead of other Upper Basin states, the Wyoming State Engineer's Office submitted a budget request for initiation of a multi-year effort to improve the agency's consumptive use water data in the Green River Basin.[80] To address the Colorado River Basin water issues, the Wyoming State Engineer's Office created a new program entitled the "Colorado River Compact Administration Program."[81]

The first and foremost objective for the program was the development and approval of the "Green River Basin Consumptive Use Determination Plan" (CU Plan).[82] The CU Plan was initiated to outline the steps the State Engineer's Office and the State of Wyoming should take to build and implement a comprehensive and efficient monitoring program in the Green River Basin.[83] The purpose of this program is twofold. First, the program seeks to provide the State Engineer's Office with the capability to accurately estimate the quantity of water consumptively used annually in Wyoming's portion of the Colorado River Basin.[84] Second, the program seeks to strengthen the state's ability to perform administrative requirements within Wyoming that might be required under the 1922 and 1948 Compacts.[85] This program is intended to ensure that Wyoming is the leading authority on Colorado River water use in the state.[86] As the 2008 State Engineer's

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[78] WYO. WATER DEV. COMM'N., *supra* note 2.

[79] *See id.*; WYO. STATE ENG'R'S OFFICE, COLORADO RIVER COMPACT ADMINISTRATION PROGRAM, CONSUMPTIVE USE DETERMINATION PLAN 1 (2008) *available at* http://seo.wyo.gov/system/app/pages/search?scope=search-site&q=consumptive+use+determination+plan [hereinafter CONSUMPTIVE USE PLAN].

[80] *See* CONSUMPTIVE USE PLAN, *supra* note 79. For example, Colorado's Decision Support System is a water management system developed by the Colorado Water Conservation Board and the Colorado Division of Water Resources for each of Colorado's major water basins. The Green River Basin comprises nearly 21,000 square miles in the southwest corner of Wyoming. Counties that contribute large areas to the Basin are Sweetwater, Sublette, Carbon, Lincoln, and Uinta, with small areas in Fremont and Teton counties. WYO. WATER DEV. COMM'N., *supra* note 2, at ch. 3. The major towns in the Basin are Rock Springs, Green River, Kemmerer, Pinedale, and Baggs. *Id.*

[81] *See* CONSUMPTIVE USE PLAN, *supra* note 79.

[82] *Id.*

[83] *Id.*

[84] *Id.*

[85] *Id.*

[86] *Id.* at 1–2.

Office annual report states, "the ultimate goal of any action taken under auspices of this CU Plan and the overall Colorado River Compacts Administration Program is to have a clearly defined and defensible approach to the implementation and administration of an Upper Colorado River Basin Commission initiated curtailment."[87] In satisfaction of these goals, the state has determined the current and anticipated consumptive use in Wyoming.[88]

1. Current Water Use in the Green River Basin of Wyoming

Accurately estimating the amount of current consumption in the Green River Basin serves two important functions. First, it allows Wyoming to have a tabulation of year-to-year consumption in case there is a need for curtailment.[89] Second, it allows for an estimation of the water that can still be developed and used in the state.[90] An examination of both the water currently consumed in the state and the likely future demand provides insight into Wyoming's position in the Colorado River Basin.[91]

In 2010, Wyoming completed the 2010 Green River Basin Plan (2010 GRB Plan).[92] This plan gathers comprehensive data to preserve Wyoming's Colorado River compact allocation of water and ensure against future water shortages.[93] The 2010 GRB Plan estimated the total consumptive use of Colorado River water in Wyoming is 603,878 acre-feet per year.[94]

To accurately estimate Wyoming's current consumption, the 2010 GRB Plan divided the total Green River Basin water use among seven sectors: agriculture, municipal, domestic, industrial, recreational, environmental, and evaporation.[95] Table 1 lists the consumptive use of these seven sectors.

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[87] WYO. STATE ENG'R'S OFFICE, *2008 Wyoming State Engineer's Office, Annual Report*, 25 (2008), *available at http*://seo.wyo.gov/seo-files.

[88] WYO. WATER DEV. COMM'N, *supra* note 2, at chs. 5-95, 6-127.

[89] *See* CONSUMPTIVE USE PLAN, *supra* note 79, at 3-4.

[90] *Id.*

[91] *See* WYO. WATER DEV. COMM'N., *supra* note 2.

[92] *Id.*

[93] *Id.* at ch. 1-2.

[94] *Id.* at ch. 5-95.

[95] *Id.* at ch. 5-52.

Table 1. Consumptive use in the Green River Basin of Wyoming[96]

Sector	Type of use	Consumptive use (acre-feet/year)
Agricultural	Irrigation[97]	396,246
	Stock use	1,755
Municipal[98]	Surface Water	6,578
	Groundwater	884
	City of Cheyenne Diversions	15,281
Domestic	Groundwater[99]	3,047
Industrial	Surface water	56,833
	Groundwater	1,954
Recreational		Non-consumptive
Environmental		Non-consumptive
Evaporation	Main Stem	88,500
	In State	32,800
Total		**603,878**

2. *Estimated Future Water Uses in the Green River Basin of Wyoming*

The 2010 GRB Plan also analyzes the amount of Colorado River Basin water that will be required to satisfy the future water needs of Green River Basin water users.[100] The two main factors affecting the future consumptive uses of water in the Green River Basin are population and economic growth rates.[101] To estimate

[96] *Id.* at ch. 5-95.

[97] These use values are based on "normal year" estimates. Id.

[98] The Green River Basin cities, towns, and joint power water boards that supply water to their citizens or customers from surface water are summarized in Appendix I. The largest municipal user of water in the Green River Basin actually lies well outside of the Basin; the City of Cheyenne, Wyoming, diverted an average of approximately 15,300 acre-feet of water per year from the Little Snake River Basin to the North Platte River Basin from 2003 through 2007. *Id.* at Ch. 5-68. Finally, the 2010 GRB Plan determined the consumptive use attributed to annual evaporation within Wyoming combined with the State's share of main stem evaporative losses totaled 121,300 acre-feet per year. *Id.*

[99] This value represents the average of the range of domestic ground water usage. *Id.* at ch. 5-95.

[100] WYO. WATER DEV. COMM'N., *supra* note 2, at ch. 6.

[101] *Id.* at ch. 6-97.

future population in the Basin, the 2010 GRB Plan explored three possible growth scenarios.[102] Using low, moderate, and high growth scenarios, the 2010 GRB Plan provides wide estimates of how the current Basin population of around 60,000 could increase to anywhere between 66,464 and 134,225 by the year 2055.[103] These population estimates permit the evaluation of Wyoming's remaining compact allocation based on current use against possible future demands.[104]

The 2010 GRB Plan projects that the largest changes from current consumption will be due to industrial and municipal demand increases.[105] Table 2 summarizes the total estimated Colorado River water depletions depending on the projected growth scenario according to the 2010 GRB plan.

Table 2. Wyoming's Remaining Compact Allocation[106]

Surface Water	50 year Projected Growth Scenario (acre feet/year)		
	Low	Moderate	High
Wyoming's Allocation of the Upper Colorado River Water[107]	847,000	847,000	847,000
Total Estimated Depletions	608,295	680,076	784,675
Remaining Compact Allocation[108]	238,705	166,294	62,325

[102] The river planning process developed by the WWDC determined population estimates would be developed for 10, 30 and 50 years into the future for each of the three planning scenarios: (1) Low Growth; (2) Moderate Growth; and (3) High Growth. WWC ENGINEERING, TECHNICAL MEMORANDUM: GREEN RIVER BASIN PLAN II- POPULATION PROJECTIONS, 9 (2009), *available at* http://waterplan.state.wy.us/plan/green/2010/techmemos/Population_Projections.html.

[103] *Id.*

[104] *Id.* at 20. Appendix II lists the projected domestic, industrial, and municipal consumptive uses through 2055.

[105] *See* WWC ENGINEERING, TECHNICAL MEMORANDUM: GREEN RIVER BASIN PLAN II- INDUSTRIAL USE PROJECTIONS (2011); *see* WWC ENGINEERING, TECHNICAL MEMORANDUM: GREEN RIVER BASIN PLAN II- MUNICIPAL USE PROJECTIONS (2009).

