To: URGWOM Technical Team Members
Date: September 20, 2021
Subject: Notes of the September 14, 2021 URGWOM Technical Team Meeting

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These notes summarize the items discussed during the September 14, 2021 Upper Rio Grande Water Operations Model (URGWOM) Technical Team meeting. The meeting began at 9:00 am and was conducted as an on-line collaboration hosted by the Corps of Engineers using the Corps' WebEx account. All those participating in the meeting introduced themselves and their names and affiliation are listed on the last page of these meeting notes.

This month's meeting agenda topics include reports changes on to the Colorado portion of URGWOM, simplified Lower Rio Grande demand, a follow-up on adding the Santa Fe River system to the model, RiverWare updates and enhancements and general updates on ongoing URGWOM related activities from the Corps of Engineers, the Bureau of Reclamation and the Interstate Stream Commission. Phil noted that the USGS is not able to attend today's meeting but that Dave Moeser requested that he be placed on the agenda for a presentation for next month's meeting.

Phil reported that Marc Sidlow would be returning to work part time (20 hrs. per week) with the Albuquerque District at the end of the month. Phil also reported that Marc's old position has been filled and the individual would begin working by November 1, 2021.

Nick began a discussion on the disabling of the Colorado portion of the model by summarizing the two methods currently used in the model to forecast the Lobatos flow. These include 1) routing of forecasted inflow values and the accounting of diversion and return flow using the water right solver with the remainder arriving at Lobatos, and 2) develop a forecasted flow at Lobatos based on Compact delivery requirements and the selection of an historic hydrograph that matches the current year Compact delivery forecast volume. Nick presented hydrographs showing that both methods will meet the Compact delivery requirements at Lobatos but with different shapes. Nick reported that there are ways to disable the Colorado portion of the model by revising existing scripts, or another alternative would be to delete all of the Colorado objects, rules and edit the initialization rules. Planning runs could be based on direct input of Lobatos flow data if the Colorado portion were disabled. After additional discussion, Lucas indicated that it may be best to leave Colorado in the model for now. Reclamation will be using the Colorado portion of the model in the Basin Study and he suggested that the Technical Team could revisit this question sometime in the future.

Lucas reported on the following updates that Reclamation has made to the model (version 8.3);

- Modified the maximum Abiquiu account storage;
- Reduced the maximum ESA release rate from 500 cfs to 200 cfs;

- Updated the DMI's to enable the use the latest DSS database file;
- Modified the script layout to take advantage of changes in model version 8.3 that will allow easier access to commonly used scripts;
- Added a new AOP script that would provide for the disabling of the Lower Rio Grande portion of the model and sets the Elephant Butte hydroelectric power plant optimization; this change saved about 6 KB in storage requirements and the run time has been reduced by about one minute;

Lucas reported that by using the second method described above for the Lobatos inflow forecast and turning off the Colorado portion of the model will reduce the model run time by about 50 seconds. When both the Colorado and Lower Rio Grande portions of the model are disabled, the run time for an AOP model is reduced by one-half. Lucas will add the scripts to disable the Colorado and Lower Rio Grande portions in the next update.

Other updates include:

- Implement changes to the Colorado portion of the model by adding a script to enable the elimination of the use of the water right solver in Colorado;
- Modified (lowered) the minimum flow used for the Middle Rio Grande target flows, which changes were made in consultation with representatives of the MRGCD;
- Modified the Caballo storage due to implementation of the Elephant Butte power plant optimization;

Lucas will include a report on model updates or changes made to the model at each future Technical Team meeting.

Lucas presented information on the alternative Lower Rio Grande release method compared to the pattern based and demand based releases currently used in the model. The alternative method would be used when quick runs are to be made when the Lower Rio Grande portion of the model is disabled. Lucas presented several hydrographs showing the results of releases made using the various methods for the 1975-2014 period. Based on his review, Lucas observed that the model may be over-estimating inflow to Elephant Butte, that the Alternative method results in satisfactory results during dry and moderate water supply years, but the alternative inflow method does not simulate inflow well during wet years when compared to the other two methods. Lucas also noted that when using the pattern-based release method, the release goes to zero in 2014, perhaps due to a problem with the accounting of carry-over storage in Elephant Butte.

The Pattern based release will not function properly when the Lower Rio Grande is disabled as the Caballo Reservoir release will result in unreliable values. Nick reported that the believed that the rules could be edited to improve the model simulation of Caballo releases when the Lower Rio Grande portion of the model is disabled. Also, when running the current model

configuration for years prior to the adoption of the 2008 Rio Grande Project Operating Agreement model simulation of flow for years prior to 2008 will not reliably simulate historic flows.

Lucas solicited comments from Technical Team members on the addition of the Santa Fe River system to the model. He reported that the return flow options (Alternative A or B) have been removed from the model and Santa Fe return flow will not be added until the City decides on the preferred option; an NMOSE return flow credit permit application has not been filed as of this time. The addition of Santa Fe system to the model will result in a better representation of Abiquiu Reservoir Article VI and Article VII storage and release values, although the Santa Fe system will be switched off (disconnected from model) by default.

Cindy reported that the NMISC has asked Hydros to review the plan for disabling the Colorado portion of the model and provide a review of the addition of the Santa Fe River system to the model. Cindy inquired about the reason why the Albuquerque Bernalillo County Water Utility diversion from the Rio Grande is not located in the correct reach of the Rio Grande. Cindy will check with Nabil to see if he has an answer to this question.

The next meeting of the Technical Team is scheduled for October 12, 2021, although it is possible that the meeting could be changed to October 19, 2021. Phil will send to the Technical Team information about the NASA Jet Propulsion Laboratory regarding incorporating high resolution data into runoff forecasts.

There being no additional matters to be brought before the Team, the meeting was adjourned at about 10:15 am.

