AGENDA
UPPER YAMPA WATER CONSERVANCY DISTRICT
BOARD OF DIRECTORS MEETING
THURSDAY, JULY 16, 2020 (10:00 PM)
MOUNTAIN VALLEY BANK COMMUNITY ROOM – ACCESS IS LIMITED TO DIRECTORS AND STAFF ONLY
PUBLIC ACCESS VIA HTTPS://BLUEJEANS.COM/870246034

INSTRUCTIONS ON HOW TO JOIN A BLUEJEANS MEETING FOLLOW THE AGENDA

A Board of Directors meeting packet is available for public review on our website at http://www.upperyampawater.com/board-of-directors/agendas/ on the Friday before the meeting. Amendments to the Agenda and new documents that are generated or submitted after the original posting of the meeting materials will be posted under "Additional Documents" on the website for the relevant meeting.

MEETING PROCEDURE: Comments from the Public are welcome at two different times during the course of the meeting: 1) Comments no longer than three (3) minutes on items **not** scheduled on the Agenda will be heard under Public Input and Comment; and 2) Comments no longer than three (3) minutes on all scheduled public hearing items will be heard following the presentation. Please wait until you are recognized by the President. With the exception of subjects brought up during Public Input and Comment, on which no action will be taken or a decision made, the Board may take action on, and may make a decision regarding, ANY item referred to in this agenda, including, without limitation, any item referenced for "review", "update", "report", or "discussion" whether or not listed as an "Action Item."

(1) *10:00 AM* Establishment of Quorum and Call to Order;

(2) *10:05 AM* Approval of Agenda for Meeting

(3) *10:15 AM* Executive Session:
Executive Session under CRS § 24-6-402 (3.5) and (4)(e)(I) concerning employment of a new general manager. This session will be recorded, and a copy of the recording maintained for not less than 90 days.

(4) *11:15 AM* Appointment for UYWCD General Manager Position **Action Item**

11:45 AM Break for Lunch (30 minutes)

Resume Meeting

(5) *12:15 AM* Public Input and Comment
The Board will make no decision nor take action, except to direct the General Manager. Those addressing the Board are requested to identify themselves by name, organization, if any, and address. Comments shall not exceed three (3) minutes.

(6) *12:25 PM* Consent Agenda; **Action Item**

a) Approval of the minutes of June 18, 2020 Board meeting
b) Approval of disbursements;

c) Financial Report including Budget comparison and 2020 budget required deadlines and schedule
d) Augmentation Contract

(7) *12:30 PM* Report of General Manager;
a) Report on Findings of Risk Study Analysis of Yampa Doctrine and Equitable Apportionment (Presentation and Q&A with Taylor Adams of Hydros Engineering)
b) Morrison Creek Wastewater Plant Upgrades (Steve Colby, Morrison Creek Water and Sanitation District, Engineering Consultant available for Q&A)
c) Colorado Water Trust Stagecoach Reservoir Water Storage Contract **Action item**
d) UYWCD Strategic Plan Implementation - 2020 Strategic Plan and Work Efforts Update, Proposed Schedule for 2021 Strategic Plan Update.
e) Proposal for Revised Schedule for 2020 UYWCD BOD Meetings **Action item**

(8) *2:00 PM* Committee Reports

(9) *2:10 PM* Report of General Counsel
a) Bylaws Amendment **Action item**

(10) *2:20 PM* District Engineer Report
a) Reservoir Water Status
b) Capital Projects Update

(11) *2:30 PM* Consideration/Action on District Project
a) UYWCD Infrastructure Grants
b) Scholarships

(12) *2:40 PM* Board Member Reports

(13) *2:50 PM* Discussion of Pending Legislation and State Affairs – Definition of the Waters of the United States (WOTUS): State of Colorado vs. United States Environmental Protection Agency and Corp of Engineers

(14) *3:00 PM* Pending Water Cases
a) Water resumes;
i) Catamount Application
b) Status of other water cases, if any;
i) Water Horse Update
ii) Colorado Division of Water Resources 2020 Abandonment List

(15) *3:15 PM* New Business

(16) *3:20 PM* Executive Sessions:
a) Executive session under CRS § 24-6-402(4)(b) to discuss legal issues on Water Resumes, Water Cases, Contract Negotiations and n/a. Mere presence or participation of an attorney at an executive session is not sufficient to satisfy the requirements of CRS § 24-6-402(4)(b). Executive sessions to discuss legal matters are not recorded.

(17) *3:25 PM* Board actions in regard to Executive Sessions

(18) *3:30 PM* Determination of next meeting agenda - September

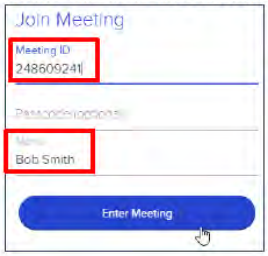
(19) *3:35 PM* Adjournment.

How to join a BlueJeans meeting

Go to: **BlueJeans.com** and click on "**Join Meeting**" 

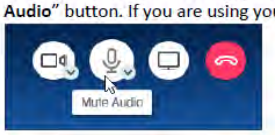
located in the upper right hand corner.

In the "**Join Meeting**" dialogue box, enter the "**Meeting ID**" (the ID number is provided in the meeting agenda) and your "**Name**" and then click "**Enter Meeting.**"



You will now be launched into the BlueJeans meeting. The "**Use Phone Audio**" dialogue box will appear. Follow the steps to connect via phone audio. Once you are connected, or if you were already connected, click on the "**X**" in the upper right hand corner to close the box.

When you enter the meeting, place your phone on Mute. If have used your computer for audio, click on the "**Mute Audio**" button. If you are using your own phone, press the mute button. Unmute to join the conversation.



Contact Deb Bastian for any questions

- Email: dbastian@upperyampawater.com
- Phone: 970-819-0189

RECORD OF PROCEEDINGS

UPPER YAMPA WATER CONSERVANCY DISTRICT
BOARD OF DIRECTORS MEETING
JUNE 18, 2020 12:00 PM
ONLINE MEETING: HTTPS://BLUEJEANS.COM/411279117

MINUTES

Chairman Ken Brenner called the meeting to order and declared a quorum present. In addition to Chairman Brenner, the Board members present were Bob Woodmansee, Doug Monger, Jim Haskins, John Redmond, Ron Murphy, Lyn Halliday, Tom Sharp, and Webster Jones. Acting General Manager/District Engineer Andy Rossi, Marketing/Communication Manager Holly Kirkpatrick, Chief Accountant Karina Craig, Business Manager Deb Bastian, General Counsel Bob Weiss and Special Counsel Scott Grosscup were also present. Members of the public present for some portion of the meeting included Tim Mayberry, Mayberry & Company, LLC; Jon Snyder and Kelly Romero-Heaney, City of Steamboat Springs; Erin Light, Colorado Division of Water Resources; Mickey O'Hara, Colorado Water Trust; Jackie Brown, Tri-State Generation & Transmission Association; John Kuosman, Nicole Seltzer and Kevin McBride.

This meeting was held entirely by videoconference utilizing the BlueJeans platform. The meeting agenda included instructions to the public describing the process to participate in the meeting and comment on agenda items.

The following agenda was proposed:

AGENDA

(1) ***12:00 PM*** **Establishment of Quorum and Call to Order**

(2) ***12:05 PM*** **Approval of Agenda for Meeting** **Action item**

(3) ***12:10 PM*** **Public Input and Comment**

The Board will make no decision nor take action, except to direct the General Manager. Those addressing the Board are requested to identify themselves by name, organization, if any, and address. Comments shall not exceed three (3) minutes.

(4) ***12:15 PM*** **Consent Agenda;** **Action item**

a) Approval of the minutes of May 21, 2020 meeting

(5) ***12:20 PM*** **Audit** **Action item**

(6) ***12:*****30 PM Report of General Manager**

a) Stagecoach contract water pricing **Action item**

b) Budget Amendment **Action item**

(7) ***2:00 PM*** **Committee Reports**

(8) ***2:05 PM*** **Report of General Counsel**

a) Bylaws Amendment

(9) ***2:20 PM*** **District Engineer Report**
- a) Water Quality Sampling @ SC 2020
- b) USGS Report and Cost Share Summary

(10) ***2:35 PM*** **Board Member Reports**
- a) Update on GM search and acceptance of minutes of the May 13, 2020, May 20, 2020, May 27, 2020 and June 4, 2020 Search Committee Meetings. **Action item**

(11) ***2:50 PM*** **Discussion of Pending Legislation**
- a) Water Resumes;
- b) Status of other Water Cases, if any;

(12) ***3:10 PM*** **New Business**

(13) ***3:15 PM*** **Executive Sessions:**
- a) Executive session under CRS § 24-6-402(4)(b) to discuss legal issues on Water Resumes, Water Cases and Contract Negotiations. Mere presence or participation of an attorney at an executive session is not sufficient to satisfy the requirements of CRS § 24-6-402(4)(b). Executive sessions to discuss legal matters are not recorded.

(14) ***3:45 PM*** **Determination of Next Meeting Agenda**

(15) **Adjournment.**

Chairman Brenner established a quorum and called the meeting to order at 12:03 PM.

Approval of Agenda for Meeting. Chairman Brenner requested item (**13) (b) Board actions in regard to Executive Sessions** be added to the agenda. Director Woodmansee made a motion to approve the meeting agenda with the addition of item (13) (b). Director Jones seconded the motion, which was unanimously approved.

Public Input and Comment. Chairman Brenner invited the members of the public present to comment on items not otherwise scheduled on the agenda. There were no comments.

Consent Agenda. Director Sharp requested that the spelling of Linda Bassi's name be corrected in the May 21, 2020 minutes. Director Redmond moved to approve the minutes with the correction as noted by Director Sharp. Director Woodmansee seconded the motion, which was unanimously approved.

Audit. Auditor Tim Mayberry of Mayberry & Company, LLC provided an overview of the audit process and findings and noted that there were no issues encountered. Chairman Brenner requested that for future audits staff work with the auditor to develop a proposed schedule and timeline for the audit process and to include an initial meeting with the Board and auditor in the timeline. Director Woodmansee made a motion to approve the audit report as presented. Director Redmond seconded the motion, which was unanimously approved.

Report of the General Manager

Stagecoach contract water pricing

The materials provided in the packet were reviewed and the Board discussed ERC pricing. Director Monger moved to price2020 ERC water at the same price as the Colorado Water Trust water in 2019. Director Jones seconded the motion. There was further discussion to clarify the price to be set for 2020 ERC water. Director Monger amended the motion to set the 2020 ERC price at the 2018 price plus the CPI increase since then. Director Jones accepted the amendment. The motion passed with a vote of eight in favor and one opposed. Director Sharp did not support the motion.

The Board further discussed the pricing for Yamcolo raise pool and original municipal pool recommended by staff. Director Sharp made a motion to adopt staff recommendations to price 2020 Yamcolo raise water and original municipal pool water at $13/AF. Director Murphy seconded the motion. Andy Rossi noted that one of the details of the recommendation is that the water out of original municipal pool be offered to agricultural users first who were not able to purchase out of the raise water. Directors Sharp and Murphy agreed with the amendment. The motion was unanimously approved.

Chairman Brenner asked if staff had enough direction to move forward. Andy Rossi stated that he will take the input received from the Board on the subject of water pricing for Stagecoach Reservoir and work with UYWCD staff to provide a proposal of categories and potential base price methodology calculations for those categories at a future Board meeting.

Budget Amendment

The committee reviewed the staff recommendation for a budget amendment. Director Monger moved to approve the budget amendment as presented. Director Sharp seconded the motion. The motion passed with a vote of eight in favor and one opposed. Director Brenner did not support the motion as he wants to wait until the July board meeting where the actuals for the first 6 months will be presented and then it could be determined if there is enough appropriated in the budget to support the requests from staff.

Committee Reports. No reports were provided. Director Monger requested staff to investigate the ability to have an in-person Board meeting for July.

Report of General Counsel

Bylaws Amendment

Counsel Weiss presented a memo describing potential Bylaw amendments. The Board reviewed amendments a through f (except d) and indicated its support. Director Monger noted that he would like to see that item a (New Business) allow for the Board to provide staff direction. Item d (Term of Board President) was separately discussed. Director Sharp moved to amend the Term of the Board President to provide that effective 2020 the maximum consecutive number of years that a Board president can serve is 2 years, unless in any year there are no candidates for President other than the incumbent President. The existing Bylaw provisions providing for the annual election of the Board President and allowing a Board President to serve again after a two year break in service are not changed. Director Jones seconded the motion. The motion passed with a vote of seven in favor, one opposed and one abstention. Director Woodmansee did not support

the motion and Director Brenner abstained. Counsel Weiss will draft Bylaw amendments consistent with Board direction for the July Board meeting.

District Engineer Report
Water Quality Sampling at SC 2020
The water quality sampling was discussed.

USGS Report and Cost Share Summary
The report and summary were discussed.

Board Member Reports
Update on GM Search/acceptance of minutes
The current status of the General Manager search was discussed, and memo reviewed. Director Monger moved to accept the Search Committee Meeting minutes as presented. Director Woodmansee seconded the motion which was unanimously approved.

Discussion of Pending Legislation
Water Resumes
Special Counsel Grosscup discussed the application filed by Catamount Development, Inc. and the Catamount Metropolitan District. Director Sharp moved for the District to file a statement of opposition to the Catamount refill. Director Monger seconded the motion which was unanimously approved.

Director Monger requested a short analysis be drafted to assist in explaining and analyzing the potential effects of the impacts of the Catamount Application on the District's water rights. Special Counsel Grosscup will provide for the July meeting.

Status of other Water Cases
The cases were reviewed. The Board requested an update at the July meeting on the Army Corp of Engineers 404 permitting process.

New Business. There was no new business.

Executive Session. After discussion, if was determined there was no need for an Executive Session.

Determination of next meeting agenda. The scheduled date for the next Board meeting was confirmed, being Thursday, July 16, 2020 at 12:00 PM. Staff was requested to provide the report on Findings of Risk Study Analysis of Yampa Doctrine and Equitable Apportionment as soon as possible before the July board meeting. Director Sharp requested that the opinion piece from State Engineer regarding Colorado River Compact curtailment be provided to the Board before the next meeting.

Director Sharp moved to adjourn the meeting at 3:39PM. The motion was seconded by Director Woodmansee which was unanimously approved.

RECORD OF PROCEEDINGS

I certify that the foregoing constitutes a true and correct summary of the proceedings at the above referenced meeting.

_____ Date: _____
Andy Rossi, Acting District Secretary/Manager

UPPER YAMPA WATER
CONSERVANCY DISTRICT

BOARD COMMUNICATION FORM

From: Karina Craig, Chief Accountant.

Date: July 9, 2020

Item: **Financial Reports: Cash Disbursement Report, Budget Comparison Report. Local Government Budget Calendar**

_____ DIRECTION
__X__ INFORMATION
_____ MOTION
_____ RESOLUTION

I. Request/Issue and Background Information:

The ***Cash Disbursement Report*** contains disbursements of reconciled monthly statements. These include disbursements incurred with check payments through May 31, 2020 and credit card payments through June 3, 2020. Disbursements include operating and capital expenditures.

The ***Budget Comparison report*** was run on July 1, 2020 with transactions accrued up to and including June 15, 2020. Additional transactions for the month of June are expected.

Power Revenues, Routt County *Tax Revenues* and Moffat County *Tax Revenues* reported are those received through June 15, 2020, for the period January-May 2020.

Water Sale Revenues projected for the year 2020 vary slightly from budgeted revenues. Sources of such variances include:

- ✓ Contracts with a price per acre foot of water that is adjusted annually with a CPI index that is published every new fiscal year, after the budget has been adopted.
- ✓ Recently signed Yamcolo Reservoir water storage contracts for agricultural use, presenting slight pricing variations from budget.

The District is in the process of finalizing contract specifics with the Colorado Water Trust (4,000 AF or less) and there are potential Yamcolo Enlargement water sales (400 AF or less) for the current year. They are not included in the annual water sales projections presented in this report.

Budgeted amounts for the *Board of Directors Department* include approved funds for the recruiting of a General Manager for the District. The budget for the project contemplates a certain amount of consulting hours and the possible hiring of a candidate from out-of-town and appropriate relocating expenses. The project has continued to move forward; consultancy hours are expected to be slightly higher than initially planned, while current finalists are local and relocating

expenses are foreseen not to be needed. Projections were adjusted accordingly.

The Budget for this department also includes expenses arising from Directors' participation in conferences and related travel expenses. The unexpected emergence of Coronavirus has affected conferences, such that some have been canceled, postponed, or are scheduled to take place exclusively online, maintaining conference registration fees and voiding travel expenses. Projected expenses have been adjusted accordingly.

The combination of the items above bring annual projections for this department to be $33,770 below budget.

There are minor differences between budget and projections in other departments that in aggregate when combined with the Board of Directors projections represent approximately $60,000 of projections below the approved budget. The UYWCD staff will continue to look for cost saving measures in the remainder of 2020.

Pass through revenues and accrued expenditures in reference to the *Upper Yampa River Basin Nutrient and Sediment Study* are shown in the report as well, for both the 2019 Fiscal Year and 2020-to-date.

Local Government Budget Calendar

The information provided here is presented for general reference.

As a local government providing services to citizens, the UYWCD determines the services it will provide through a budget process. The District is required to prepare, adopt and file a budget annually. UYWCD is subject to compliance of applicable Colorado Revised Statutes and budgetary requirements by the Colorado Department of Local Affairs (DOLA).

DOLA prepares a *Local Government Budget Calendar* (attached) to guide local governments, which lists deadlines for the budget, for the audit and for the property tax certification process. Some of the deadlines listed in the calendar are not statutory but reflect good budgeting practices. The District adheres to and is consistently compliant with DOLA's Budget Calendar.

Some of the most important Budget Dates are:

- June 30th — Audit is submitted to the District's governing body, the Board of Directors.
- July 31st — Audit is submitted to the Office of the State Auditor.
- August 25th — Preliminary assessed values are released by Routt and Moffat Counties.
- October 15th — Proposed Budget is submitted to the District's governing body. A "Notice of Budget" is published.
- December 10th — Final assessed values are released by Routt and Moffat Counties.
- December 15th — Certification of mill levy is released by the District to County Commissioners.
- December 31st — Deadline to adopt Budget.
- January 31st — Budgets are due to DOLA.

UPPER YAMPA WATER
CONSERVANCY DISTRICT

II. Summary and Alternatives: none**.**

III. Staff Recommendation: Accept reports.

IV. Legal Issues: None

V. Consistency with Board Goals and Policies: Goal 3.

Attachments:
Attachment 1: Cash Disbursement Report.
Attachment 2: Budget Comparison Report.
Attachment 3: Colorado Department of Local Affairs, Local Government Budget Calendar.

Upper Yampa Water Conservancy District
Cash Disbursement Report
May 31, 2020

Date	Name	Memo	Amount
03/24/2020	CenturyLink	SC Telephone. March 1, 2020 to March 31, 2020.	145.26
03/26/2020	Jeffrey D Erickson, Lynx	Snow Removal February	2,275.00
04/05/2020	Adobe	Monthly Acropro November	14.99
04/05/2020	CrashPlan Code42	Admin Software: Cloud Backup	9.99
04/07/2020	Garmin	Monthly Support	34.95
04/08/2020	Intuit QuickBooks	Intuit Quickbooks software	2,232.00
04/08/2020	Bosski Built	Yamcolo O&M	82.79
04/10/2020	New Pig Corporation	Stagecoach maintenance	332.00
04/10/2020	Supplyhouse.com	Low pressure reducing valve. Stagecoach O&M maintenance	154.86
04/14/2020	CenturyLink	Office Telephone. April 7 to May 6, 2020.	230.75
04/15/2020	Jennifer Poelman	March Office Cleaning	150.00
04/15/2020	Microsoft	Software subscription	139.01
04/16/2020	Advanced Copier Solutions, Inc.	Savin Printer. March	195.86
04/16/2020	ACE Hardware	Office cleaning supplies, Stagecoach powerhouse supplies	147.22
04/16/2020	Flat Tops Ranch Supply	Yamcolo maintenance. #3081, $3116, #3140	134.75
04/17/2020	Edge Communications	4 SIP trunks 5 US DID February 2020. Bill 352922. Apr 6 to May 5, 2020 service.	103.69
04/21/2020	Adobe	Adobe Acrobat software	118.93
04/22/2020	Staples	Office Supplies	364.90
04/22/2020	YVEA	Electrical power, Stagecoach powerhouse and shed.	226.03
04/22/2020	CenturyLink	SC Telephone. April 1, 2020 to April30, 2020.	144.72
04/22/2020	Adobe	Monthly Acropro November	14.99
04/24/2020	Adobe	Monthly subscription	24.99
04/27/2020	SmartVault	Software, interphase with quickbooks	42.40
04/30/2020	Colorado Parks & Wildlife	OHV Registration Renewal	25.25
		Subtotal	**7,345.33**

Upper Yampa Water Conservancy District
Cash Disbursement Report
May 31, 2020

Date	Name	Memo	Amount
05/01/2020	Internal Revenue Service	Federal Taxes	14,861.32
05/01/2020	Mountain Valley Bank	May Rent	6,471.94
05/02/2020	NDS Northwest Data Services	Cloud Services May	137.75
05/02/2020	Verizon Wireless	Stagecoach Cell phones 4-14-2020 to 5-13-2020	106.99
05/04/2020	Western Slope Health Care	Health Insurance	10,422.81
05/04/2020	ICMA-401a	Retirement accounts	4,537.27
05/04/2020	ICMA-457	Retirement accounts	1,659.54
05/04/2020	Family Support Registry	Remittance ID 13032339	930.58
05/04/2020	Metlife	Dental Insurance	733.54
05/05/2020	CrashPlan Code42	Admin Software: Cloud Backup	9.99
05/07/2020	Garmin	Monthly Support	34.95
05/13/2020	Kirkpatrick, Elizabeth	Reimbursement of Stillwater Ditch legal fees	1,020.93
05/13/2020	Five Pine LLC - Frank Schaffner	Reimbursement of Stillwater Ditch legal fees	943.09
05/13/2020	Redmond, John & Sara	Reimbursement of Stillwater Ditch legal fees	673.44
05/13/2020	Collins, Anne	Reimbursement of Stillwater Ditch legal fees	164.92
05/13/2020	Verizon Wireless	Stagecoach Cell phones 05-14-2020 to 6-13-2020.	106.99
05/14/2020	CBI - Consensus Building Institute	Consulting 03/01-03/31/20	5,520.00
05/14/2020	Conoco Universal WEX	Gasoline.	265.17
05/14/2020	CenturyLink	Office Telephone. May 7 to June 6, 2020.	221.63
05/15/2020	Home Depot	Yamcolo O&M	314.29
05/18/2020	Resource Engineering	Water rights accounting. Stagecoach Reservoir and Elk River.	8,595.50
05/18/2020	CDC Civil Design Consultants	SW Ditch Services	5,939.95
05/18/2020	USGS	20REJFACO115 Streamflow gaging stations, Yampa River above and below Stagecoach Reservoir	5,400.00
05/18/2020	Balcomb & Green, P.C.	Miscellaneous Matters and 18CW3020 Opposition 4/1/20 - 4/30/20	976.00
		Subtotal	**70,048.59**

Upper Yampa Water Conservancy District
Cash Disbursement Report
May 31, 2020

Date	Name	Memo	Amount
05/18/2020	Element Print and Design	Website and Communications. Flyers.	298.17
05/18/2020	Edge Communications	4 SIP trunks 5 US DID February 2020. Bill 354392. May 6 to June 5, 2020 service.	103.69
05/18/2020	Amazon	Office supplies	18.63
05/19/2020	Amazon	Office supplies	38.05
05/19/2020	Element Print and Design	Website and communications. Flyers.	21.59
05/20/2020	CBI - Consensus Building Institute	Consulting 04/01-04/30/20	3,360.00
05/20/2020	Barbara Wilson	March and April services	258.75
05/20/2020	YVEA	Electrical power, Stagecoach powerhouse and shed.	234.81
05/20/2020	Adobe	Adobe software, 5-20-20 to 6-19-20	118.93
05/21/2020	Big House Burgers	Board meeting supplies	87.56
05/21/2020	Amazon	Stagecoach O&M	44.71
05/24/2020	CenturyLink	SC Telephone. May 1, 2020 to May 31, 2020.	144.32
05/28/2020	Quickbooks Payroll Service	Payroll May 2020	53,194.99
05/28/2020	SmartVault	Software, interphase with quickbooks	42.40
05/29/2020	Weiss & Van Scoyk	Legal services March. General matters, Stagecoach and Yamcolo reservoirs and Stillwater ditch.	10,107.00
05/29/2020	Weiss & Van Scoyk	Legal services April. General matters, Stagecoach and Yamcolo reservoirs.	11,734.50
05/29/2020	CDC Civil Design Consultants	SW Ditch Services 4/1 to 4/30/2020	9,381.00
05/29/2020	Steamboat Powersports	Stillwater Ditch O&M	148.34
06/02/2020	Mountain Valley Bank	Fees	43.46
06/02/2020	Grey Matter Systems	Training. Stagecoach O&M, power.	2,495.00
06/02/2020	Steamboat Specialties, Inc.	Nametags	12.45
		Subtotal	**91,888.35**
		Total Amount	**169,282.27**

UPPER YAMPA WATER CONSERVANCY DISTRICT - 2020 BUDGET COMPARISON REPORT, AS OF JUNE 15, 2020

		2018 ACTUALS	2019 ACTUALS	2020 BUDGET Approved Nov 20, 2019	2020 BUDGET Amended June 18, 2020	2020 YTD ACTUALS rev 7/1/20	2020 PROJECTIONS
	Fund Opening Balance including Encumbered Funds	12,688,407	14,279,517	16,012,901	16,012,901	16,012,901	16,012,901
	Encumbered Funds	919,734	919,734	6,222,280	6,222,280	6,222,280	6,222,280
	Emergency Facilities Reserve			4,485,814	4,485,814	4,485,814	4,485,814
	Capital Maintenance Reserve			752,436	752,436	752,436	752,436
	Stagecoach Wetlands Mitigation Reserve	419,734	419,734	419,734	419,734	419,734	419,734
	Routt County Road #14 Contribution	500,000	500,000	500,000	500,000	500,000	500,000
	Tabor Reserve			64,296	64,296	64,296	64,296
	Unencumbered Funds	11,768,673	13,359,783	9,790,621	9,790,621	9,790,621	9,790,621
	Revenues						
	Facilities						
	Stagecoach Reservoir						
1	**Power Sales**	129,492	234,324	200,000	200,000	121,644	200,000
2	**Water Sales**	505,201	433,769	116,379	116,379		116,999
	Yamcolo Reservoir						
2	**Water Sales**	130,760	121,052	163,653	163,653		163,689
3	**Stillwater Ditch & Reservoir Company**	7,744	7,965	45,279	45,279		45,279
4	**Property taxes**	2,269,399	2,415,730	2,496,565	2,496,565	1,980,765	2,496,565
5	**Interest earned**	261,280	327,104	296,100	296,100	71,642	296,100
6	**Other income**		4,000				
	Pass through income		23,644			21,437	
	revenues	**3,303,875**	**3,567,587**	**3,317,976**	**3,317,976**	**2,195,488**	**3,318,633**
	Expenditures						
	Operating						
	Facilities						
7	**Stagecoach Reservoir - Power Generation**	171,623	214,868	224,582	224,582	84,983	224,082
7	**Stagecoach Reservoir - Water storage**	279,641	220,348	278,537	300,537	93,848	297,537
8	**Yamcolo Reservoir**	132,790	125,183	156,631	156,631	52,235	153,602
9	**Stillwater Ditch & Reservoir Company**	13,379	34,520	40,834	40,834	9,908	40,834
10	**Administration**	139,144	184,031	305,889	334,465	99,001	334,465
11	**Board of Directors**	65,006	71,720	115,304	190,684	74,879	156,914
12	**External Affairs**	58,016	70,807	121,909	121,909	53,660	117,267
13	**Finance**	99,340	111,594	152,813	152,813	53,745	147,763
14	**Legal**	166,889	125,521	158,090	158,090	85,477	158,090
15	**Planning**	136,625	205,229	74,572	74,572	20,082	74,572
16	**Grants, Scholarships & Public Information**	39,038	170,299	253,390	253,390	72,910	243,510
17	**Treasurer fees**	72,507	74,607	80,650	80,650	45,274	80,650
	Pass through expenses		11,724			24,137	
	Subtotal Operating	**1,373,999**	**1,620,451**	**1,963,200**	**2,089,156**	**770,140**	**2,029,286**
	Capital						
7	**Stagecoach Reservoir - Power Generation**	3,967	27,533	50,000	50,000	2,085	50,000
7	**Stagecoach Reservoir - Water storage**	27,462	22,214	50,000	50,000		50,000
8	**Yamcolo Reservoir**	302,537	57,852	80,000	80,000	13,902	80,000
9	**Stillwater Ditch & Reservoir Company**		38,426		120,000	5,940	120,000
10	**Office Space**	4,800	67,728				
	Subtotal Capital	**338,766**	**213,752**	**180,000**	**300,000**	**21,927**	**300,000**
	expenditures	**1,712,765**	**1,834,203**	**2,143,200**	**2,389,156**	**792,067**	**2,329,286**
	net income (loss)	**1,591,111**	**1,733,384**	**1,174,775**	**928,819**	**1,403,421**	**989,347**
	Ending Fund Balance	**14,279,517**	**16,012,901**	**17,187,676**	**16,941,720**	**17,416,322**	**17,002,248**

COLORADO
Department of Local Affairs
Division of Local Government

LOCAL GOVERNMENT BUDGET CALENDAR

The budget calendar is a general listing of the deadlines for the budget, for an audit and for the property tax certification process. Some deadlines are not statutory, but reflect good budgeting practices. For details on the applicable statutes listed below, please refer to the most current Colorado Revised Statutes ("C.R.S.")

DATE	EVENT / ACTIVITY
1-Jan	Start of Fiscal Year; begin planning for the budget of the next year.
10-Jan	Deadline for assessor to deliver tax warrant to county treasurer (C.R.S 39-5-129.)
31-Jan	A certified copy of the adopted budget must be filed with the Division. (C.R.S 29-1-113(1)). **- If a budget is not filed, the county treasurer may be authorized to withhold the local government's tax revenues. -**
10-Feb	The Division sends notification to local governments whose budgets have not been filed with the Division.
1-Mar	The U.S. Bureau of Labor Statistics releases the Consumer Price Index (the "CPI") for the Denver/Boulder area. This annual percent change is used with "local growth" to calculate "fiscal year spending" and property tax revenue limitations of TABOR. (Article X, Sec. 20, Colo. Const.)
15-Mar	The Division will authorize the county treasurer to withhold tax revenues until a certified copy of the budget is filed with the Division.
31-Mar	Deadline to request exemption from audit. (C.R.S 29-1-604(3)) Contact the Local Government Audit Division, Office of the State Auditor, (303) 869-2800. The Division notifies local governments of its determination that the entity has exceeded the statutory property tax revenue limit (the "5.5%" limit).
30-Jun	Deadline for auditor to submit audit report to local government governing body. (C.R.S 29-1-606(a)(1))
31-Jul	Deadline for submitting annual audit report to the Office of the State Auditor. (C.R.S 29-1-606(3)) Deadline for request for extension of audit. (C.R.S 29-1-606(4)) **- If an audit is required but has not been filed, the county treasurer may be authorized to withhold the local government's tax revenue -**
25-Aug	Assessors certify to all taxing entities and to the Division of Local Government the total new assessed and actual values (for real and personal property) used to compute the statutory and TABOR property tax revenue limits. (C.R.S 39-5-121 (2)(b) and 39-5-128,.) **If applicable, upon receipt of the Certification of Valuation, submit to the Division certifications of service impact from increased mining production and/or from increased valuation due to previously exempt federal property which has become taxable. Certifications of impact are required if the value is to be excluded from the tax revenue limit.** If applicable, apply to the Division for authorization to exclude from the limit the assessed valuation attributed to new primary oil or gas production from any producing land or leaseholds.
15-Oct	Budget officer must submit proposed budget to the governing body. (C.R.S. 29-1-105) Governing body must publish "Notice of Budget" upon receiving proposed budget. (C.R.S. 29-1-106(1))
1-Nov	Deadline for submitting applications to the Division for an increased levy pursuant to 29-1-302, C.R.S. and applications for exclusion of assessed valuation attributable to new primary oil or gas production from the 5.5% limit pursuant to (C.R.S. 29-1-301 (1)(b))
10-Dec	Assessors' changes in assessed valuation will be made only once by a single notification (re-certification) to the county commissioners or other body authorized by law to levy property tax, and to the DLG. (C.R.S. 39-1-111(5))
15-Dec	Deadline for certification of mill levy to county commissioners (C.R.S 39-5-128(1)). Local governments levying property tax must adopt their budgets before certifying the levy to the county. If the budget is not adopted by certification deadline, then **90 percent** of the amounts appropriated in the current year for operations and maintenance expenses shall be deemed re-appropriated for the purposes specified in such last appropriation. (C.R.S. 29-1-108(2) and (3))
22-Dec	Deadline for county commissioners to levy taxes and to certify the levies to the assessor. (C.R.S. 39-1-111(1))
31-Dec	Local governments not levying a property tax must adopt the budget on or before this date; governing body must enact a resolution or ordinance to appropriate funds for the ensuing fiscal year. If the budget is not adopted by certification deadline, then **90 percent** of the amounts appropriated in the current year for operations and maintenance expenses shall be deemed re-appropriated for the budget year. (C.R.S 29-1-108(4))

More information and contact information is available on our website – www.dola.colorado.gov/budgets

Use our  **system by visiting** www.dola.colorado.gov/e-filing

UPPER YAMPA WATER
CONSERVANCY DISTRICT

BOARD COMMUNICATION FORM

From: Holly Kirkpatrick, Communications & Marketing Manager

Date: 7/10/2020

Item: Augmentation Contract No. A3-009-2020

_____ DIRECTION
x_____ INFORMATION
x_____ MOTION
_____ RESOLUTION

I. Request/Issue and Background Information:

KTH Enterprises is requesting a Yampa River augmentation contract in the amount of 3.022 acre feet (AF). Augmentation Contract No. A3-009-2020 is attached for your review.

II. Summary and Alternatives:

N/A

III. Staff Recommendation:

Staff recommends approval of the augmentation contract for KTH Enterprises in the amount of 3.022 AF.

IV. Legal Issues:

N/A

V. Consistency with Board Goals and Policies:

UYWCD Strategic Plan Goal: 4.2

Attachments:

Attachment 1: Augmentation Contract No. A3-009-2020

AUGMENTATION CONTRACT No. A3-009-2020
UPPER YAMPA WATER CONSERVANCY DISTRICT

KTH Enterprises, LLC (hereinafter "Applicant") has applied to the Upper Yampa Water Conservancy District (hereinafter the "District") a political subdivision of the State of Colorado, organized pursuant to and existing by virtue of Section 37-45-101, Colorado Revised Statutes, *et seq.*, for an augmentation contract for use of water supplies owned, leased, or hereafter acquired by the District. By execution of this Contract, Applicant and District agree to the following terms and conditions.

1. AUGMENTATION SUPPLY.

A. In consideration of the covenants and conditions herein contained, Applicant shall be entitled to the release of 3.022 acre feet per year of storage or other augmentation water owned or controlled by the District (the "Contracted Water") for use to augment depletions from Applicant's out-of-priority diversions pursuant to the District's Decree entered December 15, 2008 in Case No. 06CW049, Colorado Water Division No. 6 ("Augmentation Decree") and any amendments thereof obtained by the District in its sole discretion.

B. The Contracted Water amount is based on the water requirements table attached hereto as Exhibit A. Applicant shall restrict consumptive use under this Contract to that amount. Any increase or change in the water requirements to be supplied by the District shall require application for and issuance of a replacement contract, and cancelation of this Contract.

C. Any quantity of the Applicant's Contracted Water that is not used by Applicant by the end of each water year shall not carry over for the Applicant's future use but shall revert to the water supplies of the District. Such reversion shall not entitle Applicant to any refund of payment made for such water supply.