[106] WYO. WATER DEV. COMM'N., *supra* note 2, at ch. 6-127.

[107] Wyoming's allocation of the Upper Colorado River Water was estimated by the Wyoming State Engineer's Office based on a position of 6,100,000 acre-feet of water supply per year and NO requirement to meet one-half of the Mexican Water Treaty obligation. Letter from John Shields, Interstate Streams Engineer, Wyoming State Engineer's Office, to Murray Schroeder, WWC Engineering Sept. 30, 2012. (on file with author).

[108] The state can store 120,000 acre-feet of water in Fontenelle Reservoir. WYO. WATER DEV. COMM'N., *supra* note 2, at ch. 6-127. The estimate of Remaining Compact Allocation is based on the assumption that the future industrial depletion shown will be met, in part, by the State of Wyoming's water storage in Fontenelle. *Id.*

This table illustrates two important parts of the 2010 GRB Plan. First, Wyoming's allocation of Colorado River water is 847,000 acre-feet on a yearly basis. Second, using this yearly figure, the State of Wyoming will have sufficient water for all anticipated water uses, even under the "High Growth Scenario." Thus, under the 2010 GRB Plan, Wyoming appears to be in a good position with sufficient water for both current and anticipated demands.

C. The Growing Disparity Between Colorado River Water Supply and Demand

In 2012, the Bureau of Reclamation, in collaboration with representatives of the seven Colorado River Basin states, completed the Colorado River Basin Water Supply and Demand Study (Supply and Demand Study).[109] A major purpose of the Supply and Demand Study was to define current and future imbalances between water supply and demand in the Colorado River Basin.[110] Water supply and demand assessments were two major phases used to accomplish this goal.[111]

1. Decreased Water Supply in the Colorado River Basin

The Supply and Demand Study explains climate is a driving force in the Colorado River's water supply.[112] The Supply and Demand Study determined change in the climate is likely to decrease the annual flows of the Colorado River, resulting in a decreased mean natural projected annual flow of between 13.7 to 15.0 maf at Lee Ferry by 2060.[113] In 2007, the Bureau of Reclamation conducted an extensive review of Colorado River climate and hydrology studies.[114] The

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[109] FINAL STUDY REPORT, *supra* note 8.

[110] EXECUTIVE SUMMARY, *supra* note 1, at ES-4.

[111] WATER DEMAND ASSESSMENT, *supra* note 69, at ch. C-1.

[112] *See* U.S. DEP'T OF THE INTERIOR BUREAU OF RECLAMATION, COLORADO RIVER BASIN WATER SUPPLY AND DEMAND STUDY: TECHNICAL REPORT B- WATER SUPPLY ASSESSMENT, ch. B-16 (2012), *available at* http://www.usbr.gov/lc/region/programs/crbstudy/finalreport/techrptB.html [hereinafter WATER SUPPLY ASSESSMENT].

[113] *Id.* at chs. B-74, 76.

[114] *Id.* at ch. B-8. This report provides a summary of the assessment of the state of knowledge with regard to climate change and modeling for the Colorado River Basin and provides recommendations on future research and development needs. CLIMATE TECHNICAL WORK GROUP, U.S. DEPT. OF THE INTERIOR BUREAU OF RECLAMATION, REVIEW OF SCIENCE AND METHODS FOR INCORPORATING CLIMATE CHANGE INFORMATION INTO RECLAMATION'S COLORADO RIVER BASIN PLANNING STUDIES U-2 (2007), *available at* http://www.usbr.gov/lc/region/programs/strategies/FEIS/AppU.pdf. This review found: (1) that there is strong scientific consensus that the earth has been warming and will continue to warm, and is due substantially to human emissions of greenhouse gases; (2) the impacts of climate change on the Colorado River Basin are less certain, but indicate the regional temperatures will increase; (3) The studies, taken together, show a common message; that runoff will decrease; (4) that system storage in the Basin is very sensitive to changes in mean inflows as well as to sequences of dry and wet years. *Id.*

Bureau of Reclamation's Supply and Demand Study provides a summary of this review and concluded: "Common to nearly all this research is the projection of continued and accelerated warming in the Basin and very likely increases in the severity of future droughts."[115] The Intergovernmental Panel on Climate Change (IPCC) also predicts an overall warming in the United States, with increasingly severe temperature changes in the Southwest by the end of the 21st century.[116] The Supply and Demand Study reports that the average annual mean temperature of the Colorado River Basin has increased approximately 3 °F since 1910 with a 2 °F increase since 1970.[117] Going forward, the authors of the Supply and Demand Study predict a median increase in temperature of about 6 °F by 2080.[118] Increased temperatures result in increased evapotranspiration, increased potential evapotranspiration, decreased snowpack, earlier runoff, and decreased soil moisture, which all contribute to decreased supply.

2. *Increased Water Demand in the Colorado River Basin*

The demand section of the Colorado River Supply and Demand Study provides a very thorough determination of the anticipated future demands for Colorado River Basin water.[119] The Supply and Demand Study estimated Colorado River demand to increase to between 17.7 and 20.1 maf in 2060, factoring in Mexico's allotment and losses, reservoir evaporation, phreatophyte losses, and operational inefficiencies.[120]

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[115] WATER SUPPLY ASSESSMENT, *supra* note 112, at chs. B-8, 9.

[116] The Intergovernmental Panel on Climate Change study found that under most combinations of model, scenario, season and region, warming will occur in the range of 1 to 3 °C for the 2010 to 2039 time frame. By the end of the century, projected annual warming is expected to be realized across much of the United States, but more than 5 °C during the summer in the Southwest. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: WORKING GROUP II: IMPACTS, ADAPTATION AND VULNERABILITY, 14.3 Assumptions About Future Trends (2007), *available at* http://www.ipcc.ch/publications_and_data/ar4/wg2/en/contents.html.

[117] WATER SUPPLY ASSESSMENT, *supra* note 112, at ch. B-16.

[118] *Id.* at ch. B-52.

[119] *See* WATER DEMAND ASSESSMENT, *supra* note 69. The water demand scenarios in the Supply and Demand Study were constructed based on alternative views of the future demand for Colorado River water. *Id.* at ch. C-5.

[120] *Id.* at ch. C-23. "'Colorado River demand' is calculated as Study Area demand less the demand projected to be supplied by other sources." *Id.* at ch. C-22. Thus, the study is anticipating additional sources of water from outside the Colorado River Basin. This means that these numbers would be even larger if the Supply and Demand Study does not make this assumption. *See id.* Thus, "Study Area demand" is Colorado River demand plus the demand projected to be supplied by other sources. So the actual demand on the Colorado River absent any future supplied sources will be the Study Area demand which the Supply and demand estimated to be between 28.7 and 32.5 maf by 2060. *Id.*

Both the population and the climate of the Basin will influence future demand.[121] Population increases in the Lower Basin will account for the majority of increased demand in the Basin.[122] About forty million people are estimated to reside in the Study Area today; the Supply and Demand Study anticipates this number to increase to between forty-nine and seventy-seven million by 2060.[123] According to the IPCC, the vulnerability of water systems to extended drought is exacerbated by population growth and economic development.[124] Population growth and economic development create more water demands from agricultural, municipal, and industrial uses, resulting in frequent over-allocation of water.[125] Climate affects not only water supply, but also water demand.[126] The Supply and Demand Study also concluded temperature changes are likely to increase demand from agricultural, municipal, and industrial sectors and also increase losses from reservoir evaporation.[127]

D. The Effects of Decreased Supply and Increased Demand in the Colorado River Basin

The Supply and Demand Study compared the median water supply projections against the median Colorado River water demand projections and determined the long-term projected imbalance in future supply and Colorado River demand results in a shortfall of about 3.2 maf per year by 2060.[128] The disparity between supply and demand is already significant.[129] The Bureau of Reclamation estimated the total consumptive use, including evaporation, in the Colorado River Basin for 2005 to have already increased to16.998 maf, with the average annual supply being around 15 maf.[130] Thus, the waters of the Colorado River Basin are already over-allocated, making supply and demand imbalances even more likely and more pronounced in the future.[131] To date, these imbalances have been managed and demands have been met through the use of the considerable amount of water

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[121] *See id.*

[122] *Id.* at ch. C-22.