ATTENDANCE LIST
URGWOM TECHNICAL TEAM MEETING
September 14, 2021

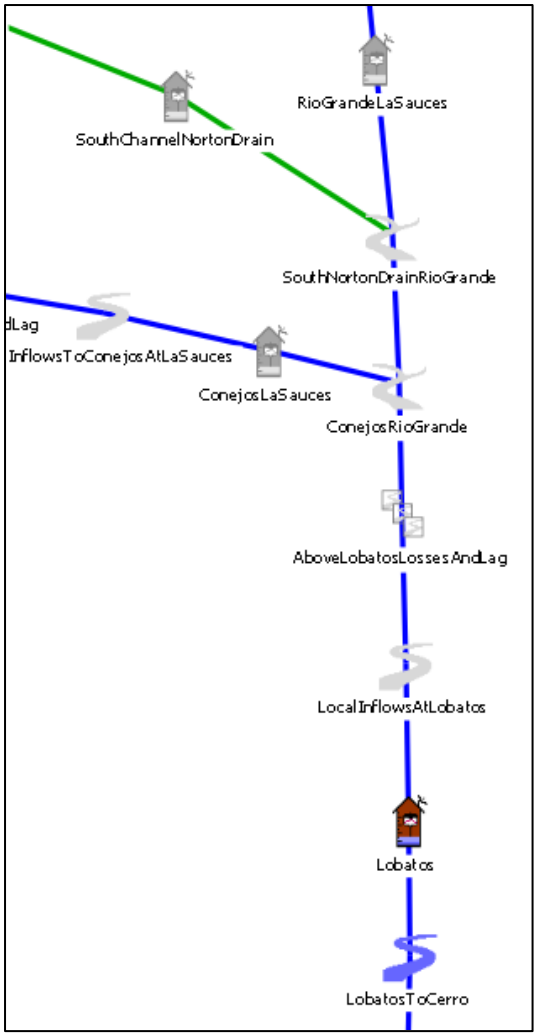
NAME	REPRESENTING
Phillip Carrillo	USACE
William Miller	Southwest Water Design/USACE Contractor
Mike Brown	Tetra Tech/USACE Contractor
Frederick Shean	ABCWUA
Lucas Barrett	Bureau of Reclamation
Michele Estrada Lopez	Bureau of Reclamation
Andrew Gelderloos	Bureau of Reclamation
Jerry Melendez	Bureau of Reclamation
Carolyn Donnelly	Bureau of Reclamation
David Neumann	CADSWES
Nick Mander	Hydros Consulting
John Carron	Hydros Consulting
Zhuping Sheng	Paso del Norte Watershed Council
Guillermo Martinez	Intera
Brian Westfall	Keller-Bliesner Engineering
Cindy Stokes	NM Interstate Stream Commission

Turning off or removing Colorado from URGWOM

Hydros Consulting Inc.
August 19, 2021

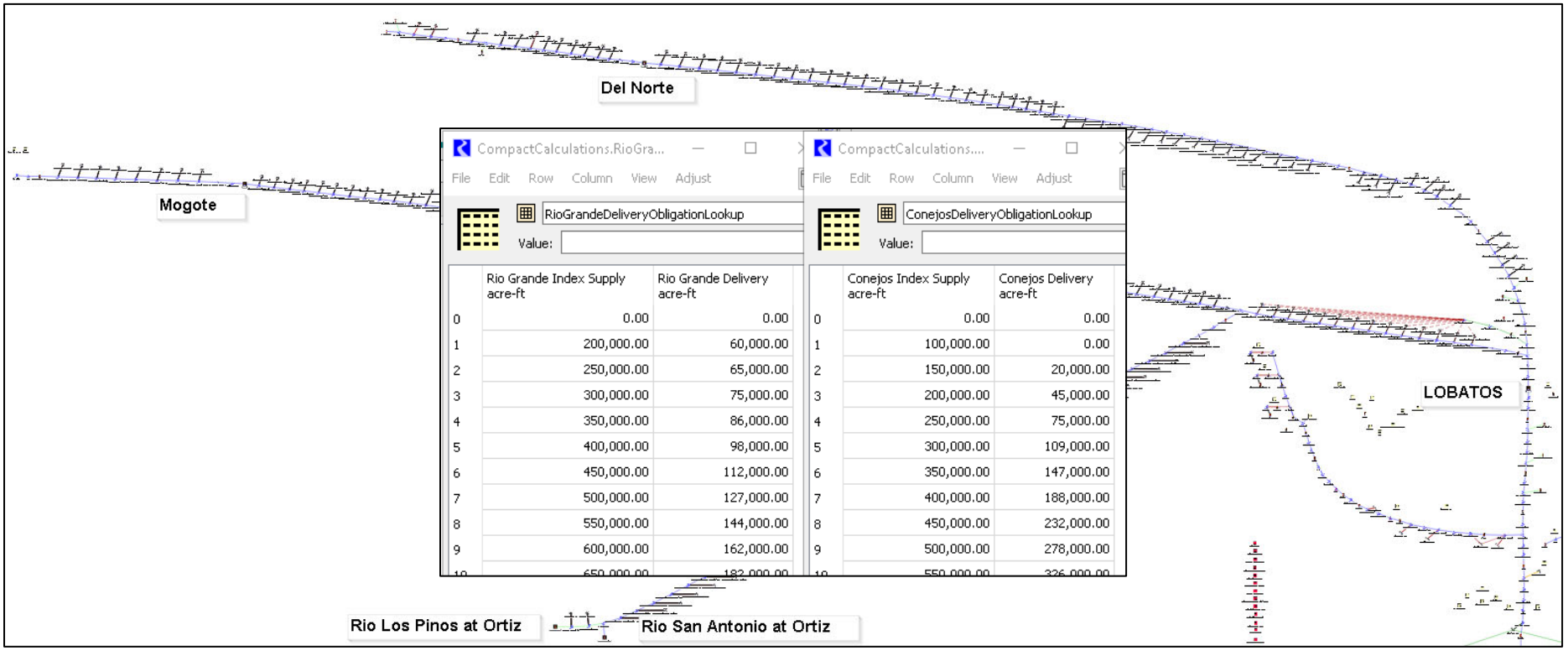
Purpose

- BOR mentioned during the 8/10/21 Tech Tech meeting that they're occasionally interested in turning off the Colorado portion of URGWOM (to help speed up runtime).
- NMISC also has this interest
- USACE is interested in deleting the Colorado portion of URGWOM



Lobatos Forecast

- If a Lobatos forecast is not input (NRCS usually doesn't release a Lobatos forecast), then URGWOM computes a Lobatos forecast which is exactly equal to the Compact delivery obligation
- The delivery obligation is based on Forecasted flows upstream:



Example: April 2021 Lobatos Annual Forecast

- The 70% annual NRCS forecast for Del Norte is 424 KAF
- The 70% annual Forecast for the Conejos is 255 KAF

CompactCalculations.RioGra...

File Edit Row Column View Adjust

RioGrandeDeliveryObligationLookup

Value:

	Rio Grande Index Supply acre-ft	Rio Grande Delivery acre-ft
0	0.00	0.00
1	200,000.00	60,000.00
2	250,000.00	65,000.00
3	300,000.00	75,000.00
4	350,000.00	86,000.00
5	400,000.00	98,000.00
6	450,000.00	112,000.00
7	500,000.00	127,000.00
8	550,000.00	144,000.00
9	600,000.00	162,000.00
10	650,000.00	182,000.00

CompactCalculations....