D. Contracted Water will be derived from exercise of the District's water rights decreed for augmentation pursuant to the Augmentation Decree. The District shall have the right, but not the obligation, to designate the water right(s) from which the Applicant's Contracted Water shall be released and to change that designation at any time in its discretion.

E. Applicant's use of any of the Contracted Water shall be subject to any and all terms and conditions imposed by the Water Court on the use of the District's water rights.

F. The water service provided hereunder is expressly subject to the provisions of the District's Water Marketing Policy, which provides, in part, for the possible curtailment of uses upon the occurrence of certain events and upon the District giving notice of such curtailment, all as more fully set forth therein. The service is specifically dependent on the legal and physical availability of the Contracted Water for delivery, and the District shall have no liability to Applicant for its inability to deliver any or all of the Contracted Water for such reasons.

G. Nothing herein gives the Applicant any equitable or legal title interest or ownership in or to any of the District's water or water rights or the facilities by which they are managed for use. Applicant is only entitled to benefit from the water supply allotted hereunder subject to the limitations, obligations and conditions of this Contract. Applicant shall not institute any legal proceedings for the approval of an augmentation plan and/or any change of the District's water rights.

H. The District's issuance of this Contract to the Applicant is based upon the Applicant's written application and the related information provided by the Applicant to the District in connection with that application. Applicant represents and warrants that the information provided in the contract application is accurate and complete.

2. PURPOSE AND LOCATION OF USE.

A. Applicant will use the Contracted Water to augment diversions at Applicant's point(s) of diversion. Applicant will use the Contracted Water within or through facilities or upon land owned, operated, or served by Applicant, which land is within the District's boundaries and is described on Exhibit B attached hereto; provided, that the location and purpose of Applicant's use of Contracted Water must be legally recognized and permitted by the applicable governmental authorities having jurisdiction over the property served. Any change in the location of use shall require application for and issuance of a replacement contract.

B. Applicant's contemplated use for the Contracted Water is for augmentation of the following use or uses as the same are defined in the

District's Water Marketing Policy: [Select] □ Domestic, □ Commercial, □ Industrial, □ Irrigation, □ Recreation (pond and channel evaporation).

3. AUGMENTATION PLAN IMPLEMENTATION AND COMPLIANCE.

A. The District shall be responsible for the implementation of the Augmentation Decree including, without limitation, the review of water allotment contract applications with the Division Engineer and any other parties, making needed augmentation releases, and accounting for augmentation releases made for Applicant and other District allottees.

B. Applicant shall provide, at its own expense, a totalizing flow meter or other device approved by the District prior to installation, to continuously and accurately measure at all times all water diverted pursuant to the Augmentation Decree. On or before November 5 of each year, or more frequently if required by the Division Engineer, Applicant shall provide accurate readings from such device or meter (recorded on a monthly basis for the period November 1 through October 30 of each year) to the District, the Division Engineer and Water Commissioner. Applicant acknowledges that failure to comply with these provisions could result in legal action to terminate Applicant's diversion of water by the District or the State of Colorado, Division of Water Resources.

C. Applicant hereby specifically allows the District, through its authorized agents, to enter upon Applicant's property during ordinary business hours for the purposes of determining Applicant's measurement capabilities and actual use of water.

D. If Applicant intends to divert through a well, Applicant must provide to the District a copy of Applicant's valid well permit before the District is obligated to deliver any Contracted Water, and it is the Applicant's continuous duty to maintain a valid well permit. Applicant shall also comply with all restrictions and limitations set forth in the well permit obtained from the Colorado Division of Water Resources. Applicant must comply with the well-spacing requirements set forth in C.R.S. § 37-90-137, as amended, if applicable. Compliance with said statutory well-spacing criteria is an express condition of the extension of service hereunder, and the District shall in no way be liable for an Applicant=s failure to comply. Applicant agrees to mark the well in a conspicuous place with the permit number.

4. PAYMENTS.

A. Applicant shall pay the District annually for the Contracted Water herein at a price to be fixed annually by the Board of Directors of the District for such service. Payment of the annual fee shall be made, in full, within fifteen (15) days after the date of a notice from the District that the payment is due. Said notice will advise the Applicant, among other things, of the water delivery year to which the payment shall apply and the price which is applicable to that year. If a payment is not made by the due date, a late fee of $50 (or such other amount as the Board may set from time to time) will be assessed and final written notice of the delinquent account and late fee assessment will be sent by the District to the Applicant at Applicant's address set forth below. If payment is not made within thirty (30) days after said final written notice, the District may, at its option, elect to terminate all of the Applicant's right, title, or interest under this Contract, in which event the Contracted Water may be transferred, leased or otherwise disposed of by the District at the discretion of its Board of Directors.

B. If water deliveries hereunder are made by or pursuant to agreement with some other person, corporation, quasi-municipal entity, or governmental entity, and in the event the Applicant fails to make payments as required hereunder, the District may, at its sole option and request, authorize said person or entity to curtail the Applicant's water service pursuant to this Contract, and in such event neither the District nor such persons or entity shall be liable for such curtailment.

C. Applicant agrees that so long as this Contract is valid and in force, Applicant will budget and appropriate from such sources of revenues as may be legally available to the Applicant the funds necessary to make timely annual payments. Applicant will hold harmless the District and any person or entity involved in the delivery of water pursuant to this Contract for discontinuance in service due to the failure of Applicant to maintain the payments herein required on a current basis.

5. TERM. The term of this contract shall be for forty (40) years from January 1st of the year in which it is executed.

6. ASSIGNMENTS.

A. The Contracted Water shall be beneficially used for the purposes and in the manner specified herein, and this Contract is for the exclusive benefit of the Applicant's property and shall inure to the benefit of any successor in interest to the fee title to said property upon written assignment and notice thereof to the District, and subject to proof of eligibility as provided in the District's Water Marketing Policy, said assignment to be made using the District's approved assignment form.

B. Upon the sale of the real property to which this Contract pertains, Applicant has a duty to make the buyer aware of this Contract and of the need to assign the Contract to the buyer. Written notice of assignment to the District shall be necessary for the assignment to become effective. Payment of an assignment fee in an amount determined by the Board shall be required as a prerequisite to approval of the assignment.

C. If the Contracted Water will be used for the benefit of land that is now or will hereafter be subdivided or otherwise held or owned in separate ownership interests, Applicant may assign Applicant's rights hereunder only to a homeowners association, property owners association, water district, water and sanitation district or other special district, or other entity properly organized and existing under and by virtue of the laws of the State of Colorado, and then only if such entity establishes to the satisfaction of the District that it has the ability and authority to assure its performance of the Applicant's obligations under this Contract. In no event shall the owner of a portion but less than all of the property served under this Contract have any rights hereunder, except as such rights may exist through an association or special district as above provided.

D. The restrictions on assignment contained herein shall not preclude the District from holding the Applicant, or any successor to the Applicant, responsible for the performance of all or any part of the Applicant's covenants and agreements herein contained.

7. MULTIPLE OWNERSHIP.

A. In the event of the division of the property served by this Contract into two or more parcels owned by different persons or entities, in addition to the obligations in Section 5 C. above, the Applicant shall give notice to purchasers of any part of the subject property of the obligations of this Contract and shall record

such notice in the records of the Clerk and Recorder of the county in which such property is located.

B. If such divided property is to be served by a shared well, as a condition of service under this Contract, all of the owners of such property shall execute and record a well sharing agreement in a form acceptable to the District and provide evidence thereof to the District.

8. APPLICANT'S LEGAL COMPLIANCE.

A. Applicant's rights under this Contract shall be subject to the Water Marketing Policy and to any Water Service Plan adopted by the District and amended from time to time; provided, that such Policy and Plan shall apply uniformly throughout the District among water users receiving the same service from the District. Applicant shall also be bound by all applicable laws and regulations, including, for example, the provisions of the Water Conservancy Act of the State of Colorado.

B. Applicant shall comply with all federal, state, and local governmental laws and regulations in the construction, maintenance, operation, replacement or repair of the facilities required to divert and use water that is augmented pursuant to this Contract. Upon demand of the District, Applicant shall provide the District with documentary proof of such compliance.

C. Applicant shall only charge its water customers, if any, who are supplied based upon the Contracted Water such rates, charges, and fees as are permitted by Colorado law.

D. Applicant shall not discriminate in availability of or charges for any water service or water supply made available pursuant to or based upon the Contracted Water on account of race, color, religion, national origin, or any other criteria prohibited under state or federal law.

E. Applicant shall implement and use commonly accepted conservation practices with respect to use of water augmented by the supply allotted under this Contract and shall be bound by any conservation plan hereafter adopted by the District, as the same may be amended from time to time.

9. CONTRACT TERMINATION.

A. Termination by District:

1. The District may terminate this Contract for any violation or breach of the terms of this Contract by Applicant, including as provided in Section 4.A. above regarding delinquent payments.

2. The District may terminate this Contract if, in its discretion, any judicial or administrative proceeding initiated by Applicant threatens the District's authority to contract for delivery or use of the District's water rights, or threatens the District's permits, water rights, or other interests of the District.

3. The District may terminate this contract if Applicant opposes any of the District's Water Court applications regarding the District's water rights used for augmentation pursuant to the Augmentation Decree.

B. Termination by Applicant: Applicant may terminate this Contract in its entirety for any reason by notifying the District in writing of the termination on or before April 1. Notice by said date will prevent the Applicant's liability for the next annual contract charge.

C. Notice to Division Engineer: Upon termination of this Contract by either the District or Applicant, the District will provide notice of such termination to the Office of the Division Engineer, Colorado Division of Water Resources. The District shall have no liability to Applicant for any administrative or legal action taken by the Division Engineer or other representatives of the State of Colorado to curtail or limit Applicant's use of water previously augmented by the Contracted Water under this Contract.

10. FORCE MAJEURE. The District shall not be responsible for any losses or damages incurred as a result of the District's inability to perform pursuant to this Agreement due to the following causes if beyond the District's control and when occurring through no direct or indirect fault of the District, including without limitation: Acts of God; natural disasters; actions or failure to act by governmental authorities; unavailability of supplies or equipment necessary to the District's ability to perform; major equipment or facility breakdown; and changes in Colorado or federal law, including, without limitation, changes in any permit requirements.

11. NOTICES. All notices required or appropriate under or pursuant to this contract shall be given in writing mailed or delivered to the parties or sent by internet communication at the following addresses:

Notice to Applicant
KTH Enterprises LLC
c/o Tom & Karen Hill
268 Larkspur Drive
Carbondale, CO 81623

Notice to District
Upper Yampa Water Conservancy District
Attention: Holly Kirkpatrick
P.O. Box 775529
Steamboat Springs, CO 80477
hkirkpatrick@upperyampawater.com and
uywcd@upperyampawater.com

Either Party may by notice given in accordance with this provision change the addresses to which future notices shall be mailed or delivered.

12. BREACH AND REMEDIES.

A. In the event of any breach of this Contract by the Applicant, the District may, in addition to contract termination as provided herein, pursue any additional remedy available to the District against the Applicant in law or in equity. Applicant may do likewise in the event of breach by the District. The prevailing party in any litigation regarding such breach shall be entitled to recovery of its reasonable attorneys' fees.

B. Venue for any dispute regarding this Contract shall be in the District Court for Routt County, Colorado.

13. RECORDING OF MEMORANDUM. In lieu of recording this Water Augmentation Contract, a Memorandum of Water Augmentation Contract will be recorded with the Routt County Clerk and Recorder's Office. The costs of recording the Memorandum shall be paid by Applicant.

APPLICANT:
KTH Enterprises LLC
BY: Tom Hill

Tom Hill, Owner

Applicant's Address:
268 Larkspur Drive
Carbondale, CO 81623

Telephone No.: (970) 379-1237

STATE OF COLORADO)
) ss.
COUNTY OF Eagle)

Subscribed and sworn to before me this 6th day of July, 2020, by Thomas Carl Hill.

WITNESS my hand and official seal.
My commission expires: January 11, 2023

Notary Public

FATIMA MARTINEZ HERNANDEZ
NOTARY PUBLIC - STATE OF COLORADO
NOTARY ID 20184045969
MY COMMISSION EXPIRES JAN 11, 2023

UPPER YAMPA WATER CONSERVANCY DISTRICT

This contract was executed by the District effective February 1, 2018.

By: _____
Ken Brenner, President

STATE OF COLORADO)
) ss.
COUNTY OF ROUTT)

Subscribed and sworn to before me this _____ day of _____, 20__, by _____, President, Upper Yampa Water Conservancy District.

WITNESS my hand and official seal.
My commission expires:

_____
Notary Public

ATTEST:

_____
Andy Rossi, Secretary

STATE OF COLORADO)
) ss.
COUNTY OF ROUTT)

Subscribed and sworn to before me this _____ day of _____, 20__, by _____, Secretary, Upper Yampa Water Conservancy District.

WITNESS my hand and official seal.
My commission expires:

_____
Notary Public

UPPER YAMPA WATER
CONSERVANCY DISTRICT

BOARD COMMUNICATION FORM

From: Andy Rossi, Acting General Manager
Hydros Consulting
Date: 07/8/20

Item: Colorado River Risk Study Phase III Yampa Doctrine and Equitable Apportionment Analysis

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__X__ DIRECTION
__X__ INFORMATION
_____ MOTION
_____ RESOLUTION

I. Background Information:

The Colorado River Basin is in the midst of a drought that began in 2000 and continues today. Average naturalized flows at Lee Ferry during this period are less than would be needed to meet the full compact allotments of the seven basin states and to the Mexican Treaty obligation to Mexico. Recent droughts have significantly reduced storage levels in Lake Powell. If these droughts were to repeat themselves today, the ability of Lake Powell to satisfy its compact-obligation and power-generation purposes would be threatened. Drought Contingency Plans (DCP) are being developed for both the Upper and Lower Basins. While those plans, if implemented, would reduce the risk of a compact deficit or critically low storage levels at Lake Powell, they do not completely eliminate the risk for the Upper Basin States.

Concurrent with the DCP efforts, Colorado completed its Water Plan, which lays the foundation for a secure water supply for the State. Point #4 of the Plan's Seven Point Framework is to take actions that minimize the risk of a Colorado River Compact curtailment. That objective, plus concerns voiced by the West Slope Basin Round Tables (BRTs) in a joint meeting in December 2014, provided the catalyst for the Colorado River Risk Study.

Phase I of the Colorado River Risk Study built directly upon work conducted for the Upper Colorado River Commission that explored risks to Lake Powell and Upper Basin water users, and the effectiveness of proposed Drought Contingency Plans in reducing or eliminating

those risks. Particular emphasis was given to potential deficits at Lake Powell relative to critical target elevations, and Colorado's potential share of those volumes. The Phase I analyses utilized Reclamation's CRSS model.

Phase II further refined the "Big River" analysis from Phase I, and explored certain aspects of demand management, shepherding, and water banking options within the State of Colorado, using the State's CDSS (StateMod) tools. The purpose of the StateMod investigation was two-fold. One purpose was to better understand how StateMod could be used to model demand management, water banking, and delivery of conserved demand management water to Lake Powell. A second objective was to better understand the variability in yields across the west-slope sub-basins under different hydrologic conditions, levels of demand management, and water shepherding assumptions.

Phases I and II of the Risk Study set the stage for Phase III by evaluating system-wide risks in the Colorado Basin, and also by developing a new approach to modeling both in-state (Colorado) impacts of potential involuntary curtailment, and/or the development of a demand management program. This modeling approach utilizes the State of Colorado's StateMod water rights simulation model and Reclamation's CRSS (Colorado River Simulation Model). The models share data generated by evaluation of different management, conservation, and administration scenarios, and can be used to better understand the feedback mechanisms and relationships between in-State actions and Basin-wide conditions (particularly at Lake Powell). The Phase III study utilized these tools to revisit current and future risks and explore some potential approaches to involuntary curtailment. The final reports for Phases I, II, And II are included with this communication as reference.

II. Summary and Alternatives:

In December of 2019, the Upper Yampa Water Conservancy District (UYWCD) partnered with the Colorado River District to employ Hydros Consulting to conduct an analysis of the Yampa Doctrine and Equitable Apportionment concepts in the framework of the Phase III Risk Study. The Draft Technical Report on this analysis is presented along with background information on the Colorado River Risk Study. Taylor Adams of Hydros Consulting will present the findings of the Yampa Doctrine and Equitable Apportionment analysis.

UPPER YAMPA WATER
CONSERVANCY DISTRICT

III. Staff Recommendation:

Direct UYWCD General Manager to develop next steps for continued Risk Study Analysis for the Yampa Basin to be included for discussion at the October 2020 UYWCD BOD retreat.

IV. Legal Issues:

NA

V. Consistency with Board Goals and Policies:

2020 UYWCD Strategic Plan 1.1

Attachments:

1. DRAFT REPORT: Colorado River Risk Study Yampa Doctrine and Equitable Apportionment Analysis
2. 2009 Memo authored by Tom Sharp on the origins of the Yampa Doctrine
3. Slides from a presentation given by State Engineer, Kevin Rein on the State Engineer's Office Compact Compliance Strategy
4. The document that started all of this: The 1922 Colorado River Compact
5. The 1948 Upper Colorado River Basin Compact
6. Final Report: Phase I and II Colorado River Risk Study
7. Final Report: Phase III Colorado River Risk Study
8. 1997 Memo from Bart L. Rickenbaugh Asst. AG to Wendy Weiss 1st Asst. AG State of Colorado RE: Yampa Apportionment

DRAFT TECHNICAL REPORT

Colorado River Risk Study
Yampa Doctrine and
Equitable Apportionment Analyses

May 12, 2020

Prepared for the Upper Yampa Water Conservancy District and the Colorado River District

Prepared by:
Hydros Consulting Inc.
1628 Walnut Street
Boulder, Colorado 80302

Disclaimer

Hydros Consulting Inc., the Upper Yampa Water Conservancy District, and the Colorado River District, acknowledge that the findings presented herein are based on specific modeling assumptions and are intended for discussion purposes only. Neither this Report, nor any of the findings contained herein, represent an official or final position of the Upper Yampa Water Conservancy District, the Colorado River District, or any other entity with respect to the law of the Colorado River or State of Colorado water use, law, administration or policy. This study is a work in progress, and the assumptions and conclusions are subject to future modification based on pertinent developments and/or the intent of the proponents to study risk under different scenarios.

I. Introduction

The Yampa Doctrine concept has its roots in Article XIII of the Upper Colorado River Compact. In essence, that Article states that Colorado shall not deplete the Yampa River, as measured at the Yampa River near Maybell, CO gage (USGS gage 09251000), such that the rolling 10-year total volume is less than 5.0 million acre-feet (MAF). Unless and until such a situation occurred, the Yampa Doctrine asserts that all water rights in the Yampa Basin are protected and exempt from curtailment under a Colorado River Compact call. This report documents analysis of the application of the Yampa Doctrine to hypothetical curtailment scenarios that were evaluated in Phase III of the Colorado River Risk Study.

In addition to discussion of the impacts of the Yampa Doctrine on the full and partial call scenarios from the Risk Study, this report documents enhancements made to an Excel spreadsheet model that was developed for exploration of Equitable Apportionment scenarios. The Excel spreadsheet model allows for calculation of curtailment volumes for user-defined scenarios based upon reducing depletions first in basins with the highest ratio of depletions to natural flow. Analysis of an Equitable Apportionment scenario based upon post-compact depletions is also included as an example of the water rights administration that would correspond to Equitable Apportionment.

II. Analysis of Yampa Doctrine Compact Call Scenarios

The Phase III Colorado River Risk Study Report (Section V) provides a detailed description of the assumptions and methods applied to simulate a Colorado River Compact call and calculates the yield of a hypothetical call. This report's analysis of the Yampa Doctrine focuses on the full statewide and partial statewide call

scenarios from the Phase III report. The Phase III Study included simulation of a baseline scenario (no Compact call). The ten-year sum of flows at the Yampa River at Maybell gage in the baseline scenario exceeds 9 MAF at all times, which is sufficiently higher than the 5 MAF threshold defined by the Yampa Doctrine to prevent curtailment within the Yampa Basin. Accordingly, this analysis focuses on the impact to water users in other basins if no Compact curtailment of post-compact rights occurred in the Yampa Basin.

A) Full Statewide Call Scenario

The potential impact of application of the Yampa Doctrine to the full statewide call scenario was assessed by comparing the yield of a Compact call in the Yampa Basin to the yield from the remainder of the Colorado River basins within Colorado. By comparing the annual yield from the Yampa Basin to the monthly yields from the remainder of the State, the additional amount of time over which a call would need to remain in place to offset the impact of the Yampa Doctrine can be estimated.

The simulated annual yield of a Compact call in the Yampa Basin ranges from 50,440 AF to 68,468 AF, with an average value of 58,438 AF. The Colorado River Compact defines the ten-year period which determines if a call is applied as ending on September 30th of each year. No details are available to indicate that implementation of curtailment would not begin immediately in the following October, so this analysis applies the assumption that annual calls would persist from October through the following September. Table 1 lists the number of months in the following water year over which the call would need to persist to achieve the previous water year's yield simulated for a full call in the Yampa Basin.

Readers may notice that the table below shows a multi-month call in order to yield roughly 58 KAF on average, although that volume is only a little more than 5% of the total volume of post-Compact depletions. The duration of the call is longer than may be expected because the call would persist into the late fall and winter, when consumptive uses are generally very low. If the "extra" call were to occur in mid-summer, that volume could be easily achieved within a single month.

Table 1. Additional Length of Prolonged Statewide Full Call by Water Year

Water Year	Additional Months Required
1988	2
1989	2
1990	3
1991	2
1992	2
1993	2
1994	2
1995	2
1996	2
1997	3
1998	5
1999	3
2000	3
2001	2
2002	3
2003	2
2004	3
Average	2.5

B) Partial Statewide Call Scenarios

The partial statewide call scenarios evaluated in Phase III of the Risk Study involved determination of a call date that could be applied in each basin to achieve yields of 100 KAF, 300 KAF, or 600 KAF per year on average. Applying the Yampa Doctrine to these scenarios involves determining the call date that would achieve these volumes without any curtailment of water rights in the Yampa Basin.

For the 100 KAF scenario, the call date is the same whether or not the Yampa Doctrine is applied. This result occurs because a call date in August of 1957 produces less than 100 KAF of yield on average, and a call date in July of 1957 produces more than 100 KAF of yield on average regardless of whether the Yampa Doctrine is applied. For the 300 KAF and 600 KAF scenarios, application of the Yampa Doctrine increases the seniority of the required call. The most significant change results from the 300 KAF scenario, where the seniority of the call increases by 4 years and 3 months. In the 600 KAF scenario, the seniority of the call increases by only one month. Table 2 lists the partial call dates that result from application of the Yampa Doctrine for each scenario.

Table 2. Call Dates for Partial Call Scenarios

Scenario	Baseline Call Date	Yampa Doctrine Call Date
100 KAF	July 1957	July 1957
300 KAF	September 1940	June 1936
600 KAF	August 1935	July 1935

III. Equitable Apportionment Analysis

The fundamental basis of the Equitable Apportionment concept is that no basin would be curtailed while other basins are depleting a higher relative proportion of their natural flow. Variations on this concept include basing the calculations on total depletions, or on post-compact depletions only, and whether the definition of the Upper Colorado Basin includes trans-mountain diversions (TMDs) or if the TMDs are handled as a separate basin. In addition to these variations, the results of Equitable Apportionment calculations are affected by the period chosen for calculating natural flow and depletion volumes.

In order to facilitate the analysis of user-defined hypothetical versions of the Equitable Apportionment concept, an Excel workbook was developed by Colorado River District staff and modified by Hydros. In addition to a description of the workbook, this report includes analysis of the call dates that would result in the Equitable Apportionment curtailment volumes for the partial call scenarios using post-compact depletions as the basis for apportionment and separating TMDs as a unique basin.

A) Equitable Apportionment Workbook

The Excel workbook that carries out Equitable Apportionment calculations is conceptually organized into the following sections:

- User Interface
- Data Tables
- Results Tables

The User Interface section of the workbook is depicted in Figure 1:

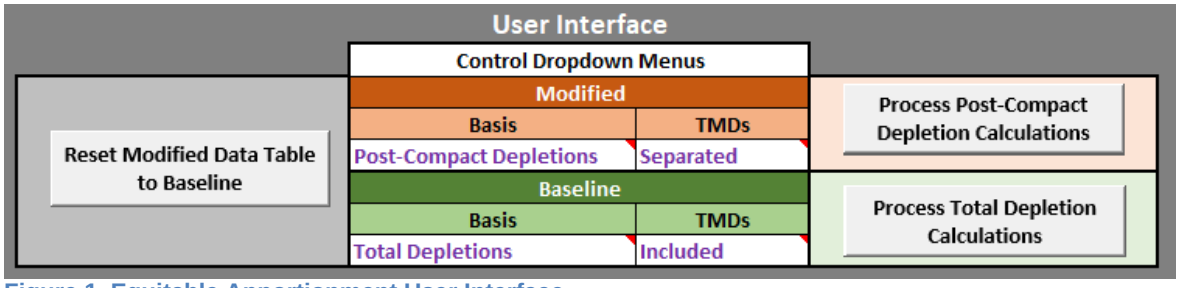

Figure 1. Equitable Apportionment User Interface

The cells with purple text contain dropdown menus that allow the user to define whether post-compact or total depletions are used as the basis of the Equitable Apportionment calculations, and whether TMDs are included in the Upper Colorado Basin, or separated as their own unique basin. The buttons on the right carry out Equitable Apportionment calculations for either the baseline or the modified scenario, and the button on the left can be used to reset the modified data table to the values of the baseline scenario.

The modified data table is depicted in Figure 2:

	Modified Data Table					
River Basin	Natural Flow	Total Depletions	Post-Compact Depletions	Total Depletion % of Natural Flow	Post- Compact Depletion % of Natural Flow	Include Basin in Modified Scenario Calculations?
Yampa	1,234,543	197,982	58,441	16.04%	4.73%	TRUE
White	569,153	62,060	11,888	10.90%	2.09%	TRUE
Colorado		-	-	**0.00%**	**0.00%**	TRUE
Colorado TMDs	**3,574,133**	551,129	531,956	15.42%	14.88%	TRUE
Colorado in-basin		669,257	94,260	18.73%	2.64%	TRUE
Gunnison	2,323,568	551,150	57,273	23.72%	2.46%	TRUE
Dolores / San Juan	2,806,000	500,717	178,163	17.84%	6.35%	TRUE
Total	**10,507,397**	**2,532,295**	**931,981**	**24.10%**	**8.87%**	

Figure 2. Modified Data Table

The modified data table is structured similarly to the baseline data table, with the exception that the modified table includes the option to include each basin in the calculations or not, which is not an option for the baseline scenario. Cells with red text in the modified data table indicate values that differ from baseline values. In the example depicted in Figure 2, the post-compact depletions in the Yampa have been altered from the baseline, which affects the four cells with red text.

After the user has defined the assumptions for the scenarios and made any desired modifications to the modified data table, the calculations can be carried out using the buttons on the right of the User Interface. The calculations proceed by iteratively reducing depletions in the basin with the highest proportional depletion of natural flow until that basin's depletion as a percentage of natural flow matches the next highest, and then adding the next highest basin to the

group of curtailed basins, and adjusting the group so that the proportion of remaining depletions in the curtailed basins are equal. Figure 3 illustrates the results table for the baseline scenario, using post-compact depletions as the basis for apportionment and separating TMDs as a unique basin:

	Results: Allocation of Reduced Depletion Volumes Scenario 4: Post-Compact Depletions, TMDs Separated.							
	100,000 AF		300,000 AF		600,000 AF		932,000 AF	
River Basin	Volume coming from individual basin	Remaining Post-Compact Depletions as %	Volume coming from individual basin	Remaining Post-Compact Depletions as %	Volume coming from individual basin	Remaining Post-Compact Depletions as %	Volume coming from individual basin	Remaining Post-Compact Depletions as %
Yampa	-		-		29,195	2.37%	58,442	0.00%
White	-		-		-		11,889	0.00%
Colorado	-		-		-		-	
Colorado TMDs	100,000	12.09%	300,000	6.49%	447,289	2.37%	531,961	0.00%
Colorado in-basin	-		-		9,593	2.37%	94,265	0.00%
Gunnison	-		-		2,230	2.37%	57,276	0.00%
Dolores / San Juan	-		-		111,692	2.37%	178,167	0.00%
Total	**100,000**		**300,000**		**600,000**		**932,000**	

Figure 3. Post-Compact, TMD-Separated Baseline Results Table

The proportional post-compact depletions of the TMDs are the highest of any basin, which results in curtailment of the TMDs until their remaining post-compact depletions equal 6.35% of their natural flow, which is the percentage of the next highest basin. Based upon this, the entire curtailment volume for both the 100 and 300 KAF partial call scenarios is apportioned to the TMDs. For the 600 KAF scenario, reductions are required in all basins other than the White, and the reductions are apportioned so that the remaining amount of post-compact depletions in each basin corresponds to 2.37% of the natural flow. In addition to the three partial call scenarios evaluated for the baseline scenario, the modified scenario includes a user-specified partial call scenario, where the target volume for curtailment can be set to a new hypothetical value.

B) Equitable Apportionment Example Scenario Call Dates

The Equitable Apportionment volumes depicted in Figure 3 were analyzed using the call date estimation procedure described in the Risk Study Phase III report as an example of the water rights administration that would be required to achieve the targeted curtailment volumes. The call date estimation procedure involves determining the month in which the call date would need to fall to produce the targeted volume on average through comparative analysis of StateMod run results.

The call dates that produce the target volumes listed in Figure 3 are shown in Figure 4. Referring back to Figure 3, the 600 KAF call is apportioned such that each of the basins other than the White is curtailed to the point where post-compact depletions equal 2.37% of the natural flow. The White Basin is not curtailed, because un-curtailed post-compact depletions equal 2.09% of the natural flow. With this in mind, the dates listed as 600 KAF call dates in Figure 4

correspond to the month in which post-compact depletions passed 2.37% of the natural flow in each basin. These dates vary widely across the basins, due to differences in the pace of development across the State.

Post-Compact Depletions, TMDs Separated			
River Basin	**100 KAF Call Date**	**300 KAF Call Date**	**600 KAF Call Date**
Yampa			8/1/1960
White			
Colorado TMDs	5/1/1948	8/1/1935	9/1/1934
Colorado in-basin			1/1/1981
Gunnison			11/1/1957
Dolores / San Juan			8/1/1940

Figure 4. Equitable Apportionment Partial Call Dates

MEMO:

FROM: **Tom Sharp, Steamboat Springs, CO**

TO: **Whom it may concern**

RE: **EXPLANATION AND JUSTIFICATION FOR THE "YAMPA DOCTRINE" REGARDING ARTICLE XIII OF THE UPPER COLORADO RIVER COMPACT**

DATE: **November 17, 2009**

Article XIII of the Upper Colorado River Compact states that, "Subject to the provisions of this compact, the rights to the consumptive use of the water of the Yampa river . . . are hereby apportioned between the states of Colorado and Utah in accordance with the following principles: (a)The state of Colorado will not cause the flow of the Yampa River at the Maybell gauging station to be depleted below an aggregate of 5,000,000 acre-feet for any period of ten consecutive years reckoned in continuing progressive series . . . ."

Such Article XIII is an apportionment of the Yampa River between Utah and Colorado, in the amount of 5,000,000 AF per 10 year rolling periods. That number averages to 500,000 per year deliverable to Utah from the Yampa River. The apportionment nature of such Article XIII is also recognized in Article III(b)(3)(i).

Article IV(a)(c) provides one of the principles upon which the Upper Colorado River Commission shall determine curtailment of water by the Upper Basin states in the event such curtailment is necessary under Article III of the 1922 Colorado River Compact. Such Article IV(a)(c) states that "the extent of curtailment by each state of the upper division of the consumptive use of water apportioned to it by Article III of this compact [51.75% to Colorado] shall be such as to result in the delivery at Lee's Ferry of a quantity of water which bears the same relation to the total required curtailment of use by the states of the upper division as the consumptive use of the Upper Colorado river system water which was made by each such state during the water year immediately preceding the year in which the curtailment becomes necessary bears to the total consumptive use of such water in the states of the upper division during the same water year; . . . ." In other words, Colorado must curtail, and therefore pass to Lee's Ferry, the percentage of the entire upper basin states' curtailment obligation represented by a fraction, the numerator of which is Colorado's consumptive use of Colorado River water for the previous water year and the denominator of which is the total consumptive use of Colorado River water by all upper basin states for the previous water year. That fraction may be more or less than 51.75%, and that fraction is referred to herein as the "Colorado Curtailment Fraction."

Within Colorado, the provisions of Article XIII do not interfere with the right or power of Colorado to regulate within Colorado the "appropriation, use and control" of water within its boundaries up to the 51.75%. See Article XV(b), determination by a state regarding curtailment of use of water under Article IV due to a lower basin compact call. But please note that Article XV(b) does not say that the provisions of the 1948 compact do not apply to or interfere with the

right or power of each upper basin state to formulate and apply curtailment rules within each state to accomplish the Colorado Curtailment Fraction. Indeed, as more fully explored below, provisions of the four apportionment Articles of the 1948 compact, being Article XI (Little Snake River), Article XII (Henry's Fork of Green River), Article XIII (Yampa River), and Article XIV (San Juan River), clearly show that the ability of each upper basin state to formulate and apply internal curtailment rules is limited by the apportionments of those 4 Articles.

Therefore, the "Yampa Doctrine" asserts that the apportionment of the water of the Yampa River under Article XIII must be taken into account internally within Colorado as Colorado determines how it will effectuate a curtailment of water pursuant to the Colorado Curtailment Fraction in the event of a lower basin compact call which has triggered a directive of curtailment by the Upper Colorado River Commission. Specifically, the "Yampa Doctrine" asserts that the State of Colorado may not impose a curtailment of consumptive uses of Yampa River water during such a lower basin compact call if the flow of the Yampa River past the Maybell gage to Utah has exceeded the apportionment requirement in the preceding water year, i.e., has exceeded 500,000 AF of water.

The analysis of the justification for the "Yampa Doctrine" relies upon a close review of the provisions of the Upper Colorado River Compact itself. Any legislation or contract must be interpreted in accordance with its plain meaning, giving effect to all provisions, and reference to outside sources can only be used in the case of clear ambiguity. The "Yampa Doctrine" assumes the 1948 compact is clear and unambiguous.

There are several major tributaries to the Colorado River arising in Colorado and delivering water into Utah: The Little Snake, Yampa, White, Colorado mainstem, Gunnison, Dolores, and San Juan are among those tributaries. Three are specifically referenced in separate Articles in the Upper Colorado River Compact: The Little Snake River, the Yampa River, and the San Juan River. Article XI applying to the Little Snake apportions that river between Colorado and Wyoming by a division of the river for administration purposes at approximately the confluence of Savery Creek, and subsection (b)(1) requires that "the curtailment," which must mean "curtailment" under Article IV, must be equally applied to waters consumed or stored in Wyoming and waters consumed or stored in Colorado, on the basis of equal application of irrigated acreage standard. Clearly, that directive on curtailment on the Little Snake is expected to be taken into account by each of Colorado and Wyoming in determining their respective policies of curtailment to meet a lower basin call.

In similar fashion, Article XIV applies to the San Juan River, and apportions the river between Colorado and New Mexico by requiring Colorado to always deliver to New Mexico in the San Juan River sufficient water, when added to the native water originating in the San Juan River from New Mexico drainages, to enable New Mexico to make "full use" of New Mexico's 11.25% apportionment under Article III, subject to recognition of existing pre-1949 water rights and planned US BuRec projects. But since that apportionment is "measured" by the very allocation under Article III, Subsection XIV(d) then goes on specifically to add that "The curtailment of water use by either state in order to make deliveries at Lee's ferry as required by Article IV of this compact shall be independent of any and all conditions imposed by this Article and shall be made by each state, as and when required, without regard to any provision of this

article." So, for the San Juan, the apportionment methodology may be ignored by either state in formulating their in-state curtailment rules.