[123] *Id.* at ch. C-20.

[124] INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 116, at 14.2.1.

[125] *Id.*

[126] *See* WATER DEMAND ASSESSMENT, *supra* note 69, at ch. C-2.

[127] *Id.* at ch. C-50. A phreatophyte is a deep-rooted plant that obtains its water from the water table or the layer of soil just above it. Phreatophyte Definition, Merriam Webster.com, http://www.merriam-webster.com/dictionary/phreatophyte (last visited May 1, 2013).

[128] EXECUTIVE SUMMARY, *supra* note 1, at ES-6.

[129] U.S. DEP'T OF THE INTERIOR BUREAU OF RECLAMATION, COLORADO RIVER BASIN CONSUMPTIVE USES AND LOSSES REPORT 2001-2005, iv (2012) *available at* https://www.usbr.gov/uc/library/envdocs/reports/crs/pdfs/cul2001-05.pdf.

[130] *Id.*; WATER SUPPLY ASSESSMENT, *supra* note 112, at ch. B-22.

[131] *Id.* at ch. B-1.

storage available in the basin and the fact that the Upper Basin states have not fully developed their apportionment.[132]

1. *Storage Capacity of the Colorado River System*

The Colorado River experiences highly fluctuating flows on an annual basis.[133] Without the storage built into this system, the Upper Basin would face chronic calls for curtailment of water use from the Lower Basin.[134] The storage capacity of the Colorado River System is around 60 maf, four times the yearly average flow.[135] The reality of continued consumptive uses exceeding supply has taken a toll on the immense storage of the Colorado River. At the end of water year 2004, Lake Powell was at thirty-eight percent of capacity, and Lake Mead was at fifty-four percent of capacity.[136] At the end of water year 2012, the overall level of storage had not improved much, with Lake Powell measured at fifty-seven percent of capacity and Lake Mead at fifty percent in 2012.[137]

A recent study assessing the vulnerability of water supply in the United States (Vulnerability Study) concluded "Climate change can increase water demand and decrease water supply to the extent that, barring major adaptation efforts, substantial future water shortages are likely, especially in the larger southwest."[138] The Vulnerability Study found that, because of increasing demand and a likely decreasing supply due to climate change, the storage levels in Lakes Powell and Mead will fall to zero around 2030 and will rarely rise above this level going forward.[139]

The Bureau of Reclamation recently stated that under the 2007 Colorado River Interim Guidelines, only 7.48 maf will be released from Lake Powell in water year 2014.[140] This is the lowest release of water from Lake Powell since

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[132] EXECUTIVE SUMMARY *supra* note 1, at ES-1; WATER SUPPLY ASSESSMENT *supra* note 112, at ch. B-1.

[133] *See* WATER SUPPLY ASSESSMENT *supra* note 112, at ch. B-22 (stating that the inflow to Lake Powell in the period from 1895 through 2003 has averaged only about 15 maf per year, with a range from 5.6 maf in 1977 to 25 maf in 1984).

[134] *See* Hobbs, *supra* note 43, at 22.

[135] EXECUTIVE SUMMARY, *supra* note 1, at ES-1.

[136] U.S. DEP'T OF THE INTERIOR BUREAU OF RECLAMATION, 2005 ANNUAL OPERATING PLAN FOR COLORADO RIVER RESERVOIRS, 6 (2004), *available at* http://www.usbr.gov/uc/water/rsvrs/ops/aop/aop05_final.pdf.

[137] U.S. DEP'T OF THE INTERIOR BUREAU OF RECLAMATION, 2013 ANNUAL OPERATING PLAN FOR COLORADO RIVER RESERVOIRS, 7 (2012), *available at* http://www.usbr.gov/lc/region/g4000/aop/AOP13.pdf.

[138] *See* Foti, *supra* note 7.

[139] *Id.* at 130.

[140] Press release, U.S. DEP'T OF THE INTERIOR BUREAU OF RECLAMATION, Bureau of Reclamation Forecasts Lower Water Release from Lake Powell to Lake Mead for 2014 (August 16, 2013), *available at* http://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=44245.

it was filled in the 1960s.[141] The Bureau of Reclamation anticipates this lower-than-average water release will cause Lake Mead to drop an additional eight feet next year.[142] In explaining the current situation in the Colorado River Basin, the Bureau of Reclamation noted: "Currently the longer-term projections from Reclamation's hydrologic models show a very small chance of lower basin delivery shortages in 2015, with the first significant chance of reduced water deliveries in the lower basin in 2016."[143]

2. *The Upper Basin Has Not Developed Its Full Compact Allocation*

At the time of the signing of the 1922 Compact, the Lower Basin economy was growing at a faster rate, thus developing more Colorado River water than the Upper Basin states.[144] The Upper Basin states wanted to protect its right to future development of Colorado River Water and develop water at a pace consistent with their needs.[145] The Upper Basin has still not developed its full apportionment under the 1922 Compact.[146] The Upper Basin's estimated use and evaporation for 2005 were estimated at 3.796 maf.[147] The Bureau of Reclamation estimated the Upper Basin's average total consumptive use—including evaporation and other losses—for the 2006-2010 time period had increased to an average 4.499 maf per year for this period.[148] As consumption in the Upper Basin continues to increase, it will be more difficult to ensure that the Upper Basin complies with Article III(d) of the 1922 Compact.

III. ANALYSIS

The discrepancy between supply and demand in the Colorado River Basin presents many issues to Wyoming water users. This comment will first discuss the amount of water that will likely be available to Wyoming water users in the future.[149] Second, it will explain how a call on Wyoming water users could happen

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[141] *Id.*

[142] *Id.*

[143] *Id.*

[144] Daniel Tyler, *Delphus Emory Carpenter and the Colorado River Compact of 1922*, 1 U. DENV. WATER L. REV. 228, 237 (1998).

[145] *See* Charles J. Meyers, *The Colorado River*, 19 STAN. L. REV. 1, 11 (1966); Tyler, *supra* note 144, at 237.

[146] Robert W. Adler, *Revisiting the Colorado River Compact: Time for A Change?*, 28 J. LAND RESOURCES & ENVTL. L. 19, 46 (2008).

[147] *Id.*

[148] U.S. DEP'T OF THE INTERIOR BUREAU OF RECLAMATION, PROVISIONAL UPPER COLORADO RIVER BASIN CONSUMPTIVE USES AND LOSSES REPORT 2006-2010, v (2013) *available at* http://www.usbr.gov/uc/library/envdocs/reports/crs/pdfs/cul2006-2010prov.pdf [hereinafter USES AND LOSSES REPORT]. The USBR website does not contain data for the Lower Basin for the 2006–2010 time frame. *Id.*

[149] *See infra* notes 154–71 and accompanying text.

despite the state having not used its full 1922 Compact allocation.[150] Third, it will discuss how the state's share of a curtailment will likely be determined under the 1948 Compact.[151] Fourth, this comment will describe which water users will likely be affected by a valid curtailment.[152] Finally, this comment will outline and critique proposed options the state has suggested for dealing with the difficulties facing Wyoming users of Colorado River Basin water.[153]

A. Colorado River Water Likely Available to Wyoming Based on Predicted Hydrology of the River

Because Wyoming has taken progressive efforts to quantify the current levels of consumptive use in the basin, the state knows how much water it is currently consuming.[154] However, estimates of the water available to Wyoming water users in the future vary widely. Consumptive use of Green River Basin water in Wyoming is limited by the 1922 Colorado River Compact, the 1948 Upper Colorado River Basin Compact, and possibly the 1944 Treaty with Mexico.[155]

1. Obligation Under the 1944 Treaty with Mexico

Whether the Upper Basin has an obligation to supply one-half of the delivery to Mexico under the 1922 Compact and the 1944 Treaty has been a point of contention.[156] A thorough discussion of this contention is beyond the scope of this comment; however, a brief description is warranted for context. The Upper Basin states argue they have no obligation because there is a surplus available in the Basin, and the Lower Basin is consuming it illegally and thus should curtail its own use to satisfy the obligation under the 1944 treaty.[157] The Lower Basin states, on the other hand, contend that they are not consuming surplus Colorado River water.[158] The Lower Basin argues they are instead consuming tributary water and this use is exempt from Compact apportionment and therefore, the Upper and Lower Basins should split the Mexican apportionment from main stem Colorado River water.[159]

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[150] *See infra* notes 180–85 and accompanying text.