File Edit Row Column View Adjust

ConejosDeliveryObligationLookup

Value:

	Conejos Index Supply acre-ft	Conejos Delivery acre-ft
0	0.00	0.00
1	100,000.00	0.00
2	150,000.00	20,000.00
3	200,000.00	45,000.00
4	250,000.00	75,000.00
5	300,000.00	109,000.00
6	350,000.00	147,000.00
7	400,000.00	188,000.00
8	450,000.00	232,000.00
9	500,000.00	278,000.00
10	550,000.00	326,000.00

ForecastsApril

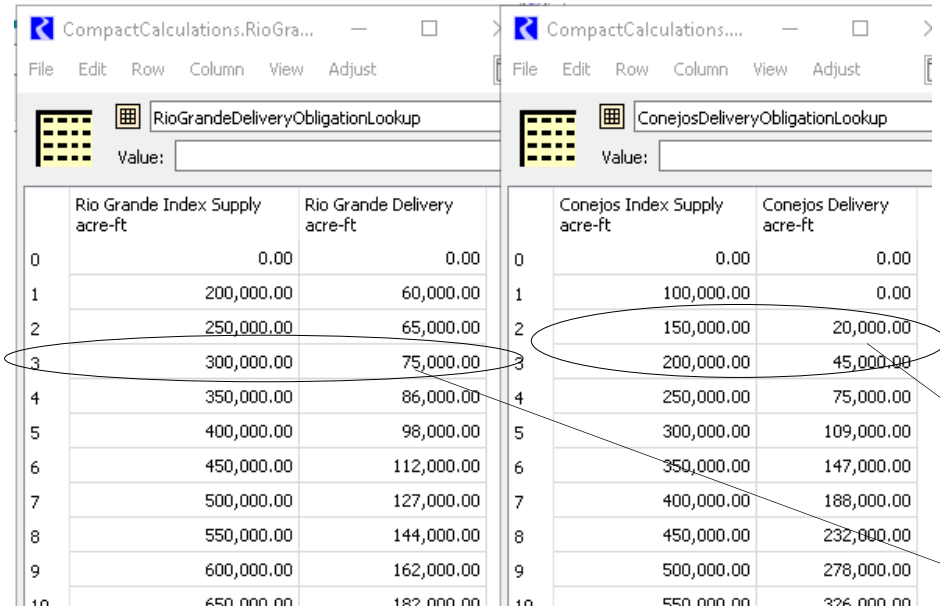
Value: 173

	90 1000 acre-ft	**70** **1000 acre-ft**
0: ThirtyMileBridge	54.00	73.00
1: WagonWheelGap	150.00	200.00
2: SouthFork	66.00	82.00
3: PlatoroInflow	37.00	44.00
4: Mogote	109.00	134.00
5: RioSanAntonioAtOrtiz	3.50	5.20
6: RioLosPinosAtOrtiz	34.00	42.00
7: Lobatos	62.00	NaN
8: LobatosAnnual	155.00	173.00

- Lobatos delivery obligation is 105 + 78 = 183 - 10 adjustment = 173 KAF
- THIS Lobatos delivery obligation is used as the LOBATOS FORECAST

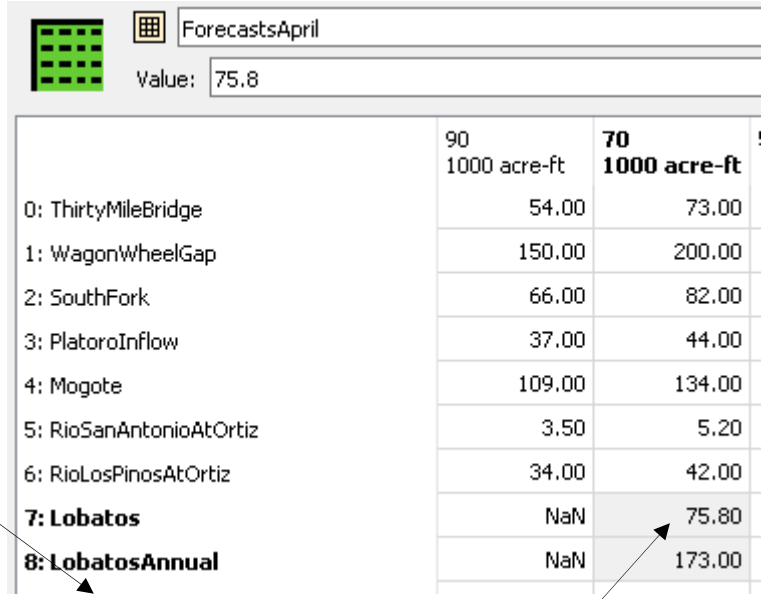
Example: April 2021 Lobatos April-July Forecast

- 70% annual NRCS forecast for Del Norte is **424 KAF**, MINUS **63 KAF** Jan 1- March 31 gaged flow, minus **51 KAF** October 1 – December 31 forecasted flow = 424 – 63 – 51 = **310 KAF**
- The 70% annual Forecast for the Conejos is **255 KAF**, MINUS **60 KAF** Jan 1- March 31 gaged flow, minus **22 KAF** October 1 – December 31 forecasted flow = 255– 60 – 22 = **173 KAF**



	Rio Grande Index Supply acre-ft	Rio Grande Delivery acre-ft
0	0.00	0.00
1	200,000.00	60,000.00
2	250,000.00	65,000.00
3	300,000.00	75,000.00
4	350,000.00	86,000.00
5	400,000.00	98,000.00
6	450,000.00	112,000.00
7	500,000.00	127,000.00
8	550,000.00	144,000.00
9	600,000.00	162,000.00
10	650,000.00	182,000.00

	Conejos Index Supply acre-ft	Conejos Delivery acre-ft
0	0.00	0.00
1	100,000.00	0.00
2	150,000.00	20,000.00
3	200,000.00	45,000.00
4	250,000.00	75,000.00
5	300,000.00	109,000.00
6	350,000.00	147,000.00
7	400,000.00	188,000.00
8	450,000.00	232,000.00
9	500,000.00	278,000.00
10	550,000.00	326,000.00