What are we to make of one specific Article apportioning the Little Snake river and requiring that Colorado and Wyoming must take into account that apportionment when determining their in-state curtailment policy, whereas another specific Article apportioning the San Juan river requires that Colorado and New Mexico must not take into account that apportionment when determining their in-state curtailment policy? Why does the "Yampa Doctrine" hold that the "general rule" of interpretation of the interface between Article IV & Article XV(b), on the one hand, and the 4 apportionment Articles (XI, XII, XIII, and XIV), on the other hand, is that the apportionment language of such 4 latter Articles supercede any contrary in-state policy on curtailment and must be followed by the applicable states without authority to modify? The following reasons apply.

Article XII of the Upper Colorado River Compact apportions waters of Henry's Fork of the Green River and its tributaries between Wyoming and Utah. It is significant here that the Article describes in detail how consumptive use of waters shall be charged, and the duty of water administrative officials of each state to release stored water to the other state under certain circumstances. That Article XII goes on to state that the state engineers of the two states will jointly appoint a special water commissioner who "shall have authority to administer the water in both states in accordance with the terms of this article." The obvious implication is that such wording on administration is to be applicable and taken into account in the event of curtailment pursuant to a lower basin call, but Article XII, like Article XIII for the Yampa River, does not have specific wording regarding "curtailment."

Article XIII, being the Article that apportions the waters of the Yampa River between Colorado and Utah, does not include the word "curtailment." How is that "silence" to be interpreted? The "Yampa Doctrine" contends that the apportionment of the Yampa River under Article XIII must be included in Colorado's in-state policy determinations regarding how a curtailment ordered by the Upper Colorado River Commission under Article IV can be implemented in Colorado. The "Yampa Doctrine" then contends that, if curtailment is ordered, the State of Colorado cannot curtail consumptive use in the Yampa River basin so long as the Yampa River is delivering 500,000 AF or more of water to Utah in the measured water year prior to the year of curtailment, so that Utah is getting its full portion of the apportionment of the Yampa River under Article XIII.

The conclusions of the "Yampa Doctrine" as above stated arise from a reading of the 1948 Compact and the application of ordinary legal principles of legislative and contract interpretation. The silence in Article XIII respecting how the apportionment is to be treated in the event of a curtailment by Colorado due to a lower basin compact call can only be interpreted one of two ways: Either (i) Article XIII is entirely subordinate to the determinations of Colorado regarding how it will administer a curtailment order from the Upper Colorado River commission with respect to Yampa River consumption, or (ii) Article XIII is senior to such a determination, and the State of Colorado must administer such a curtailment with due applicability of the apportionment of Article XIII and a determination of whether the Yampa River is over-

delivering water to Utah under Article XIII, and if not, exempting Yampa River consumption from such curtailment.

The following interpretation concepts are applicable:

1. If the apportionments of Articles XI, XII, XIII, and XIV are subordinate to each state's internal determination of what water rights to curtail in the event of a compact call, then Article XIV(d) was unnecessary. If subordination was intended as the "general rule," there was no reason for inserting it in Article XIV. It was unnecessary surplusage. General interpretation principles assume that there is a reason for each section and subsection of legislation, and it should be interpreted to give full force to all wording.

2. If the "subordinate" interpretation is the general rule, the very specific provisions regarding Henry's Fork and the specially appointed joint water commissioner provisions of Article XII could be ignored by either state in determining how to implement that state's in-state curtailment policy. But that also makes no sense. The very insistence in XII(h) of a joint water commissioner renders that interpretation as applied to XII as nonsense. The very specificity evidences the compact drafters' intent that the apportionment wording in XII is intended to supercede any contrary application by each state internally.

3. The absence of wording regarding curtailment in Article XII regarding the Henry's Fork is illuminating, since a reading of the detail of such Article XII would lead to ordinary interpretation that the specifics, including the "joint" water commissioner's authority, are intended to "override" any contrary interpretation by either state in formulating its in-state curtailment policy. In other words, the very nature of the detail of such Article XII on the Henry's Form must mean that such terms, which are an apportionment, must be complied with by both states in formulating their in-state curtailment policy. Hence, silence in Article XII cannot be interpreted to mean that each state can adopt contrary administrative policies in formulating their respective in-state curtailment policies.

4. Since Article XIV for the San Juan River expressly provides that the apportionment not be regarded when each state determines its internal curtailment policy, it follows that the only reason for the inclusion of that specificity is to distinguish the San Juan from the more logical "general rule": That "general rule" would be that the apportionments described in the 4 apportionment Articles (including the Article XII regarding Henry's Fork) are required to be an integral part of each upper basin state's policies on the in-state curtailment of water in the event of a lower basin compact call. Only the San Juan is "exempted" from that general rule by the specific language of Article XIV(d).

5. So if the "general rule" is that the apportionments must be regarded in each state's in-state curtailment rule, why did the drafter's include in the Little Snake apportionment, Article XI, Sections (b)(1) and (b)(2), wording regarding

> "curtailment"? In reading such sections, it is obvious that the inclusion of curtailment language was inserted to specify the detail about how each state must administer a curtailment internally, that for direct flow curtailments the consumptive use per acre must be equally curtailed on an acreage basis in Wyoming and in Colorado, and for storage curtailments the measurement must also be based upon irrigated acreage equality of sufferance by each state. Those subsections make clear that the seniority of the apportionment based upon "equality of irrigated acreage" supercedes each state's ability to come to contrary conclusions in its in-state policies respecting compact curtailment enforcement.

Thus, a general "rule" that the 4 apportionment Articles must not be superceded by any state's internal policies regarding enforcement of compact curtailment is the only interpretation making sense. A contrary interpretation would allow states to ignore the specifics of the Little Snake and Henry's Fork detail, and would render unnecessary a specific "exemption" wording in the San Juan Article. That makes no sense.

Under such correct "general rule," both the Yampa River Article XIII and the Henry's Form Article XII are subject to such "general rule." There is nothing in those two articles that would indicate that the absence of reference to curtailments in one is to be treated opposite of the absence of reference to curtailments in the other. Since the "general rule" must be that the apportionment of Article XIII must not be superceded by Colorado's policies regarding enforcement of compact curtailment, it follows that the consumptive uses in the Yampa Basin cannot be curtailed so long as the apportionment requirement of Article XIII is being met, i.e., so long as Colorado has not caused the flow of the Yampa River at the Maybell gaging station to be less than 500,000 AF per year on a 10 year running average.

State Engineer's Office
Compact Compliance Strategy
Colorado River Basin

Southwest Basin Roundtable; May 13, 2020

Kevin Rein, P.E., State Engineer
Division of Water Resources

March 31, 2020

COLORADO
Division of Water Resources
Department of Natural Resources

“Four Takeaways for Today”

1. Understand the SEO’s Compact Compliance Strategy
2. What influences Compact Compliance Strategy?
3. Current activity of the State Engineer’s Office
4. Compact Administration, one scenario

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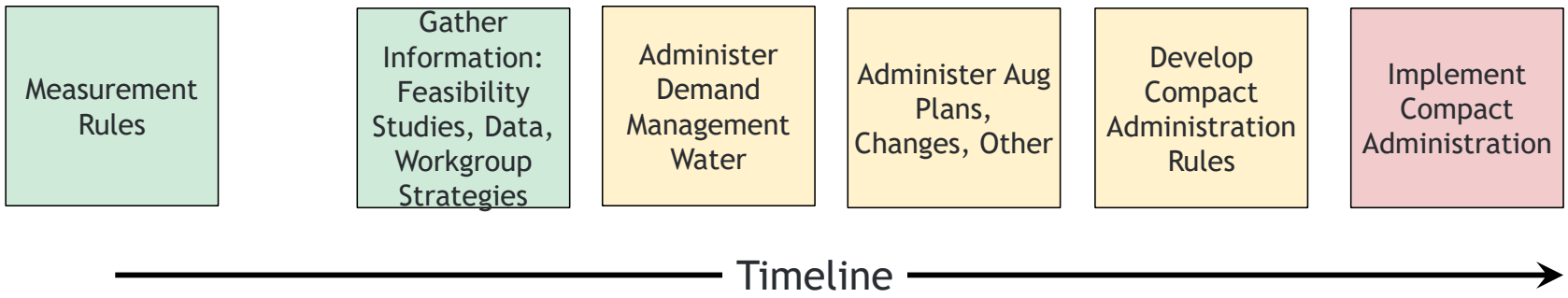
Understand Compact Compliance Strategy

Some Components of the State Engineer's Efforts on Compact Compliance Strategy



Understand Compact Compliance Strategy

Why are we talking about a Compact *Compliance Strategy* instead of Compact *Curtailment*?

- *A discussion about curtailment only*: Common assumption
  - If and when Colorado is "out of compliance,"
  - the State and Division Engineers need only curtail water use according to priority of appropriation,
  - Colorado will then again be "in compliance,"
- The actual discussion, and potential course of action is more complex

Understand Compact Compliance Strategy

But what does the
Upper Colorado River Compact say (Article IV)?

a) "In the event curtailment…shall become necessary in order that the flow at Lee ferry shall not be depleted below that required by article III of the Colorado river compact…

b) "…the extent of curtailment by each state of the consumptive use of water apportioned to it…shall be in such quantities and at such times as shall be determined by the commission…"

c) "…the extent of curtailment by each state of the upper division of the consumptive use of water apportioned to it by article III of this compact shall be such as to result in the delivery…"

- Therefore, three considerations: a) "In the event…"; b) "determined by the commission…"; c) "…the extent…by each state…shall be such as to result in the delivery…" (states decide)
- *Compact Compliance Strategy* addresses a), b), and c).

Understand Compact Compliance Strategy

- *Therefore, the State Engineer's actions are part of a Compact Compliance Strategy, not Compact Curtailment*
- *Multi-faceted, holistic approach that addresses a), b), and c),*
  a) What is the strategy before and after the "In the event…" condition is met?
  b) How does direction from the UCRC influence the strategy?
  c) How does Colorado's latitude influence, actually, form the strategy?

Understand Compact Compliance Strategy

- Consider the South Platte River Compact:
  - Flows at Julesburg less than 120 cfs, April 1 – October 15?
  - **Curtail** all diversions in WD 64 junior to June 14, 1897
  - Colorado is in compliance
  - Colorado does not take any special actions before compliance becomes an issue

Understand Compact Compliance Strategy

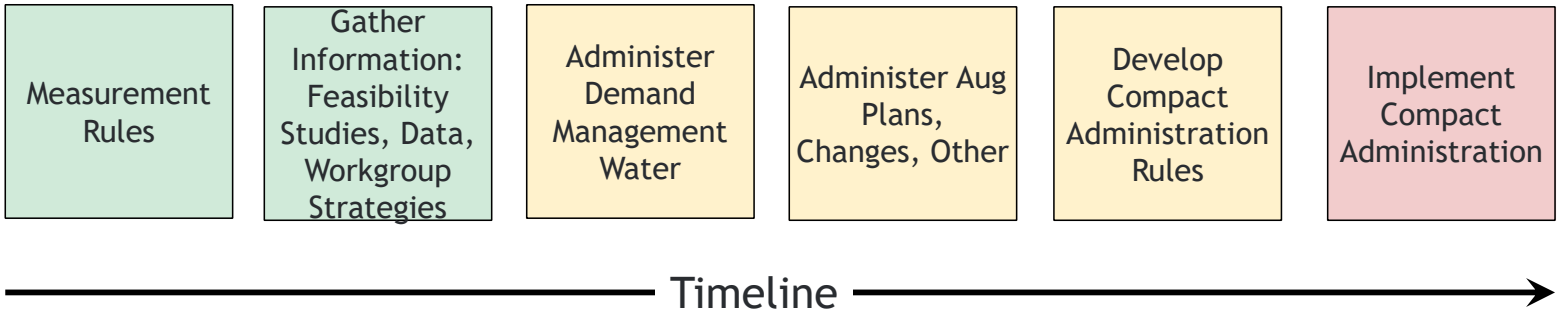
- Consider the La Plata River Compact:
  - From February 16 – November 30, determine flows at Hesperus gauge
  - If flow at the gauge is less than 100 cfs
  - **Curtail** diversions (in priority) to ensure delivery of one half that amount at the state line on the following day
  - Colorado is in compliance
  - Colorado does not take any special actions before compliance becomes an issue

Understand Compact Compliance Strategy

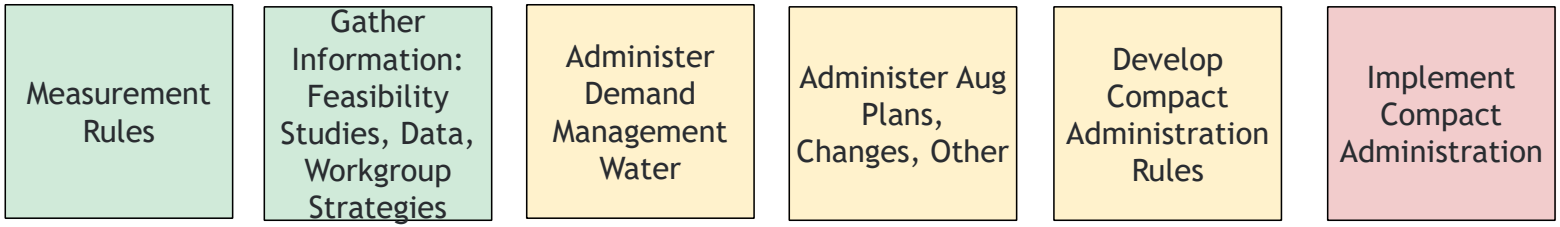
- Consider the Colorado River Compact:
  - The states of the Upper Division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of ten consecutive years…
  - That is the recognized (Upper Basin States') standard for maintaining compact compliance,
  - What is compliance? How do we maintain it?

Understand Compact Compliance Strategy

Some Components of the State Engineer's Efforts on Compact Compliance Strategy



Understand Compact Compliance Strategy



Understand Compact Compliance Strategy

“Four Takeaways for Today”

1. Understand the SEO’s Compact Compliance Strategy
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What Influences Compact Compliance Strategy?

- What influences Compact Compliance Strategy?
  - Probability that based on UCRC determination, Colorado would need to take action and implement Compact Administration,
  - Upper Colorado River Compact; UCRC role,
  - Develop an approach,
  - Implement Compact Administration as a part of Compact Compliance Strategy.

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  - Develop an approach,
  - Implement Compact Administration as a part of Compact Compliance Strategy.

What Influences Compact Compliance Strategy?

- Probability of need to take action and implement Compact Administration
  - Currently (2018) the Upper Basin States' delivery stands at 92,124,000 acre-feet,

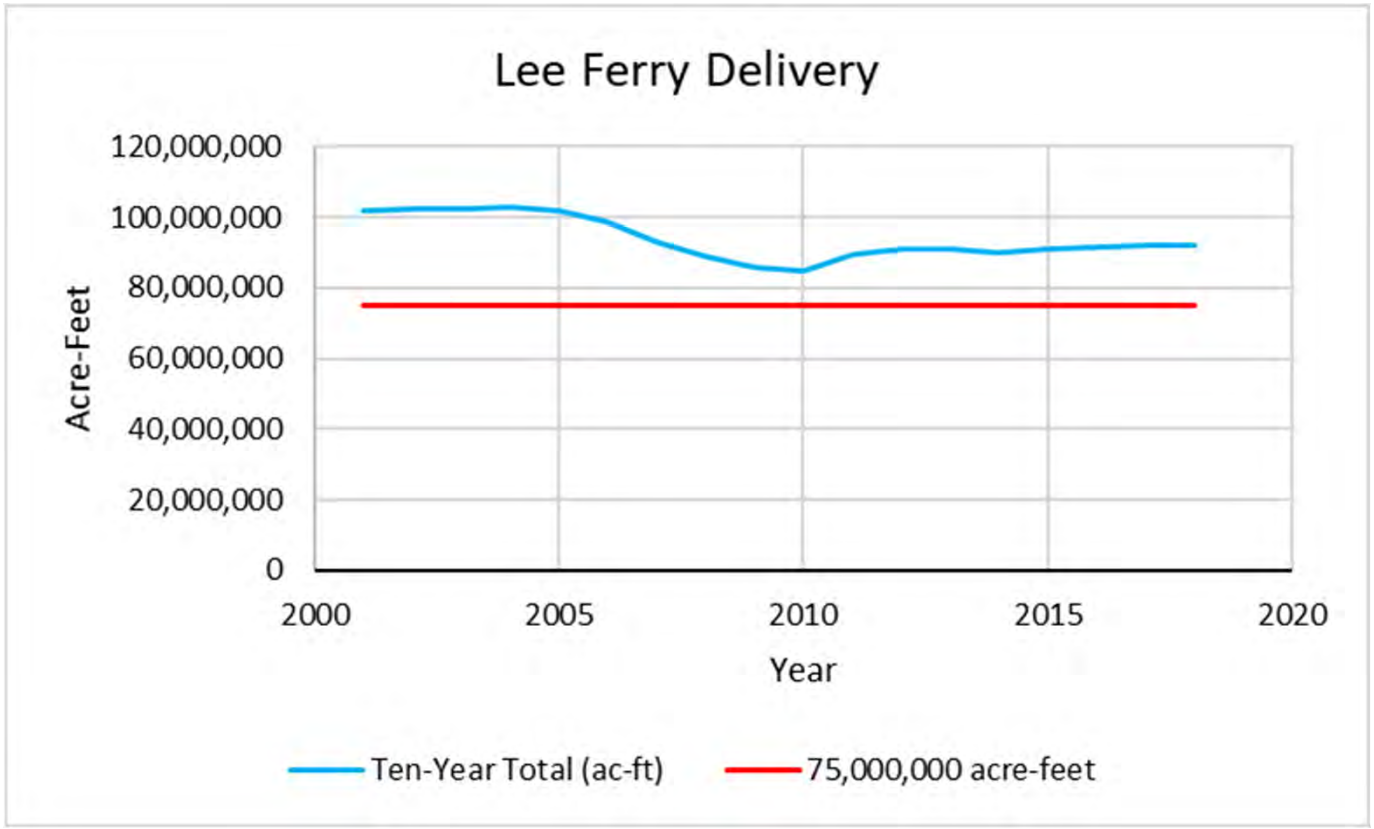
Probability of need to take action, Compact Administration

Year	AnnuaL Lee Ferry Flow (ac-ft)	Ten-Year Total (ac-ft)
2000	9,530,000	101,754,000
2001	8,361,000	101,983,000
2002	8,348,000	102,308,000
2003	8,372,000	102,543,000
2004	8,348,000	102,585,000
2005	8,395,000	101,738,000
2006	8,508,000	98,716,000
2007	8,422,000	93,265,000
2008	9,180,000	89,004,000
2009	8,406,000	85,870,000
2010	8,436,000	84,777,000
2011	13,227,000	89,643,000
2012	9,534,000	90,829,000
2013	8,289,000	90,746,000
2014	7,590,000	89,988,000
2015	9,157,000	90,750,000
2016	9,138,000	91,380,000
2017	9,175,000	92,133,000
2018	9,171,000	92,124,000

Probability of need to take action, Compact Administration

Year	AnnuaL Lee Ferry Flow (ac-ft)	Ten-Year Total (ac-ft)
2012	9,534,000	90,829,000
2013	8,289,000	90,746,000
2014	7,590,000	89,988,000
2015	9,157,000	90,750,000
2016	9,138,000	91,380,000
2017	9,175,000	92,133,000
2018	9,171,000	92,124,000

Probability of need to take action, Compact Administration



Probability of need to take action, Compact Administration

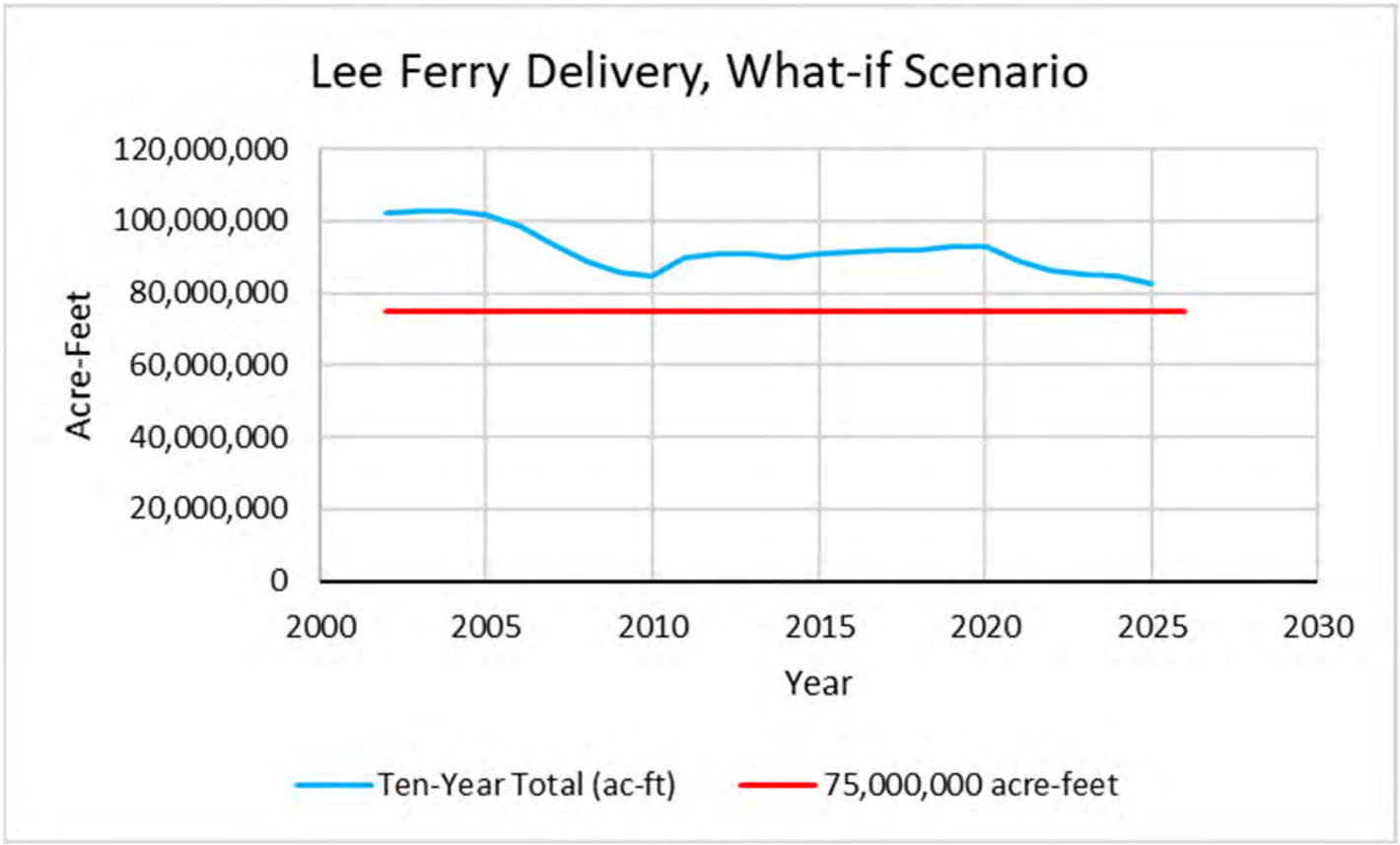
- 2017-2018 Actual Totals
- 2019-2021; Current projection, November 2019 24-Month Study*
- 2022-2025; Minimum release under '07 Guidelines = 7,000,000 acre-feet*
- Acknowledge Mexico "obligation"

- Consider 150,000 ac-ft gain in river, Powell to Lee Ferry

Year	AnnuaL Lee Ferry Flow (ac-ft) (Year Ending September 30)	Ten-Year Total (ac-ft)
2017	9,175,000	92,133,000
2018	9,171,000	92,124,000
2019	9,150,000	92,867,000
2020	8,380,000	92,811,000
2021	9,150,000	88,734,000
2022	7,150,000	86,350,000
2023	7,150,000	85,211,000
2024	7,150,000	84,771,000
2025	7,150,000	82,764,000

COLORADO
Division of Water Resources
Department of Natural Resources

Probability of need to take action, Compact Administration



Probability of need to take action, Compact Administration

- Probability of need to take action and implement Compact Administration;
  - Currently (2018) the Upper Basin State's delivery stands at 92,124,000 acre-feet,
  - The reservoir operations direct deliveries at least in amounts that exceed the "What-if Scenario."

Low probability between now and 2026

What Influences Compact Compliance Strategy?

- What influences Compact Compliance Strategy?
  - Probability that based on UCRC determination, Colorado would need to take action and implement Compact Administration,
  - Upper Colorado River Compact; UCRC role,
  - Develop an approach,
  - Implement Compact Administration as a part of Compact Compliance Strategy.

What Influences Compact Compliance Strategy?

- Upper Colorado River Compact; UCRC Role;
  - The need for curtailment is determined by the Upper Colorado River Commission, which includes Colorado's Commissioner, due to imminent need,
  - Colorado actions limited by Upper Colorado River Compact.

What Influences Compact Compliance Strategy?

- What influences Compact Compliance Strategy?
  - Probability that based on UCRC determination, Colorado would need to take action and implement Compact Administration,
  - Upper Colorado River Compact; UCRC role,
  - Develop an approach,
  - Implement Compact Administration as a part of Compact Compliance Strategy.

What Influences Compact Compliance Strategy?

- Develop an approach;
  - Priority administration?
  - Acquire relevant information, data, rules?

What Influences Compact Compliance Strategy?

- Develop an approach;
  - Simple priority administration may not be enough. Why?
  - Use available information, data, rules?

What Influences Compact Compliance Strategy?

- Develop an approach
  - Simple priority administration? Can we do more?
  - Use available information, data, rules?
    - Informed, contemplated, more precise,
    - Stakeholder involvement,
    - Allows for planning, develop options,
    - Acknowledge legal concerns.

What Influences Compact Compliance Strategy?

- Use available information, data, rules?
  - Compact Compliance Study,
  - Renegotiation of ’07 Guidelines,
  - Data (Measurement Rules),
  - Demand Management (consider the outcome of the workgroups),
  - Compact Administration Rules.

What Influences Compact Compliance Strategy?

- Use available information, data, rules?
  - Compact Compliance Study,
  - Renegotiation of ’07 Guidelines,
  - Data (Measurement Rules),
  - Demand Management (consider the outcome of the workgroups),
  - Compact Administration Rules.

What Influences Compact Compliance Strategy?

- Why Measurement Rules?
  - Consider administration in other basins,
  - Data is critical; accuracy is critical,
  - Consider as an important first step,
  - What would Measurement Rules entail?

What Influences Compact Compliance Strategy?

- Components of Measurement Rules
  - Statutory Authority (section 37-84-112, C.R.S.)
  - Objective, Scope, Applicability,
  - Definitions
  - Measurement Methods, Functional Standards
  - Reporting
  - Enforcement

Components of Measurement Rules

- Statutory Authority (section 37-84-112, C.R.S.)
  - "(1) The owners of any irrigation ditch, canal, flume, or reservoir in this state, taking water from any stream, shall erect where necessary and maintain in good repair, at the point of intake of such ditch, canal, flume, or reservoir, a suitable and proper headgate of height and strength and with embankments sufficient to control the water at all ordinary stages and suitable and proper measuring flumes, weirs, and devices and shall also erect and maintain in good repair suitable wastegates where necessary in connection with such ditch, canal, flume, or reservoir intake."
  - Understand "…where necessary…"

Components of Measurement Rules

- Objective, Scope, Applicability
  - Objective:
    - Basins with increasing demand, over-appropriation, need for administration
    - Augmentation plans, need for verification of operation
    - Data to plan for and implement Compact Compliance Administration
  - Scope and Applicability
    - Surface water, groundwater
    - Colorado River Basin? Statewide?

Components of Measurement Rules

- Measurement Methods, Functional Standards
  - Surface water
    - Flumes, weirs, current meters, radar, alternative
  - Groundwater
    - Totalizing Flow Meter, Power Consumption Coefficient?
  - Accuracy and verification standards
  - Consider geography, source, administrative need

Components of Measurement Rules

- Reporting and Enforcement
  - Frequency of measurement and reporting, types of information,
    - Administration-based, by decree, Compact administration requirements
  - Enforcement
    - Ensure compliance
    - Consider geography, source, administrative need

Components of Measurement Rules

- Going forward (one plan, **dependent on the ability to travel and gather**)
  - Informal outreach by State Engineer's Office
    - Spring, Summer 2020
  - Informal stakeholder, gathering information and input
    - Late 2020 (How to reach people?)
  - Initiate Rulemaking
    - 2021
    - Formal stakeholder meetings
    - Draft Rules
    - Initiate formal rulemaking; SEO authority? APA?

What Influences Compact Compliance Strategy?

- Use available information, data, rules?
  - Compact Compliance Study,
  - Renegotiation of ’07 Guidelines,
  - Data (Measurement Rules),
  - Demand Management (consider the outcome of the workgroups),
  - Compact Administration Rules.

What Influences Compact Compliance Strategy?

- What could Compact Administration Rules look like?
  - Guide the State Engineer in Compact Administration
    - Define process
    - Acknowledge UCRC and its role, interaction with UCRC
    - Monitoring methodology
    - Guidance on strict application of priority
    - Guidance on enforcement
    - Consider "Present Perfected Rights," how that influences administration
    - Mechanisms for allowing diversion by water rights that would otherwise be curtailed

What Influences Compact Compliance Strategy?

- What influences Compact Compliance Strategy?
  - Probability that based on UCRC determination, Colorado would need to take action and implement Compact Administration,
  - Upper Colorado River Compact; UCRC role,
  - Develop an approach,
  - Implement Compact Administration as a part of Compact Compliance Strategy.

What Influences Compact Compliance Strategy?

- Implement Compact Administration;
  - Certain direction from UCRC,
  - Reliable data is available,
  - Certain process if Compact Administration Rules are developed,
  - Precise, focus to maintain compliance while avoiding over-delivery.

“Four Takeaways for Today”

1. Understand the SEO’s Compact Compliance Strategy
2. What influences Compact Compliance Strategy?
3. Current activity of the State Engineer’s Office
4. Compact Administration, one scenario

Current Activity of the State Engineer's Office

- The need for Compact Administration is not imminent
- Then why all this activity right now?

Current Activity of the State Engineer's Office

- Then why all this activity right now?
  - Drought Contingency Plan; why?
  - Demand management; why?
  - Measurement Rules, why?
  - Compact Administration; why not?
    - A final plan for Compact Administration now is not helpful
      - Not needed now, too much information is pending
    - However, understanding the scope of a Compact Compliance Strategy now is important to other activities

Current Activity of the State Engineer's Office

- The need for Compact Administration is not imminent
- We will continue to get more guidance and information; helpful and necessary to Compact Administration
- Begin with Basin Measurement Rules, upcoming outreach
- Refine our understanding:
  - Coordination with CWCB and UCRC
  - Scope of a Compact Compliance Strategy
  - Available Tools
  - Investigate and Plan: Scope and Process for Rulemaking; Structure of Rules
- Incorporate this information into a Compact Compliance Strategy; communicate with Colorado stakeholders

“Four Takeaways for Today”

1. Understand the SEO’s Compact Compliance Strategy
2. What influences Compact Compliance Strategy?
3. Current activity of the State Engineer’s Office
4. Compact Administration, one scenario

Compact Administration, a Scenario

- Upper Colorado River Commission determination
  - "Curtailment" is necessary to maintain compliance
  - Colorado is informed of its obligation, time and amount
- State Engineer's Office implements Compact Administration,
  - Potential guidance from Compact Administration Rules
  - Status of CRSPA Reservoirs influences administration
  - Present perfected rights influences the administration
  - Rules provide for consideration of priority
  - Potential availability of Demand Management water
  - Rules provide for other mechanisms
  - Administration is guided by the outcome of studies of water use
- Result is precise, informed, legally sound administration (which may include curtailment) that is targeted toward compliance while avoiding over-delivery

Colorado River Compact, 1922

The States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, having resolved to enter into a compact under the Act of the Congress of the United States of America approved August 19, 1921 (42 Statutes at Large, page 171), and the Acts of the Legislatures of the said States, have through their Governors appointed as their Commissioners:

W.S. Norviel for the State of Arizona,

W.F. McClure for the State of California,

Delph E. Carpenter for the State of Colorado,

J.G. Scrugham for the State of Nevada,

Stephen B. Davis, Jr., for the State of New Mexico,

R.E. Caldwell for the State of Utah,

Frank C. Emerson for the State of Wyoming,

who, after negotiations participated in by Herbert Hoover appointed by The President as the representative of the United States of America, have agreed upon the following articles:

ARTICLE I

The major purposes of this compact are to provide for the equitable division and apportionment of the use of the waters of the Colorado River System; to establish the relative importance of different beneficial uses of water, to promote interstate comity; to remove causes of present and future controversies; and to secure the expeditious agricultural and industrial development of the Colorado River Basin, the storage of its waters, and the protection of life and property from floods. To these ends the Colorado River Basin is divided into two Basins, and an apportionment of the use of part of the water of the Colorado River System is made to each of them with the provision that further equitable apportionments may be made.

ARTICLE II

As used in this compact-

(a) The term "Colorado River System" means that portion of the Colorado River and its tributaries within the United States of America.

(b) the term "Colorado River Basin" means all of the drainage area of the Colorado River System and all other territory within the United States of America to which the waters of the Colorado River System shall be beneficially applied.

(c) The term "States of the Upper Division" means the States of Colorado, New Mexico, Utah, and Wyoming.

(d) The term "States of the Lower Division" means the States of Arizona, California, and Nevada.

(e) The term "Lee Ferry" means a point in the main stream of the Colorado River one mile below the mouth of the Paria River.

(f) The term "Upper Basin" means those parts of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming within and from which waters naturally drain into the Colorado River System above Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the System above Lee Ferry.

(g) The term "Lower Basin" means those parts of the States of Arizona, California, Nevada, New Mexico, and Utah within and from which waters naturally drain into the Colorado River System below Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the System below Lee Ferry.

(h) The term "domestic use" shall include the use of water for household, stock, municipal, mining, milling, industrial, and other like purposes, but shall exclude the generation of electrical power.

ARTICLE III

(a) There is hereby apportioned from the Colorado River System in perpetuity to the Upper Basin and to the Lower Basin, respectively, the exclusive beneficial consumptive use of 7,500,000 acre-feet of water per annum, which shall include all water necessary for the supply of any rights which may now exist.

(b) In addition to the apportionment in paragraph (a), the Lower Basin is hereby given the right to increase its beneficial consumptive use of such waters by one million acre-feet per annum.

(c) If, as a matter of international comity, the United States of America shall hereafter recognize in the United States of Mexico any right to the use of any waters of the Colorado River System, such waters shall be supplied first from the waters which are surplus over and above the aggregate of the quantities specified in paragraphs (a) and (b); and if such surplus shall prove insufficient for this purpose, then, the burden of such deficiency shall be equally borne by the Upper Basin and the Lower Basin, and whenever necessary the States of the Upper Division shall deliver at Lee Ferry water to supply one-half of the deficiency so recognized in addition to that provided in paragraph (d).

(d) The States of the Upper Division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of ten consecutive years reckoned in continuing progressive series beginning with the first day of October next succeeding the ratification of this compact.

(e) The States of the Upper Division shall not withhold water, and the States of the Lower Division shall not require the delivery of water, which cannot reasonably be applied to domestic and agricultural uses.

(f) Further equitable apportionment of the beneficial uses of the waters of the Colorado River System unapportioned by paragraphs (a), (b), and (c) may be made in the manner provided in paragraph (g) at any time after October first, 1963, if and when either Basin shall have reached its total beneficial consumptive use as set out in paragraphs (a) and (b).

(g) In the event of a desire for a further apportionment as provided in paragraph (f) any two signatory States, acting through their Governors, may give joint notice of such desire to the Governors of the other signatory States and to The President of the United States of America, and it shall be the duty of the Governors of the signatory States and of The President of the United States of America forthwith to appoint representatives, whose duty it shall be to divide and apportion equitably between the Upper Basin and Lower Basin the beneficial use of the unapportioned water of the Colorado River System as mentioned in paragraph (f), subject to the legislative ratification of the signatory States and the Congress of the United States of America.