[151] *See infra* notes 187–208 and accompanying text.

[152] *See infra* notes 209–13 and accompanying text.

[153] *See infra* notes 214–55 and accompanying text.

[154] *See supra* notes 92–98 and accompanying text.

[155] *See infra* notes 156–71 and accompanying text.

[156] *For example*, a thorough discussion is made in: Lochhead, *supra* note 16, at 320; Douglas Kenney et al., *The Colorado River and the Inevitability of Institutional Change,* 32 PUB. LAND & RESOURCES L. REV. 124 (2011).

[157] Lochhead, *supra* note 16, at 320.

[158] Kenney et al., *supra* note 156, at 124.

[159] *Id.*

2. *Wyoming's Allocation Under the 1922 and 1944 Compacts*

Collectively, the 1922 and 1944 Compacts allocate to the Upper Basin consumptive use of 7.5 maf on a yearly basis, of which Wyoming is apportioned 14%.[160] Assuming the Upper Basin has consumptive use of the full 7.5 maf allocated in the 1922 Compact, Wyoming can consume 14% of the 7.5 maf, or 1.043 maf of water, on a yearly basis.[161] However, the Upper Basin is not guaranteed 7.5 maf of consumptive use under the 1922 Compact.[162] Article III(c) and (d) of the 1922 Compact entitle the Upper Basin to the consumptive use of water only after the delivery obligation of the seventy-five maf per ten year requirement has been met, and satisfaction of a valid delivery obligation to Mexico.[163]

Wyoming is thus entitled to 14% of the waters allocated to the Upper Basin only after the Upper Basin's obligations under the 1922 and 1948 Compacts have been met. Therefore, the amount of water available to Wyoming depends on two factors: (1) whether the Upper Basin has a delivery obligation of 0.75 maf per year under the 1944 Treaty with Mexico and (2) what amount of the 7.5 maf per year allocated to the Upper Basin is actually available because of the requirement to meet the obligation of seventy-five maf per ten years. Incorporating these two conditions, the Wyoming State Engineer's Office computed the following table to describe the variability of water available to Wyoming appropriators.[164]

Table 3 illustrates the substantial variability in the amount of water Wyoming can ultimately expect to consume from the Green River Basin based on these two factors.

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[160] 1922 Compact, *supra* note 18, art. III(a); 1948 Compact, *supra* note 18, art. III(a).

[161] *See* 1948 Compact, *supra* note 18, art. III(a).

[162] *See* 1922 Compact *supra* note 18, art. III(c), (d).

[163] *Id.*

[164] Shields, *supra* note 107.

Table 3. Wyoming's Allocation of the Colorado River

	Upper Basin Annual Supply (acre-feet/yr)	**Arizona's Upper Basin Share** (acre-feet/yr)	**1944 Mexico Treaty obligation** (acre-feet/yr)	**Wyoming's 14% Share** (acre-feet/yr)
Scenario A[165]	7,500,000	50,000		**1,043,000**
Scenario B[166]	7,500,000	50,000	750,000	**938,000**
Scenario C[167]	6,100,000	50,000		**847,000**
Scenario D[168]	6,100,000	50,000	750,000	**742,000**
Scenario E[169]	6,000,000	50,000		**833,000**
Scenario F[170]	6,000,000	50,000	750,000	**728,000**

The 2010 GRB plan is based on the state having an allocation of 847,000 acre-feet of water available on a yearly basis.[171] This reflects a position represented by "Scenario C" that there is 6.1 maf available to the Upper Basin, and the Upper Basin is not responsible for one-half of the delivery obligation to Mexico.[172]

3. How Changes in These Two Variables Can Affect Wyoming Water Users

The 2010 GRB Plan estimated Wyoming will have water remaining under the state's allocation from the 1922 compact, assuming the hydrology of the River will remain current through 2055 and that the Upper Basin has no delivery requirement under the 1944 treaty with Mexico.[173] However, it is possible for

[165] Scenario A is based on 7.5 maf of water supply per year and no requirement to meet one-half of the Mexican Water Treaty obligation. *Id.*

[166] Scenario B is based on 7.5 maf of water supply per year and the Upper Division States being required to supply one-half of the Mexican Water Treaty obligation of 1.5 maf per year. *Id.*

[167] Scenario C is based on 6.1 maf of water supply per year and no requirement to meet one-half of the Mexican Water Treaty obligation. *Id.*

[168] Scenario D is based on 6.1 maf of water supply per year and the Upper Division States being required to supply one-half of the Mexican Water Treaty obligation of 1.5 maf per year. *Id.*

[169] Scenario E is based on 6.0 maf of water supply per year and no requirement to meet one-half of the Mexican Water Treaty obligation. *Id.*

[170] Scenario F is based on 6.0 maf of water supply per year and the Upper Division States being required to supply one-half of the Mexican Water Treaty obligation of 1.5 maf per year. *Id.*

[171] *See* WYO. WATER DEV. COMM'N., *supra* note 2, at ch. 6-127.

[172] *See supra* note 106 and accompanying text.

[173] WYO. WATER DEV. COMM'N., *supra* note 2, at ch. 6-127.

either of these variables to change. In estimating future uses, it is important to realize that this is only an estimate and it may be found the Upper Basin does in fact have an obligation under the treaty with Mexico, and the water available to the Upper Basin will change depending on the hydrology of the river. Thus, the 847,000 figure the 2010 GRB plan uses is likely based on more water than will actually be available to the Upper Basin as a whole.

Decreased supply and the potential for an Upper Basin responsibility for one-half of the delivery to Mexico can result in significantly less water availability for Wyoming.[174] A simplified calculation shows the effects of these variables.[175] If the annual flow of the Colorado River is measured at 13.7 maf, and 7.5 is subtracted to satisfy Article III(d) of the 1922 Compact, 0.0050 maf is subtracted for Arizona's share under the 1948 Compact, and 0.496 maf is subtracted to account for the evaporation chargeable to the Upper Basin, then 5.654 maf of consumptive use is available to the Upper Basin.[176] Under this calculation, Wyoming's share would be 0.792 maf.[177] However, if the Upper Basin is responsible for one-half of the delivery obligation to Mexico, the Upper Basin's share is reduced to 4.89 maf and would decrease Wyoming's share to 0.684 maf.

The 2010 GRB plan estimates there is sufficient water available to the Green River Basin to meet current as well as all projected demand requirements through 2055 and still have a surplus Compact allocation remaining.[178] However, under a setting where Wyoming is only entitled to consume 0.684 maf, sufficient water will not be available for the future "high growth scenario" in the 2010 GRB Plan and the remaining Compact allocation is significantly decreased.[179] The state is unable to control the hydrology of the Colorado River System, but should continue to argue that the Upper Basin states are not responsible for one-half of the obligation under the 1944 Treaty, thus protecting water available for future use in the state.

B. Remaining Compact Allocation, but Still Subject to a Call by the Lower Basin

A scenario similar to one in which the Upper Basin is only entitled to around 4.89 maf of Colorado River water would also severely limit the Upper Basin states' ability to meet the requirements of Article III(d) of the 1922 Compact

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[174] WATER SUPPLY ASSESSMENT, *supra* note 112, at ch. B-74, 76.

[175] This is a simplified calculation meant to illustrate the how the annual average flow and potential Upper Basin responsibility for one-half of the delivery to Mexico affects the amount of water available to the Upper Basin as a whole.

[176] USES AND LOSSES REPORT, *supra* note 148, at 10.

[177] *Id.*

[178] *See* WYO. WATER DEV. COMM'N., *supra* note 2, at ch. 6-127.