	90 1000 acre-ft	**70 1000 acre-ft**
0: ThirtyMileBridge	54.00	73.00
1: WagonWheelGap	150.00	200.00
2: SouthFork	66.00	82.00
3: PlatoroInflow	37.00	44.00
4: Mogote	109.00	134.00
5: RioSanAntonioAtOrtiz	3.50	5.20
6: RioLosPinosAtOrtiz	34.00	42.00
7: Lobatos	NaN	75.80
8: LobatosAnnual	NaN	173.00

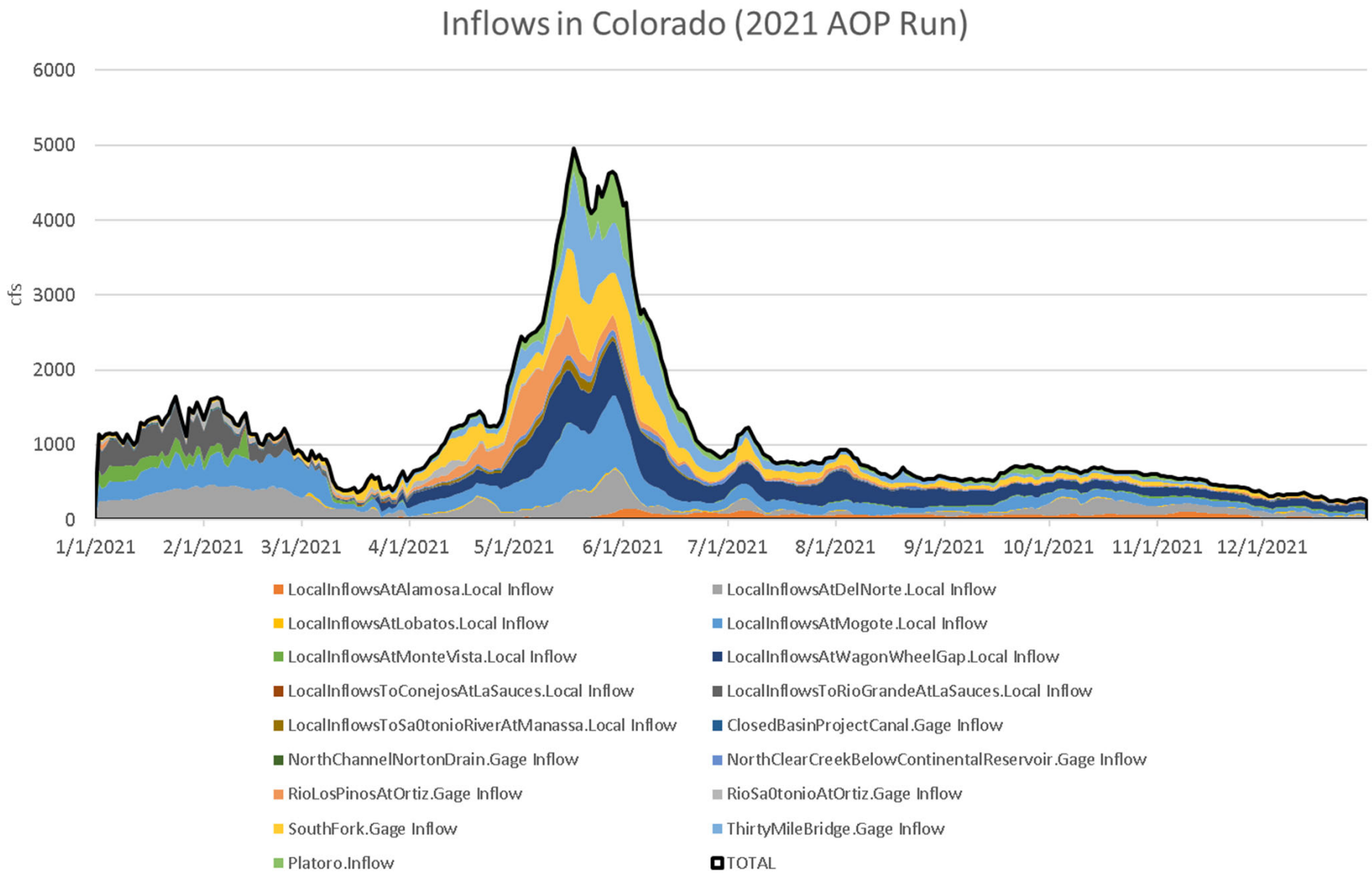
- The Lobatos Apr-Jul delivery obligation is 77 + 31 = 108 X 70% (assume 70% of Apr-Oct Lobatos flow occurs Apr-July) = **75.8 KAF**