ARTICLE IV

(a) Inasmuch as the Colorado River has ceased to be navigable for commerce and the reservation of its waters for navigation would seriously limit the development of its Basin, the use of its waters for purposes of navigation shall be subservient to the uses of such waters for domestic, agricultural, and power purposes. If the Congress shall not consent to this paragraph, the other provisions of this compact shall nevertheless remain binding.

(b) Subject to the provisions of this compact, water of the Colorado River System may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes.

(c) The provisions of this article shall not apply to or interfere with the regulation and control by any State within its boundaries of the appropriation, use, and distribution of water.

ARTICLE V

The chief official of each signatory State charged with the administration of water rights, together with the Director of the United States Reclamation Service and the Director of the United States Geological Survey shall cooperate, ex-officio:

(a) To promote the systematic determination and coordination of the facts as to flow, appropriation, consumption, and use of water in the Colorado River Basin, and the interchange of available information in such matters.

(b) To secure the ascertainment and publication of the annual flow of the Colorado River at Lee Ferry.

(c) To perform such other duties as may be assigned by mutual consent of the signatories from time to time.

ARTICLE VI

Should any claim or controversy arise between any two or more of the signatory States: (a) with respect to the waters of the Colorado River System not covered by the terms of this compact; (b) over the meaning or performance of any of the terms of this compact; (c) as to the allocation of the burdens incident to the performance of any article of this compact or the delivery of waters as herein provided; (d) as to the construction or operation of works within the Colorado River Basin to be situated in two or more States, or to be constructed in one State for the benefit of another State; or (e) as to the diversion of water in one State for the benefit of another State; the Governors of the States affected, upon the request of one of them, shall forthwith appoint Commissioners with power to consider and adjust such claim or controversy, subject to ratification by the Legislatures of the States so affected.

Nothing herein contained shall prevent the adjustment of any such claim or controversy by any present method or by direct future legislative action of the interested States.

ARTICLE VII

Nothing in this compact shall be construed as affecting the obligations of the United States of America to Indian tribes.

ARTICLE VIII

Present perfected rights to the beneficial use of waters of the Colorado River System are unimpaired by this compact. Whenever storage capacity of 5,000,000 acre-feet shall have been provided on the main Colorado River within or for the benefit of the Lower Basin, then claims of such rights, if any, by appropriators or users of water in the Lower Basin against appropriators or users of water in the Upper Basin shall attach to and be satisfied from water that may be stored not in conflict with Article III.

All other rights to beneficial use of waters of the Colorado River System shall be satisfied solely from the water apportioned to that Basin in which they are situate.

ARTICLE IX

Nothing in this compact shall be construed to limit or prevent any State from instituting or maintaining any action or proceeding, legal or equitable, for the protection of any right under this compact or the enforcement of any of its provisions.

ARTICLE X

This compact may be terminated at any time by the unanimous agreement of the signatory States. In the event of such termination all rights established under it shall continue unimpaired.

ARTICLE XI

This compact shall become binding and obligatory when it shall have been approved by the Legislatures of each of the signatory States and by the Congress of the United States. Notice of approval by the Legislatures shall be given by the Governor of each signatory State to the Governors of the other signatory States and to the President of the United States, and the President of the United States is requested to give notice to the Governors of the signatory States of approval by the Congress of the United States.

IN WITNESS WHEREOF, the Commissioners have signed this compact in a single original, which shall be deposited in the archives of the Department of State of the United States of America and of which a duly certified copy shall be forwarded to the Governor of each of the signatory States.

DONE at the City of Santa Fe, New Mexico, this twenty-fourth day of November, A.D. One Thousand Nine Hundred and Twenty-two.

W. S. NORVIEL
W. F. McCLURE
DELPH E. CARPENTER
J. G. SCRUGHAM
STEPHEN G. DAVIS, JR.
R. E. CALDWELL
FRANK C. EMERSON

Approved:
HERBERT HOOVER

Upper Colorado River Basin

Compact

Entered Into By The States of

ARIZONA

COLORADO

NEW MEXICO

UTAH

WYOMING

SANTA FE, NEW MEXICO

OCTOBER 11, 1948

UPPER COLORADO RIVER BASIN COMPACT

The State of Arizona, the State of Colorado, the State of New Mexico, the State of Utah and the State of Wyoming, acting through their Commissioners,

Charles A. Carson for the State of Arizona,

Clifford H. Stone for the State of Colorado,

Fred E. Wilson for the State of New Mexico,

Edward H. Watson for the State of Utah and

L. C. Bishop for the State of Wyoming,

after negotiations participated in by Harry W. Bashore, appointed by the President as the representative of the United States of America, have agreed, subject to the provisions of the Colorado River Compact, to determine the rights and obligations of each signatory State respecting the uses and deliveries of the water of the Upper Basin of the Colorado River, as follows:

ARTICLE I

(a) The major purposes of this Compact are to provide for the equitable division and apportionment of the use of the waters of the Colorado River System, the use of which was apportioned in perpetuity to the Upper Basin by the Colorado River Compact; to establish the obligations of each State of the Upper Division with respect to the deliveries of water required to be made at Lee Ferry by the Colorado River Compact; to promote interstate comity; to remove causes of

present and future controversies; to secure the expeditious agricultural and industrial development of the Upper Basin, the storage of water and to protect life and property from floods.

(b) It is recognized that the Colorado River Compact is in full force and effect and all of the provisions hereof are subject thereto.

ARTICLE II

As used in this Compact:

(a) The term "Colorado River System" means that portion of the Colorado River and its tributaries within the United States of America.

(b) The term "Colorado River Basin" means all of the drainage area of the Colorado River System and all other territory within the United States of America to which the waters of the Colorado River System shall be beneficially applied.

(c) The term "States of the Upper Division" means the States of Colorado, New Mexico, Utah and Wyoming.

(d) The term "States of the Lower Division" means the States of Arizona, California and Nevada.

(e) The term "Lee Ferry" means a point in the main stream of the Colorado River one mile below the mouth of the Paria River.

(f) The term "Upper Basin" means those parts of the States of Arizona, Colorado, New Mexico, Utah and Wyoming within and from which waters naturally drain into the Colorado River System above Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the Colorado River

System above Lee Ferry.

(g) The term "Lower Basin" means those parts of the States of Arizona, California, Nevada, New Mexico and Utah within and from which waters naturally drain into the Colorado River System below Lee Ferry, and also all parts of said States located without the drainage area of the Colorado River System which are now or shall hereafter be beneficially served by waters diverted from the Colorado River System below Lee Ferry.

(h) The term "Colorado River Compact" means the agreement concerning the apportionment of the use of the waters of the Colorado River System dated November 24, 1922, executed by Commissioners for the States of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming, approved by Herbert Hoover, representative of the United States of America, and proclaimed effective by the President of the United States of America, June 25, 1929.

(i) The term "Upper Colorado River System" means that portion of the Colorado River System above Lee Ferry.

(j) The term "Commission" means the administrative agency created by Article VIII of this Compact.

(k) The term "water year" means that period of twelve months ending September 30 of each year.

(l) The term "acre-foot" means the quantity of water required to cover an acre to the depth of one foot and is equivalent to 43,560 cubic feet.

(m) The term "domestic use" shall include the use of water for household, stock, municipal, mining, milling, industrial and other like purposes, but shall exclude the generation of electrical power.

(n) The term "virgin flow" means the flow of any stream undepleted by the activities of man.

ARTICLE III

(a) Subject to the provisions and limitations contained in the Colorado River Compact and in this Compact, there is hereby apportioned from the Upper Colorado River System in perpetuity to the States of Arizona, Colorado, New Mexico, Utah and Wyoming, respectively, the consumptive use of water as follows:

(1) To the State of Arizona the consumptive use of 50,000 acre-feet of water per annum.

(2) To the States of Colorado, New Mexico, Utah and Wyoming, respectively, the consumptive use per annum of the quantities resulting from the application of the following percentages to the total quantity of consumptive use per annum apportioned in perpetuity to and available for use each year by Upper Basin under the Colorado River Compact and remaining after the deduction of the use, not to exceed 50,000 acre-feet per annum, made in the State of Arizona.

State of Colorado - - - - - - - - - 51.75 per cent,

State of New Mexico - - - - - - - 11.25 per cent,

State of Utah - - - - - - - - - - - 23.00 per cent,

State of Wyoming -- - - - - - - - 14.00 per cent.

(b) The apportionment made to the respective States by paragraph (a) of this Article is based upon, and shall be applied in conformity with, the following principles and each of them:

(1) The apportionment is of any and all man-made depletions;

(2) Beneficial use is the basis, the measure and the limit of the right to use;

(3) No State shall exceed its apportioned use in any water year when the effect of such excess use, as determined by the Commission, is to deprive another signatory State of its apportioned use during that water year; provided, that this sub-paragraph (b) (3) shall not be construed as:

(i) Altering the apportionment of use, or obligations to make deliveries as provided in Article XI, XII, XIII or XIV of this Compact;

(ii) Purporting to apportion among the signatory States such uses of water as the Upper Basin may be entitled to under paragraphs (f) and (g) of Article III of the Colorado River Compact; or

(iii) Countenancing average uses by any signatory State in excess of its apportionment.

(4) The apportionment to each State includes all water

necessary for the supply of any rights which now exist.

(c) No apportionment is hereby made, or intended to be made, of such uses of water as the Upper Basin may be entitled to under paragraphs (f) and (g) of Article III of the Colorado River Compact.

(d) The apportionment made by this Article shall not be taken as any basis for the allocation among the signatory States of any benefits resulting from the generation of power.

ARTICLE IV

In the event curtailment of use of water by the States of the Upper Division at any time shall become necessary in order that the flow at Lee Ferry shall not be depleted below that required by Article III of the Colorado River Compact, the extent of curtailment by each State of the consumptive use of water apportioned to it by Article III of this Compact shall be in such quantities and at such times as shall be determined by the Commission upon the application of the following principles:

(a) The extent and times of curtailment shall be such as to assure full compliance with Article III of the Colorado River Compact;

(b) If any State or States of the Upper Division, in the ten years immediately preceding the water year in which curtailment is necessary, shall have consumptively used more water than it was or they were, as the case may be, entitled to use under the apportionment made by Article III of this Compact, such State or States shall be

required to supply at Lee Ferry a quantity of water equal to its, or the aggregate of their, overdraft or the proportionate part of such overdraft, as may be necessary to assure compliance with Article III of the Colorado River Compact, before demand is made on any other State of the Upper Division;

(c) Except as provided in subparagraph (b) of this Article, the extent of curtailment by each State of the Upper Division of the consumptive use of water apportioned to it by Article III of this Compact shall be such as to result in the delivery at Lee Ferry of a quantity of water which bears the same relation to the total required curtailment of use by the States of the Upper Division as the consumptive use of Upper Colorado River System water which was made by each such State during the water year immediately preceding the year in which the curtailment becomes necessary bears to the total consumptive use of such water in the States of the Upper Division during the same water year; provided, that in determining such relation the uses of water under rights perfected prior to November 24, 1922, shall be excluded.

ARTICLE V

(a) All losses of water occurring from or as the result of the storage of water in reservoirs constructed prior to the signing of this Compact shall be charged to the State in which such reservoir or reservoirs are located. Water stored in reservoirs covered by this paragraph (a) shall be for the exclusive use of and shall be charged to the State in which the reservoir or reservoirs are located.

(b) All losses of water occurring from or as the result of the storage of water in reservoirs constructed after the signing of this Compact shall be charged as follows:

(1) If the Commission finds that the reservoir is used, in whole or in part, to assist the States of the Upper Division in meeting their obligations to deliver water at Lee Ferry imposed by Article III of the Colorado River Compact, the Commission shall make findings, which in no event shall be contrary to the laws of the United States of America under which any reservoir is constructed, as to the reservoir capacity allocated for that purpose. The whole or that proportion, as the case may be, of reservoir losses as found by the Commission to be reasonably and properly chargeable to the reservoir or reservoir capacity utilized to assure deliveries at Lee Ferry shall be charged to the States of the Upper Division in the proportion which the consumptive use of water in each State of the Upper Division during the water year in which the charge is made bears to the total consumptive use of water in all States of the Upper Division during the same water year. Water stored in reservoirs or in reservoir capacity covered by this subparagraph (b) (1) shall be for the common benefit of all of the States of the Upper Division.

(2) If the Commission finds that the reservoir is used, in whole or in part, to supply water for use in a State of the Upper Division, the Commission shall make findings, which in no event shall be contrary to the laws of the United States of America under which any reservoir is constructed, as to the reservoir or reservoir capacity utilized to supply water for use and the State in which such water will be used. The whole or that proportion, as the case may be, of reservoir losses as found by the Commission to be reasonably and properly chargeable to the State in which such water will be used shall be borne by that State. As determined by the Commission, water stored in reservoirs covered by this subparagraph (b) (2) shall be earmarked for and charged to the State in which the water will be used.

(c) In the event the Commission finds that a reservoir site is available both to assure deliveries at Lee Ferry and to store water for consumptive use in a State of the Upper Division, the storage of water for consumptive use shall be given preference. Any reservoir or reservoir capacity hereafter used to assure deliveries at Lee Ferry shall by order of the Commission be used to store water for consumptive use in a State, provided the Commission finds that such storage is reasonably necessary to permit such State to make the use of the water apportioned to it by this Compact.

ARTICLE VI

The Commission shall determine the quantity of the consumptive use of water, which use is apportioned by Article III hereof, for the Upper Basin and for each State of the Upper Basin by the inflow-outflow method in terms of man-made depletions of the virgin flow at Lee Ferry, unless the Commission, by unanimous action, shall adopt a different method of determination.

ARTICLE VII

The consumptive use of water by the United States of America or any of its agencies, instrumentalities or wards shall be charged as a use by the State in which the use is made; provided, that such consumptive use incident to the diversion, impounding, or conveyance of water in one State for use in another shall be charged to such latter State.

ARTICLE VIII

(a) There is hereby created an interstate administrative agency to be known as the "Upper Colorado River Commission." The Commission shall be composed of one Commissioner representing each of the States of the Upper Division, namely, the States of Colorado, New Mexico, Utah and Wyoming, designated or appointed in accordance with the laws of each such State and, if designated by the President, one Commissioner representing the United States of America. The President is hereby requested to designate a Commissioner. If so designated the Commissioner representing the United States of America shall be the presiding

officer of the Commission and shall be entitled to the same powers and rights as the Commissioner of any State. Any four members of the Commission shall constitute a quorum.

(b) The salaries and personal expenses of each Commissioner shall be paid by the Government which he represents. All other expenses which are incurred by the Commission incident to the administration of this Compact, and which are not paid by the United States of America, shall be borne by the four States according to the percentage of consumptive use apportioned to each. On or before December 1 of each year, the Commission shall adopt and transmit to the Governors of the four States and to the President a budget covering an estimate of its expenses for the following year, and of the amount payable by each State. Each State shall pay the amount due by it to the Commission on or before April 1 of the year following. The payment of the expenses of the Commission and of its employees shall not be subject to the audit and accounting procedures of any of the four States; however, all receipts and disbursement of funds handled by the Commission shall be audited yearly by a qualified independent public accountant and the report of the audit shall be included in and become a part of the annual report of the Commission.

(c) The Commission shall appoint a Secretary, who shall not be a member of the Commission, or an employee of any signatory State or of the United States of America while so acting. He shall serve for such term and receive such salary and perform such duties as the Commission

may direct. The Commission may employ such engineering, legal, clerical and other personnel as, in its judgment, may be necessary for the performance of its functions under this Compact. In the hiring of employees, the Commission shall not be bound by the civil service laws of any State.

(d) The Commission, so far as consistent with this Compact, shall have the power to:

(1) Adopt rules and regulations;

(2) Locate, establish, construct, abandon, operate and maintain water gaging stations;

(3) Make estimates to forecast water run-off on the Colorado River and any of its tributaries;

(4) Engage in cooperative studies of water supplies of the Colorado River and its tributaries;

(5) Collect, analyze, correlate, preserve and report on data as to the stream flows, storage, diversions and use of the waters of the Colorado River, and any of its tributaries;

(6) Make findings as to the quantity of water of the Upper Colorado River System used each year in the Upper Colorado River Basin and in each State thereof;

(7) Make findings as to the quantity of water deliveries at Lee Ferry during each water year;

(8) Make findings as to the necessity for and the extent of the curtailment of use, required, if any, pursuant to Article IV hereof;

(9) Make findings as to the quantity of reservoir losses and as to the share thereof chargeable under Article V hereof to each of the States;

(10) Make findings of fact in the event of the occurrence of extraordinary drought or serious accident to the irrigation system in the Upper Basin, whereby

deliveries by the Upper Basin of water which it may be required to deliver in order to aid in fulfilling obligations of the United States of America to the United Mexican States arising under the Treaty between the United States of America and the United Mexican States, dated February 3, 1944 (Treaty Series 994) become difficult, and report such findings to the Governors of the Upper Basin States, the President of the United States of America, the United States Section of the International Boundary and Water Commission, and such other Federal officials and agencies as it may deem appropriate to the end that the water allotted to Mexico under Division III of such treaty may be reduced in accordance with the terms of such Treaty;

(11) Acquire and hold such personal and real property as may be necessary for the performance of its duties hereunder and to dispose of the same when no longer required;

(12) Perform all functions required of it by this Compact and do all things necessary, proper or convenient in the performance of its duties hereunder, either independently or in cooperation with any state or federal agency;

(13) Make and transmit annually to the Governors of the signatory States and the President of the United States of America, with the estimated budget, a report covering the activities of the Commission for the preceding water year.

(e) Except as otherwise provided in this Compact the concurrence of four members of the Commission shall be required in any action taken by it.

(f) The Commission and its Secretary shall make available to the Governor of each of the signatory States any information within its possession at any time, and shall always provide free access to its records by the Governors of each of the States, or their representatives,

or authorized representatives of the United States of America.

(g) Findings of fact made by the Commission shall not be conclusive in any court, or before any agency or tribunal, but shall constitute prima facie evidence of the facts found.

(h) The organization meeting of the Commission shall be held within four months from the effective date of this Compact.

ARTICLE IX

(a) No State shall deny the right of the United States of America and, subject to the conditions hereinafter contained, no State shall deny the right of another signatory State, any person, or entity of any signatory State to acquire rights to the use of water, or to construct or participate in the construction and use of diversion works and storage reservoirs with appurtenant works, canals and conduits in one State for the purpose of diverting, conveying, storing, regulating and releasing water to satisfy the provisions of the Colorado River Compact relating to the obligation of the States of the Upper Division to make deliveries of water at Lee Ferry, or for the purpose of diverting, conveying, storing or regulating water in an upper signatory State for consumptive use in a lower signatory State, when such use is within the apportionment to such lower State made by this Compact. Such rights shall be subject to the rights of water users, in a State in which such reservoir or works are located, to receive and use water, the use of which is within the apportionment to such State by this Compact.

(b) Any signatory State, any person or any entity of any signatory State shall have the right to acquire such property rights as are necessary to the use of water in conformity with this Compact in any other signatory State by donation, purchase or through the exercise of the power of eminent domain. Any signatory State, upon the written request of the Governor of any other signatory State, for the benefit of whose water users property is to be acquired in the State to which such written request is made, shall proceed expeditiously to acquire the desired property either by purchase at a price satisfactory to the requesting State, or, if such purchase cannot be made, then through the exercise of its power of eminent domain and shall convey such property to the requesting State or such entity as may be designated by the requesting State; provided, that all costs of acquisition and expenses of every kind and nature whatsoever incurred in obtaining the requested property shall be paid by the requesting State at the time and in the manner prescribed by the State requested to acquire the property.

(c) Should any facility be constructed in a signatory State by and for the benefit of another signatory State or States or the water users thereof, as above provided, the construction, repair, replacement, maintenance and operation of such facility shall be subject to the laws of the State in which the facility is located, except that, in the case of a reservoir constructed in one State for the benefit of another State or States, the water administration officials of the State

in which the facility is located shall permit the storage and release of any water which, as determined by findings of the Commission, falls within the apportionment of the State or States for whose benefit the facility is constructed. In the case of a regulating reservoir for the joint benefit of all States in making Lee Ferry deliveries, the water administration officials of the State in which the facility is located, in permitting the storage and release of water, shall comply with the findings and orders of the Commission.

(d) In the event property is acquired by a signatory State in another signatory State for the use and benefit of the former, the users of water made available by such facilities, as a condition precedent to the use thereof, shall pay to the political subdivisions of the State in which such works are located, each and every year during which such rights are enjoyed for such purposes, a sum of money equivalent to the average annual amount of taxes levied and assessed against the land and improvements thereon during the ten years preceding the acquisition of such land. Said payments shall be in full reimbursement for the loss of taxes in such political subdivisions of the State, and in lieu of any and all taxes on said property, improvements and rights. The signatory States recommend to the President and the Congress that, in the event the United States of America shall acquire property in one of the signatory States for the benefit of another signatory State, or its water users, provision be made for like payment in reimbursement of loss of taxes.

ARTICLE X

(a) The signatory States recognize La Plata River Compact entered into between the States of Colorado and New Mexico, dated November 27, 1922, approved by the Congress on January 29, 1925 (43 Stat. 796), and this Compact shall not affect the apportionment therein made.

(b) All consumptive use of water of La Plata River and its tributaries shall be charged under the apportionment of Article III hereof to the State in which the use is made; provided, that consumptive use incident to the diversion, impounding or conveyance of water in one State for use in the other shall be charged to the latter State.

ARTICLE XI

Subject to the provisions of this Compact, the consumptive use of the water of the Little Snake River and its tributaries is hereby apportioned between the States of Colorado and Wyoming in such quantities as shall result from the application of the following principles and procedures:

(a) Water used under rights existing prior to the signing of this Compact.

(1) Water diverted from any tributary of the Little Snake River or from the main stem of the Little Snake River above a point one hundred feet below the confluence of Savery Creek and the Little

Snake River shall be administered without regard to rights covering the diversion of water from any down-stream points.

(2) Water diverted from the main stem of the Little Snake River below a point one hundred feet below the confluence of Savery Creek and the Little Snake River shall be administered on the basis of an interstate priority schedule prepared by the Commission in conformity with priority dates established by the laws of the respective States.

(b) Water used under rights initiated subsequent to the signing of this Compact.

(1) Direct flow diversions shall be so administered that, in time of shortage, the curtailment of use on each acre of land irrigated thereunder shall be as nearly equal as may be possible in both of the States.

(2) The storage of water by projects located in either State, whether of supplemental supply or of water used to irrigate land not irrigated at the date of the signing of this Compact, shall be so administered that in times of water shortage the curtailment of storage of water available for each acre of land irrigated thereunder shall be as nearly equal as may be possible in both States.

(c) Water uses under the apportionment made by this Article shall be in accordance with the principle that beneficial use shall be the basis, measure and limit of the right to use.

(d) The States of Colorado and Wyoming each assent to diversions and storage of water in one State for use in the other State, subject to compliance with Article IX of this Compact.

(e) In the event of the importation of water to the Little Snake River Basin from any other river basin, the State making the importation shall have the exclusive use of such imported water unless by written agreement, made by the representatives of the States of Colorado and Wyoming on the Commission, it is otherwise provided.

(f) Water use projects initiated after the signing of this Compact, to the greatest extent possible, shall permit the full use within the Basin in the most feasible manner of the waters of the Little Snake River and its tributaries, without regard to the state line; and, so far as is practicable, shall result in an equal division between the States of the use of water not used under rights existing prior to the signing of this Compact.

(g) All consumptive use of the waters of the Little Snake River and its tributaries shall be charged under the apportionment of Article III hereof to the State in which the use is made; provided, that consumptive use incident to the diversion, impounding or conveyance of water in one State for use in the other shall be charged to the latter State.

ARTICLE XII

Subject to the provisions of this Compact, the consumptive use of the waters of Henry's Fork, a tributary of Green River originating in the State of Utah and flowing into the State of Wyoming and thence into the Green River in the State of Utah; Beaver Creek, originating in the State of Utah and flowing into Henry's Fork in the State of Wyoming; Burnt Fork, a tributary of Henry's Fork, originating in the State of Utah and flowing into Henry's Fork in the State of Wyoming; Birch Creek, a tributary of Henry's Fork originating in the State of Utah and flowing into Henry's Fork in the State of Wyoming; and Sheep Creek, a tributary of Green River in the State of Utah, and their tributaries, are hereby apportioned between the States of Utah and Wyoming in such quantities as will result from the application of the following principles and procedures:

(a) Waters used under rights existing prior to the signing of this Compact.

Waters diverted from Henry's Fork, Beaver Creek, Burnt Fork, Birch Creek and their tributaries, shall be administered without regard to the state line on the basis of an interstate priority schedule to be prepared by the States affected and approved by the Commission in conformity with the actual priority of right of use, the water requirements of the land irrigated and the acreage irrigated in connection therewith.

(b) Waters used under rights from Henry's Fork, Beaver Creek, Burnt Fork, Birch Creek and their tributaries, initiated after

the signing of this Compact shall be divided fifty percent to the State of Wyoming and fifty percent to the State of Utah and each State may use said waters as and where it deems advisable.

(c) The State of Wyoming assents to the exclusive use by the State of Utah of the water of Sheep Creek, except that the lands, if any, presently irrigated in the State of Wyoming from the water of Sheep Creek shall be supplied with water from Sheep Creek in order of priority and in such quantities as are in conformity with the laws of the State of Utah.

(d) In the event of the importation of water to Henry's Fork, or any of its tributaries, from any other river basin, the State making the importation shall have the exclusive use of such imported water unless by written agreement made by the representatives of the States of Utah and Wyoming on the Commission, it is otherwise provided.

(e) All consumptive use of waters of Henry's Fork, Beaver Creek, Burnt Fork, Birch Creek, Sheep Creek, and their tributaries shall be charged under the apportionment of Article III hereof to the State in which the use is made; provided, that consumptive use incident to the diversion, impounding or conveyance of water in one State for use in the other shall be charged to the latter State.

(f) The States of Utah and Wyoming each assent to the diversion and storage of water in one State for use in the other State, subject to compliance with Article IX of this Compact. It shall be the duty of the water administrative officials of the State where the

water is stored to release said stored water to the other State upon demand. If either the State of Utah or the State of Wyoming shall construct a reservoir in the other State for use in its own State, the water users of the State in which said facilities are constructed may purchase at cost a portion of the capacity of said reservoir sufficient for the irrigation of their lands thereunder.

(g) In order to measure the flow of water diverted, each State shall cause suitable measuring devices to be constructed, maintained and operated at or near the point of diversion into each ditch.

(h) The State Engineers of the two States jointly shall appoint a Special Water Commissioner who shall have authority to administer the water in both States in accordance with the terms of this Article. The salary and expenses of such Special Water Commissioner shall be paid, thirty percent by the State of Utah and seventy percent by the State of Wyoming.

ARTICLE XIII

Subject to the provisions of this Compact, the rights to the consumptive use of the water of the Yampa River, a tributary entering the Green River in the State of Colorado, are hereby apportioned between the States of Colorado and Utah in accordance with the following principles:

(a) The State of Colorado will not cause the flow of the Yampa River at the Maybell Gaging Station to be depleted below an aggregate

of 5,000,000 acre-feet for any period of ten consecutive years reckoned in continuing progressive series beginning with the first day of October next succeeding the ratification and approval of this Compact. In the event any diversion is made from the Yampa River or from tributaries entering the Yampa River above the Maybell Gaging Station for the benefit of any water use project in the State of Utah, then the gross amount of all such diversions for use in the State of Utah, less any returns from such diversions to the River above Maybell, shall be added to the actual flow at the Maybell Gaging Station to determine the total flow at the Maybell Gaging Station.

(b) All consumptive use of the waters of the Yampa River and its tributaries shall be charged under the apportionment of Article III hereof to the State in which the use is made; provided, that consumptive use incident to the diversion, impounding or conveyance of water in one State for use in the other shall be charged to the latter State.

ARTICLE XIV

Subject to the provisions of this Compact, the consumptive use of the waters of the San Juan River and its tributaries is hereby apportioned between the States of Colorado and New Mexico as follows:

The State of Colorado agrees to deliver to the State of New Mexico from the San Juan River and its tributaries which rise in the State of Colorado a quantity of water which shall be sufficient, together with water originating in the San Juan Basin in the State of New Mexico, to enable the State of New Mexico to make full use of

the water apportioned to the State of New Mexico by Article III of this Compact, subject, however, to the following:

(a) A first and prior right shall be recognized as to:

(1) All uses of water made in either State at the time of the signing of this Compact; and

(2) All uses of water contemplated by projects authorized, at the time of the signing of this Compact, under the laws of the United States of America whether or not such projects are eventually constructed by the United States of America or by some other entity.

(b) The State of Colorado assents to diversions and storage of water in the State of Colorado for use in the State of New Mexico, subject to compliance with Article IX of this Compact.

(c) The uses of the waters of the San Juan River and any of its tributaries within either State which are dependent upon a common source of water and which are not covered by (a) hereof, shall in times of water shortages be reduced in such quantity that the resulting consumptive use in each State will bear the same proportionate relation to the consumptive use made in each State during times of average water supply as determined by the Commission; provided, that any preferential uses of water to which Indians are entitled under Article XIX shall be excluded in determining the amount of curtailment to be made under this paragraph.

(d) The curtailment of water use by either State in order to

make deliveries at Lee Ferry as required by Article IV of this Compact shall be independent of any and all conditions imposed by this Article and shall be made by each State, as and when required, without regard to any provision of this Article.

(e) All consumptive use of the waters of the San Juan River and its tributaries shall be charged under the apportionment of Article III hereof to the State in which the use is made; provided, that consumptive use incident to the diversion, impounding or conveyance of water in one State for use in the other shall be charged to the latter State.

ARTICLE XV

(a) Subject to the provisions of the Colorado River Compact and of this Compact, water of the Upper Colorado River System may be impounded and used for the generation of electrical power, but such impounding and use shall be subservient to the use and consumption of such water for agricultural and domestic purposes and shall not interfere with or prevent use for such dominant purposes.

(b) The provisions of this Compact shall not apply to or interfere with the right or power of any signatory State to regulate within its boundaries the appropriation, use and control of water, the consumptive use of which is apportioned and available to such State by this Compact.

ARTICLE XVI

The failure of any State to use the water, or any part thereof, the use of which is apportioned to it under the terms of this Compact, shall not constitute a relinquishment of the right to such use to the Lower Basin or to any other State, nor shall it constitute a forfeiture or abandonment of the right to such use.

ARTICLE XVII

The use of any water now or hereafter imported into the natural drainage basin of the Upper Colorado River System shall not be charged to any State under the apportionment of consumptive use made by this Compact.

ARTICLE XVIII

(a) The State of Arizona reserves its rights and interests under the Colorado River Compact as a State of the Lower Division and as a State of the Lower Basin.

(b) The State of New Mexico and the State of Utah reserve their respective rights and interests under the Colorado River Compact as States of the Lower Basin.

ARTICLE XIX

Nothing in this Compact shall be construed as:

(a) Affecting the obligations of the United States of America to Indian tribes;

(b) Affecting the obligations of the United States of America under the Treaty with the United Mexican States (Treaty Series 994);

(c) Affecting any rights or powers of the United States of America, its agencies or instrumentalities, in or to the waters of the Upper Colorado River System, or its capacity to acquire rights in and to the use of said waters;

(d) Subjecting any property of the United States of America, its agencies or instrumentalities, to taxation by any State or sub-division thereof, or creating any obligation on the part of the United States of America, its agencies or instrumentalities, by reason of the acquisition, construction or operation of any property or works of whatever kind, to make any payment to any State or political sub-division thereof, State agency, municipality or entity whatsoever, in reimbursement for the loss of taxes;

(e) Subjecting any property of the United States of America, its agencies or instrumentalities, to the laws of any State to an extent other than the extent to which such laws would apply without regard to this Compact.

ARTICLE XX

This Compact may be terminated at any time by the unanimous agreement of the signatory States. In the event of such termination, all rights established under it shall continue unimpaired.

ARTICLE XXI

This Compact shall become binding and obligatory when it shall have been ratified by the legislatures of each of the signatory States and approved by the Congress of the United States of America. Notice of ratification by the legislatures of the signatory States shall be given by the Governor of each signatory State to the Governor of each of the other signatory States and to the President of the United States of America, and the President is hereby requested to give notice to the Governor of each of the signatory States of approval by the Congress of the United States of America.

IN WITNESS WHEREOF, the Commissioners have executed six counterparts hereof each of which shall be and constitute an original, one of which shall be deposited in the archives of the Department of State of the United States of America, and one of which shall be forwarded to the Governor of each of the signatory States.

Done at the City of Santa Fe, State of New Mexico, this 11th day of October, 1948.

Charles A. Carson
Commissioner for the State of Arizona

Clifford H. Stone
Commissioner for the State of Colorado

Fred E. Wilson
Commissioner for the State of New Mexico

Edward H. Watson
Commissioner for the State of Utah

L. C. Bishop
Commissioner for the State of Wyoming

Grover A. Giles, Secretary

Approved:

Harry W. Bashore
Representative of the United States of America

Colorado River Risk Study: Executive Summary

Final

August 1, 2018

Colorado River Risk Study: Executive Summary

August 1, 2018

Submitted to the Colorado River District and Project Participants

Prepared by:
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Disclaimer

The findings presented herein are for discussion purposes only, and do not represent the official position of any entity with respect to factual or legal matters concerning the Colorado River.

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I. Background

The Colorado River Basin is in the midst of a drought that began in 2000 and continues today. Average naturalized flows at Lee Ferry during this period are approximately 12.6 maf (million acre-feet), or 4.0 maf annually less than would be needed to meet the full compact allotments of the seven basin states and to the Mexican Treaty obligation to Mexico. Recent droughts have significantly reduced storage levels in Lake Powell. If these droughts were to repeat themselves today, the ability of Lake Powell to satisfy its compact-obligation and power-generation purposes would be threatened (Figure 1). Drought Contingency Plans (DCP) are being developed for both the Upper and Lower Basins (See Hydros 2015 report "Summary Report on Contingency Planning in the Colorado River Basin"). While those plans, if implemented, would reduce the risk of a compact deficit or critically low storage levels at Lake Powell, they do not completely eliminate the risk for the Upper Basin States.

Concurrent with the DCP efforts, Colorado completed its Water Plan (https://www.colorado.gov/pacific/cowaterplan/plan), which lays the foundation for a secure water supply for the State. Point #4 of the Plan's Seven Point Framework is to take actions that minimize the risk of a Colorado River Compact curtailment. That objective, plus concerns voiced by the West Slope Basin Round Tables (BRTs) in a joint meeting in December 2014, provided the catalyst for this work.