[179] *See id.*

while also developing their own water uses. This is especially relevant given the current and anticipated storage concerns.[180] Even though it appears Wyoming will likely have sufficient water under most scenarios outlined in the 2010 GRB Plan, under Article IV(c) of the 1948 Compact, Wyoming water users could be subject to a short-term curtailment if the Upper Basin, as a whole, fails to deliver the amount of water at Lee Ferry required by Article III(d) of the 1922 Compact.[181] Failure to meet the average flow requirements of Article III(d) would result in the Lower Basin "calling" on the Upper Basin to reduce consumption by the amount necessary to supply the required amount of water at Lee Ferry.[182] A call on the river by the Lower Basin because of the Upper Basin's failure to meet the ten-year average flow obligation at Lee Ferry has never happened.[183] However, it is important to understand how such a call could happen.

In a situation where the Upper Basin, as a whole, has failed to comply with Article III(d) of the 1922 Compact, the Lower Basin can request delivery of the undersupplied amount.[184] The possibility of a call is concerning to Upper Basin states, including Wyoming, because it would force the Upper Basin water users to curtail their use in order to ensure delivery of this amount of water at Lee Ferry. Decreased water supply and increased water demand will make it more difficult for the Upper Basin to store water and therefore fulfill this obligation in dry years.[185]

C. Determining Wyoming's Share of a Valid Curtailment Request

The Upper Basin states must formulate a plan based on how the 1948 Compact will likely be interpreted if the Upper Basin fails to meet the Article III(d) requirements of the 1922 Compact.[186] Fortunately, there has never been a curtailment on the Colorado River due to a failure of the Upper Basin to meet these requirements, but this also means there is little guidance to the states about how the Compact will be interpreted should a curtailment become necessary.[187] In 2005, the Wyoming State Engineer, facing continued drought and its corresponding effects on the water storage in the Colorado River Basin, commissioned a report (Consultant Report) to summarize Wyoming's obligation

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[180] *See supra* notes 133–43 and accompanying text.

[181] *See* 1922 Compact, *supra* note 18, art. III(d).

[182] *Id.*

[183] *See* Lindgren, *supra* note 73, at 11–12.

[184] *See* 1922 Compact, *supra* note 18, art. III.

[185] *See* EXECUTIVE SUMMARY, *supra* note 1, at Ch. ES-3; *see supra* notes 112–43 and accompanying text.

[186] PURCELL CONSULTING, COLORADO RIVER COMPACT ADMINISTRATION PROJECT PREPARED FOR: WATER AND NATURAL RESOURCES DIVISION WYOMING ATTORNEY GENERAL'S OFFICE AND THE WYOMING STATE ENGINEER (2005) (on file with author).

[187] *Id.*

should the Upper Basin face curtailments because of a failure to comply with Article III(d).[188] The Consultant Report provides a plain language interpretation of the 1922 and 1948 Compacts to determine Wyoming's share of a curtailment where no Upper Basin state used more than its allocated share where all Upper Basin states must share in the curtailment under Article IV(c) of the 1948 Compact.[189] The Consultant Report concluded that under the current state of affairs in the Colorado River Basin, Wyoming would make its own decisions regarding how to comply with a valid request for curtailment under the 1922 and 1948 Compacts.[190] Consequently, beyond these Compacts, which illustrate how a curtailment might occur, Wyoming statutes and the prior appropriation doctrine are the only guideposts available to the Wyoming State Engineer if there is a valid curtailment request.[191] Thus, under Wyoming state law, the State Engineer will administer a curtailment under the prior appropriation doctrine as a matter of state law, not interstate law.[192] The Compacts will determine *when* a curtailment is required, but Wyoming law will determine *how* it is administered in the state.[193]

The Consultant Report further clarifies the 1922 and 1948 Compacts.[194] The Consultant Report notes these Compacts are unique in that the entitlements to water are based on consumptive use.[195] Therefore, the extent of any curtailments will be based on the amount of consumptive use that must be reduced in order to meet the terms of the curtailment.[196] Quantification of consumption is therefore increasingly important, as the resources of the Colorado River are subject to decreased supply and increased demand.[197] Because the 1948 Compact bases curtailment on an individual state's consumptive use from the prior year, this information gathered by the state is critical in knowing which uses will be curtailed.[198] Both the 1922 and 1948 Compacts protect water rights in use prior to the signing of the 1922 Compact.[199] Therefore, Wyoming is not obligated to

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[188] *Id.*

[189] *See id.*; *See* 1948 Compact, *supra* note 18, art. IV.

[190] PURCELL CONSULTING, *supra* note 186, at 3.

[191] *Id.* Under the prior appropriation doctrine, water use is based on a system of priority. COLO. DEP'T OF NATURAL RES., *Prior Appropriation Law*, http://water.state.co.us/surfacewater/swrights/pages/priorapprop.aspx (last visited Apr. 22, 2014). This means the person with the oldest, or most senior, water right receives his or her water before anybody else on a stream can use water.

[192] *Id.*

[193] *See id*; *see also* Hobbs, *supra* note 134, at 23.

[194] PURCELL CONSULTING, *supra* note 186, at 2.

[195] *Id.*

[196] *Id.* at 3.

[197] *See* EXECUTIVE SUMMARY, *supra* note 1, at ES-9; *see* CONSUMPTIVE USE PLAN, *supra* note 79.

[198] 1948 Compact, *supra* note 18, art. IV.

[199] *Id.* arts. IV, VIII.

curtail the use of water rights perfected prior to November 24, 1922.[200] The plain language of the 1922 and 1948 compacts provide that if Wyoming has curtailed the use of all rights perfected on or after November 24, 1922, and has still not reduced consumptive use to the quantity specified in the curtailment request, no other rights should be affected.[201] Taking this language literally, the Wyoming water users with rights perfected prior to November 24, 1922 cannot be forced to curtail their use.

To satisfy a valid curtailment request, the State Engineer must be able to determine the priority date of water rights being exercised to satisfy a valid curtailment request because both Compacts provide protection for rights perfected prior to November 24, 1922.[202] Thus, in a curtailment situation, the State Engineer must first determine the previous year's consumptive water use in the Green River Basin and then separate which uses occurred under pre-Compact rights and which did not.[203] With these points in mind, the Consultant Report provides a hypothetical example of how a curtailment of existing water uses in the Upper Basin might be handled in any given water year.[204] In this hypothetical scenario, the Upper Basin states agree that consumptive use in the Upper Basin should be curtailed by 1.2 maf to meet obligations under the 1922 Compact.[205] Article IV(c) of the 1948 Compact explains that each state's proportionate share of any curtailment is based on the individual consumptive use in each state in the year prior to the curtailment.[206] The following table represents this hypothetical scenario, where the water curtailment in year 2 would be based on consumptive use in year 1, the preceding year.

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[200] PURCELL CONSULTING, *supra* note 186, at 3; *see* 1922 Compact, *supra* note 18, art. VIII; 1948 Compact, *supra* note 18, art. IV.

[201] *See* PURCELL CONSULTING, *supra* note 186, at 3; *see* 1922 Compact, *supra* note 18, art. VIII; *see* 1948 Compact, *supra* note 18, art. IV.

[202] CONSUMPTIVE USE PLAN, *supra* note 79, at 3.

[203] *Id.*

[204] PURCELL CONSULTING, *supra* note 186, at 2.

[205] *Id.*

[206] *Id.* at 3.

Table 4. Example of Determining an Individual State's Share of Curtailment[207]

State	Year 1 Total Consumptive Use (A)	Year 1 Consumptive Use of Post November 23, 1922 Water Rights (B)	Percentage of (A) based on (B) (C)	Year 2- Share of Curtailment- (C) x 1,200,00 AF (D)
CO	2,300,000	1,500,000	60	720,000
NM	400,000	300,000	12	144,000
UT	900,000	500,000	20	144,000
WY	400,000	200,000	8	96,000
Total	4,000,000	2,500,000	100	1,200,000

Under this scenario—where the Upper Basin is obligated to curtail 1.2 maf acre-feet of consumptive use in Year 2—Wyoming's share would be 96,000 acre-feet based on the fact that it consumed eight percent of the total Upper Basin's Consumption in Year 1.[208] The table demonstrates the need to quantify the total consumptive use in the Green River Basin as well as the consumptive uses of pre-November 24, 1922 water rights on an annual basis.