2 Methods for creating hydrograph at Lobatos

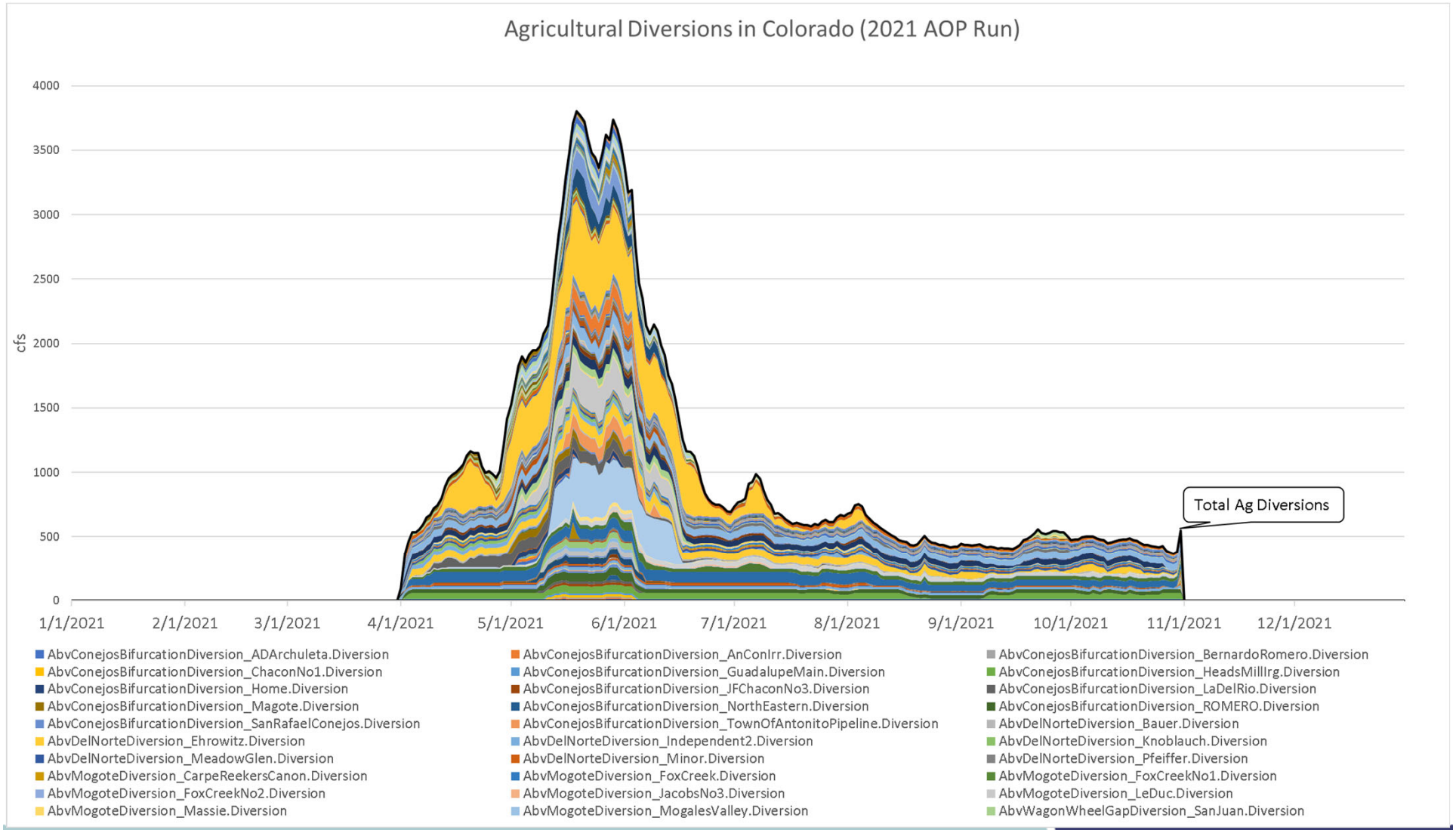
Hydros Consulting

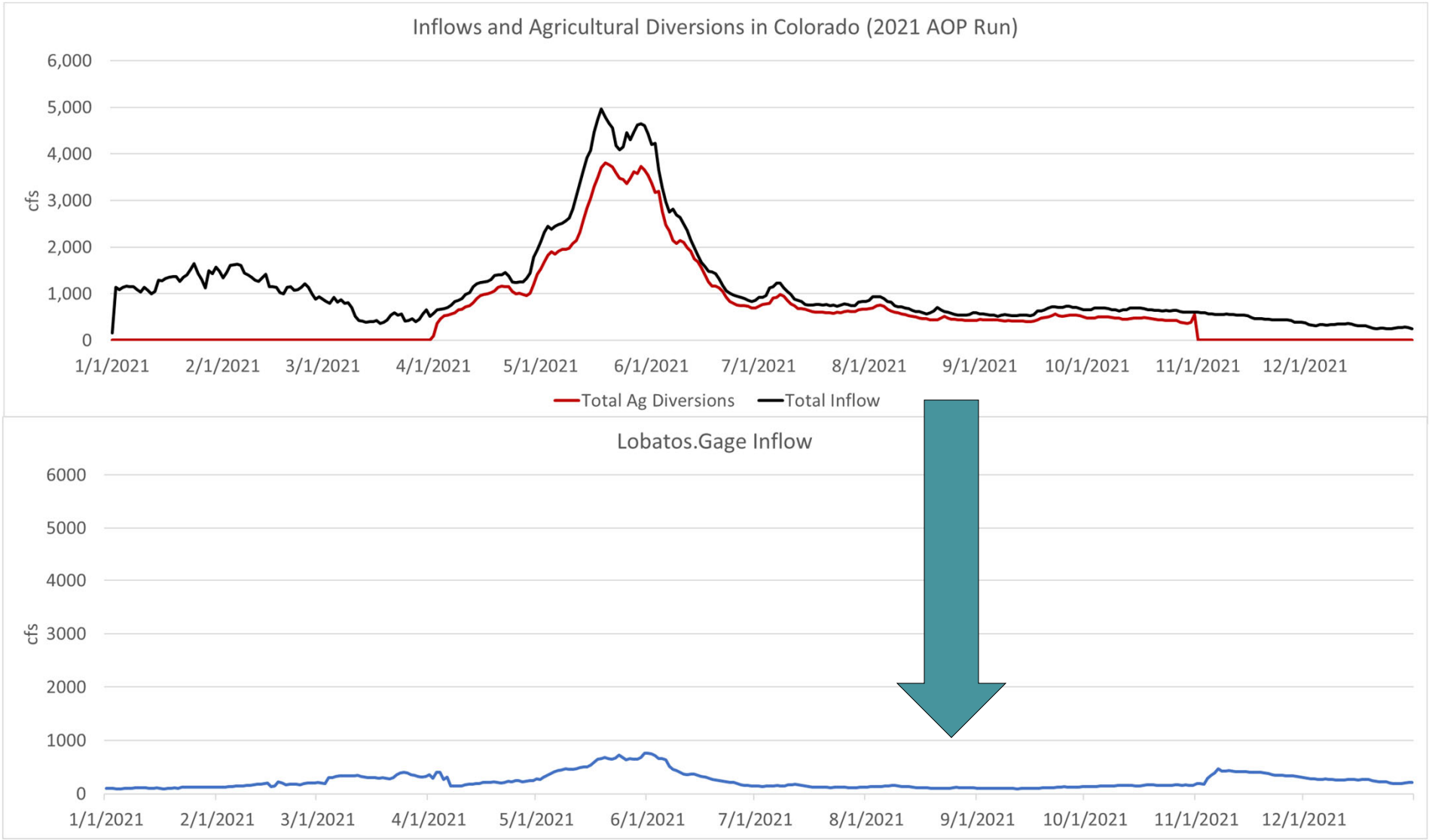
- Lobatos annual delivery obligation: 173 KAF
- URGWOM will always meet this obligation, but has 2 methods for shaping the hydrograph at Lobatos:

1) Method 1 requires that Colorado is explicitly modeled.
   - Forecasted inflows are modeled throughout Colorado
   - Agricultural diversions are modeled throughout Colorado (but limited by the RiverWare water rights solver so that the 173 KAF is delivered)