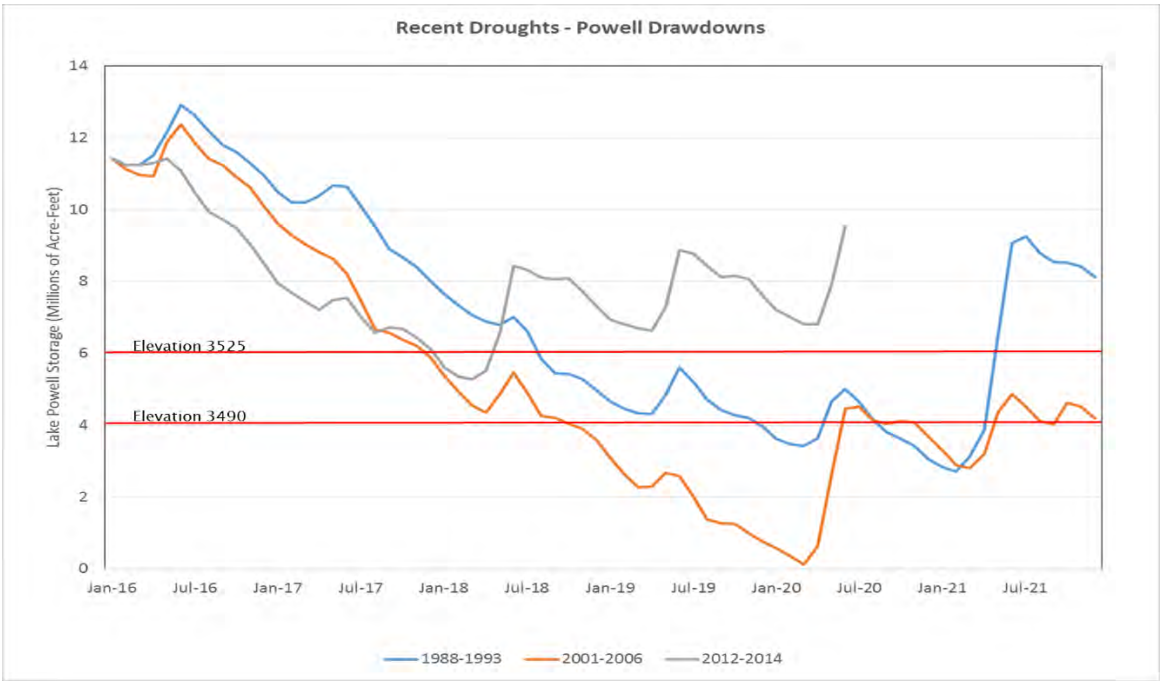

Figure 1. Past Lake Powell drawdowns superimposed on current conditions. A repeat of any of the last three drought events and subsequent drawdown of Powell would threaten the Upper Basin's ability to meet its obligations under the 2007 Interim Guidelines. The Upper Basin States and Reclamation have designed a Contingency Plan to keep Powell's elevation above the 3525' threshold.

II. Project Scope and Objectives

This Executive Summary covers Phases I and II of the Colorado River Risk Study. A third phase is scheduled for the second half of 2018. Phase I built directly upon work conducted for the Upper Colorado River Commission that explored risks to Lake Powell and Upper Basin water users, and the effectiveness of proposed Drought Contingency Plans in reducing or eliminating those risks. Particular emphasis was given to potential deficits at Lake Powell relative to critical target elevations, and Colorado's potential share of those volumes. The Phase I analyses utilized Reclamation's CRSS model.

Phase II further refined the "Big River" analysis from Phase I, and also explored certain aspects of demand management, shepherding, and water banking options within the State of Colorado, using the State's CDSS (StateMod) tools. The purpose of the StateMod investigation was two-fold. One purpose was to better understand how StateMod could be used to model demand management, water banking, and delivery of conserved demand management water to Lake Powell. A second objective was to better understand the variability in yields across the west-slope sub-basins under different hydrologic conditions, levels of demand management, and water shepherding assumptions.

III. Model Assumptions

A. CRSS

Phase I and Phase II Task 1 utilize Reclamation's CRSS model. The model is configured to replicate as closely as possible, with publicly available information, the proposed Drought Contingency Plan for the Lower Basin and the CRSP Drought Operations component of the Upper Basin's Plan. Additional key assumptions in the CRSS modeling include:

- Most simulations utilized the 1988-2012 historical period of hydrology (aka "Stress Test"). This period is also being used by Reclamation and the Basin States in the DCP process. Certain scenarios were also simulated using paleo-hydrology, climate change hydrology, and an extended historical period. These additional datasets are directly from the Colorado River Basin Study database.
- The 2007 Interim Guidelines are assumed to continue unchanged beyond 2026.
- Demand data are directly from or based on Reclamation's Colorado River Basin Study. Demand scenario A is the "current trends" data from the study, while the 90%D1 dataset is a scaled back version of the D1 demand set.
- Water Banking scenarios utilize the non-equalized reservoir construct from the Basin Study.
- Upper Basin demand management volumes are not assumed to come from specific water users or states.

These model simulations evaluated the likelihood of reaching critical elevations at Lake Powell, and were then used to quantify volumes of water that Colorado might need to conserve in order to avoid or reduce that risk.

B. StateMod

Phase II Task 2 primarily utilizes StateMod, Colorado's surface water allocation and operations modeling tool. While this task did produce interesting results, particularly with respect to variability of yield under different demand management programs, its primary purpose was to better understand strengths and weaknesses of the models themselves when simulating demand management, water banking, and shepherding operations. For this task, each of the west-slope StateMod models was run using the baseline data set, which imposes current levels of water demand and use onto the period of historical hydrology (1903-2013). The analysis of results focused on the 1988-2012 stress-test period, to coincide with the CRSS simulation outputs. The analysis explored several aspects of modeling demand management, including:

- How much additional water could be realized at the state line if each basin were to forego 5%, 10%, or 15% of its direct flow consumptive uses?
- How does the ability to shepherd or not shepherd that conserved water impact the yield?
- How do yields change between dry and wet years?
- What mechanisms are available within StateMod, and what additional functionality may be desirable, to simulate demand management and water banking activities?

C. Coupled StateMod / CRSS

In addition to the StateMod-specific simulations, a loosely coupled model of in-state demand management (StateMod) and basin-wide river operations including drought contingency plans and water banking (CRSS) was examined. The objective of this exercise was to evaluate the utility of both models in evaluating questions that are not readily addressed in either model by itself. The coupling involves removing the Colorado portion of CRSS and replacing that piece of the basin-wide model with outputs generated by StateMod. This allows a more accurate representation of in-state operations including non-federal reservoir operations, ditch and water-right specific consumptive use data, and more realistic outcomes from demand management activities. By incorporating with CRSS, those in-state actions can be modified based on "big-river" operations, including specifically changing conditions at Lake Powell.

IV. Summary of Findings

Results from Phase I indicate that under certain drought sequences, as seen in the early part of this century, significant volumes of water could be needed to maintain Lake Powell elevations at or above elevation 3525 (Figure 2). These volumes would be required even AFTER taking in to account the release of stored water from other CRSP reservoirs as anticipated by the Upper Basin DCP.

These actions were modeled as single year reductions (with the possibility of consecutive years of conservation during extended drought), for purposes of identifying required volumes. There appears to be broad consensus, based on feedback from various groups including participants in the Colorado River Water Bank Work Group, the System Conservation Pilot Project, and the UCRC, that single-year conservation volumes of the magnitudes shown in Figure 2 are probably not feasible under a voluntary program.

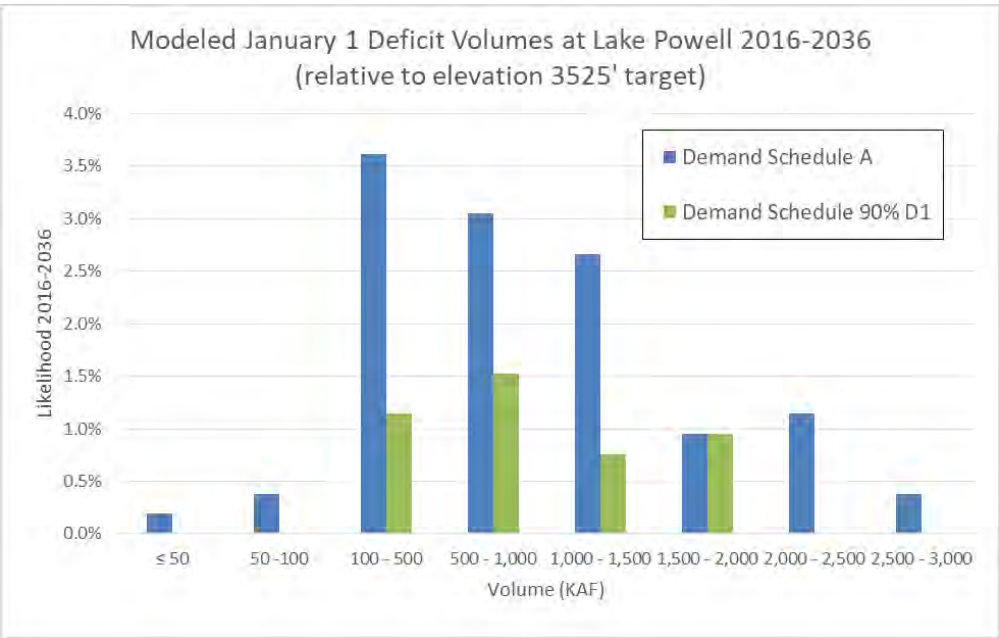

Figure 2. January 1 volumes required AFTER CRSP drought operations to maintain Powell at 3525'. Simulations using Stress Test (1988-2012) hydrology.

An alternate approach to conserving large volumes of water over a short period of time to mitigate the risk to Lake Powell is to create an upper basin water bank or other type of storage account, into which conserved consumptive use water could be deposited pro-actively over a span of many years. A hypothetical proactive demand management program combined with a water bank was simulated in CRSS, using the stress test hydrology (1988-2012) and two demand scenarios (A and 90%D1). Results indicate that the hypothetical bank can reduce the likelihood of Powell dropping below 3525. As demands are reduced, and with the inclusion of the Lower Basin DCP and Upper Basin CRSP Drought Operations, the frequency of bank usage and the total deficit volume at Powell are both decreased. The frequency and magnitude of remaining Powell deficits after bank operation is also significantly reduced.

Phase II analysis focused on the baseline StateMod models, and the ability to quantify state line yields under yields under a hypothetical demand management program. Results for the stress test period (1988-2012) are 2012) are shown in Table 1. Average annual demand management volumes conserved in each of the 5%, 10% and 15% scenarios are shown as "conserved CU". The average annual increase in flow at the state line is for the un-shepherded scenarios (we would expect all the conserved water, minus some loss factor, to make it to

the state line in a shepherded scenario). The yield is a reflection of the expected "loss" incurred in transit for waters conserved but not shepherded (i.e., made available to other water users).

Table 2 contains the same information, but for the 8 driest years of the stress test period. Note the change in flow at the state line and yield percentages and the variation across the sub-basins. Basin such as the Upper Colorado and San Juan, where depletions are a larger percentage of total supply, exhibit greater differences in state line flows under dry conditions.

Table 1. Conserved consumptive use and state line yields by sub-basin, 1988-2012

	5%			10%			15%		
	Conserved CU (AF/yr)	Flow at State Line (AF/yr)	Yield %	Conserved CU (AF/yr)	Flow at State Line (AF/yr)	Yield %	Conserved CU (AF/yr)	Flow at State Line (AF/yr)	Yield %
Yampa	10,134	8,774	87%	20,269	17,930	88%	30,403	27,189	89%
White	2,982	2,917	98%	5,963	5,894	99%	8,945	8,940	100%
Upper Colorado	52,673	42,873	81%	105,346	87,250	83%	158,019	133,701	85%
Gunnison	28,655	20,631	72%	57,310	42,056	73%	85,964	64,256	75%
San Juan & Dolores	23,439	14,476	62%	46,879	31,387	67%	70,318	49,449	70%

Table 2. Conserved consumptive use and state line yields by sub-basin, 8 driest years, 1988-2012

	5%			10%			15%		
	Conserved CU (AF/yr)	Flow at State Line (AF/yr)	Yield %	Conserved CU (AF/yr)	Flow at State Line (AF/yr)	Yield %	Conserved CU (AF/yr)	Flow at State Line (AF/yr)	Yield %
Yampa	9,809	7,101	72%	19,617	14,852	76%	29,426	22,678	77%
White	2,916	2,720	93%	5,833	5,545	95%	8,749	8,434	96%
Upper Colorado	51,685	21,110	41%	103,370	40,213	39%	155,055	67,529	44%
Gunnison	26,345	8,427	32%	52,689	21,877	42%	79,034	37,658	48%
San Juan & Dolores	20,706	9,541	46%	41,412	19,744	48%	62,118	28,870	46%

The final exercise of Phase II was to test the utility of coupling the CRSS and StateMod models. Each model has strengths, but to have a dynamic model that can simulate Lake Powell and other federal reservoir operations together with specific demand management activities within Colorado, and to understand how each impacts the other, requires use of both. This demonstration showed how StateMod could be used to generate volumes of conserved water through a demand management program, with that water being subsequently stored in hypothetical water bank accounts in a reservoir. That water bank account can then be managed within CRS, with refilling and releases made as required to deliver water into Lake Powell's system pool. The models provide a flexible framework for specifying specific water user participants and for dynamic management of the demand management account.

Takeaway summary:

1. Likelihood of Lake Powell dropping below critical elevations is small, but impact to upper basin water users could be catastrophic.
2. The deficit volumes at Lake Powell, even after proposed Drought Operations of CRSP reservoirs, could be on the order of millions of acre-feet if critical drought periods repeat.
3. It is unlikely that the upper basin could generate that volume of water in a short period of time through a reactive demand management program.
4. A proactive demand management program (voluntary, compensated) combined with a water banking program intended to support Lake Powell elevations could significantly reduce the risks. The size of the bank, its location(s), and operating constraints are important considerations.
5. StateMod is the best tool for modeling in-state demand management activities, non-federal reservoir operations, and yield estimation from participating water rights / water users.
6. CRSS is necessary for understanding Lake Powell operations and other "big river" issues that are the key drivers to demand management requirements.
7. The two models can be combined effectively to simulate complex demand management questions within Colorado as well as the impacts of those actions on Lake Powell, and impacts of basin-wide operations on Colorado water use.

V. Other Reports

The analysis and findings summarized above are further described in three reports:

1. Colorado River Risk Study – Phase I Summary Report
2. Colorado River Risk Study – Phase II Task 1 Report
3. Colorado River Risk Study – Phase II Task 2 Report

These include additional detail on model assumptions, objectives, analysis and results.

Colorado River Risk Study Phase III Final Report

November 20, 2019

Colorado River Risk Study

Phase III Final Report

November 20, 2019

Prepared for the Colorado River District and the Southwestern Water Conservation District

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Disclaimer

Hydros Consulting Inc., the Colorado River District, and the Southwestern Water Conservation District acknowledge that the findings presented herein are based on specific modeling assumptions and are intended for discussion purposes only. Neither this Report, nor any of the findings contained herein, represent an official or final position of the Colorado River District, the Southwestern Water Conservation District or any other entity with respect to the law of the Colorado River or State of Colorado water use, law, administration or policy. This study is a work in progress, and the assumptions and conclusions are subject to future modification based on pertinent developments and/or the intent of the proponents to study risk under different scenarios.

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I. Introduction

A. Background

The Colorado River Basin has experienced significantly lower than average annual flows since 2000. Whether this is the result of a long-term drought or the new "normal" is subject to debate. Regardless, average naturalized flows at Lee Ferry during the period 2000-2017 were approximately 12.6 million acre-feet (Maf)[1]. Storage levels in Lake Powell have remained below 65% full since 2000 (except for 2011; **Error! Reference source not found.**). In spite of a good snowpack in 2019 resulting in an increase in storage from the previous year, Lake Powell remains just above half-full, and is forecast to end 2019 about 58% full[2]. A repeat of the 1988-1993 or 2001-2006 severe drought periods could threaten hydropower generation at Lake Powell and possibly the Upper Basin's ability to meet its obligations under the 2007 Interim Guidelines, the Colorado River Compact, or both. Note that during both of those historical drought events which occurred prior to the 2007 Interim Guidelines, Powell was releasing 8.23 Maf/yr. Under the 2007 Interim Guidelines, releases in non-equalization years have averaged 8.8 Maf/yr.

Drought Contingency Plans (DCP) have been developed and approved for both the Upper and Lower Basins. While those plans, if fully implemented, would reduce the risk of a Compact deficit or critically low storage levels at Lake Powell, they may not completely eliminate the risks for the Upper Basin States.

Concurrent with the DCP efforts, Colorado completed its Water Plan (https://www.colorado.gov/pacific/cowaterplan/plan), which lays the foundation for a secure water supply for the State. Point #4 of the Plan's Seven Point Framework is to take actions that minimize the potential for an involuntary Colorado River Compact curtailment. That objective, plus concerns voiced by the Colorado River Basin Round Tables (BRTs) in a joint meeting in December 2014, provided the catalyst for the Colorado River Risk Study.

B. Phase III Purpose and Scope of Work

From the original scope: "*The purpose of Phase III of the Risk Study is to build on Phases I and II and continue to answer Colorado River system risk questions asked by the West Slope roundtables in the context of Colorado's Water Plan and the development of the IBCC Conceptual Framework. Most notably the Risk Study Phase III will continue to address the IBCC Conceptual Framework Summary Point No. 4 which states: An insurance policy that protects against involuntary curtailment is needed for existing uses and some reasonable increment of future development in the Colorado River system, but will not cover a new TMD.*"

[1] http://www.usbr.gov/lc/region/g4000/NaturalFlow/index.html
[2] https://www.usbr.gov/lc/region/g4000/24mo/index.html

Phases I and II set the stage for Phase III by evaluating system-wide risks in the Colorado Basin, and also by developing a new approach to modeling both in-state (Colorado) impacts of potential involuntary curtailment, and/or the development of a demand management program. This modeling approach utilizes the State of Colorado's StateMod water rights simulation model and Reclamation's CRSS (Colorado River Simulation Model). The models share data generated by evaluation of different management, conservation, and administration scenarios, and can be used to better understand the feedback mechanisms and relationships between in-State actions and Basin-wide conditions (particularly at Lake Powell). In Phase III we utilize these tools to revisit current and future risks, and explore some potential approaches to involuntary curtailment.

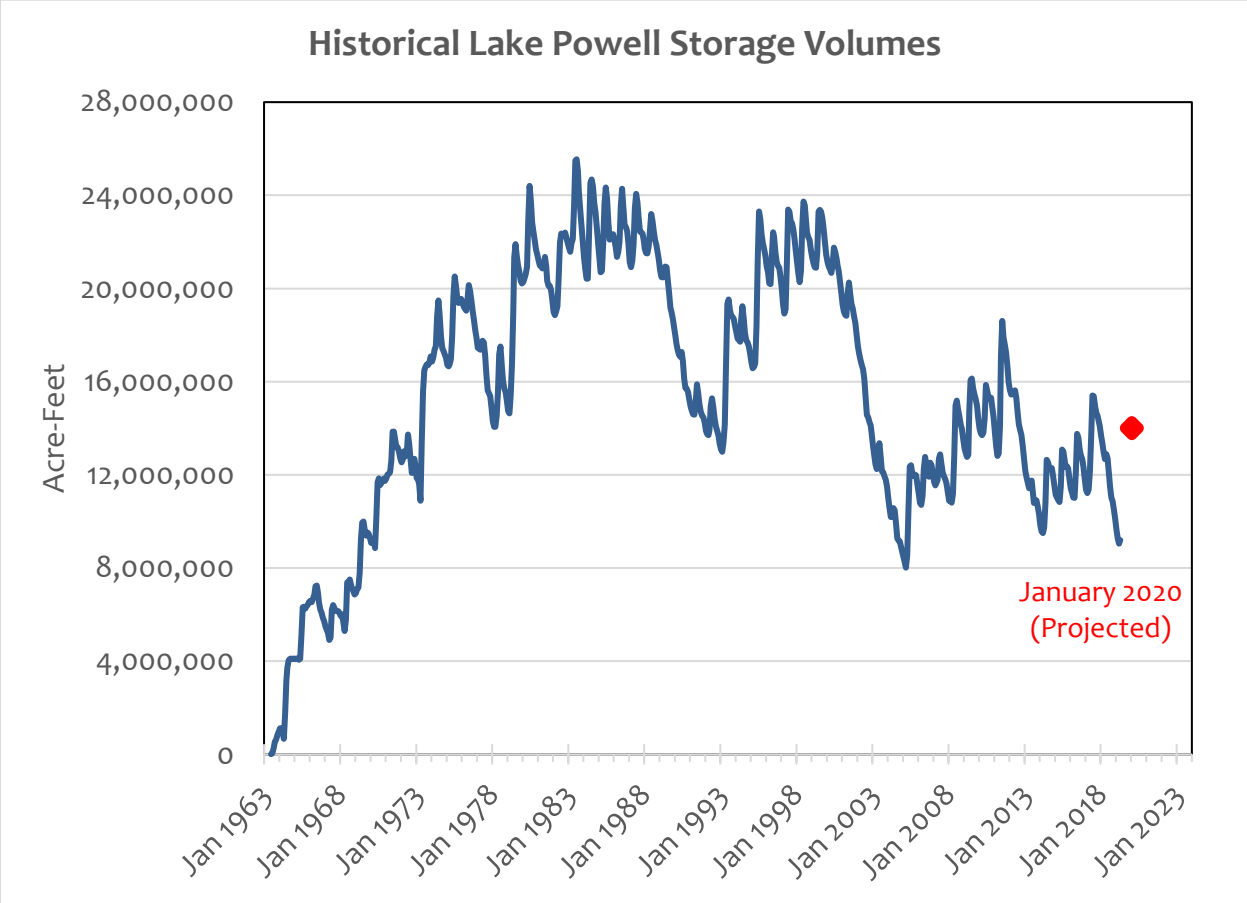

Figure 1. Historical Lake Powell storage with January 1, 2020 projection based on July 2019 24-month study.

The tasks identified for Phase III included:

a. Update the Lake Powell risk analysis (likelihood of dropping below elevation 3525' and likelihood of not meeting the 75 or 82.5 Maf over 10 year obligations) from previous phases to: 1) evaluate levels of risk using current demands as well as a reasonably probable increment of future growth, and 2) evaluate the efficacy of the Lower and Upper Basin Drought Contingency Plans (DCPs) in reducing or eliminating those risks.

b. Obtain, review, and modify as needed the State of Colorado's linked StateMod model. This model version was used for the State's Compact Compliance Study, which is being conducted under the purview of the Attorney General's office and remains confidential. The CWCB made the model publicly available in early 2018 (minus any model assumptions regarding future demands, hydrology, or analyzed approaches to administration of a Compact curtailment).
c. Evaluate a variety of scenarios in which an involuntary curtailment is applied to some or all post-Compact rights. These scenarios include conceptual "allocations" of a Compact shortage across basins and use-types, and include a variety of different deficit assumptions ranging from a full Compact call to different consumptive use reduction target volumes.
d. Evaluate the impacts to Lake Powell levels and risk with a hypothetical 1.0 Maf non-equalized demand management account. Volumes of 100 Kaf and 200 Kaf annually from the four Upper Basin states are assumed to come from voluntary, compensated, and temporary reductions in consumptive use. Colorado is assumed to contribute half of the total annual volume. Also evaluate the recovery time required when using part or all of the non-equalized pool, and the frequency and volumes of water supply deficit that the pool could not fully meet.

While Tasks A-C were completed as written with only minor modifications to scope, Task D will not be completed as part of Phase III and instead may be re-scoped for a future Phase IV. After the original scope and contract were approved, the 7 Basin States finalized, and Congress passed legislation approving the DCPs and their accompanying agreements. Significant to this study is the approval of a 500 Kaf storage account in one or more of the initial CRSP units that could be filled by a (yet-to-be fully defined) demand management program in the Upper Basin. Our initial approach to modifying the scope to align with the DCP was to reduce the volumes of both the demand management storage account and the annual contributions by half, to match the DCP. However, additional uncertainty exists over exactly when and under what circumstances water stored under an Upper Basin demand management program would be released – and hence no specific policy to follow when modeling these operations led us to postpone this task. In lieu of a full analysis of the potential benefits of a demand management account, we provide additional post-processing analysis of the one-time impacts such an account might have on Lake Powell elevations and Lee Ferry volumes (see Section III.c.)

II. Modeling Approach

Phase II of the Risk Study[3] described a new approach to modeling the complexities of both in-state water rights administration (using StateMod) and basin-wide "big river" operations (using CRSS). StateMod[4] is a highly detailed model capable of simulating water rights administration within the State of Colorado, and represents thousands of individual water rights, diversion structures and

[3] Colorado River Risk Study, Phase II Task 2 Final Report, Hydros Consulting Inc., 2018
[4] https://www.colorado.gov/pacific/cdss/statemod

reservoirs, as well as operating policies that govern numerous exchanges, instream flow requirements, interstate compacts, and other water rights administration actions. StateMod also includes the necessary physical representations of return flow timing and spatial distribution, and naturalized inflows for historical hydrology to enable simulation of the results of the combination of historical hydrology with current or future levels of demand. Herein it is used primarily to examine how possible Compact administration protocols might be implemented, the impacts of those protocols to each basin within Colorado, and the potential amounts of pre-Compact and post-Compact depletions in each of Colorado's west-slope basins.

CRSS is a comprehensive model of the Colorado River system, which simulates the policy-based operations of the major Federal reservoirs as prescribed by the 2007 Interim Guidelines[5] and the modified operations and water deliveries anticipated by the recently signed Drought Contingency Plans[6]. The larger spatial scale of CRSS in comparison to StateMod necessitates a higher level of spatial aggregation in representations both of inflow sources and smaller-scale water users, both of which exist primarily in the Upper Basin. The large contract water users and sparse inflows in the Lower Basin, as well as deliveries to Mexico, are also represented. CRSS simulations illustrate how the operations of the large mainstem reservoirs are affected by basin-scale factors such as regional hydrology and increasing demands due to regional population growth. In this study, CRSS allows for the evaluation of systemic risks such as critically low Lake Powell elevations impacting power generation and possible Compact deficits (flows past Lee Ferry), and is used to quantify the impacts of in-state activities on these metrics.

All of the risk profile analyses for Lake Powell and Lee Ferry in this Phase of the Risk Study use the linked StateMod/CRSS modeling tools previous developed in Phase II. This approach allows us to maintain consistency when modeling Colorado's water uses across both models. Additional information on the synchronization of the two models is provided in Section D below, while details on the model run sequencing and hydrologic trace simulation protocols are in Section E.

Technical details relating to comparisons made between the models are summarized in Appendix A. The versions of each model are listed in Appendix B, along with details on the process for obtaining each model.

A. Common Assumptions

Previous modeling using CRSS utilized demand datasets from the Colorado River Basin Study[7], which all increase over time based on various growth rate assumptions. StateMod uses fixed demands which do not vary over time, except to represent changes in irrigation water requirements due to variations in temperature and precipitation. StateMod models of individual basins within Colorado have differing lengths of hydrology data, and the linked StateMod model has a different hydrologic

[5] https://www.usbr.gov/lc/region/programs/strategies/RecordofDecision.pdf
[6] https://www.usbr.gov/dcp/
[7] https://www.usbr.gov/lc/region/programs/crbstudy/info.html

dataset than CRSS. Due to these differences, it was necessary to synchronize the demands and hydrology between the two models, so that the coupled simulations used the same data to the greatest extent possible.

All model runs for Phase III were carried out using fixed demand sets representing two different levels of use: "current demands" and "future demands" (described below). Hydrology data is from the years 1988-2015. This period is often called the "Stress Test", due to its lower-than-average flows (although it does include some periods of above average flows that are useful in simulating reservoir recovery), and was used extensively in Reclamation's modeling for the DCPs. Some hydrologic data filling was required in StateMod, because none of the basin models have hydrology extending through 2015.

B. StateMod Assumptions

StateMod simulations are carried out through a set of rules that execute in an order that follows the priority system used for water rights administration in Colorado. These rules include representations of direct diversions from streamflow, reservoir operations, exchanges, return flows, and many more water rights operations.

1. Hydrology

The physical processes simulated in StateMod are incorporated into algorithms that estimate timing and amount of flow, by accounting for the impacts of measured diversions and assumed return flows on observed stream gage flows from the historical record. The process of developing these input hydrologic datasets is described in detail in the modeling dataset documentation for each basin model, which is provided online, along with a detailed description of the assumptions applied for developing the demand dataset[8].

2. Current Demands

Current demands in StateMod are generally based upon historical acreage of irrigated lands, estimated crop water use requirements, and estimated system efficiencies. Historical and Baseline demand datasets exist for each basin model, with the Baseline dataset representing the best estimate of the demand for water by currently existing uses across the historical years of simulation. The Baseline demand dataset was used for this analysis, with adjustments as described below in Section **Error! Reference source not found.**. The total Baseline demand for depletions for the years 1988-2005 for the State of Colorado in StateMod is 2.803 Maf/yr. Annual supply shortages reduce the amount by 0.271 Maf/yr. resulting in an average simulated baseline annual depletion of 2.532 Maf/yr for the years 1988-2005.

[8] https://www.colorado.gov/pacific/cdss/modeling-dataset-documentation

3. Future Demands

Demands for the "future conditions" scenarios were developed through cooperation with Basin Roundtable technical representatives and staff from the two Conservation Districts. The purpose of the future condition demands was solely to examine how an increment of additional depletions could impact the risk profiles at Lake Powell and Lee Ferry. The identified increases in consumptive use were a combination of additional use of existing rights/projects as well as new uses. When available, Programmatic Biological Opinion (PBO) depletion allowances formed the basis for "allowable" growth without any Federal re-consultation requirements. PBO depletion allowances were used to set the future demand data for the Yampa, Gunnison, and Colorado mainstem basins. The southwest basins (San Juan, Dolores, and various tributaries), and the White basin future demands were developed primarily by in-basin BRT representatives with input from River District and Southwestern District staff. A total of 26 new or enlarged water use demands were identified and added to the model, consisting of agricultural, municipal, and industrial uses. The total increase in demands across all Colorado basins under the future growth scenario total 384 Kaf, or an increase of 13.7% over current demand levels. Actual modeled depletions from these demands averaged 11.5%.

C. CRSS Assumptions

The reservoir operational policies that currently guide system operations most significantly are the 2007 Interim Guidelines for Coordinated Operations of Lakes Powell and Mead, and these Guidelines are used as the operational policy throughout the simulation period. We recognize that the guidelines will be replaced by a new agreement after 2026, and that operations from 2027 into the future will likely be somewhat different. Nevertheless, absent a "better" guess at those future operations, the 2007 Guidelines are used throughout.

1. Hydrology

Natural flow hydrology input data for CRSS is developed by the Bureau of Reclamation, based upon the gage records of 20 stream gages in the Upper Basin, and 9 stream gages in the Lower Basin[9]. The streamflow data from these gages are processed along with historical demand datasets to calculate natural inflows. The demand sets used in development of the natural inflow data come from the Consumptive Uses and Losses Reports prepared by Reclamation[10]. The differences between the consumptive use amounts in the demand sets used for flow naturalization, and the scheduled amounts of consumptive use anticipated in the various demand sets used in simulations, are important to note and are discussed in detail in Appendix A.

2. Demands

CRSS contains spatially-aggregated representations of demands for depletions, and these demands were compared to the corresponding demands in StateMod to provide context for differences in simulation results. The basin-specific depletions simulated in CRSS were calculated through addition

[9] https://www.usbr.gov/lc/region/g4000/NaturalFlow/documentation.html
[10] https://www.usbr.gov/uc/envdocs/plans.html#CCULR

of computational sub-basins and a data object that summarizes depletions within each sub-basin. StateMod depletions were aggregated by basin and compared to the corresponding values in CRSS, and these comparisons are presented in Appendix A. The demands for all Upper Basin users outside of the State of Colorado were set based upon the 2007 UCRC demand schedule, which is the most recent UCRC demand schedule incorporated into CRSS. The demands for the Lower Basin were drawn from the demand schedule provided for the 2007 Interim Guidelines FEIS, with updated demands for Nevada from December 2016.

3. Drought Contingency Plans

The operations of the Upper Basin and Lower Basin DCPs are represented in CRSS as they were implemented for the round of modeling carried out by Reclamation in October of 2017 to support analysis of the impacts of the DCPs. These DCP implementations include re-operations of the Upper Basin CRSP reservoirs, and mandatory contributions in the Lower Basin with progressively greater reductions in use triggered as storage levels in Lake Mead decrease. The voluntary demand management program and corresponding non-equalized storage account that are discussed as potential options in the ratified version of the Upper Basin DCP are not explicitly included in CRSS, but the potential benefits from such programs are considered in the analysis of risk presented in Section III.

D. Model Synchronization

StateMod and CRSS are significantly different in terms of spatial and temporal resolution. The greater resolution of StateMod within the State of Colorado led to implementation of a model linkage where the portion of CRSS representing Colorado was replaced by StateMod.

1. Conceptual Linkage Implementation

The portions of CRSS that represent the State of Colorado were disconnected from the remainder of the model at points corresponding to the gage nearest the State line in each of the West Slope river basins. Table 1 lists these gages for each of the river basins on the West Slope of Colorado, along with the node in StateMod representing that gage, and the link in CRSS where the existing connection to the remainder of the Upper Colorado River Basin was replaced. The outflow simulated by StateMod at each of the nodes in Table 1 was input directly into CRSS as a reach inflow on a monthly timestep.

Table 1. Gages Linking StateMod and CRSS

River Basin	Linking Gage	USGS ID	CRSS Link
Yampa	Yampa River at Deerlodge Park, CO	09260050	YampaAtDeerlodge.GageInflow
White	White River near Watson, UT	09306500	WhiteNearWatson.GageInflow
Upper Colorado & Gunnison	Colorado River near CO-UT State Line	09163500	ColoradoNearCO_UTStateLine.GageInflow
Dolores	Dolores River near Cisco, UT	09180000	DoloresNearCisco.GageInflow
McElmo*	McElmo Creek near CO-UT State Line	09372000	LowerSanJuanRiver: BelowFourCorners.LocalInflow
Mancos*	Mancos River near Towaoc, CO	09371000	
La Plata**	La Plata River at CO-NM State line	09366500	SanJuanSJTribs.Inflow2
Animas**	Animas River near Cedar Hill, NM	09363500	
Los Pinos***	Los Pinos River at La Boca, CO	09354500	Navajo.Inflow
Piedra***	Piedra River near Arboles, CO	09349800	
San Juan***	San Juan River near Carracas, CO	09346400	

* ** *** These outflows were combined using confluence objects in CRSS to enter the system as aggregated flows at the specified links

Figure 2 displays the connections for the Yampa, White, Upper Colorado, Gunnison, and Dolores Rivers, and Figure 3 displays the connections for the San Juan River and its many tributaries. These monthly inflows are re-sequenced as part of the Index Sequential Method trace generation process, along with the rest of the natural inflows in CRSS.

In the White and Dolores basins, the gages used to link the models are downstream of water users in Utah that are not represented in StateMod, which ends at the State Line in each basin, above the River Gages used for linkage. To account for this, the Utah depletions were subtracted from the flows at the basin outflow nodes in StateMod. These Utah depletions total 6,487 AF/yr in the Dolores River Basin, and 3,958 AF/yr in the White River Basin. Depletions of the San Juan River and its tributaries outside of the State of Colorado are represented explicitly in CRSS, due to the implementation of the linkage in those basins, which is depicted in Figure 3. The San-Juan Chama Project depletions were removed from both the demands and the inflows in the linked StateMod model since these uses occur in the Rio Grande basin in New Mexico, and are represented separately within the CRSS model.