This Consultant Report provides useful analysis to Wyoming water users. Because the Upper Basin has never failed on its obligation to supply the required water at Lee Ferry as required by the 1922 Compact, a curtailment situation has never occurred and therefore, it is unknown how the curtailment provisions of the 1948 Compact will be interpreted. The Consultant Report provides a plain language interpretation of how a valid curtailment would affect the individual Upper Basin states under the 1948 Compacts. This interpretation illustrates the significance and value of rights perfected prior to November 24, 1922 and the vulnerability of more junior rights.

D. Wyoming Users of Colorado River Basin Water at Risk

Wyoming's share of a valid curtailment request will depend on several factors and is therefore highly unpredictable. However, the Wyoming water users that will likely be affected by curtailment can be determined more easily. Two factors allow this determination. First, as discussed above, both the 1922 Compact and

[207] *Id.* at 2.

[208] *Id.*

1948 Compact specify that water rights perfected prior to the signing of the 1922 Compact are excluded from any necessary curtailment.[209] Thus, rights perfected under Wyoming law prior to 1922 are protected from a compact call under both the 1922 and 1948 Compacts while subsequent rights are not.[210] Second, Wyoming water law is based on the principles of prior appropriation; therefore, a compact call by the Lower Basin will require curtailment of the most junior Wyoming appropriators' consumptive water use until enough water flows past the state line to satisfy Wyoming's portion of the curtailment.[211]

Under these factors, Wyoming water users can determine if their use is vulnerable to a possible curtailment situation. As a general rule, the majority of the agricultural water rights in the Green River Basin in Wyoming have priority dates prior to November 1922, and the majority of municipal and industrial water rights have priority dates subsequent to November 1922.[212] Therefore, it will be the most junior users, primarily municipal and industrial, who will face short-term impacts if curtailment is required to meet the flow requirement outlined in Article III(d) of the 1922 Compact.[213]

E. Wyoming's Proposed Options to Prepare for Curtailment

The state has outlined several strategies to help prevent a curtailment or at least lessen its effect on the users who would likely be affected by curtailment.[214] Suggesting ways in which water users can overcome challenges of water availability in the event of a curtailment requirement was an objective of the 2010 GRB Plan.[215] The following section discusses the proposed recommendations and strategies in the 2010 GRB plan.

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[209] 1922 Compact, *supra* note 18, art. IV(c); 1948 Compact, *supra* note 18, art. IV.

[210] Under Wyoming law, it is possible for water appropriators to use water under permits that have not been adjudicated. Green River Dev. Co. v. FMC Corp., 660 P.2d 339, 348 (Wyo. 1983). Therefore, it must be determined exactly when a right is actually "perfected" under state law to know whether it will be subject to curtailment in the event of a compact call. As there has never been a compact call, the definition of a perfected water right under the compacts has not been established. However, the Wyoming Supreme Court in the *Green River* decision concluded that a water right is "perfected" at the time of beneficial use. *Id.* at 349.

[211] *See* WYO. CONST. art. VIII, § 3.

[212] CONSUMPTIVE USE PLAN, *supra* note 79, at 9.

[213] Tables A-1 and A-2 in Appendix 1 list the municipal and industrial water users in the Green River Basin.

[214] WYO. WATER DEV. COMM'N., *supra* note 2, at ch. 8.

[215] *Id.* at ch. 1.

1. *Trans-Basin Diversions*[216]

Because the Green River Basin has unused compact allocations, it is a potential source of water for trans-basin diversions.[217] Although a trans-basin diversion would physically take water away from the Green River Basin, such a diversion could have beneficial effects on the Basin.[218] In any trans-basin diversion, the resulting negative impacts to the basin of origin must be mitigated under Wyoming law.[219] The 2010 plan identifies this requirement as an opportunity to barter currently available surplus water for improvements in the Basin, such as reservoir construction or enlargement to aid agricultural or municipal users.[220] However, the drawbacks to trans-basin diversions in certain situations can be prohibitive.[221] Trans-basin diversions can be expensive, time-consuming, and complex because of environmental and other regulations, and be subject to political and social controversies.[222]

Though often inviting controversy, trans-basin diversions can provide water to Wyoming water users outside of the Basin who are unable to appropriate water while also providing benefits to water users in the Green River Basin. The mitigation requirement of these diversions can allow storage to be built in areas of the Green River Basin that do not currently have adequate storage. High Savery Reservoir is an example of a mitigation reservoir built in exchange for an out-of-basin diversion by the City of Cheyenne, which is located in a fully appropriated water system.[223] Because the Green River Basin has unallocated water, it is in a unique position to barter water for the costs associated with building storage that can be used to benefit water users in the Green River Basin.

2. *Evaluate Water Rights Leasing*[224]

Under Wyoming law, a water right can be transferred either temporarily or permanently to a new water user without losing its priority date.[225] Typically, transfers require the new water user to petition the Wyoming Board of Control for permission for the transfer of the water right after demonstrating compliance

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[216] *Id.* at ch. 8-161.

[217] *Id.*

[218] *Id.*

[219] WYO. STAT. ANN. § 41-2-121 (2012).

[220] WYO. WATER DEV. COMM'N., *supra* note 2, at ch. 8-162.

[221] *Id.* at ch. 8-161.

[222] *Id.* at ch. 8-162.

[223] *Id.*

[224] *Id.* at ch. 8-163.

[225] *See* WYO. STAT. ANN. § 41-3-104 (2012); *see* WYO. STAT. ANN. § 41-3-110 (2012).

with the statute allowing the transfer.[226] Temporary transfers of water rights are available for a period of up to two years.[227] As discussed earlier, the overwhelming majority of pre-1922 water rights in the Green River Basin are surface rights for irrigation purposes.[228] As the Basin diversifies and the population increases, junior priority industrial and municipal water users can look to these senior and dependable water rights for transfer to provide a more predictable supply of water.[229]

Water rights perfected prior to November 24, 1922 are valuable to Wyoming water users because, under the plain language of the 1922 and 1948 Compacts, they will not be curtailed. Current Wyoming law allows permanent transfers of water rights, but this process has limitations in practice.[230] Thus, any municipal or industrial entity that transfers an agricultural right will only be able to use the water during the traditional time it was used, which is the irrigation season, and will also be subject to the no injury rule.[231] The process to change the water right to the new use is an onerous process typically requiring a hydrologic consultation to ensure compliance with the statutory requirements.[232] Wyoming law also allows for the temporary change of use that is much less burdensome to the parties but is still subject to the no injury rule and is only effective for two years.[233] Water right transfers, either on a temporary or permanent basis, can be a good way for water users to ensure that they have sufficient water in a curtailment, depending on their individual situation.

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[226] *See* WYO. STAT. ANN. § 41-3-104 (2012). The State Board of Control is composed of the Wyoming State Engineer and the Superintendents for the four Water Divisions in the State. WYOMING STATE ENGINEER'S OFFICE, http://seo.wyo.gov/agency-divisions/board-of-control. The State Board of Control is a quasi-judicial body with sole jurisdiction in the adjudication, administration, and amendment of water rights. *Id.*

[227] WYO. STAT. ANN.§ 41-3-110 (2012).

[228] *See supra* notes 209–13 and accompanying text.

[229] WYO. WATER DEV. COMM'N., *supra* note 2, at ch. 8-163.

[230] Section 41-3-104 of the Wyoming Statutes allows transfers provided that the quantity of water transferred does not: (1) exceed the amount of water historically diverted under the existing use, (2) does not exceed the historic rate of diversion of the existing use, (3) does not increase the historic amount of consumptive use under the existing use, (4) decrease the historic amount of return flow, or (5) injure existing lawful appropriators in any manner. WYO. STAT. ANN. § 41-3-104 (2012).