Inflows in Colorado (2021 AOP Run)
cfs
6000
5000
4000
3000
2000
1000
0
1/1/2021
2/1/2021
3/1/2021
4/1/2021
5/1/2021
6/1/2021
7/1/2021
8/1/2021
9/1/2021
10/1/2021
11/1/2021
12/1/2021
LocalInflowsAtAlamosa.Local Inflow
LocalInflowsAtDelNorte.Local Inflow
LocalInflowsAtLobatos.Local Inflow
LocalInflowsAtMogote.Local Inflow
LocalInflowsAtMonteVista.Local Inflow
LocalInflowsAtWagonWheelGap.Local Inflow
LocalInflowsToConejosAtLaSauces.Local Inflow
LocalInflowsToRioGrandeAtLaSauces.Local Inflow
LocalInflowsToSa0tonioRiverAtManassa.Local Inflow
ClosedBasinProjectCanal.Gage Inflow
NorthChannelNortonDrain.Gage Inflow
NorthClearCreekBelowContinentalReservoir.Gage Inflow
RioLosPinosAtOrtiz.Gage Inflow
RioSa0tonioAtOrtiz.Gage Inflow
SouthFork.Gage Inflow
ThirtyMileBridge.Gage Inflow
Platoro.Inflow
TOTAL

Hydros Consulting




Inflows and Agricultural Diversions in Colorado (2021 AOP Run)
6,000
5,000
4,000
3,000
2,000
1,000
0
cfs
1/1/2021
2/1/2021
3/1/2021
4/1/2021
5/1/2021
6/1/2021
7/1/2021
8/1/2021
9/1/2021
10/1/2021
11/1/2021
12/1/2021
Total Ag Diversions
Total Inflow
Lobatos.Gage Inflow
6000
5000
4000
3000
2000
1000
0
cfs
1/1/2021
2/1/2021
3/1/2021
4/1/2021
5/1/2021
6/1/2021
7/1/2021
8/1/2021
9/1/2021
10/1/2021
11/1/2021
12/1/2021

Method 2

- The 2nd Method for shaping the Lobatos hydrograph does not require Colorado to be modeled
- Same Lobatos forecasts as before…

ForecastsApril

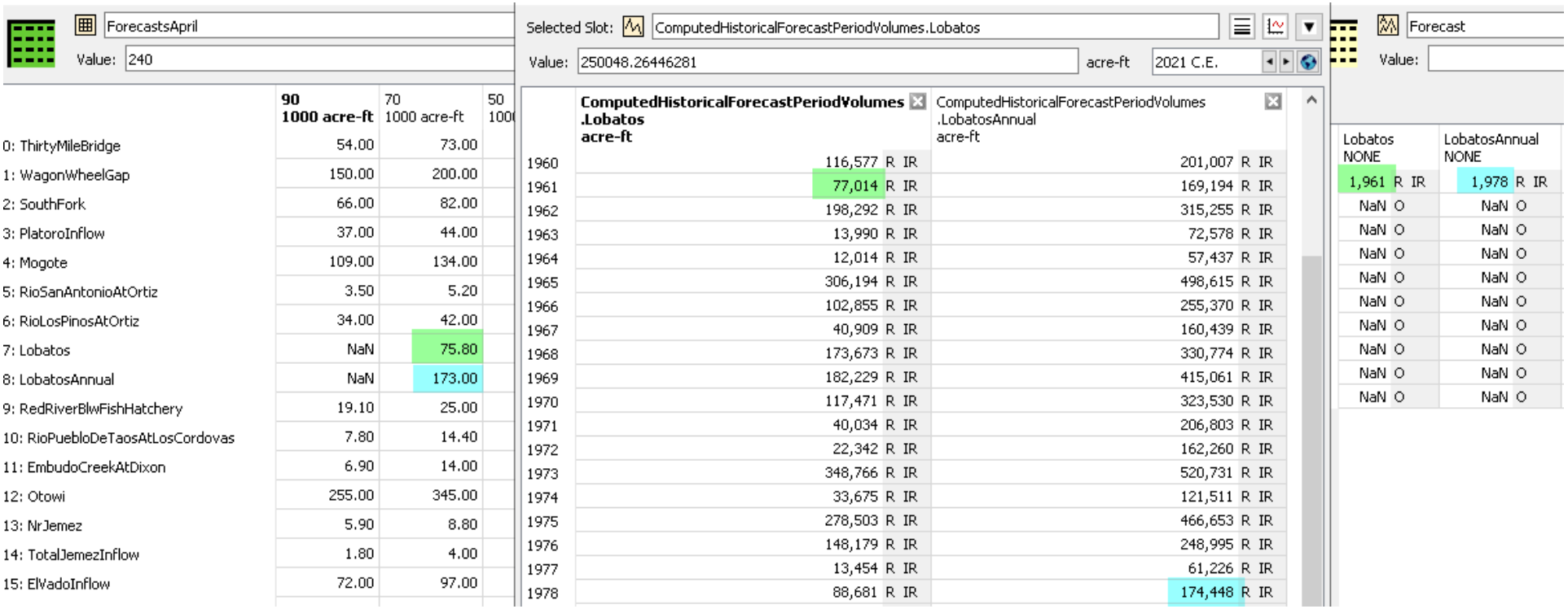
Value: 75.8

	90 1000 acre-ft	**70** **1000 acre-ft**
0: ThirtyMileBridge	54.00	73.00
1: WagonWheelGap	150.00	200.00
2: SouthFork	66.00	82.00
3: PlatoroInflow	37.00	44.00
4: Mogote	109.00	134.00
5: RioSanAntonioAtOrtiz	3.50	5.20
6: RioLosPinosAtOrtiz	34.00	42.00
7: Lobatos	NaN	75.80
8: LobatosAnnual	NaN	173.00

Annual delivery obligation

Method 2

…but instead of routing flows down from Colorado, URGWOM matches these 2 NRCS forecasts with the closest historical years