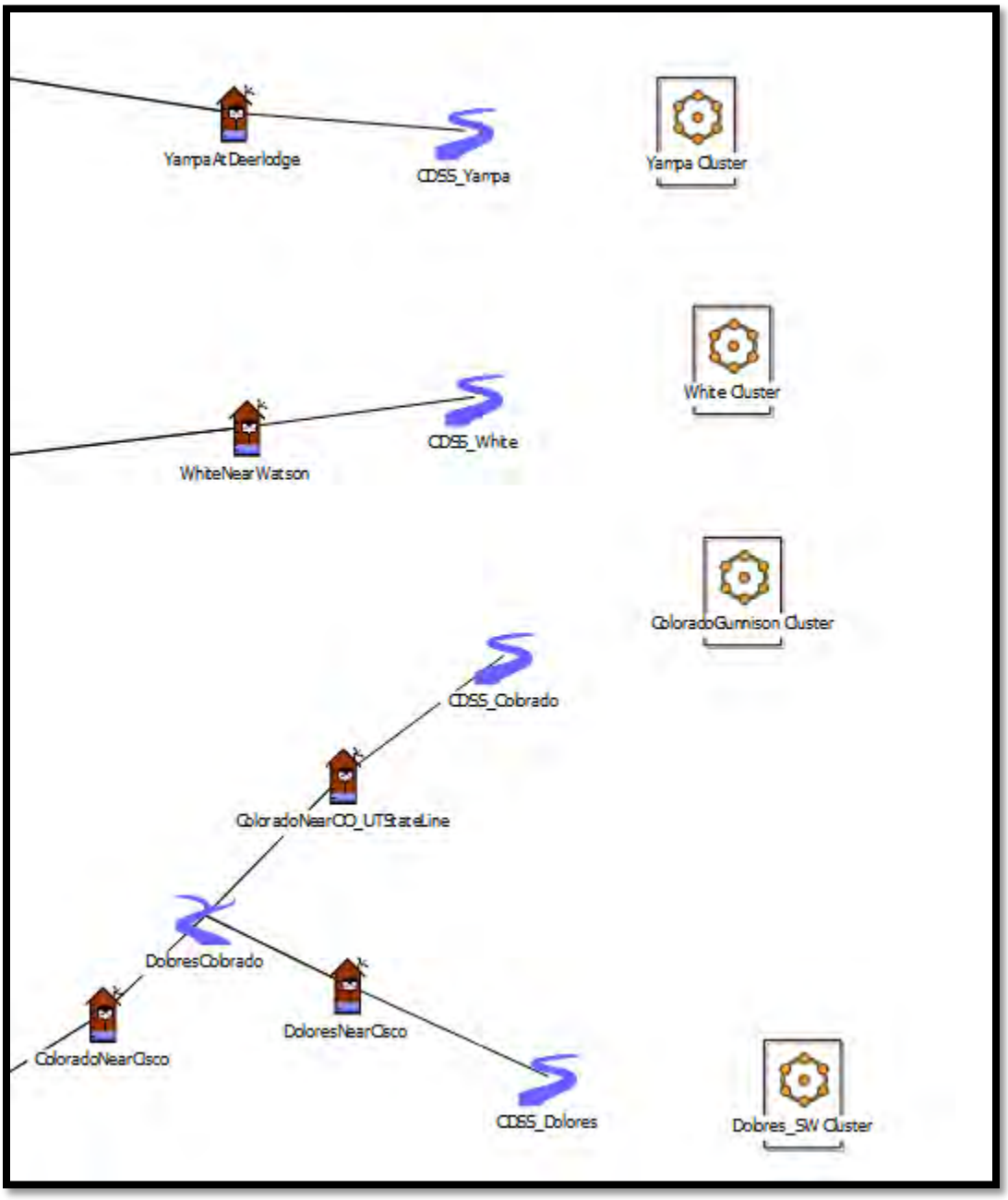

Figure 2. Yampa, White, Upper Colorado/Gunnison, and Dolores Basin Linkages

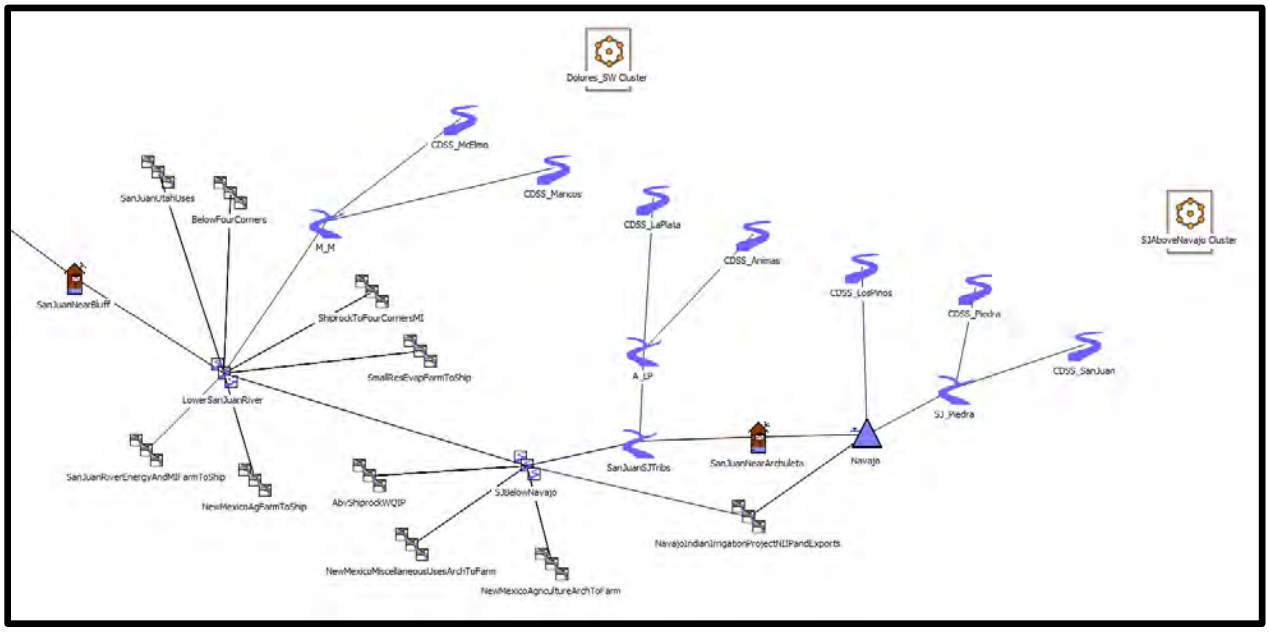

Figure 3. Southwest Colorado Basin Linkages

2. StateMod Surrogate Years

The simulation period for the StateMod linked model ends in 2005, while the Stress Test period used in CRSS covers the period 1988-2015. In order to fill in the years 2006-15 in StateMod, annual flow of the Colorado River at the Colorado-Utah state line for each of the years 2006-2015 was compared to the years 1909-2005, and the year with the closest total annual volume was selected as a surrogate. Table 2 lists the years and percent differences in flow, calculated by subtracting the observed flow in the recent year from flow in the surrogate year. The appropriate year-specific StateMod data from each surrogate year was then appended to the linked model input datasets.

Table 2. Surrogate Years for StateMod Extended Stress Test Simulation

Recent Year	Surrogate Year	% Difference in Flow
2006	1925	-0.7%
2007	1991	0.5%
2008	1938	-0.9%
2009	1971	-0.1%
2010	1991	0.3%
2011	1917	0.0%
2012	1981	3.0%
2013	1940	0.1%
2014	1948	-0.2%
2015	1944	0.1%

E. Simulation Protocols

As discussed above, both CRSS and StateMod were configured to run over the period 1988-2015. CRSS utilizes the Index Sequential Method (ISM) to generate multiple model runs using a single input dataset. In ISM, each year of the simulation period is used once as the first year of a trace (a "trace" as used herein describes one set of hydrology and demands that is run through the model). For the Stress Test period, there are 28 years of data, and thus 28 different traces that comprise a single CRSS scenario simulation. For example, when simulating the current demand schedule with the DCP, CRSS will cycle through the dataset 28 times, each time using a different starting year. Each trace can be thought of as a possible future, and we treat the 28 Stress Test traces as our collection of all possible futures for this analysis. Within a single trace's run, when the model reaches 2015, it loops back to 1988 and continues. All of the data associated with a given year remain synchronized through all the traces.

- Trace 1: 1988-2015
- Trace 2: 1989-2015 + 1988
- Trace 3: 1990-2015 + 1988-1989
- Trace 4: 1991-2015 + 1988-1990
- …
- Trace 28: 2015 + 1988-2014

StateMod does not have the ability to perform ISM-type simulations. However, the key outputs from StateMod that feed into the CRSS simulations are flows at the Colorado state line. It is thus straightforward to synchronize the StateMod outputs by year as inputs into the CRSS ISM method.

Model simulations in CRSS were carried out for each of the 28 traces for each scenario (e.g., current demands + DCP, future demands + DCP, etc.). Post processing to develop statistics for the model runs used the first 25 years of each trace, hence a total of 700 years (28 traces x 25 years per trace) is used to generate the frequency data presented in the CRSS results.

For the analysis of curtailment scenarios completed entirely in StateMod, we use both the linked StateMod model as well as the individual sub-basin models. The results presented for the curtailment scenarios (Section IV) are generally developed from model outputs for the period 1988-2005. A comparison of results from this subset of the available StateMod data shows only minor differences in average consumptive use when compared to the full period of simulation.

III. Analysis of "Big River" Risks

We evaluated the likelihood of reaching critically low Lake Powell elevations as part of Phase II of this Risk Study[11]. That analysis used Reclamation's CRSS model and demand schedules A and (a modified version of) D1 from the 2012 Basin Study, which escalate over time. The increasing demands in those data sets made it difficult to discern the impact of increasing demands as compared to changes in hydrology. This modeling builds upon that analysis by examining the increased risk associated with an increment of hypothetical future growth compared to current demands, both of which are simulated at fixed levels throughout their respective simulation periods. In other words, it was assumed that there were no changes in the current demands throughout the Baseline simulation period, and the values for the future demands were fixed and did not escalate over time in the "Future Demands" scenario. In addition, the recently completed and approved DCPs for both the Upper and Lower Basins were re-evaluated, to determine the impact those plans have on the risks associated with both current and future demand conditions. The DCP simulations include the Lower Basin's delivery reductions plus Mexico's contributions under Minute 323. The Upper Basin drought operations of CRSP reservoirs (Initial Units) is simulated, but no modeling of demand management or the corresponding use of the 500 Kaf storage pool as approved by the DCP was undertaken. We do provide a post-modeling analysis of the possible efficacy of a 500 Kaf demand management account, but a more robust evaluation is needed to better understand how and when such an account might be used. For these simulations, the 2007 Interim Guideline rules for Powell and Mead operations as well as Lower Basin shortages persist for the entire duration of the runs (i.e., beyond 2026). January 1, 2019 data are used for Initial reservoir storages.

Four scenarios were evaluated, combining each of the current and future demand sets with river operations both with and without the DCPs in place:

- Scenario 1: Current Demands Baseline (without DCP)
- Scenario 2: Future Demands Baseline (without DCP)
- Scenario 3: Current Demands + DCP
- Scenario 4: Future Demands + DCP

The risks of declining storage at Lake Powell and flow at Lee Ferry were analyzed for each scenario. The risk of flows at Lee Ferry dropping below assumed critical levels is related to the risk of declining storage at Lake Powell, but with the DCPs now in place, the timing of events and relative risks

[11] Colorado River Risk Study, Phase II Task 1 Final Report, Hydros Consulting Inc., 2018

needed to be revisited. We first address the timing and cumulative frequency of risk at Lake Powell, followed by the Lee Ferry / Compact deficit analysis, and finally a short discussion of potential demand management storage program benefits.

To be consistent with the modeling from previous Phases of the Risk Study, and to maintain consistency with the analysis of the DCPs, this study uses elevations 3525' and 3490' at Lake Powell as the indicators for critically low reservoir elevation. The origin of the use of the 3525' threshold for the DCP analysis is two-fold: 1) it represents the top of the Lower Elevation Balancing Tier from the 2007 Interim Guidelines, and 2) it is only 2.0 Maf above minimum power pool (3490'), and Reclamation staff have indicated that they would get "nervous" about the use of the turbines and power generation if Powell were to drop below 3525, because of possible air entrainment in the turbines and other hydraulic issues. Elevation 3490' is the nominal minimum power pool below at which no generation is possible.

Analysis of risk at Lee Ferry uses 10-year flow targets of 82.5 Maf and 75 Maf, which are the two most commonly cited volumes when defining a potential deficit or measuring compliance under Article III(d) of the Compact. The hydrologic and demand assumptions evaluated in this study, including the runs with additional future demands, did not produce 10-year flows below 75 Maf. Even so, it should be noted that this may not suggest a zero likelihood of such an occurrence, because the hydrologic data assumed for this study do not represent the full range of variability suggested in either the paleo-hydrologic record, or in simulations of the potential impacts of Climate Change. This result is also largely driven by the combined effects of the DCPs and the 2007 Interim Guidelines, which are assumed herein to continue beyond 2026.

Note that exact calculation of the risk of a particular event happening at some point in the future is only possible when the probability associated with all important factors is known. The deep uncertainty evident in the hydrologic record and the extent to which it reflects future conditions, combined with the uncertainty inherent in conflicting interpretations of guiding policy and administrative assumptions necessitates quantification of the relative risk associated with alternative policy actions that are controllable, such as implementation of DCP agreements, and incremental development of additional depletions. The incremental changes to the baseline risk profiles resulting from the modeling assumptions described above are analyzed here, solely to provide guidance in evaluating future policy decisions.

A. Risk Profile for Lake Powell Elevations

The modeled likelihood of Powell dropping below 3525 and 3490 are presented in Figure 4 and Figure 5, respectively. The plots show the cumulative frequency of modeled events. Recall that each scenario consists of 28 different traces. If in a single trace (out of the 28 traces) Lake Powell drops below the target level, that "event" is recorded. The timing of the event can be discerned from the increase in the cumulative frequency, while the total number of traces experiencing the event is shown as the maximum of the cumulative frequency plot.

For example, in Figure 4, Scenario 3 has a maximum (cumulative) frequency of 43% (12 of 28 traces). If our dataset of 28 "futures" are indicative of future hydrology, then there is a 43% likelihood of Lake Powell reaching that critical level at some point in the next 25 years. Because the initial condition for Lake Powell is relatively low (approximately 10 Maf), the majority of events when Powell hits 3525' occur relatively early in the simulation, if at all. Over the 28 year Stress Test period, there are some wetter years, and these wetter periods (particularly the late 1990s) refill the system enough so that the very dry periods that follow do not cause Powell to drop to critical levels. It is interesting to note as well that when the future demands scenarios are simulated (Scenarios 2 and 4), the frequency of hitting 3525' increases dramatically. The additional fixed demands in those Future scenarios is large enough that even through the wetter periods, Powell does not recover sufficiently to be able to make it through the dry years without going below 3525'. Finally, note that the DCPs provide a greater benefit over time under current demand conditions as compared to future demands. This is due to the essentially fixed magnitude of CRSP releases available under drought operations being overwhelmed by the magnitude of shortages under the future demands simulation.

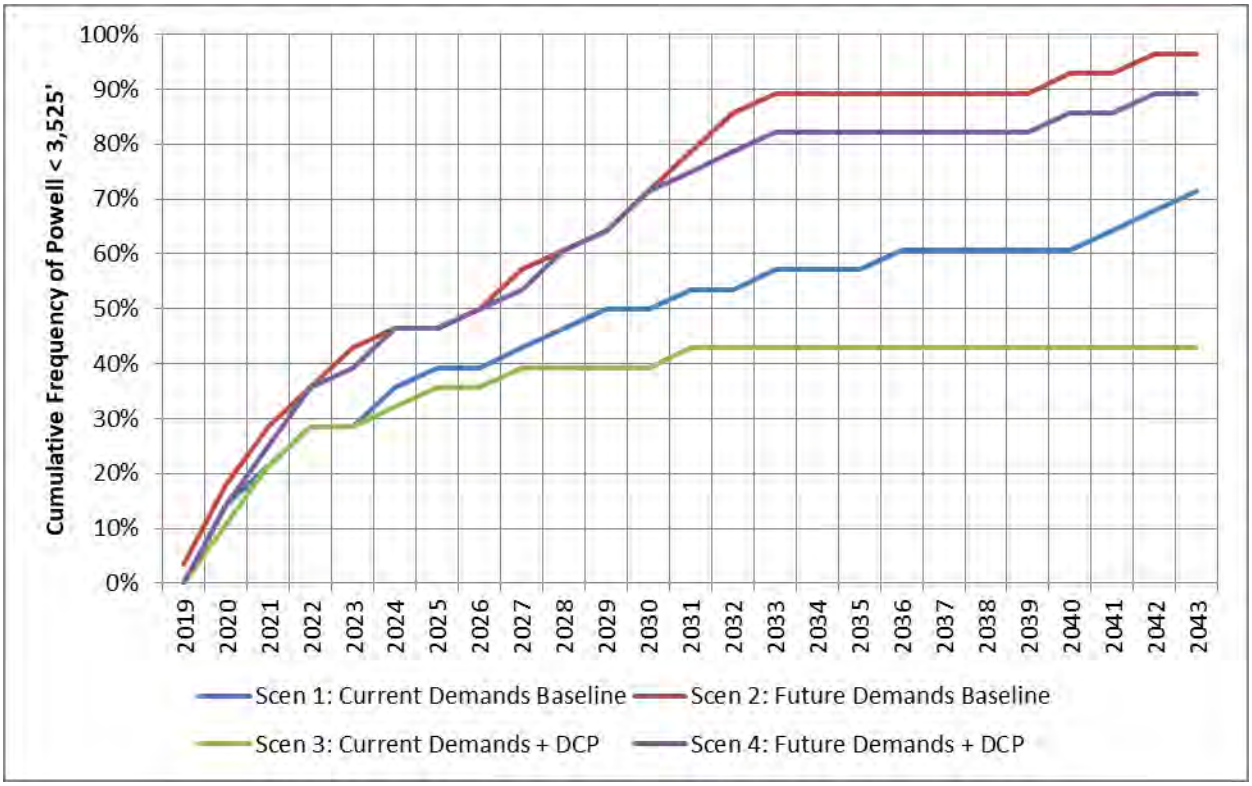

Figure 4. Risk Profile for Lake Powell elevation 3525'.

The benefit of the DCPs is more apparent under future demands when looking at the 3490' elevation power generation threshold (Figure 5). Under the future demand scenario, the DCPs act to significantly reduce the likelihood that Powell would drop below its minimum power elevation. This result is expected, as the CRSP drought operations turn on, and the Lower Basin conservation targets act to stabilize Lake Mead above elevation 1025'. With Mead stabilized above 1025, and

Powell dropping into its Lower Elevation Balancing Tier, releases from Powell are likely to be closer to 7.0 Maf than the 9.5 Maf maximum that is possible under the 2007 Interim Guidelines.

As with the 3525' threshold, the impact of increased demands is also clear. The modeled increase in Upper Basin depletions of ~11.5% roughly doubles the risk (likelihood of Lake Powell reaching that critical level at some point in the next 25 years) at both the 3525'and 3490' thresholds with the DCPs in place.

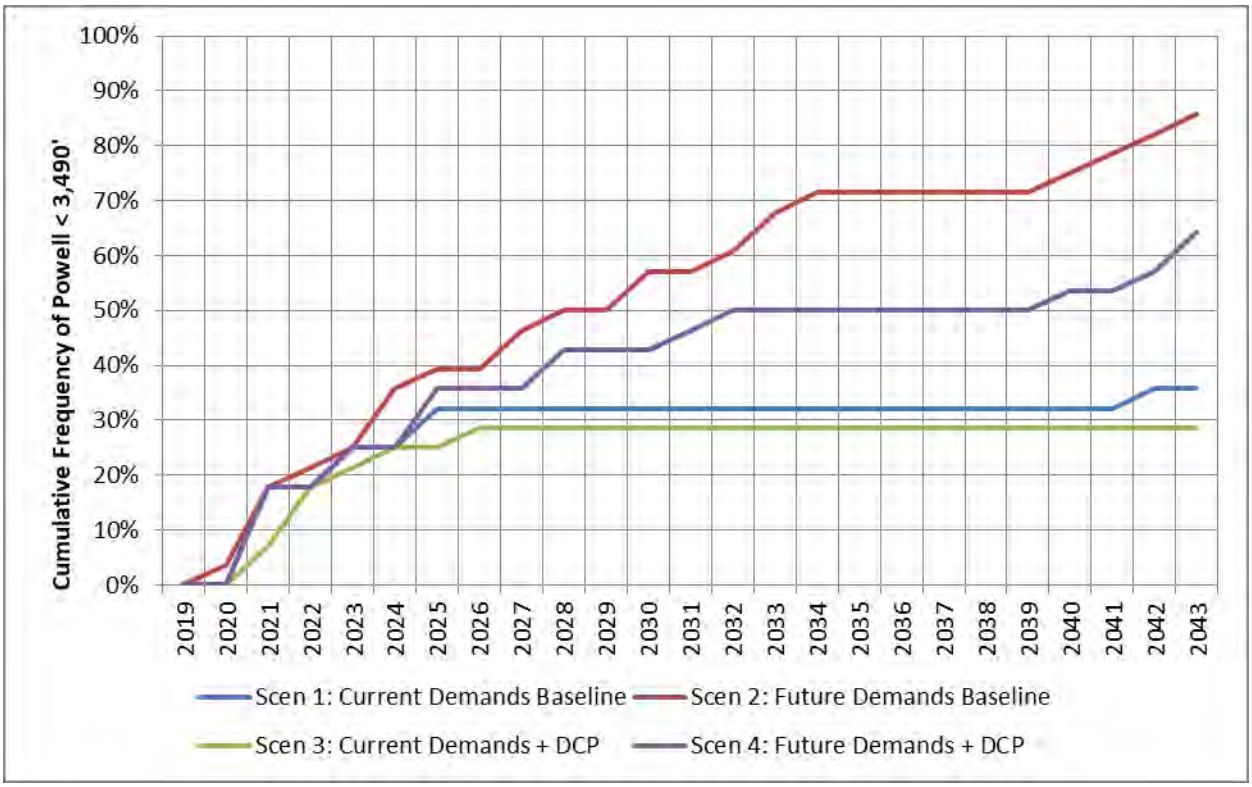

Figure 5. Risk Profile for Lake Powell elevation 3490'.

B. Risk Profile for Compact Deliveries

Exactly what the Upper Basin's obligations are with respect to Lee Ferry "non-depletion" volumes under the Colorado River Compact is the subject of much debate and uncertainty, and this study makes no attempt to answer those questions. For this study, we analyzed the two most commonly cited volumes, 75 Maf and 82.5 Maf, both of which are computed using a 10-year running total. These represent the Upper Basin obligation under Article III(d) of the 1922 Compact to "*not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75,000,000 acre-feet for any period of ten consecutive years*", and an additional 750 Kaf annually, to reflect a conservative (i.e. disadvantageous to the Upper Basin) interpretation of what the Upper Basin's obligation may be under Article III(c). As mentioned above, the simulations in this study produced no instances of 10-year totals dropping below 75 Maf. Minimum Lee Ferry volumes by scenario are shown in Table 3.

Table 3: Minimum 10-year Lee Ferry volumes by scenario.

Scenario	Minimum 10-Year Volume at Lee Ferry (af)
Current Demands Baseline	80,414,547
Future Demands Baseline	78,681,420
Current Demands + DCP	78,650,744
Future Demands + DCP	77,221,987

Figure 6. Cumulative Frequency of Lee Ferry flows < 82.5 Maf / 10-years.Figure 6 shows the cumulative frequency of dropping below the 82.5 Maf threshold at Lee Ferry for each scenario. As with the Powell elevation thresholds, the cumulative frequency statistic increases each time another trace within a given scenario drops below the 82.5 Maf threshold. For example, by the end of the 25 year time horizon, all but three of the Scenario 4 traces (see purple line) has experienced at least one year in which the trailing 10-year total was less than 82.5 Maf. Most of the Lee Ferry "deficits" at the 82.5 Maf threshold do not start occurring until 2024 or later. Because the model uses historical flows as initial conditions, and those flows have generally been in the 9.0 Maf range for the past several years, it takes several years of simulated Powell Releases of 7.48 Maf or lower before the 10- year total drops below 82.5 Maf.

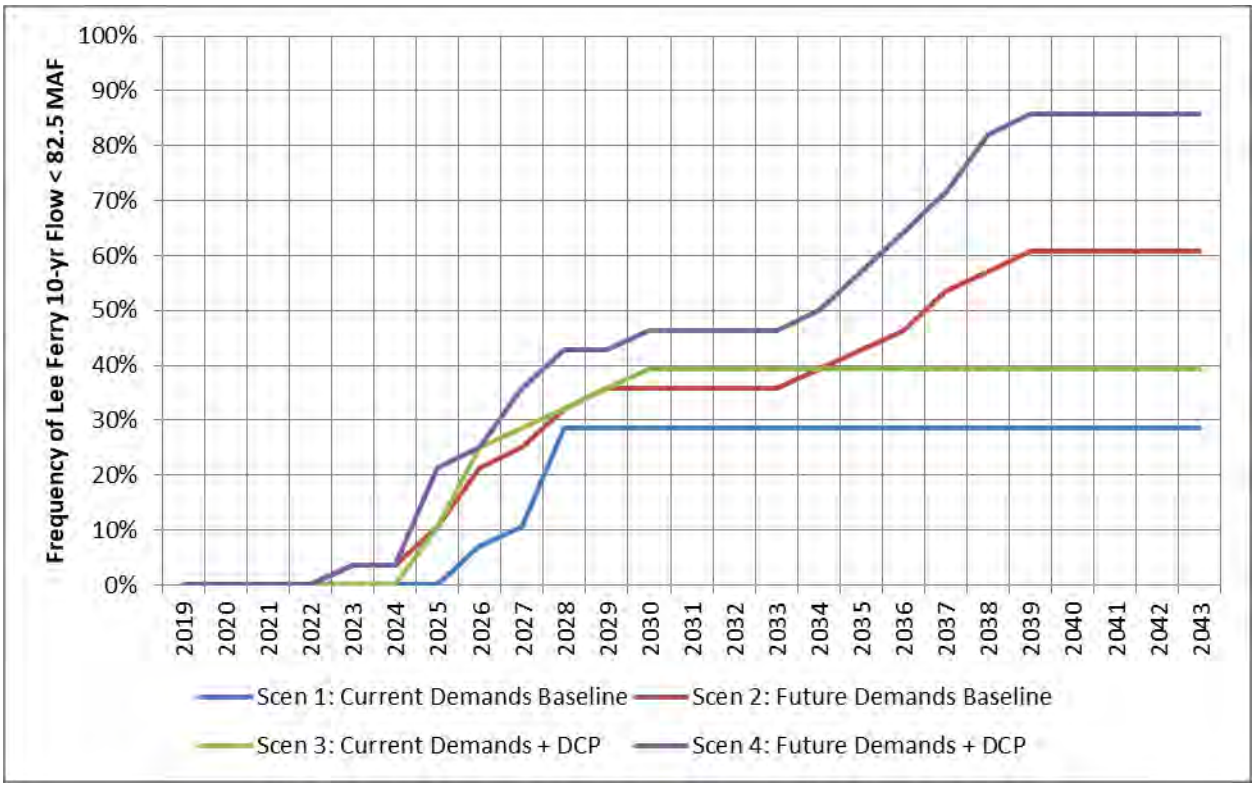

Figure 6. Cumulative Frequency of Lee Ferry flows < 82.5 Maf / 10-years.

The typical pattern of higher risk with the future demands dataset seen in the Lake Powell results carries through to Lee Ferry. However, note that the likelihood of a Lee Ferry deficit at the 82.5 Maf threshold *increases* when the DCPs are implemented. This result is expected, because the DCPs act to increase lake levels at both Powell and Mead. In doing so, the DCPs will tend to push Powell releases into the lower end of the ranges that are prescribed for each operating tier. In particular, DCP operations tend to keep Powell in the Mid-Elevation Release Tier for extended periods of time, by maintaining elevations above 3525' when possible. So instead of getting 9.0 Maf or 8.23 Maf releases, the DCP scenarios tend to result in a lot more 7.48 Maf releases. And if Powell does drop into the Lower Elevation Balancing Tier, it is more likely to have a 7.48 or even 7.0 Maf annual release than 9.0 Maf or 9.5 Maf. This trend towards reduced release volumes at Powell with the DCPs in place is further illustrated by Figure 7 and Figure 8. Under current demands, the likelihood of dropping below 82.5 Maf increases from 28% to 39% when including the DCP. The volumes of deficit increase as well, and the likelihood of a deficit greater than 1.5 Maf increases from 4% to 21%.

As seen above in Figure 4, the DCP operations do not significantly impact the cumulative frequency of maintaining Powell Pool elevations above 3,525' for the entirety of the simulation, but they can prevent the onset of shortfall for long enough, or promote recovery more quickly, such that the minimum elevation in Powell benefits significantly, as seen in Figure 5**Error! Reference source not found.**. This difference in the lowest resulting storage amounts in Powell is seen in reverse at Lee Ferry, as the amount of extra storage at Powell is equal to an amount not flowing past Lee Ferry.

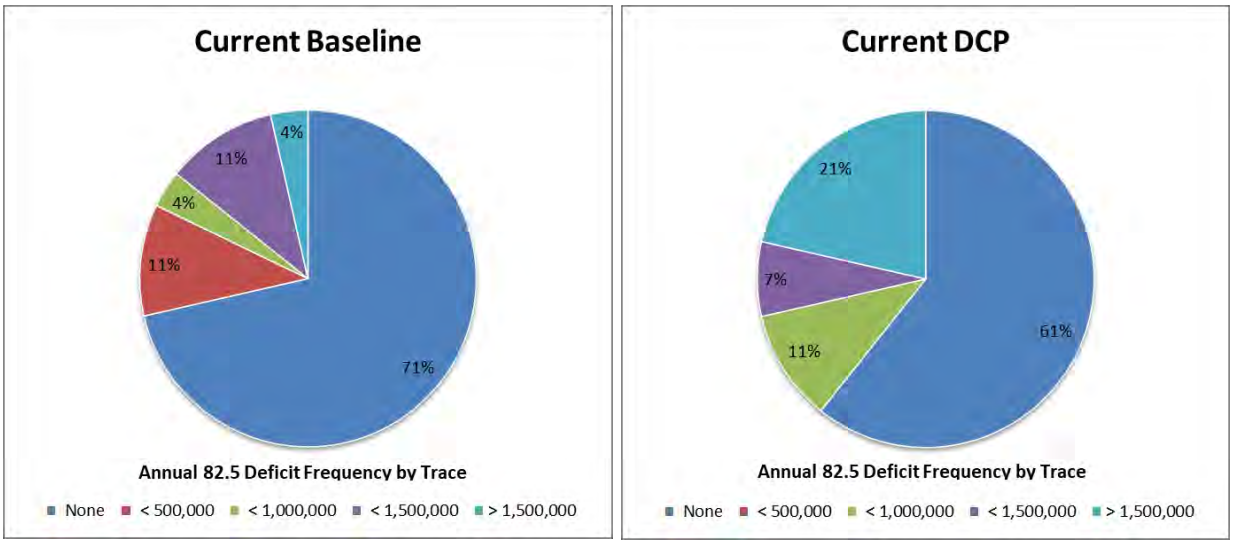

Figure 7. Current Demands Baseline and +DCP Risk Profile for Lee Ferry < 82.5 Maf. The volumes shown are the maximum deficit volumes seen in each trace.

The elevated demands in the Future Baseline scenario result in more traces with simulated Lee Ferry shortfalls, and shortfalls of greater magnitude, as compared to the Current Baseline scenario. Figure 8**Error! Reference source not found.** displays the distribution of maximum shortfall by trace, where it can be seen that 86% of traces which include the DCP experience a shortfall, and the majority of the shortfalls exceed 1.5 Maf.

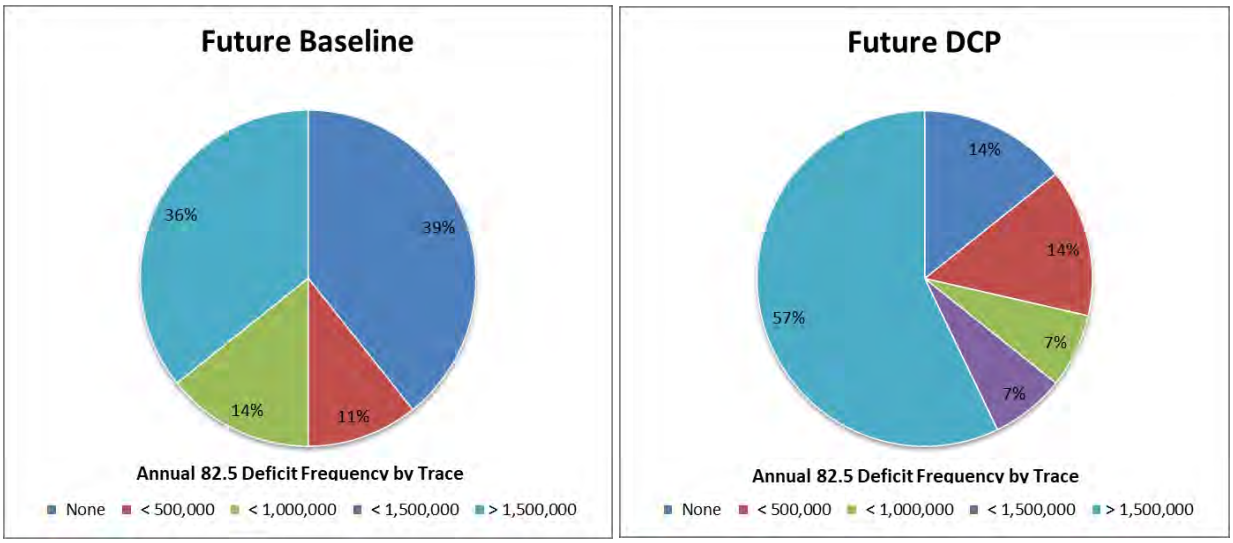

Figure 8. Future Demands Baseline and +DCP Risk Profile for Lee Ferry < 82.5 Maf. The volumes shown are the maximum deficit volumes seen in each trace.

1. Caveat to the Lee Ferry Analysis

As discussed above, the DCPs do a good job of protecting Lake Powell elevations, but actually increase the frequency of 10-year Lee Ferry volumes dropping below 82.5 Maf. When these "deficits" occur, they are often not caused by a lack of water in Powell, but instead by adhering to the policies of the Interim Guidelines. If, as a matter of policy, the Upper Basin decided to ask Reclamation to make additional releases to stay above the 82.5 Maf threshold, it is likely that a significant amount of that deficit could be readily released from Lake Powell. As an example of the intertwined nature of the risks at Lake Powell and Lee Ferry, Figure 9**Error! Reference source not found.** illustrates the simulated pool elevation and 10-year rolling average Compact volume for the hydrologic trace beginning in 2012. The dashed black line in the figure represents both the 82.5 Maf threshold for 10-year flow at Lee Ferry (left y-axis), and elevation 3,525' at Lake Powell (right y-axis). When Powell's elevation crosses the 3525' threshold, both in decline and in recovery, it precedes the 10-year Lee Ferry flow crossing the 82.5 Maf threshold, with a longer lag time between the two events in recovery resulting from the operations dictated by the Interim Guidelines. In this example, by the time the Lee Ferry deficit reaches its maximum in 2029, Powell has approximately 4.0 Maf in storage above minimum power pool.