[231] WYO. STAT. ANN. § 41-3-104 (2012). The "no injury rule" requires that the water transfer not injure existing lawful appropriators in any manner. *See* Brian C. Shuck, *Change of "Place of Use" Petitions Before the Wyoming Board of Control*, 20 WYO. LAW. 21, June 2004.

[232] *See* WYO. STAT. ANN. § 41-3-104 (2012).

[233] WYO. STAT. ANN. § 41-3-110 (2012). A temporary change of use typically only requires filling out a form with the Wyoming State Engineer's Office (and not the other requirements of the permanent transfer) and the consumptive use is determined by presuming a 50% return flow.

3. *Using Fontenelle Reservoir Water*

The 2010 GRB plan also suggests water right holders can improve their water supply using unleased water, currently available, from Fontenelle Reservoir.[234] The Fontenelle Reservoir storage right, held by the Bureau of Reclamation, has a priority date of January 22, 1962 to store 345,397 acre-feet of water.[235] Through contracts with the United States signed in 1962 and 1974, Wyoming has the right to perpetually market 120,000 acre-feet and the first right of refusal to purchase water from the remaining capacity.[236] The state currently has four active contracts for Fontenelle water.[237] Combined, these contracts could result in the use of 46,550 acre-feet per year of Fontenelle storage water, but currently these contract holders are only making "readiness-to-serve" payments, and there has never been a request for water delivery for use.[238]

The possibility of storage water in Fontenelle Reservoir serving as an interim supply during water rights curtailment was reviewed in the Consultant Report commissioned by the State Engineer in 2005.[239] The report concluded that without changes in operations, Fontenelle would not be useful in mitigating the effects of a curtailment.[240] First, the Consultant Report noted the state's water rights associated with the reservoir are relatively junior.[241] Next, the report states that the Bureau of Reclamation may be restricted from storing water if there is basin-wide curtailment of use under the Compact.[242] Furthermore, the Report reviewed Wyoming's contracts with the United States and found "that the [Bureau of Reclamation] may only be obligated to ensure that there is a reliable water supply for the water obligated by the state through exercised contracts."[243] The Report explains that under the current operations, the Bureau of Reclamation is only carrying enough water to meet the demands of the state's only long-term contract for 35,000 acre-feet per year, indicating that the historic operations of the reservoir do not consistently carry over sufficient storage water to assist water users in the event of a curtailment.[244] The Consultant Report concluded that changes

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[234] WYO. WATER DEV. COMM'N., *supra* note 2, at ch. 8-169.

[235] Wyoming Water Right Permit No. 6629R ; WWDC, TECHNICAL MEMORANDUM: USE OF WYOMING'S CONTRACT STORAGE WATER IN FONTENELLE RESERVOIR, 1 (February 2011), *available at* http://waterplan.state.wy.us/plan/green/2010/finalrept/fontenelle.pdf.

[236] *Id.*

[237] *Id.*

[238] *Id.* at 1, 2.

[239] PURCELL CONSULTING, *supra* note 186, at 7–8.

[240] *Id.* at 8.

[241] *Id.*

[242] *Id.*

[243] *Id.*

[244] *Id.*

in operations, including temporary use agreements, could result in additional carryover storage that could be used to mitigate the effects of curtailments.[245] Taking this all into consideration, for Fontenelle water to be useful in mitigating the effects of a future curtailment, water users must determine if the priority date of the reservoir will likely allow the water to be of use in a curtailment situation.

4. Continue to Evaluate Storage

The 2010 GRB plan further calls for the state to evaluate water storage in the Basin.[246] Additional storage is beneficial to the Basin, as it is a way to capture and store water for use in the state without sacrificing another beneficial use.[247] In addition, storage can help ensure reliable supplies, which may help meet compact calls with as little impact to individual water users as possible, and provide ecological benefits through minimum flows and pools.[248] Unfortunately, under Wyoming law, it is necessary to show a need for storage before a reservoir can be built or enlarged and, currently, both Fontenelle and Flaming Gorge Reservoirs have unleased water.[249] Thus, except in areas that these reservoirs cannot serve, it will be hard to demonstrate a need for additional storage. In areas where need can be demonstrated, additional storage can serve as an important mitigation tool for a possible curtailment situation.

5. Use Other States as an Example[250]

As previously discussed, it is the low-priority municipal and industrial water users who will need the most protection in the event of curtailment of use.[251] The 2010 GRB Plan references concepts used by other states facing curtailment issues to allow these municipal and industrial water users to augment their existing water supplies.[252] The Plan identifies concepts, such as rotational land fallowing and dry year leasing, as strategies which have been used in other states to keep agricultural water rights tied to the water user's land, but also give the water right holder the flexibility to make agreements with more junior water right holders in need of a dependable water supply during times of water shortage.[253] The benefit of these concepts is that they provide water to those in need of water only in the years

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[245] *Id.*

[246] WYO. WATER DEV. COMM'N., *supra* note 2, at ch. 8-164.

[247] *Id.*

[248] *Id.*

[249] *Id.*

[250] *Id.* at ch. 8-163.

[251] *See supra* notes 209–13 and accompanying text.

[252] WYO. WATER DEV. COMM'N., *supra* note 2, at ch. 8-157.

[253] *Id.* at ch. 8-164.

when their other usual water supplies are insufficient or subject to curtailment.[254] As the 2010 GRB Plan discusses, some relatively minor changes in water right law could allow Wyoming water users more flexibility to adapt to the demands from the Colorado River Compacts.[255]

Moving forward, water users in the state will likely continue to develop Wyoming's remaining allocation under the 1922 and 1948 Compacts. Both the state as a whole and individual water users can make use of the strategies outlined in the 2010 GRB Plan. The recommendations in the Plan provide the means for water users to minimize the impacts that are likely to be experienced in a curtailment situation. Planning and preparation will allow the state and individual water users to put themselves in a position where curtailment will result in minimal adverse consequences. In addition to the strategies suggested under Wyoming law, small changes to Wyoming law could help mitigate the effects of curtailment.

IV. CONCLUSION

The supply and demand imbalance in the Colorado River Basin represents a current dilemma that will be exacerbated in the future. The negotiators of the 1922 Compact assumed there would be ample supply for the Upper Basin to guarantee the availability of 75 maf passing into the Lower Basin over consecutive ten-year periods, to allow the Lower Basin to consume up to 8.5 maf per year while permitting 7.5 maf of consumptive use in the Upper Basin, and also to contemplate a future delivery requirement to Mexico.[256] As the consumptive use of Colorado River water in the Lower Basin increases, the Lower Basin states will be adamant about the 75 maf per ten-year aggregate supply coming from the Upper Basin, as well as the Upper Basin's responsibility for one-half of the water under the Treaty with Mexico. Currently, the shortfall between supply and demand has not resulted in a curtailment situation because of the immense amount of storage available and the fact that the Upper Basin has not developed its full allocation under the 1922 Compact. As the storage of the Basin is depleted and the Upper Basin continues to develop its water resource, a curtailment situation becomes much more likely.[257]

Wyoming's position in the Colorado River Basin will be subject to both the future interpretations of the Law of the River and likely changes in the River's hydrology. The State of Wyoming has been diligent in keeping abreast of the issues facing Wyoming users of Colorado River water. Based on the hydrologic

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[254] *Id.*

[255] *Id.*

[256] *See* 1922 Compact, *supra* note 18.

[257] *See* Hobbs, *supra* note 43, at 22; *See* Kenney et al., *supra* note 156, at 127.

estimations in the Supply and Demand Study, it appears likely that Wyoming has sufficient water for current uses under the Compact allocations. However, as the Upper Basin as a whole continues to develop its Compact allocations and the shortfall between supply and demand becomes more pronounced, it is important to realize this water is not guaranteed and can be subject to curtailment, even if Wyoming has not used its full compact apportionment. Hotter and drier conditions decreasing supply and increasing demand for water in the Colorado River Basin will likely result in the continued depletion of storage in the Basin, making the availability of water in the future less predictable. Under this scenario, the water users with more junior priority dates will be affected by a curtailment.