ForecastsApril
Value: 240

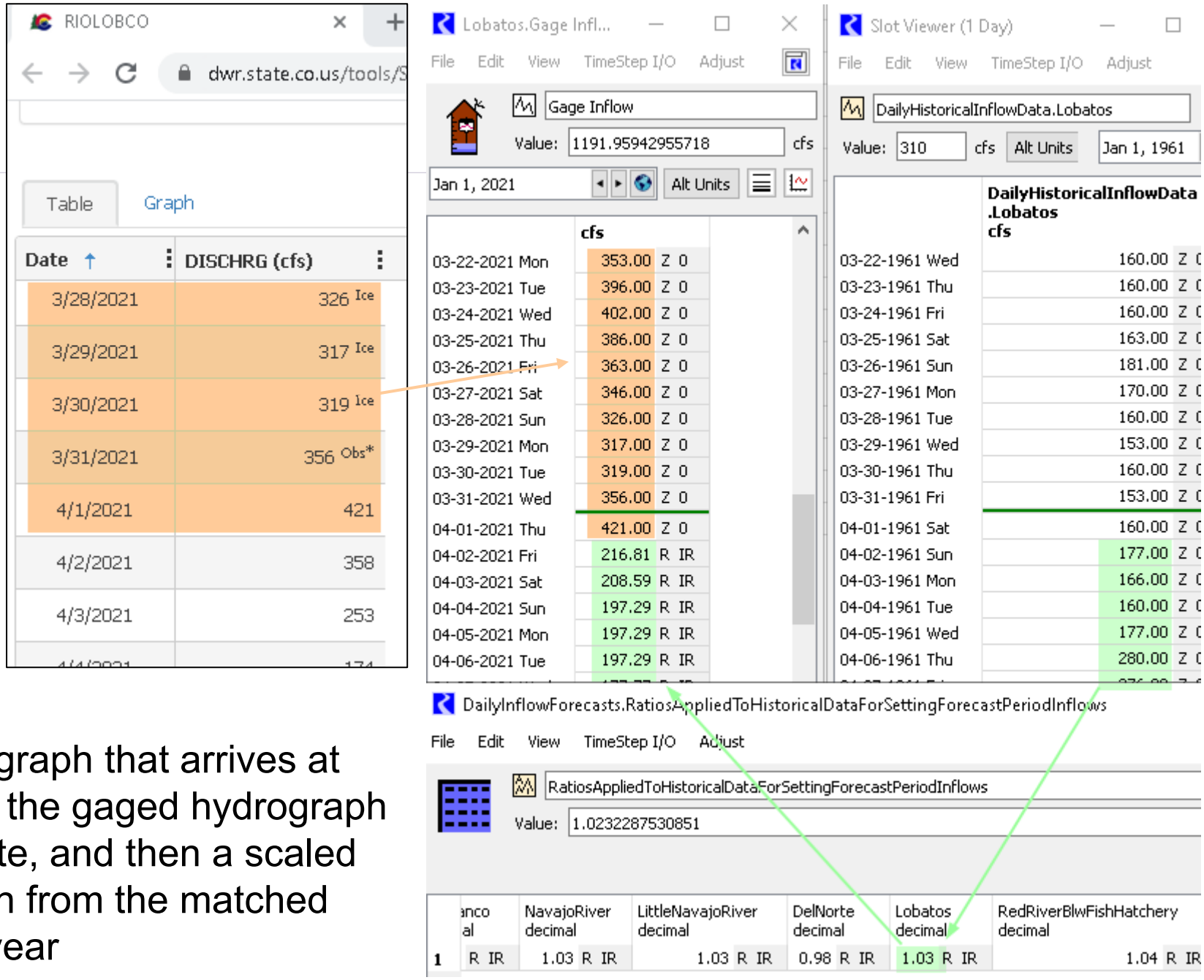
	90 1000 acre-ft	70 1000 acre-ft	50 100(
0: ThirtyMileBridge	54.00	73.00	
1: WagonWheelGap	150.00	200.00	
2: SouthFork	66.00	82.00	
3: PlatoroInflow	37.00	44.00	
4: Mogote	109.00	134.00	
5: RioSanAntonioAtOrtiz	3.50	5.20	
6: RioLosPinosAtOrtiz	34.00	42.00	
7: Lobatos	NaN	75.80	
8: LobatosAnnual	NaN	173.00	
9: RedRiverBlwFishHatchery	19.10	25.00	
10: RioPuebloDeTaosAtLosCordovas	7.80	14.40	
11: EmbudoCreekAtDixon	6.90	14.00	
12: Otowi	255.00	345.00	
13: NrJemez	5.90	8.80	
14: TotalJemezInflow	1.80	4.00	
15: ElVadoInflow	72.00	97.00	

Selected Slot: ComputedHistoricalForecastPeriodVolumes.Lobatos
Value: 250048.26446281 acre-ft 2021 C.E.

	ComputedHistoricalForecastPeriodVolumes .Lobatos acre-ft	ComputedHistoricalForecastPeriodVolumes .LobatosAnnual acre-ft
1960	116,577 R IR	201,007 R IR
1961	77,014 R IR	169,194 R IR
1962	198,292 R IR	315,255 R IR
1963	13,990 R IR	72,578 R IR
1964	12,014 R IR	57,437 R IR
1965	306,194 R IR	498,615 R IR
1966	102,855 R IR	255,370 R IR
1967	40,909 R IR	160,439 R IR
1968	173,673 R IR	330,774 R IR
1969	182,229 R IR	415,061 R IR
1970	117,471 R IR	323,530 R IR
1971	40,034 R IR	206,803 R IR
1972	22,342 R IR	162,260 R IR
1973	348,766 R IR	520,731 R IR
1974	33,675 R IR	121,511 R IR
1975	278,503 R IR	466,653 R IR
1976	148,179 R IR	248,995 R IR
1977	13,454 R IR	61,226 R IR
1978	88,681 R IR	174,448 R IR