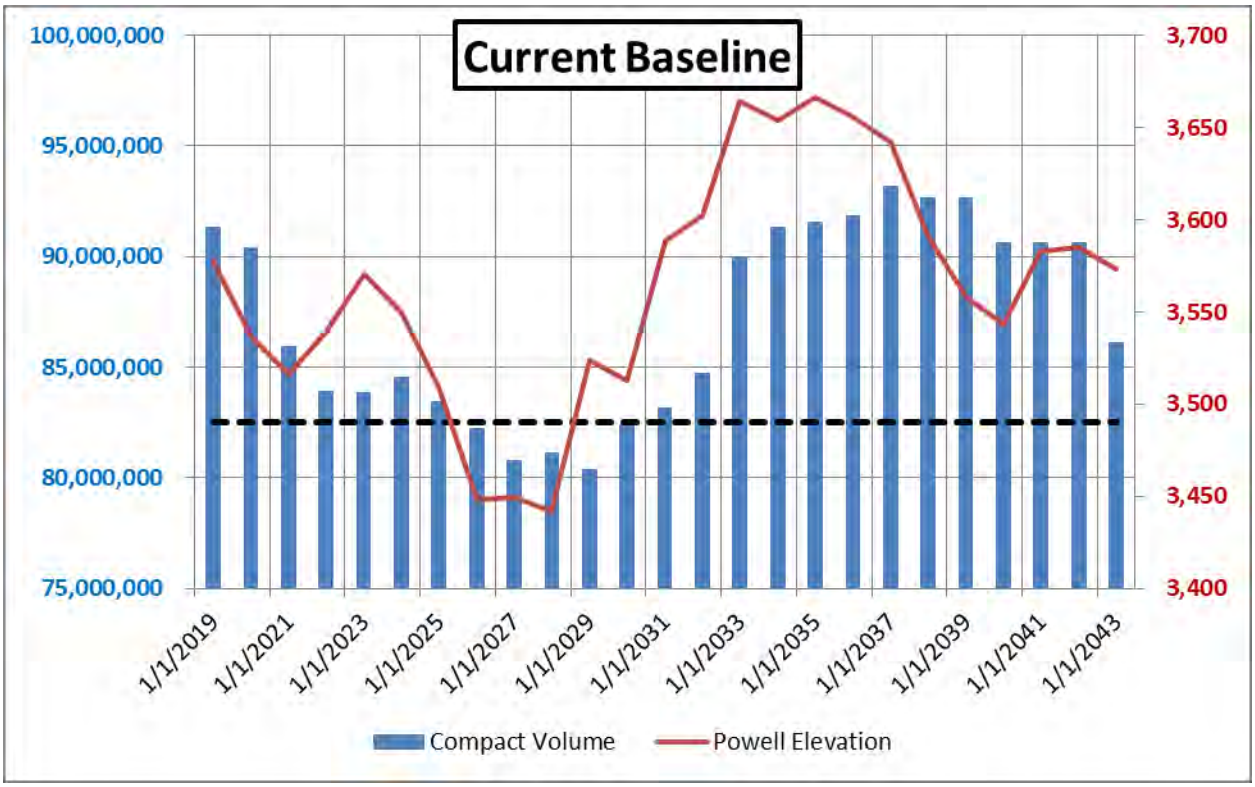

Figure 9. Illustration of the linkage between Powell elevation and Lee Ferry 10-year volumes when operating under the 2007 Interim Guidelines and Drought Contingency Plans

To investigate this phenomenon further, the 82.5 Maf deficit magnitudes were compared to the amount of storage in Lake Powell above minimum power pool (3490') that existed when those deficits occurred. This analysis was carried out as a post-processing step for all four scenarios. The analysis indicates that release of additional water from Lake Powell above the amounts dictated by the Interim Guidelines could eliminate all but one of the Lee Ferry assumed 82.5 Maf shortfalls under the Current Demands Baseline scenario. That single trace would require an additional 1.46 Maf to maintain flows of at least 82.5 Maf. The Current Demands +DCP scenario would also have one scenario in which the existing storage volumes above minimum power pool are unable to eliminate the 82.5 Maf deficit. However, with the DCP in place, the volume of that remaining deficit is only 108,000 AF.

When looking at the Future Demands scenarios, a significant number of the 82.5 Maf deficits can be eliminated by utilizing remaining Powell storage above 3490' elevation. For the Future Demands scenario, use of that water would leave 25% of the traces with a remaining deficit (compared to the original 61%). The maximum remaining deficit from those traces is about 2.1 Maf. The Future Demands +DCP scenario experiences shortfalls remaining in only 29% of traces, as compared to the original deficit frequency of 84%. The maximum volume of those remaining shortfalls is 1.38 Maf.

The exact operational modifications at Powell that would result in release of these additional amounts of water, above or below elevation 3490', were not represented in the modeling, and the

development of operational policy that could achieve such deliveries in compliance with existing operational requirements was not considered as part of this analysis.

C. Effectiveness of a 500 Kaf Demand Management Account

The DCP legislation provides for the creation of a 500 Kaf account in one or more of the CRSP Initial Units to be used, if needed, for Compact compliance. Because of uncertainty over the location and operating policy for such an account, we did not attempt to model a comprehensive demand management program in this study. In lieu of that, we analyzed how effective an existing 500 Kaf account would be in offsetting the modeled deficits relative to the 82.5 Maf threshold for compact accounting. This approach greatly simplifies the analysis by assuming that a full 500 Kaf account is available at the onset of each event, and does not reflect the reality that longer term events or events that occur more frequently would reduce the overall effectiveness of the program because of the time needed to refill an account once it has been depleted.

Current Demands Baseline: 8 of 28 traces had at least one instance of the 10 year running total dropping below 82.5 Maf. If a 500,000 AF demand management storage account were available for use at Lake Powell as contemplated in the Upper Basin DCP, it could be used to eliminate the shortfalls in 3 of the 8 traces with deficits. Recall from the previous section that this does not include the possible use of the additional storage below 3525' and above the minimum power pool (3490'). If additional storage above the minimum power pool is used, the deficits in all but one of the traces can be eliminated. The amount of the remaining assumed shortfall at Lee Ferry in the one trace where the shortfall could not be eliminated by release of the remaining water above power pool in Powell would be approximately 962 Kaf.

Current Demands +DCP: 11 of 28 traces had at least one instance of the 10 year running total dropping below 82.5 Maf. (As noted above, the DCP increases the number of traces below 82.5Maf because it generally reduces the average release from Powell). A 500,000 af demand management storage account in Lake Powell would not fully offset the deficit in any of these traces. However, use of remaining storage above minimum power pool would eliminate deficits in all of the traces.

Future Demands Baseline: 17 of 28 traces had at least one instance of the 10 year running total dropping below 82.5 Maf in the future demands baseline. A 500 Kaf demand management storage account would fully eliminate deficits in 3 of these 17 traces. Use of remaining storage above minimum power pool would eliminate deficits in another 9 traces. 5 traces would contain shortfalls after using both the demand management storage account and remaining storage above minimum power pool, with a maximum shortfall of 1.6 Maf. The reduced effectiveness of the demand management storage account in the Future Baseline, as compared to the Current Baseline, is the result of the difference between Future and Current demands greatly exceeding the size of the account when the annual demand difference (and hence reduced Lake Powell inflows) accumulates over a ten year period.

Future Demands +DCP: 24 of 28 traces had at least one instance of the 10 year running total dropping below 82.5 Maf in the future demands plus DCP scenario. A 500,000 af account would eliminate the deficit in 4 of these 24 traces. Use of remaining stored water above minimum power pool would eliminate deficits in all but 5 of the remaining traces. The maximum remaining deficit after use of Powell storage above minimum power pool is about 881 Kaf.

IV. Colorado River Depletion Analysis

The purpose of Tasks B and C was to develop a comprehensive understanding of the linked StateMod model provided by CWCB, and then implement and analyze a variety of potential curtailment scenarios for the Colorado River basins. StateMod represents in detail the water rights, diversion structures, reservoirs, instream flow rights, exchanges, and numerous other processes that characterize water administration in Colorado. Depletions in StateMod are summarized for the structures included in the model, such as diversion ditches and reservoirs, and for aggregations of structures, such as water districts, but depletions are not summarized in model output by water right. Because of this, determination of the amount of depletions that are senior or junior to key dates requires additional careful consideration.

A. Calculating Depletions at Specified Priorities

The methodology applied here for determination of amounts of depletions senior to key dates required modification of the structure of existing StateMod models. An instream flow water requirement was inserted above the downstream-most node of each StateMod model with a decreed flow rate of 9,999,999 cfs, which is a sufficient amount to call out all water use junior to the administration number of the instream flow requirement. Varying the administration number of the instream flow requirement, and analyzing the resulting depletions was carried out to determine amounts of depletions senior to dates of interest. Depletions were calculated using TSTool scripts that retrieve results directly from the StateMod binary output files. Depletions simulated in StateMod include consumptive use, reservoir evaporation, and transit losses.

This method of determining senior depletion amounts was tested by setting the call date to be senior to all water rights on the Western Slope. The administrative date used for this confirmation run was January 1, 1850. The only depletions simulated at this call date resulted from evaporation of stored water that is present as an initial condition for each of the reservoirs in the model.

B. Depletions of Colorado River Water in Colorado

The first analysis undertaken with StateMod was to simply estimate the amount of consumptive use of Colorado River water currently occurring in Colorado. Figure 10 shows minimum, average, and maximum depletion values for the period 1988-2005. Variations in depletions are caused primarily by changing hydrologic conditions from year-to-year, which in turn changes the frequency, timing, and

depth of administrative calls in each basin. Total estimated depletions of Colorado River water average just over 2.5 Maf for the simulation period.

Basin	Annual Depletions (acre-feet)		
	Minimum	Average	Maximum
Yampa	173,547	196,982	215,193
White	48,550	62,060	70,397
Colorado	1,117,487	1,220,386	1,345,192
In-Basin	*650,747*	*669,257*	*692,193*
TMDs	*466,740*	*551,129*	*652,999*
Gunnison	480,358	551,150	599,762
Southwest	335,365	500,717	556,627
Total	2,155,307	2,531,296	2,787,171

Figure 10. Depletions of Colorado River water. From the StateMod Baseline model.

C. Pre-Compact Depletions

Of the roughly 2.5 Maf of depletions, we then quantified the proportion that could be attributed to "pre-Compact" water rights. The depletions senior to two possible Compact administration dates were quantified using administration numbers (aka Holt Numbers, developed by the Colorado Division of Water Resources) and appropriation dates. The more senior of the two potential dates of Compact administration is November 24, 1922, which is the date on which six of the seven Basin States signed the Compact. The more junior of the potential dates is June 25, 1929 (administration # 29030), which is the date on which the Boulder Canyon Project act was signed into law by President Hoover. The depletion amounts senior to these dates are displayed in Figure 11Figure 11, using both the administration numbers and appropriation dates of each water right:

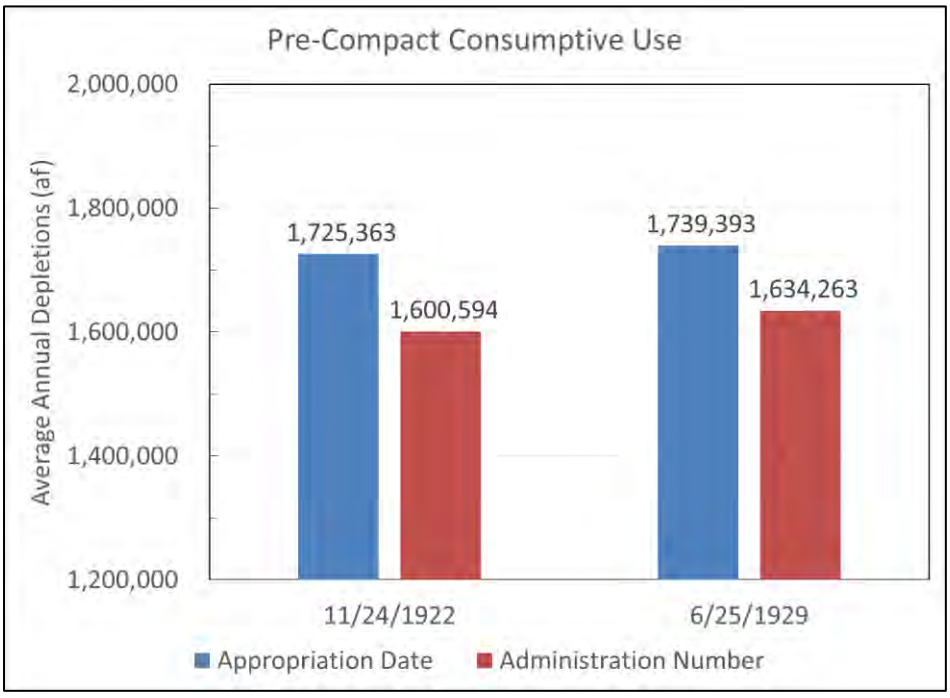

Figure 11. Pre-Compact Depletion Volumes

These depletions are different from the historical depletions associated with water rights senior to the Compact, due to historical use of water rights with priorities both senior and junior to the Compact to irrigate the same lands. These levels of pre-Compact depletions are notably elevated in comparison to some previous estimates, such as the estimate listed in the minutes of the 6th meeting of the Colorado River Commission, where an average total for the State of Colorado's irrigation of lands in production since 1920 was listed as 1,110,000 AF/yr. One of the sources of this difference is the improvement in quantification of potential consumptive use in high altitude irrigation, and another source of the difference is the enhanced efficiency with which pre-Compact water rights are simulated to be used in times of a persistent call.

For the remainder of this report, the term "pre-Compact" will be used to refer to uses with administration numbers senior to the 1922 date. Using the administration number approach will yield the lower of the two volumes of pre-Compact usage, and hence is a conservative assumption for this analysis. The lowest estimate of the amount of pre-Compact use is considered conservative because it corresponds to the highest estimate of the amount of "post-compact" use that would be subject to curtailment under the Compact. The average amounts of pre-Compact depletions by basin for each basin in Colorado are listed in Table 4, along with the proportions each basin represents in terms of total pre-Compact depletions. The Colorado main stem depletions in Table 4 are further differentiated between in-basin uses and trans-mountain diversions (TMDs).[12]

[12] The TMDs referred to in this Report divert water from the Colorado River main stem Basin into the South Platte and Arkansas River Basins. There are a number of smaller post compact trans-mountain diversions that divert from the San Juan and Gunnison Basins into the Rio Grande and Arkansas River Basins. These smaller

Table 4. Pre-Compact Depletions by Basin

Basin	Pre-Compact Depletions (AF/yr)	As Percentage of Statewide Total
Yampa	138,544	8.7%
White	50,173	3.1%
Colorado	594,169	37.2%
In-Basin	574,997	36.0%
TMDs	19,173	1.2%
Gunnison	493,879	30.9%
Southwest	322,561	20.2%
Total	1,599,327	100.0%

D. Post-Compact Depletions

The difference between depletions simulated with and without a Compact call are depletions which rely at least in part on post-Compact rights to meet their consumptive use needs. These depletions are different from the historical depletions associated with post-Compact rights for reasons similar to those that differentiate the pre-Compact depletions described in the previous section from the historical depletions attributable to pre-Compact water rights. Average annual post-Compact depletions for each basin are listed in Table 5, both as volumes and as the percentage they represent of the statewide total. The percentages of total post-Compact use are used as the basis for proportional distribution of curtailment volumes in some of the scenarios evaluated in Section V.

Table 5. Post-Compact Depletions by Basin

Basin	Post-Compact Depletions (AF/yr)	As Percentage of Each Basin's Total Use	As Percentage of Statewide Total
Yampa	58,438	29.7%	6.3%
White	11,887	19.2%	1.3%
Colorado	626,216	51.3%	67.2%
In-Basin	94,260	14.1%	10.1%
TMDs	531,956	96.5%	57.1%
Gunnison	57,271	10.2%	6.1%
Southwest	178,157	35.6%	19.1%
Total	931,969	36.8%	100.0%

trans-mountain diversions were not split from the San Juan and Gunnison Basin values as was done for the Colorado River mainstem.

V. Curtailment Scenario Analysis

The State of Colorado, through the CWCB and AG office, has undertaken a Compact compliance study, which remains confidential. The questions of how and under what conditions a Compact call might be implemented are numerous and highly uncertain. Absent any known path forward if such a situation arose, the WSBRTs wanted to have explored a variety of "what if" scenarios for curtailment. These limited scenarios are not proposals for how to implement a call, but are instead background information across a broad range of possibilities to allow for better understanding of where the impacts may be and how those impacts may vary. The risk analysis presented in the previous section indicates that evaluation of potential curtailment scenarios is a worthwhile step to prepare for future negotiations. It should also be noted that additional potential administrative scenarios are possible, but were beyond the scope of this phase of the modeling effort.

Note also that this analysis of curtailment scenarios is different from and should not be confused with the ongoing discussions and activities related to demand management. Demand management generally refers to the intentional conservation of water to be used to ensure Compact compliance while avoiding the need for water administration to meet the Upper Basin's obligations. A central concept behind any demand management program is that it should be voluntary, temporary, and compensated. The State of Colorado, through the CWCB and AG's office has proceeded with its "2019 Work Plan for Intrastate Demand Management Feasibility Investigations". See http://cwcb.state.co.us/water-management/Pages/DemandManagement.aspx for more details.

A. Scenario Definitions and Rationale

A Compact call is different from a typical administrative call in terms of the time scale associated with the upstream depletions that result in the shortfall addressed by the call, and this difference in time scale suggests that the mechanism for most equitably distributing the cutbacks required by the call could potentially be different for a Compact call, in comparison to a typical real time administrative call. In most cases, for a typical administrative call, the diversions causing the shortfall are occurring upstream of, and at the time of the call, by water users with priority junior to the water user experiencing a shortfall.

A notable exception to this in current administrative practice relates to the administration of out-of-priority upstream storage, which is codified in C.R.S § 37-80-120. Administration of out-of-priority upstream storage is handled by allowing diversions by upstream water users that have a contingency allowing the diversions to be retroactively called out, if the downstream senior right is unfulfilled at a later date. This is conceptually similar to a Compact call, which would result from upstream use junior to the Compact date that occurred at a time prior to the shortfall. The temporal disconnection between the timing of shortfall and the timing of the water use that results in a Compact call is greater than the disconnection involved in out-of-priority upstream storage, which indicates that administration of a Compact call could be based upon long-term patterns of use.

The scenarios evaluated here represent potential methods for distributing the risk of future curtailment inherent in the exercise of rights junior to a right not based upon instantaneous flow

availability. Note that these scenarios were developed through multiple meetings and conversations with various BRT groups, and are not intended in any way to represent a full set of "preferred" approaches to possible Compact administration. They are illustrative of a range of possible approaches to reducing consumptive use in an involuntary manner.

1. Direct Priority Administration

One method through which Compact administration might be carried out would be through direct priority administration applied at the same level across all basins. In the direct priority administration scenarios, a single administrative date was determined where uniform application of a call at that date across all basins would result in an average depletion reduction of a specified amount. The most stringent version of this scenario involves application of a call date equal to the date of the Compact, because users senior to the date of the Compact are explicitly exempted from curtailment by Article VIII of the Compact.

2. Basin-Specific Proportional Administration

Another hypothetical scenario for distributing the depletion reductions might be based upon proportional amounts of post-Compact depletions by basin on a long-term average basis. This method is conceptually equivalent to treating each of the basins' group of post-Compact water users as a single entity and assigning equal priorities to the entity representing each basin. So if a particular basin depletes 10% of the State's post-Compact water, it would be responsible for 10% of the state-wide target volume for reduced use.

3. Export-Differentiated Proportional Administration

A second possible variant of the basin-specific method for distributing reductions in depletions was to split the depletion reductions based on percentages of west-slope versus out-of-basin (TMD) depletions. This differentiation groups the trans-basin post-Compact users as an administrative entity separate from the post-Compact water users in the Colorado mainstem, from which the vast majority of post-Compact trans-basin diversions in Colorado occur.

B. Targeted Yield Scenarios

A call amount less than full curtailment could result from a small shortfall at Lee Ferry, or through negotiations that allow for multi-year curtailment which distributes the impacts of the call temporally in a manner similar to the temporal distribution of the depletions that caused the call. These scenarios were compared to the results of a full curtailment scenario, so that the relative reductions in the impact of the call in the targeted scenarios could be assessed. The administrative date of the call for each of the targeted yield scenarios was determined at a monthly resolution, by identifying the month in which the yield of the call switched from yielding less than the targeted amount to more than the targeted amount. Yields exactly matching the targeted amount would require partial curtailment of individual rights, and this analysis focuses on monthly call dates in recognition of the complexity of administration to target yields at single-acre-foot precision. The Targeted Yield Scenarios would result in different impacts to specific water rights compared to a full curtailment, as

certain junior rights may be curtailed for longer periods while other more senior post-compact rights might not be impacted at all.

1. Full Curtailment

The most straightforward scenario is that all post-Compact depletions would be curtailed. For this scenario, a call was placed in each of the individual models at an 11/24/1922 priority, and the amount of reduction in depletions compared to a no-call scenario was calculated on an annual basis for each basin. The depletion calculations in the Gunnison were adjusted to remove the simulated depletions associated with evaporation from the Aspinall Unit, which average approximately 23,000 AF/yr. Evaporation from the Aspinall Unit is charged to each of the Upper Basin states on a pro-rata basis of each state's percent of total Upper Basin use, and so should not be counted as part of the Gunnison basin's depletion.

Table 6. Yield of Full Curtailment by Basin

Yield (AF)	Yampa	White	Upper Colorado	In-Basin*	TMD*	Gunnison	Southwest	Total
Minimum	50,440	10,262	527,154	84,234	437,510	42,522	137,840	804,133
Average	58,438	11,887	626,216	94,264	531,952	57,271	178,157	931,969
Maximum	68,468	14,146	722,609	104,681	633,182	87,150	232,037	1,056,021

*Sub-groups of Upper Colorado

The average yield of additional water flowing out of the basin under full curtailment for each basin is essentially equal to the average amount of post-Compact use in each basin (with some minor discrepancies due to evaporative losses, return flows, etc.), and the proportional amounts of post-Compact depletions in each basin to the total were computed for use as the basis of the basin-specific administration scenarios. These proportional amounts are displayed in Figure 12.

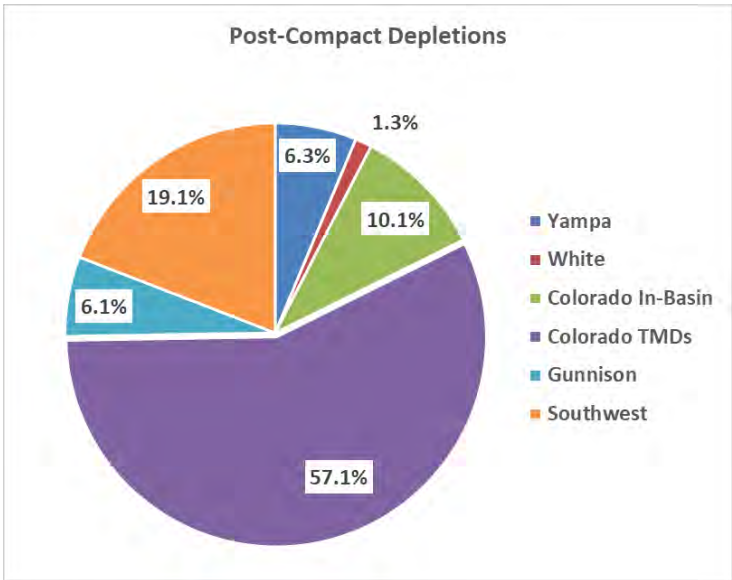

Figure 12. Distribution of Post-Compact Depletions by basin. The total Colorado mainstem portion (67.2%) is split into TMDs and in-basin uses.

2. State-Wide Target Volume Curtailments

As seen in Table 6, a full curtailment of all post-Compact water yields on average about 930 Kaf annually. The next analysis was to look at partial curtailments implemented using single state-wide call dates. For this exercise, we assumed three different target volumes (100 Kaf, 300 Kaf, 600 Kaf), and determined the seniority of the call that would be required, basin-wide, in order to yield that amount of reduced depletions. Using the linked StateMod model, calls were implemented for the duration of the run period, and refined through iteration, until the call dates shown in **Error! Reference source not found.** yielded the target volumes when averaged over 1988-2005. Note that the call dates presented throughout this report are only determined to the month and year, as described above. Refinement to estimate a specific day or even within a day was deemed unnecessary for this level of analysis.

Table 7. State-wide call date to generate a given (average) reduction in annual consumptive use.

Target Volume (acre-feet/yr)	All Colorado River Rights
100,000	Jul 1957
300,000	Sep 1940
600,000	Aug 1935
932,000	**Nov 1922**

Table 8 shows how those volumes would be distributed across the Colorado sub-basins. Note that the distributions change with different target volumes, and are in some cases considerably different than the distribution of all post-Compact rights seen in Figure 12 (and shown in the last rows of this table). This is yet again an indication of how the timing of adjudication and development of water varies across the basins. Basins that have a higher percentage at a given target volume as compared to their Full curtailment percentage developed relatively more slowly than the state-wide average rate of development between the Compact date and the date that produced the target volume, and the converse is true for basins with lower percentages as compared to their Full curtailment percentage. As an example of this type of interpretation of the results, the Gunnison basin developed more quickly than average between November of 1922 and August of 1935, but more slowly than average between November of 1922 and September of 1940.

As before, note that these are average values, and in any given year the volumes and percentages may be higher or lower. The percentage and volume of each sub-basin's post-Compact total water use is also shown for comparison, listed as "Full" in the bottom rows of Table 8.

Table 8. Impact of a state-wide partial call by sub-basin and target volume. Percentages represent the fraction of the target volume that would be curtailed in each sub-basin.

Target Volume (acre-feet/yr)	Yampa	White	Colorado	*In-Basin*	*TMDs*	Gunnison	Southwest
100,000	28%	3%	59%	*22%*	*37%*	6%	8%
(Jul 1957)	27,627	2,753	59,124	*22,309*	*36,815*	5,925	7,528
300,000	16%	2%	59%	*20%*	*39%*	7%	13%
(Sep 1940)	47,987	5,325	177,976	*59,918*	*118,058*	20,862	40,233
600,000	8%	1%	55%	*12%*	*44%*	4%	19%
(Aug 1935)	49,679	8,478	331,556	*69,452*	*262,105*	26,163	113,862
Full	6%	1%	67%	*10%*	*57%*	6%	19%
	58,440	11,888	626,171	*94,403*	*531,834*	57,273	178,163

3. Target Volume Curtailments based on a Pro-Rata Distribution

Another possible approach to curtailing a specific volume annually is to distribute the target volume across the sub-basins based on each sub-basin's share of post-Compact consumptive use. Using the percentages from Figure 12, each sub-basin would be required to curtail the amounts shown in Table 9. For each of these volumes, for each sub-basin, a call date can be developed. Again, these dates represent the call date that would be required across the years 1988-2005 to generate an average annual volume of reduced depletions in the amount shown.

Table 9. Sub-basin target volumes for a given state-wide target, based on pro-rata distribution of post-Compact depletions.

Target Volume (acre-feet/yr)	Yampa 6.3%	White 1.3%	Colorado 67.2%	*In-Basin 10.1%*	*TMDs 57.1%*	Gunnison 6.1%	Southwest 19.1%
100,000	6,270	1,276	67,186	*10,129*	*57,064*	6,145	19,116
300,000	18,811	3,827	201,557	*30,387*	*171,191*	18,436	57,348
600,000	37,622	7,653	403,114	*60,774*	*342,382*	36,871	114,697
932,000	58,440	11,888	626,171	*94,403*	*531,834*	57,273	178,163

Results of this exercise are shown in Table 10. Comparing the pro-rata by sub-basin approach to the state-wide curtailment approach reveals significant differences in the impact to individual basins, and is again reflective of the differences in the timing and magnitude of water development across the basins (**Error! Reference source not found.**Figure 13). The dates listed for the 100,000 AF scenario roughly correspond to the date to which 1/9 of that basin's depletions are junior, roughly 1/3 of each basin's depletions are junior to the date listed for the 300,000 AF scenario, and roughly 2/3 are junior to the 600,000 AF dates.

Table 10. Individual Sub-Basin call dates to yield the pro-rata volumes shown. Values shown represent the average reduced depletion over the period of simulation.

Target Volume (acre-feet/yr)	Yampa 6.3%	White 1.3%	Colorado 67.2%	Gunnison 6.1%	Southwest 19.1%
100,000	6,270	1,276	67,186	6,145	19,116
	Jul 1972	Jul 1962	Jul 1957	Nov 1957	Sep 1940
300,000	18,811	3,827	201,557	18,436	57,348
	Aug 1962	May 1955	Nov 1935	Apr 1955	Sep 1940
600,000	37,622	7,653	403,114	36,871	114,697
	Jun 1952	Jan 1938	Aug 1935	Dec 1933	Nov 1935

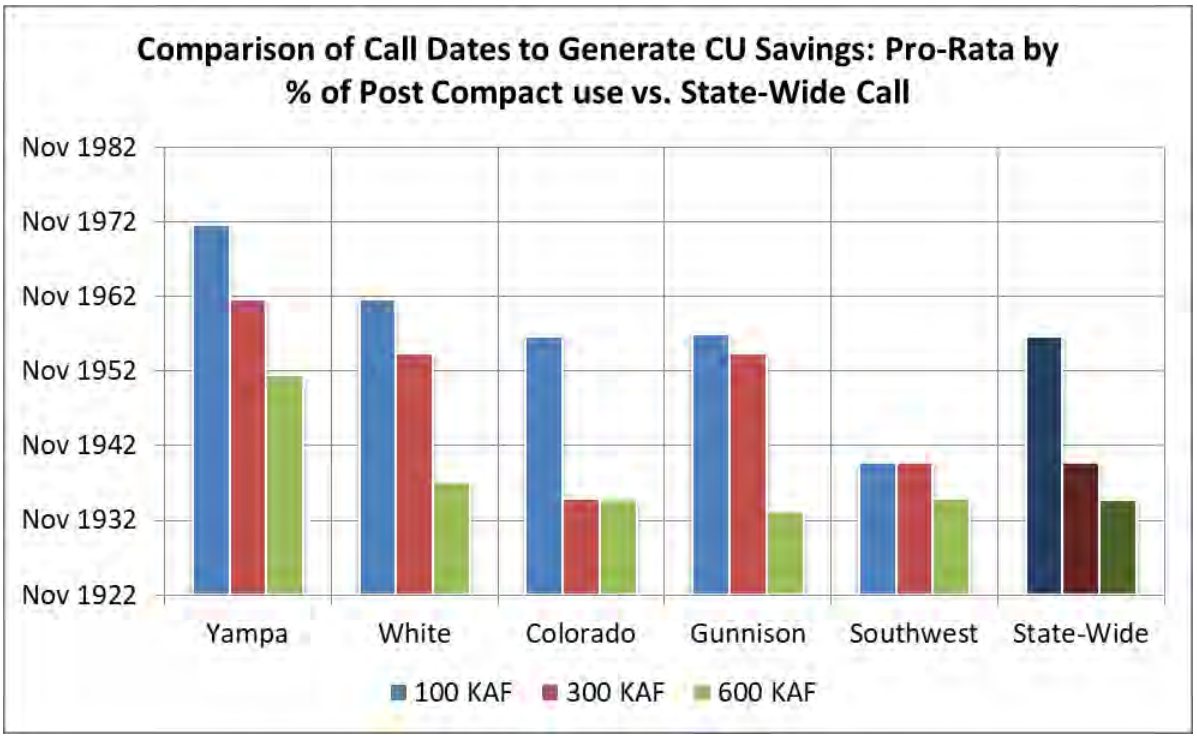

Figure 13. Graphical representation of data from Table 10.

4. Target Volumes on the Colorado Mainstem Pro-rata by in-basin and trans-mountain diversions (TMDs)

The Colorado mainstem accounts for 67.2% of post-Compact depletions, and the necessary call dates to achieve pro-rata curtailment volumes are shown above in Table 10 and Table 11. The timing of development of in-basin uses versus TMDs in this basin vary considerably, and most large TMD developments have rights dating from the mid-1930s to the late 1950s, which puts the pace of proportional development of post-Compact TMDs significantly ahead of the pace of development for in-basin post-Compact uses. For this analysis the target volume obligation of the Colorado mainstem is split into pro-rata volumes based on in-basin and TMD percentages of post-Compact use. This approach does not significantly change the call dates for the TMDs, but does provide some relief to in-basin users by allowing more of the junior in-basin uses to continue diverting.

Table 11. Required call dates and volumes when splitting the Colorado Mainstem obligation between in-basin and TMD uses.

Target Volume (acre-feet/yr)	Colorado	*In-Basin*	*TMDs*
	67.2%	*10.1%*	*57.1%*
100,000	67,186	*10,129*	*57,064*
	Jul 1957	Jan 1981	Jul 1957
300,000	201,557	*30,387*	*171,191*
	Nov 1935	Jul 1957	Aug 1935
600,000	403,114	*60,774*	*342,382*
	Aug 1935	Jul 1941	Aug 1935

Note that due to the large volumes diverted by the TMDs, one of those rights is typically the swing right during these targeted volumetric calls (i.e. it is partially called out in order to yield the target volume).

5. State Wide Target Volumes and call dates split by in-basin and trans-mountain diversions

This last analysis examines how a pro-rata distribution of curtailment would occur if the total volume of Colorado River water use is split between all in-basin uses – regardless of sub-basin – and all TMDs. Recalling that TMDs use 57.1% of all post-Compact water, the remaining 42.9% is consumed by in-basin post-Compact users.

Table 12. Required call dates and volumes when splitting total state-wide post-Compact obligations between in-basin and TMD uses.

Target Volume (acre-feet/yr)	West Slope	TMDs
	42.9%	57.1%
100,000	42,900	57,100
	Nov 1957	Jul 1957
300,000	128,700	171,300
	Jul 1952	Aug 1935
600,000	257,400	342,600
	Nov 1935	Aug 1935

The TMD call dates to yield their target volumes remain the same as when allocating volumes just within the Colorado mainstem (because their percent of the total does not change). The in-basin users are now all aggregated back together. As compared to the Colorado mainstem split above, the in-basin call would be deeper for mainstem users. Compare these in-basin call dates to the individual sub-basin call dates in Table 10 to see how this state-wide in-basin call compares to pro-rata calls. Basins that have more junior call dates in Table 10 than the West Slope call dates in Table 12 developed proportionally more slowly than the rest of the West Slope from the Compact date through the date listed in Table 12.

VI. Summary

This work refines and expands on previous Phases of the Risk Study. The results are intended to inform and support ongoing conversations regarding risk management opportunities in the Colorado River basin. The specific scenarios evaluated should not be viewed as the preferred or only approaches to a possible curtailment or any type of voluntary demand management allocation.

VII. Technical Appendices

A. Model Comparisons

As a first step towards developing the methodology for linking StateMod and CRSS, a series of comparisons between the demand and hydrology datasets of each model was made. Comparisons were also made between the Linked StateMod west-slope model and the individual basin models, to ensure that model results for the Linked Model were sufficiently representative of the individual model results.

1. StateMod Linked Model vs. Individual Basin Models

The Linked Model contains the vast majority of the components of each of the individual basin models, but array size limitations for inputs to StateMod required that some of the reservoir nodes, free river rights, and instream flow rights in the individual basin models be removed during the process of model linkage. Additionally, there were numerous undocumented differences apparent between the input settings of structures in the Linked Model as compared to the individual basin models, such as altered return flow percentages and locations. Rather than attempting to assess the impact of the individual differences between the models, the basin-wide results for simulated depletions were compared to assess the results of the aggregation of all differences in model input settings.

Average percent differences in depletions were found to be small, and the differences reflected higher levels of depletions in the individual models in most cases. Higher depletions in the individual models were expected, due to the removal of numerous reservoir nodes that was a documented part of the linkage process. The percent differences between the Linked Model and the individual models are listed in Table A- 1, where it can be seen that depletions in the individual Gunnison and Southwest models were sometimes lower than the depletions for those basins in the linked model. It was considered possible that these differences resulted from altered return flow percentages and locations. All of the other differences between the Linked Model and the individual models reflected higher depletions in the individual models, but the magnitude of the differences was low enough on average that the linked model was determined to be sufficiently similar to the individual models for use in analysis of state-wide calls. The changes made in support of linking the models were not considered to be improvements, so the individual model results are used in this study for all analyses not involving state-wide calls.