As the supply and demand imbalances are likely to be exaggerated in the future, Wyoming users of Colorado River Basin water must be vigilant to protect their water. Wyoming must continue to argue the Upper Basin states are not responsible for one-half of the obligation under the 1922 Compact. Continued consumptive use monitoring will allow the state to know which uses would have to be curtailed in the event of a call on the river by the Lower Basin. By planning ahead and acknowledging which users will likely be affected, Wyoming water users can determine the strategies that will lessen the impacts of a curtailment.

APPENDIX I—Current Water Use In The Green River Basin

The 2010 Green River Basin plan lists water use information for the fourteen Green River Basin cities, towns, and joint power water boards (JPB) that supply water to their citizens or customers.[258] Table A-1 lists those that obtain their primary water supply from surface water and their surface water sources.[259]

Table A-1. Municipal Use of Colorado River Water in Wyoming

Municipality[260]	Source[261]	Storage Right	Permit No.[262]	Priority[263]
Town of Baggs	-Little Snake River	None	620 Enl. 28995	2/9/1901 11/5/1984
Bridger Valley JPB	-Smiths Fork and Blacks Fork Rivers	1500 acre-feet	26356 26355	6/29/1978 6/29/1978
Town of Dixon	-Little Snake River		23143	11/7/1967
Town of Granger	-Ham's Fork Green River	None	Territorial 4104 Enl. 6674 Enl.	1882 3/23/1920 11/8/1978
Kemmerer-Diamondville JPB	-Kemmerer No. 1 Res.	1,770 acre-feet	5302 Res. 9776 Res.	5/24/1935 1/12/1990
	-Hams Fork River		1601 3825 Enl.	10/13/1897 10/01/1917
	-Kemmerer Springs		19392 18392	5/27/1940 7/30/1934
	-Ham's Fork		1674	11/19/1897
	-Little Canyon Drainage		30760 31809	12/27/1989 3/22/1996

[258] WYOMING WATER DEV. COMM'N., *supra* note 2, at ch. 5-66, 67.

[259] PURCELL CONSULTING, TECHNICAL MEMORANDUM: GREEN RIVER BASIN PLAN, BASIN WATER USE PROFILE-MUNICIPAL, Appendix I, 3-17 (2001) *available at* http://waterplan.state.wy.us/plan/green/techmemos/muniuse.pdf.

[260] *Id.*

[261] *Id.*

[262] *Id.*

[263] *Id.*

Town of LaBarge	-Green River	None	24979	12/8/1975
Town of Pinedale	-Fremont Lake Dam	17,439 acre-feet	1817 1817 392 Enl. 626 Enl. 1631 Enl. 1631 Enl. 18601 5289 Enl.	5/6/1898 5/6/1898 12/1/1898 2/25/1901 11/8/1906 11/8/1906 1/30/1935 1/2/1941
Green River/ Rock Springs/ Sweetwater County Joint Powers Water Board 3	-Green River	None	Territorial 4620 Enl. 6415 Enl. 6672 Enl. 9682 Enl.	1871 9/4/1928 10/27/1971 5/31/1978 11/30/1989

Table A-2. Industrial Use of Colorado River Water in Wyoming

	Source[264]	Principle Water Right and amount of diversion[265]
Electric Power Generation[266]		
Jim Bridger Power Plant (PacifiCorp)	Green River	32112-62.8cfs
Naughton Power Plant (PacifiCorp)	Hams Fork River	22297-20.0cfs
Soda Ash Production and Related Products[267]		
FMC Wyoming	Green River	22808-5cfs 20077-17.0cfs
General Chemical	Green River	22748-6.5cfs
OCI Wyoming	Green River	22075-8.72cfs
Solvay Minerals Inc	Green River	26126-5.0cfs
Church and Dwight	Green River	6304 Enl.-1.78cfs
Miscellaneous[268]		
Exxon Shute Creek Plant	Green River	29509-0.134cfs
Simplot Phosphates[269]	Green River	N/A[270]

[264] WWC ENGINEERING, TECHNICAL MEMORANDUM: GREEN RIVER BASIN PLAN II—BASIN WATER USE PROFILE INDUSTRIAL, 1 (2009) *available at* http://waterplan.state.wy.us/plan/green/2010/techmemos/Industrial_Use.html.

[265] *Id.* at 3.

[266] *Id.* at 1.

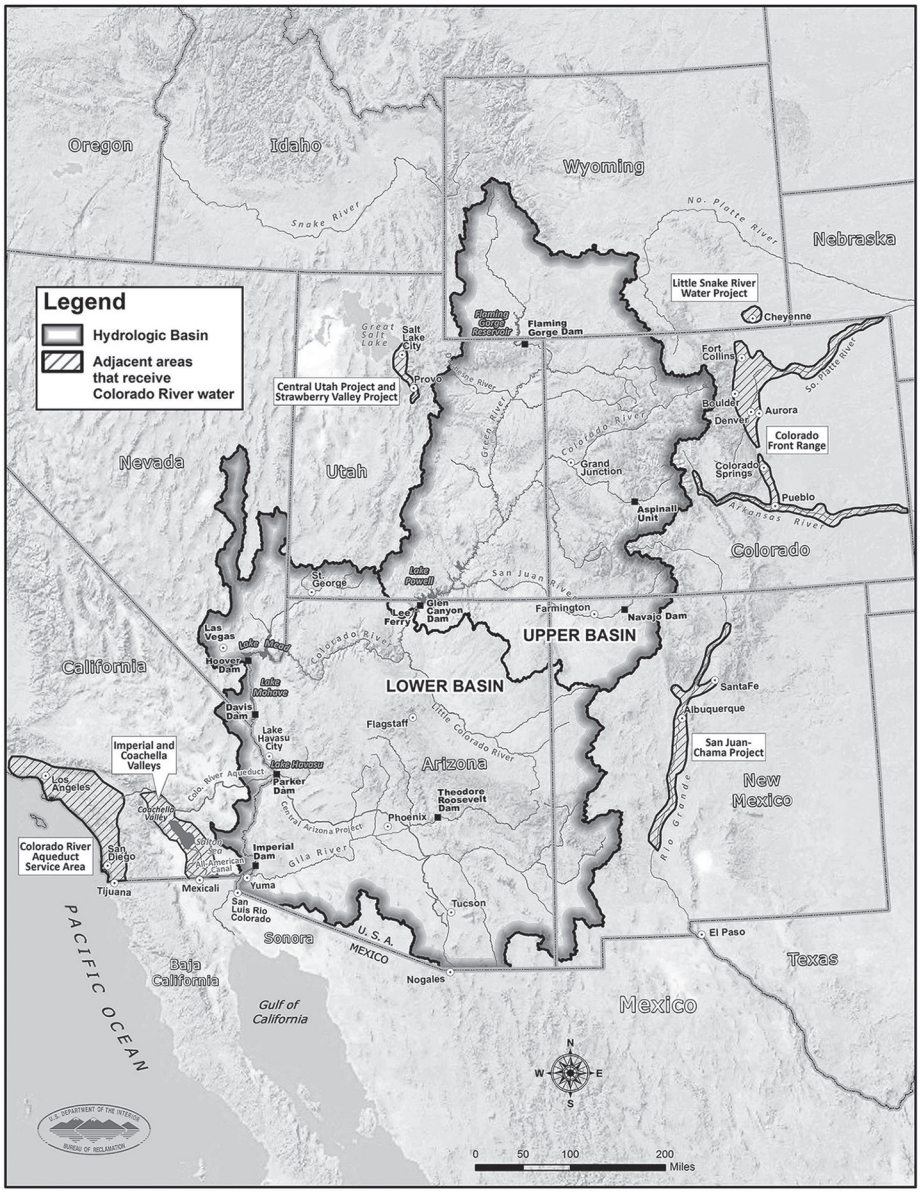
[267] *Id.*

[268] *Id.*

[269] *Id.* at 7. The current operation used an annual average of 605 acre feet from 2004 to 2008. *Id.*

[270] *Id.*

Map of the Colorado River Basin[271]



[271] USBR Lower Colorado Region http://www.usbr.gov/lc/images/maps/CRBSmap.jpg (last visited April 13, 2014). Courtesy of the Bureau of Reclamation.