Table A- 1. Percent Differences in Depletions between Linked and Individual Models

Year	Yampa	White	Upper Colorado	Gunnison	Southwest	Total
1988	-1.4%	-2.1%	-1.0%	-0.3%	-2.3%	**-1.2%**
1989	-1.5%	-1.9%	-1.0%	-0.4%	-1.6%	**-1.1%**
1990	-1.7%	-2.0%	-1.1%	-0.5%	-6.1%	**-2.0%**
1991	-1.2%	-2.3%	-1.0%	-0.6%	-4.0%	**-1.6%**
1992	-1.5%	-2.2%	-1.1%	-0.5%	-0.7%	**-0.9%**
1993	-1.2%	-2.1%	-1.1%	-0.5%	0.3%	**-0.7%**
1994	-1.1%	-1.9%	-1.1%	-0.1%	-0.7%	**-0.8%**
1995	-1.6%	-2.5%	-1.1%	-0.5%	0.8%	**-0.6%**
1996	-1.5%	-2.1%	-1.3%	-0.2%	-2.0%	**-1.2%**
1997	-1.5%	-2.7%	-1.1%	-0.5%	0.2%	**-0.7%**
1998	-1.3%	-2.1%	-1.2%	0.1%	-2.1%	**-1.1%**
1999	-1.5%	-2.3%	-1.3%	-0.5%	-0.1%	**-0.9%**
2000	-1.6%	-2.0%	-1.2%	-0.4%	-5.5%	**-1.9%**
2001	-1.6%	-2.1%	-1.0%	-0.5%	-4.5%	**-1.7%**
2002	-2.9%	-2.0%	-0.9%	0.4%	4.3%	**-0.1%**
2003	-1.5%	-2.1%	-1.3%	-0.4%	-7.7%	**-2.3%**
2004	-1.3%	-2.1%	-1.2%	-0.5%	-7.1%	**-2.2%**
2005	-2.3%	-2.2%	-1.5%	-0.5%	0.2%	**-0.9%**
Minimum	-2.9%	-2.7%	-1.5%	-0.6%	-7.7%	**-2.3%**
Average	-1.6%	-2.2%	-1.2%	-0.3%	-2.2%	**-1.2%**
Maximum	-1.1%	-1.9%	-0.9%	0.4%	4.3%	**-0.1%**

2. StateMod vs. CRSS

Comparisons made between StateMod and CRSS consisted of both comparisons of simulated depletions by basin and comparison of simulated basin outflows. The CRSS results were summarized by basin for a model run carried out using the 2019 UCRC demand schedule for each year in an ISM simulation covering the years 1988-2015. Depletions in CRSS were slightly higher than those in StateMod, with an average difference of 112 Kaf/yr, as evident in Table A- 2, which compares the average annual depletions from the StateMod individual basin models to the average annual depletions from CRSS.

Table A- 2. StateMod vs CRSS Depletions (1988-2015, average, AF/yr)

Basin	StateMod	CRSS	% Difference
Yampa	196,982	214,908	9%
White	62,060	40,289	-35%
Upper Colorado	669,397	668,459	0%
Front Range	550,989	757,643	38%
Gunnison	575,267	616,105	7%
Southwest	500,717	383,259	-23%
StateWide	2,555,413	2,667,671	4%

Comparison of the basin outflows between the models revealed greater differences, and the differences in basin outflow have a more direct impact on the risk profile at Lake Powell, so tracking down the source of those differences was considered an important step in development of the model linkage. As a first step in tracking down the source of the differences, the model-simulated inflows to Powell for the Baseline Current Conditions simulation were compared to the CRSS model run that used repeating 2019 UCRC scheduled demands. Both sets of model-simulated inflows to Powell were compared to historical observations, which are calculated by USBR based upon releases from Powell and changes in storage. Exceedance frequencies for historical and simulated annual inflow to Lake Powell are presented in Figure A- 1.

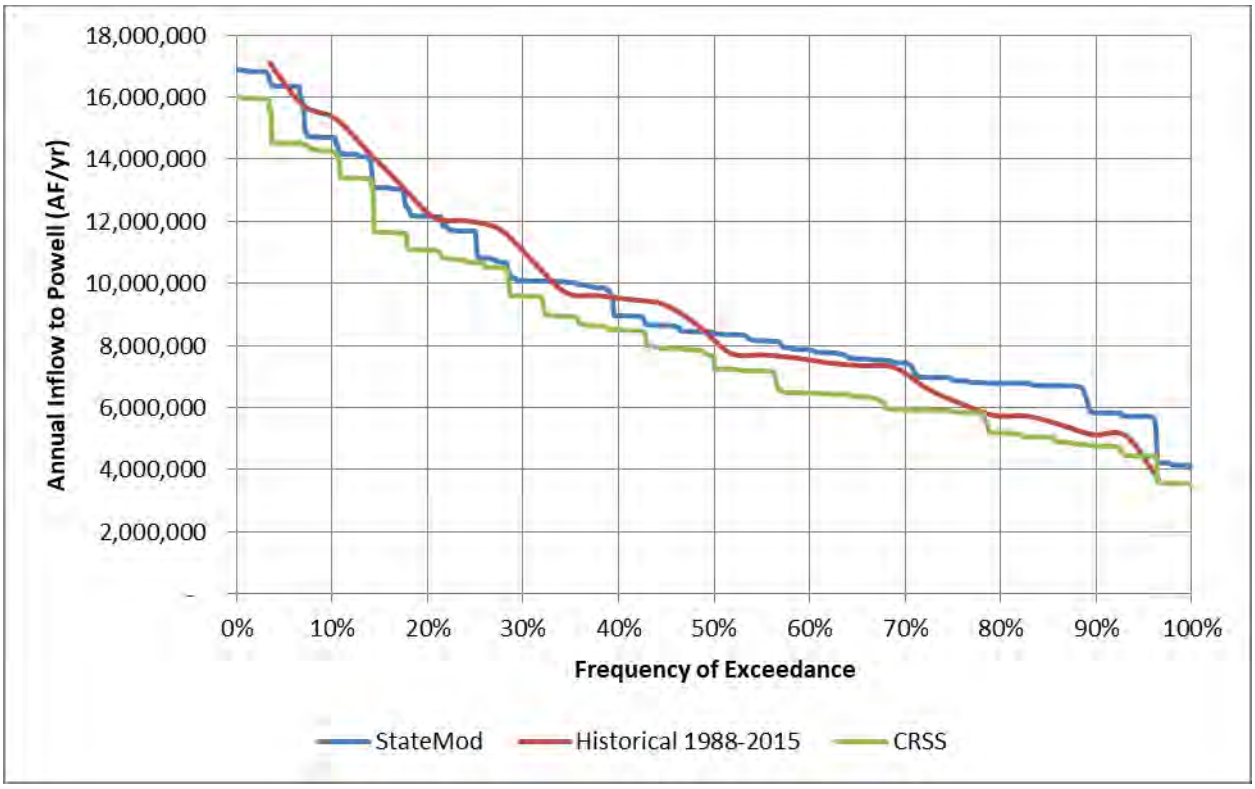

Figure A- 1. Exceedance Frequencies for Annual Powell Inflows, 1988-2015

The historical record includes higher high flows and lower low flows than the StateMod flows, and the flows from the CRSS simulation are consistently lower than both the historical observations and StateMod. The average annual inflows to Powell in the StateMod-linked Baseline Current Conditions simulation exceeded historical observations by 1.8% on average, while the inflows simulated through CRSS alone were 9.7% lower on average than historical observations. The StateMod and CRSS flows both include the CRSS representations of all components of the Upper Basin outside of the State of Colorado, but suitable modeling platforms to represent the other states of the Upper Basin other than CRSS were not available, so the remainder of the comparative analysis of basin outflows focused on gages at or near the Colorado State Line. Comparison of gage flow for the Southwest basins other than the Dolores was carried out through comparison at the San Juan near Bluff gage, which is outside of the state of Colorado, but was chosen for this analysis because its location downstream of the confluence of all seven major tributaries to the San Juan simplified the analysis significantly. Modeled CRSS depletions by New Mexico and Utah in the San Juan basin were subtracted from the gage data before comparing the gage data to StateMod simulation of state line flows.

Differences between historical observations and StateMod-simulated flows are listed in Table A- 3, where it can be seen that some basins have higher outflow in the simulations than historically observed flow, and some basins have lower simulated outflow than historical observations, with total simulated outflows from the State falling below historical observations by an average of 3%. The CRSS model tends to underestimate flows into Lake Powell when looking at the recent historical period. By using StateMod results for the State of Colorado's depletions, and CRSS for the other basin states, we are able to more closely replicate historical flows into Lake Powell. *Given the current data available for both models*, using them in this linked method appears to produce the most realistic results for Powell inflows, and hence is likely a better approach for basin-wide risk analysis.

Table A- 3. Historical Observed and Simulated State-Line Gage Flows (1988-2015, average, AF/yr)

Basin	Historical Gage	StateMod	% Difference
Yampa	1,380,056	1,317,973	-4%
White	465,817	502,395	8%
Upper Colorado	4,139,701	4,089,025	-1%
Dolores	399,015	416,278	4%
San Juan	1,292,928	1,139,437	-12%
Total	**7,677,516**	**7,465,108**	**-3%**

B. Index of Model versions, Website links, and Datasets

The modeling platforms used for this study include the following:

- Colorado River Simulation System RiverWare Model (CRSS)

    - CRSS version dcp_cmb_20171031
        - Version 2.9.0 of CRSS, modified to include the DCP
        - Modified as described below in Section **Error! Reference source not found.**
    - RiverWare version 7.4.3
    - Latest CRSS Model and Datasets Available Here:
        - http://bor.colorado.edu/Public_web/CRSTMWG/CRSS/
- CRDSS Linked Water Rights Allocation Model (StateMod Linked Model)
    - StateMod version 15.001
        - https://www.colorado.gov/pacific/cdss/statemod
- Individual West-Slope Basin Water Rights Allocation Models (StateMod Individual Models)
    - StateMod version 15.001
    - Baseline 2015 models for Yampa, White, Gunnison, and San Juan
        - https://www.colorado.gov/pacific/cdss/surface-water-statemod
    - Baseline 2009 CRWAS model for Upper Colorado
        - http://cwcb.state.co.us/technical-resources/colorado-river-water-availability-study/Pages/CRWASSupportingDocuments.aspx

C. Future Demands Dataset Development

Demands for the "future conditions" scenarios were developed through cooperation with Basin Roundtable technical representatives and the staff from the two Conservation Districts. The purpose of the future condition demands was solely to examine how an increment of additional depletions could impact the risk profiles at Lake Powell and Lee Ferry. The identified increases in consumptive use were a combination of additional use of existing rights/projects as well as new uses. When available, Programmatic Biological Opinion (PBO) studies formed the basis for "allowable" growth that could be achieved without any Federal re-consultation requirements. PBO data were used to develop future demand data for the Yampa, Gunnison, and Colorado mainstem basins. The southwest basin (San Juan, Dolores, and various tributaries), and the White basin future demands were developed primarily by in-basin BRT representatives with input from River District and Southwestern District staff. A total of 26 future uses were identified, consisting of agricultural, municipal, and industrial uses. The total increase in demands across all Colorado basins under the future growth scenario total 384 Kaf, or an increase of 13.7% over current demand levels. Actual modeled depletions from these demands averaged 11.5%. Note that Upper Basin and Colorado's consumptive uses have remained relatively flat for the last 25+ years. The demands identified for the future conditions scenario are not an endorsement of, or proposal for, any specific future use. They are simply illustrative of a range of possible future use scenarios and are intended to illustrate the risks associated with increased consumptive use. Actual growth in demand should it occur, and the timing of that development, may look very different than the future demands postulated for this modelling exercise.

The demand for these future use depletions was not always fully satisfied, resulting in shortages in some cases, and some of the future depletions resulted in shortages to existing uses, where the

future uses corresponded to conditional water rights with senior priorities relative to some existing uses. The average depletions simulated for these future uses, and the average change in depletions by basin are listed in Table C- 1**Error! Reference source not found.**, along with the corresponding input demands, for the years 1988-2015.

Table C- 1. Future Use Demands and Depletions

StateMod Linked Model	Future Use Depletions (AF/yr)		
	Average Yield of New Depletions	Average Increase in Basin Depletions	Input Demand
Yampa	29,506	29,485	30,104
White	61,839	61,787	65,000
Upper Colorado & Front Range	86,077	82,425	120,450
Gunnison	31,053	31,100	37,900
Southwest	81,104	82,355	130,084
StateWide	**289,578**	**287,153**	**383,538**

The input demand of these future uses represents a 13.8% increase over current demands, and the resulting depletions averaged 11.4% higher than current levels over the years 1988-2015. Refinements in implementation of the future demands could raise the simulated depletions closer to the increase in demand, but the simulated increase in depletions of 287,153 AF already exceeds the maximum increase from 2019 demands included in the 2007 UCRC demand schedule by 170,000 AF, so further refinement was considered to be beyond the scope of Phase III and unnecessary for this analysis.

1. Future Demand Monthly Distributions

Depletion amounts specified by the PBOs and by BRT/District representatives were provided in annual amounts, which were disaggregated through application of typical monthly patterns to develop realistic model inputs for StateMod. Future demands in each basin were categorized as one of the following classifications, and a unique monthly disaggregation pattern was developed for each classification:

1. **Industrial Direct Diversion**
2. **Agricultural Direct Diversion**
3. **Municipal Direct Diversion**
4. **Trans-Basin Export**

The pattern of monthly demands used to disaggregate annual demands for Type 1, Industrial Direct Diversion demands, was a uniform monthly pattern that reflects typical diversions for industrial uses such as power production and manufacturing. This uniform monthly distribution of demands also

reflects the uncertainty associated with the water use patterns of industrial uses, which do not necessarily follow a predictable seasonal pattern.

The pattern of monthly demand for Type 2, Agricultural Direct Diversion demands, was developed through analysis of diversion records for the Red Top Valley Ditch, which has a long and continuous record of direct diversions for irrigation of pasture grass from the Upper Colorado basin. Diversions by the Red Top Valley Ditch have historically spanned the months of May – August, with an average of 9.1% of the annual diversions occurring in May, 52.2% occurring in June, 38.3% occurring in July, and 0.3% occurring in August, and those percentages were used to disaggregate annual demands for the future uses classified as Type 2), Agricultural Direct Diversion demands.

The pattern of monthly demand for Type 3), Municipal Direct Diversion Demands, was set using a combination of the Type 1) and Type 2) demand patterns, to represent the conceptual understanding that municipal demands consist of both relatively-steady indoor demands, and seasonally-varying demand for outdoor water use. The total amounts of indoor and outdoor water use were assumed to be equal on an annual basis.

Monthly demands for future uses associated with trans-basin diversions were all set according to a uniform pattern extending only across the months of April-July. The pattern for these demands did not correspond with the eventual use, as did the direct diversion demands for types 1-3, because the trans-basin diversion demands include significant regulation through storage in East-Slope reservoirs. The uniform pattern across the months of May-July was selected in recognition of the typically higher flows in those months, during runoff.

2. Basin-Specific Future Demand Details

The future demands in each basin are listed in Table C- 2 through Table C- 6. The total annual demand for each future use is listed, along with the use type, priority date, and notes about implementation in StateMod, including the node on which the future use demand was placed. Some future use demands were implemented on nodes that were added to the river network, and these additional nodes are identified by asterisks, which reference table footnotes that describe the location of the new node in the river network of that basin.

Table C- 2. Yampa Basin Future Use Demand Details

Use Type	Annual Demand (AF)	Priority Date	Notes
Municipal	9,899	10/1/2013	District 44 Future Depletions (44_FDP001) node
Industrial	15,403	9/30/1961	Hayden Station (440522) node
Agriculture	4,802	9/30/1961	Oxbow Agriculture (44_Oxbow*) node
Total	30,104		Future Uses based upon PBO

* 44_Oxbow is a direct diversion node that was added between the 442214 and 440694 nodes of the Linked Model

Table C- 3. White Basin Future Use Demand Details

Use Type	Annual Demand (AF)	Priority Date	Notes
Municipal	2,707	10/1/2013	District 43 Future Depletions (FUD001) node
Industrial	62,293	10/1/2013	District 43 Oil Shale Direct (43_OilDem) node
Total	65,000		Future Uses based upon YWG-BRT Modeling

Table C- 4. Upper Colorado Basin Future Use Demand Details

Use Type	Annual Demand (AF)	Priority Date	Notes
Trans-mountain	28,500	6/24/1946	Roberts Tunnel (364684) node: Denver Water Blue River System Buildout
Trans-mountain	25,500	6/6/1969	Adams Tunnel (514634) node: Windy Gap Firming Project
Trans-mountain	14,450	7/9/1934	Moffat Tunnel (514655) node: Denver Water Moffat System Expansion
Trans-mountain	14,000	2/7/1956	Homestake Tunnel (374614) node: Eagle River MOU Project (Homestake Partners)
Municipal	7,000	12/14/1987	New WS_FDaGS* node: W.S. depletions above Glenwood Springs
Municipal	28,000	7/29/1957	New WS_FDbSP** node: W.S. M&I depletions below Shoshone
Trans-mountain	3,000	6/24/1946	Roberts Tunnel (364684) node: CRCA Next Steps Project
Total	120,450		Future Uses Estimated by Colorado River District Staff

*WS_FDaGS is a direct diversion node that was added between the 09070500 and 950500 nodes of the Linked Model

** WS_FDbSP is a direct diversion node that was added between the 530584 and 09072500 nodes of the Linked Model

Table C- 5. Gunnison Basin Future Use Demand Details

Use Type	Annual Demand (AF)	Priority Date	Notes
Agriculture	12,200	11/1/1905	East Canal (410520) node: Dallas Creek Project
Municipal	22,200	11/12/1957	District 62 Subordination (62USUB_M) node: Upper Gunnison Subordination
Municipal	3,500	10/1/2013	District 62 Yield (62U_MY) node: New Depletions
Total	37,900		Future Uses from Gunnison PBO

Table C- 6. Southwest Basins Future Use Demand Details

Use Type	Annual Demand (AF)	Priority Date	Notes
Municipal	1,100	4/19/1962	(WS_SJRHP*) node: San Juan River Headwaters Project
Municipal[12]	1,856	10/1/2013	(78_ADS004) node: Piedra Basin Incremental Development
Municipal[12]	14,597	10/1/2013	(31_ADS006) node: Pine Basin Incremental Development
Municipal	8,205	3/21/1966	(CO_ALP) node: Animas La Plata Project Future Uses
Municipal	16,234	12/31/2006	(WS_ARiD**) node: Animas Recreational In-channel Diversion
Agriculture	24,226	3/21/1966	(WS_SWCD***) node: SWCD Project Water Rights
Municipal[12]	26,976	10/1/2013	(71_ADS019) node: Dolores Basin Incremental Development and Reservoir Expansion
Agriculture	21,250	1/16/1967	(WS_SMP****) node: San Miguel Project
Agriculture	4,502	1/1/1985	(34_UMU) node: 2060 Scenario A Demands[13]
Agriculture	11,138	3/2/1868	(31_SUIT) node: 2060 Scenario A Demands[13]
Total	130,084		Future Uses Estimated by Southwest District Staff

* WS_SJRHP is a direct diversion node that was added between the 29_ADS002 and 09342500 nodes of the Linked Model

** WS_ARiD is a direct diversion node that was added between the 301902_Dwn and 30_ADS007 nodes of the Linked Model

*** WS_SWCD is a direct diversion node that was added between the four upstream nodes (09357500, 304662, 09359000, and 300523) and downstream node 09359500 of the Linked Model

**** WS_SMP is a direct diversion node that was added between the 601381 and 601381_Dwn nodes of the Linked Model

3. Other Upper Basin Future Demands

It was also necessary to develop future demands data for Wyoming, Utah, and New Mexico for use in CRSS. The intent was to increase those states' demands by the same percentage that those in Colorado were increased within the StateMod Model. To achieve this, the percentage increase in demands computed for Colorado and used in StateMod (13.8%) was compared to the increases in demands over current conditions from the 2007 UCRC demand schedule for Wyoming, Utah, and New Mexico. Forecast demands from that schedule show an increase of 13.6% for 2037. The 2037

[13] These demands were modeled using uniform monthly demand across April-July, which was found through calibration to increase yield in comparison to the typical municipal pattern

[14] Demands for the Southern Ute and Ute Mountain Ute nodes were set as the difference between Current and 2060 Scenario A demands from the Colorado River Basin Ten Tribes Partnership Tribal Water Study (https://www.usbr.gov/lc/region/programs/crbstudy/tribalwaterstudy.html)

demands for those States were then fixed for all simulations in CRSS as the "future demands" condition.

D. 2006-2015 Data Extension for StateMod

In order to fill in the years 2006-15, annual flow at the Colorado-Utah state line in the mainstem of the Colorado River was compared to the years 1909-2005, and the year with the closest total annual volume was selected. Table 2 lists the years and percent differences in flow, calculated by subtracting the observed flow in the recent year from flow in the surrogate year.

Table 13. Surrogate Years for StateMod Extended Stress Test Simulation

Recent Year	Surrogate Year	% Difference in Flow
2006	1925	-0.7%
2007	1991	0.5%
2008	1938	-0.9%
2009	1971	-0.1%
2010	1991	0.3%
2011	1917	0.0%
2012	1981	3.0%
2013	1940	0.1%
2014	1948	-0.2%
2015	1944	0.1%

The data from each surrogate year was then appended to the linked model input datasets, using a script developed in the R computing language. The following files were extended in this manner:

- Wslope.ddm
- Wslope.iwr
- Wslope.ifm
- Wslope.tar
- Wslope.rim
- Wslope.ipy

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December 2, 1997

David C. Hallford
General Counsel
Colorado River Water Conservation District
P.O. Box 1120
Glenwood Springs, CO 81602

RE: Yampa River legal research

Dear David:

At its meeting last week, the CWCB waived its privilege on the memo our office prepared summarizing our research on the Upper Colorado River Compact's Maybell gauge delivery requirement. I've made some minor editorial changes to Bart's memo and added a reference to and copy of a related newspaper article that was found after he left the office.

I think you'll find that Bart found pretty much what you did. To my mind, what neither of you found -- i.e., any indication that Colorado negotiated to reserve a specific quantity of water from the Yampa for future use -- is as important as what you did find -- i.e., that Utah did.

Let's discuss whether a meeting with some of the objectors might be productive at this point.

Sincerely,

WENDY C. WEISS
First Assistant Attorney General
Natural Resources Section
(303) 866-5008
(303) 866-3558 (FAX)

Enclosure

cc: Chuck Lile (w/encl.)

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August 28, 1997 (revised December 2, 1997)

C O N F I D E N T I A L M E M O R A N D U M

ATTORNEY-CLIENT PRIVILEGE WAIVED BY CWCB, NOVEMBER 24, 1997.

TO: Wendy Weiss
First Assistant Attorney General

FROM: Bart L. Rickenbaugh
Assistant Attorney General

RE: Yampa Apportionment - Upper Colorado River Basin Compact

Article XIII(a) of the Upper Colorado River Basin Compact states as follows:

> The state of Colorado will not cause the flow of the Yampa river at the Maybell gauging station to be depleted below an aggregate of 5,000,000 acre-feet for any period of ten consecutive years reckoned in continuing progressive series beginning with the first day of October next succeeding the ratification and approval of this compact. In the event any diversion is made from the Yampa river or from tributaries entering the Yampa river above the Maybell gauging station for the benefit of any water use project in the state of Utah, then the gross amount of all such diversions for use in the State of Utah, less any returns from such diversions to the river above Maybell, shall be added to the actual flow at the Maybell gauging station to determine the total flow at the Maybell gauging station.

Litigation surrounding the CWCB's instream flow application for endangered fish on the Yampa has raised the issue of whether the 5,000,000 acre-foot number creates a maximum or a minimum

delivery obligation for the state of Colorado. While the origin of this number is not entirely clear, a review of the negotiations which lead to the adoption of the Upper Colorado River Basin Compact and other relevant documents sheds some light on the issue. This memo summarizes the evolution of Article XIII, and cites a few other sources of information which might be helpful.

I. Negotiations of the Upper Colorado River Basin Compact Regarding Apportionment of the Yampa

Substantive discussion on apportionment of the interstate tributaries appears first in the Official Record of Compact Commission Meeting No. 5. The question was originally posed in the context of whether the rights of states to water in the tributaries should be addressed in this, or some other compact. The issue arose, at least in part, in response to New Mexico's fear that Colorado might "dry up" the San Juan, in order to meet its share of the Lee Ferry obligation. Colorado's delegates agreed that such action by the upstream state would be "manifestly unfair, and should not be left to the good will of Colorado." Official Record of Mtg. No. 5, p.75. The Record of Mtg. No. 5, and an early draft of the Compact found in Jean Breitenstein's personal files indicate that the Compact Commission originally envisioned apportionment of interstate tributaries on a percentage basis. Id. at 74-77; Breitenstein Documents, p. 191. Breitenstein also recognized that "so far as particular tributaries are concerned, there may be an obligation agreed upon by an upper state to maintain certain **minimum flows** at the state boundary." Official Record, Mtg. No. 5 at 74, emphasis added. (Copies of the relevant portions of the Official Record are included as Attachment A.)

Item (f) on the agenda for 6th Meeting of the Compact Commission read as follows:

> What adjustment must be made between Colorado and Utah with respect to uses of water on the main stream of the Colorado River, the Yampa River, the White River and the Dolores River, and other interstate streams tributary to either the Green River or the Colorado River.

While nothing was conclusively determined at this time, statements were made to the effect that both Echo Park Reservoir and the Deadman's Bench project could be supplied by water from the Yampa, and implied that the requirements of these projects should be incorporated into any "adjustments." Official Record Mtg. No. 6, pp. 118-19. The 1946 Bureau Report on the Colorado River indicates that the Deadman Bench project contemplated the irrigation of 89,720 acres of new land: 28,540 acres in Colorado, and 61,180 acres in Utah. Report at 115. According to the Report, the Echo Park damsite was to be located 3.5 miles downstream of the

confluence of the Green and Yampa Rivers, 2 miles east of the Utah state line. The reservoir would have extended 44 miles up the Yampa, to Lily Park, well downstream of the Maybell gauge. The Report does not discuss specific use of water from this project, but states that "[i]n addition to power, this multiple-purpose project would provide hold-over storage, flood control, silt retention, and recreational opportunities," and "would help meet the stream flow requirements at Lee Ferry specified by the Colorado River Compact." Report at 117. In its discussion of the Central Utah Project, the Report also indicates that the Bureau contemplated pumping water from Echo Park Reservoir on the Green River "to replace irrigation supplies now used on lands in the Uinta Basin which would be diverted to the Bonneville Basin under this project and to permit the expansion of irrigation in the Uinta Basin." Id. at 117-118.

The question of whether the interstate tributaries should have their own apportionment or should be subsumed into the overall apportionment was referred by the Compact Commission to a committee for discussion. Official Record of Mtg. No. 6, p. 119. However, it was generally agreed that perhaps the most workable solution was a blanket apportionment to each state, subject to adjustments on specific tributaries where necessary. Id. at 124-126. During this discussion, a statement by Mr. Wehrli of Wyoming indicates that "a minimum flow" on a tributary might be fixed as necessary. Id. at 126.

Meeting No. 7, held at Vernal Utah, produced a draft of the Compact (the "Vernal Draft"), which was essentially complete except for the details of the delivery of water by Colorado to New Mexico and Utah, on the San Juan and Yampa rivers respectively, and the division of the Green River tributaries between Wyoming and Utah. With respect to the Yampa, the draft of Article XIII produced at that meeting read as follows:

> (a) Colorado shall deliver at the mouth of the Yampa River during each water year a quantity of water which will assure Utah a flow of water out of the Yampa River reasonably adequate to assure Utah of a water supply for projects partly dependent upon the flow of the Yampa River; the amount of such flow to be based upon the water requirements as finally determined by the Bureau of Reclamation for the Central Utah and allied projects and Colorado hereby agrees that Utah may divert water from the Yampa River and the Green River in Colorado for exportation to and use within Utah for the Central Utah and allied projects.

Official Record at p. 152. The details were referred to the Engineering Advisory Committee.

It appears that Utah's main concern between the 7th meeting of the Compact Commission in July of 1948 at Vernal, and the 8th and final meeting in Santa Fe in October when the Compact was signed, was to guarantee a supply of water for the Central Utah Project. Correspondence from that period seems to indicate a dispute between Wyoming and Utah over Wyoming's refusal to guarantee a delivery of at least 500,000 acre feet per year on the Green River.

According to an August 7, 1948 letter from L.C. Bishop (Wyoming's State Engineer and Compact Commissioner), to W.J. Wehrli (Wyoming's attorney in the negotiations), Bishop met on August 6 with Ed Watson (Utah's State Engineer and Compact delegate), to discuss how they might divide the Green River tributaries, presumably those addressed in Article XIV of the Compact. However, they never got to that subject because Watson demanded

> a written guarantee from Wyoming that Wyoming will deliver, at Linwood, near the Utah-Wyoming boundary, at least 500,000 acre feet of water per year. He said this guarantee would be necessary if Utah is to get the Central Utah Project approved by Congress.

The meeting ended when, after assuring Watson that there would always be more than 500,000 AF available, Bishop refused to provide a guarantee. In another letter dated August 7, 1948 from Watson to Harry Bashore, Chairman of the Compact Commission, Watson pointed out that while there was a provision in the Compact apportioning the Yampa between Colorado and Utah, there was no similar provision apportioning the Green River between Wyoming and Utah. Watson again noted that such an agreement was necessary to "assure the existence of the Central Utah project." Watson then wrote to J.R. Riter, Chairman of the Engineering Committee on August 11, 1948 requesting a study of the yield of the Green River at the Utah state line, "[i]nasmuch as the Bureau of Reclamation has informed me it has eliminated Echo Park as a diversion dam for the Central Utah Project and is now planning on directly diverting from the Green River in Utah by gravity." While the Engineering Committee did study the flow of the Green River at the Linwood Utah gage (see the Memorandum from the Engineering Advisory Committee included at p. 5 of the Official Record of Meeting No. 8, at pp. 7-8), no provision regarding a division of the Green River mainstem between Utah and Wyoming was included in the Compact. (Copies of this, other relevant correspondence, and a related Denver Post article are included as Attachment B.)

The Engineering Advisory Committee presented its report to the Compact Commission at Meeting No. 8 in October of 1948. "After considering the stream flows of the Yampa River at Maybell and the prospective future uses of water in Colorado and Utah," the Committee recommended Article XIII in essentially its current and final form. Official Record of Mtg. No. 8, p. 6. There was no

explanation regarding the 5,000,000 acre-foot number.[1] A statement by Commissioner Watson of Utah indicates that the Article XIII set forth in the report contained a modification from the version in the Vernal Draft, "in that it contemplates the probable development of another project, namely the Deadman's Bench; hence Article XIII has been modified to encompass that fact." Id. at 15. The Record of the negotiations contains nothing further on the subject of Article XIII.

II. Additional Information

The drafts of Article XIII discussed above indicate that the apportionment of the Yampa at the Maybell gauge was primarily for the purpose of supplying water for Utah projects. This was confirmed in a written explanation of the Compact provisions submitted to the Subcommittee on Irrigation and Reclamation of the Committee on Public Lands by Jean Breitenstein during hearings before Congress on the ratification of the Compact. His explanation of Article XIII states as follows:

> This article pertains to the Yampa River, a tributary of the Green River. A compelling reason for the apportionment between Colorado and Utah of the use of the Yampa River water was the fact that Utah desired assurance of a water supply for its Central Utah project. By this article, Colorado agrees not to deplete the flow of the Yampa at the Maybell station below 5,000,000 acre-feet in a period of 10 consecutive years. The Colorado engineers are of the opinion that the supply of the Yampa River is adequate to take care of all existing and potential uses made from that stream in Colorado and still meet the required delivery at Maybell.

Hearings before the Subcommittee on Irrigation and Reclamation of the Committee on Public Lands, House of Representatives, 81st Congress 1st session, Hearings on HR 2325 etc.; Thurs. March 17, 1949, p.89.

The purpose of the Central Utah Project (CUP) was, according to the 1946 Bureau Report, to export 625,000 acre-feet annually from the Uinta Basin into the Bonneville Basin. Report at 117. However, the role of the Yampa in the plans for the CUP is unclear. The Bureau report mentions pumping water from the Echo Park Reservoir on the *Green* River, but not on the Yampa. There is a

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[1] Vol. III of the Official Record is a compilation of data and analyses used by the Engineering Advisory Committee, but there is no analysis of the conclusions leading to this version of Article XIII.

discussion of requirements of the CUP in the Engineering Advisory Committee Report presented to the Compact Commission at Meeting No. 8, (live storage capacity at the site of the gravity replacement diversion between 500,000 to 1,000,000 acre-feet), but the discussion again appears to focus on the Green River.

In his Report and Submission of the Compact to the Utah legislature on the Compact, Ed Watson discussed the difficulty of ensuring a supply of water for the CUP, in light of the fact that the Bureau had not determined whether the principal source of supply would be the Green or the Yampa. He stated that this uncertainty "necessitated even after the tentative draft of the Compact at the Vernal Meeting of a further investigation by the Engineering Committee of the availability of water for the project from the Green River and also necessitated some modification of the provisions of the Compact." Report at P. 23. Noting that the necessary changes had been made in the Compact at the 8th meeting, Watson reported that he was satisfied that there would be a sufficient supply for the CUP, whether the water was to come from the Green or the Yampa. Report at p. 25. With respect to Article XIII, he stated that "[a] compelling reason for the apportionment between Utah and Colorado of the use of the Yampa River Water was the fact that Utah desired assurance of a water supply for its Central Utah Project." Report at p. 35. (Copies of the relevant pages of the Report are included as Attachment C.)

While it is clear that Utah felt that it had assurances of a supply of water for the CUP regardless of the source of water, it appeared to focus its attention on the approval of Echo Park Dam, and water from the Yampa River, perhaps due to concerns regarding the quality of water in the Green River. Echo Park was never built and the controversy is well documented elsewhere. However, the Transcript Of Proceedings before the Department of Interior on Dinosaur National Monument Echo Park and Split Mountain Dams includes the following statement from John G. Will, General Counsel for the Upper Colorado River Commission, who had been the U.S. representative on the Legal Committee during the compact negotiations.

> During the negotiations which preceded the signing of the Upper Colorado River Compact, Utah had in mind the ultimate development of the Central Utah Project which comprehends the importation from the Green River Watershed to the Central Utah region upwards of 600,000 acre-feet of water annually. Before agreement could be reached, Article XIII of the Compact was formulated, whereby Utah could be assured of an adequate water supply from the Yampa River to insure the success of the Central Utah Unit. Although final plans for the ultimate development of the Central Utah Unit have not been formulated, the Echo Park Reservoir is bound to be a key

> feature since it is located blow the confluence of the Green and Yampa Rivers and will allow considerable latitude in the uses of these streams and still assure Utah of an adequate water supply for the ultimate importation of the desired water to the Central Utah area. In other words, an important part of the very foundation of the Upper Colorado River Basin Compact might well be undermined if the Echo Park Dam should not be authorized as an initial stage unit of the Upper Colorado River storage project.

Transcript at p. 140. (A copy of this statement is included as Attachment D.)

The only definitive statement on the Yampa delivery obligation which I came across is the following excerpt from a Bureau report on the Central Utah Project.

> Yampa River at Maybell - The Upper Colorado River Basin Compact considers the possible use of future Yampa River flows by the State of Utah, and provides for a minimum streamflow at the Maybell, Colorado gaging station.[2]

Other than this reference, the information leads only to inferences that Utah was looking for a guarantee of at least 500,000 acre-feet for the CUP; that Wyoming refused to give such a guarantee on the Green River although the Engineering Committee thought this water would be available; and that Utah was ultimately confident that it had enough water on either river to supply its project needs.

Although I'm sure you are aware of it, there is also a footnote in the Colorado Supreme Court's opinion in U.S. v. Denver, (reserved rights claims in Divs. 4, 5 and 6), to the effect that granting a reserved right in Dinosaur National Monument would result in a delivery of water to Utah which would exceed Colorado's obligation under the Compact. The Court was addressing whether Congress intended recreational boating as a one of the Monument's purposes when it was originally established. Justice Erickson stated that "[t]he issue is particularly important in this context because of the enormous potential economic impact of minimum stream flows on vested and conditional Colorado water rights." U.S. v. Denver, 656 P.2d 1, 27 (Colo. 1982). In the footnote, the Court noted that,

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[2] Report titled "Central Utah Project, Utah. A Supplement to the CRSP Report. Appendix B, Water Supply. February 1951 Salt Lake City, Utah, Region 4. Project Planning Report No. 4-8a. 50-2" at page 18.

> Dinosaur National monument is located at the lowest reaches of the Yampa River in Colorado. To find a reserved right to instream flow that far downstream would have a significant impact on upstream users. The record shows that absolutely decreed water rights in the Yampa drainage above the Monument which are junior to the 1938 reservation date total about 1200 cfs. and 12,514 acre-feet, and conditionally decreed water rights total about 9500 cfs. and 1,900,000 acre-feet. **Moreover, awarding the United States minimum flow rights would result in deliveries of water by Colorado to Utah in excess of the obligation specified in the Upper Colorado River Compact.**

Id. at n. 44.