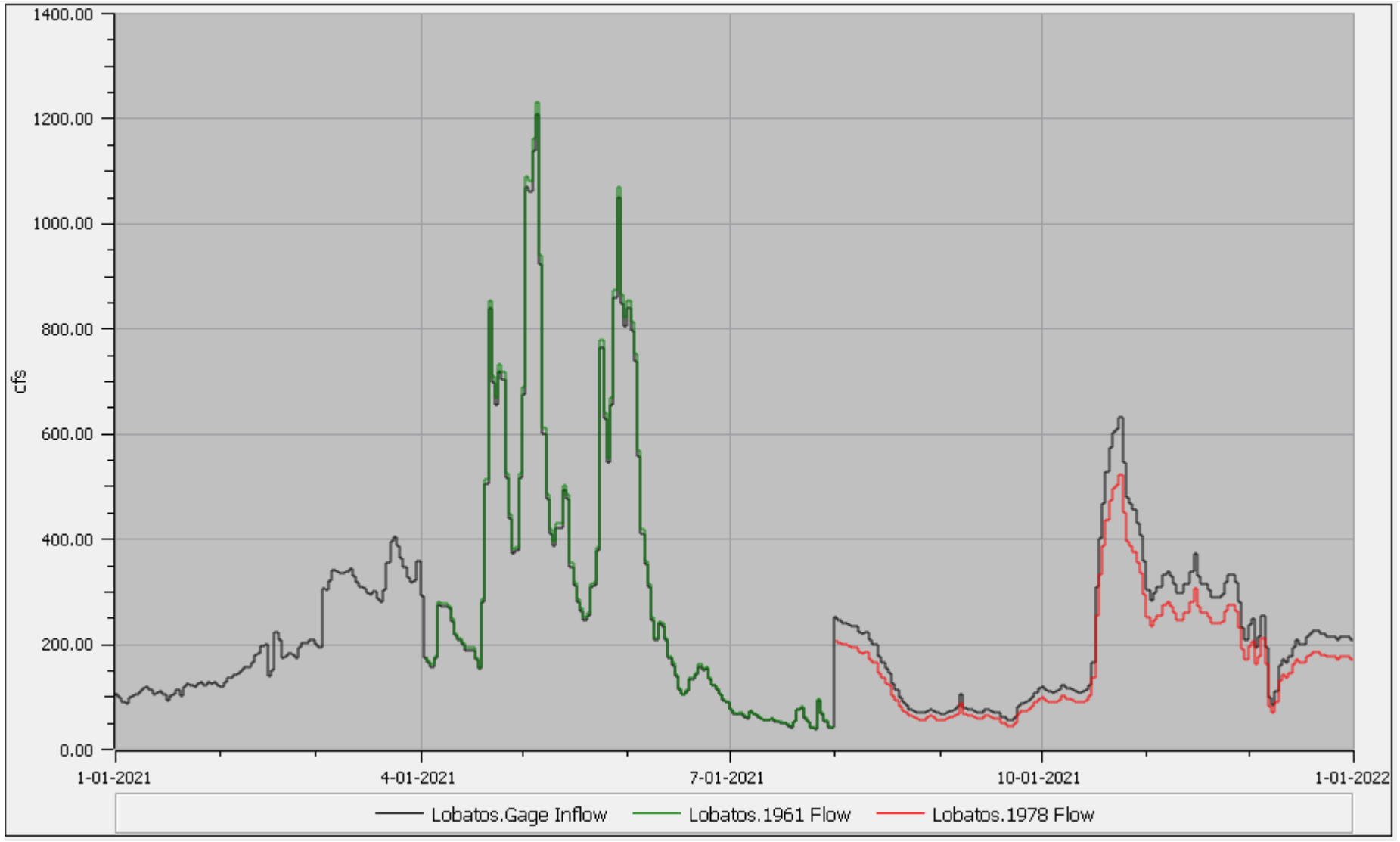
Forecast
Value:

Lobatos NONE	LobatosAnnual NONE
1,961 R IR	1,978 R IR
NaN O	NaN O
NaN O	NaN O
NaN O	NaN O
NaN O	NaN O
NaN O	NaN O
NaN O	NaN O
NaN O	NaN O
NaN O	NaN O
NaN O	NaN O

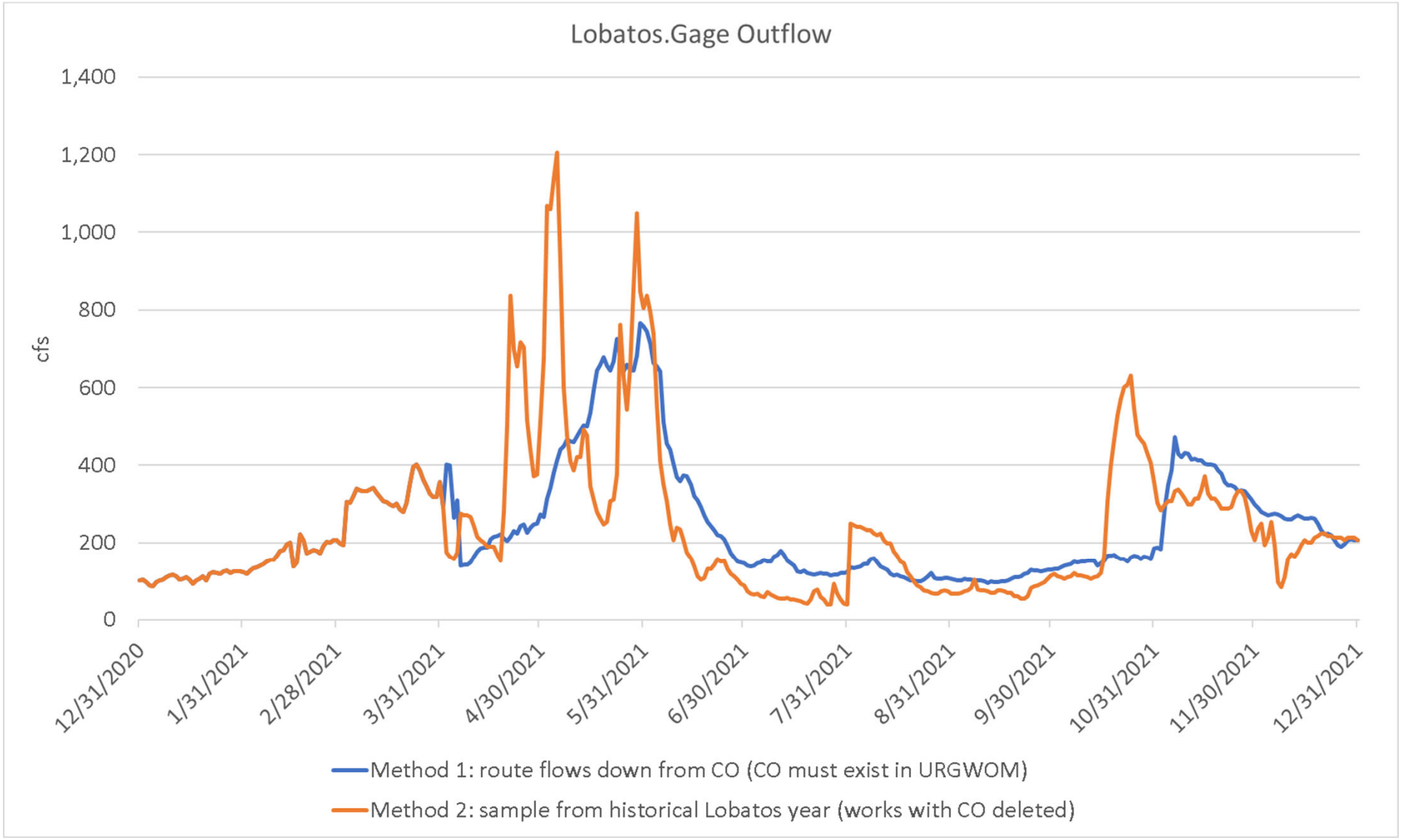


The hydrograph that arrives at Lobatos is the gaged hydrograph year-to-date, and then a scaled hydrograph from the matched historical year

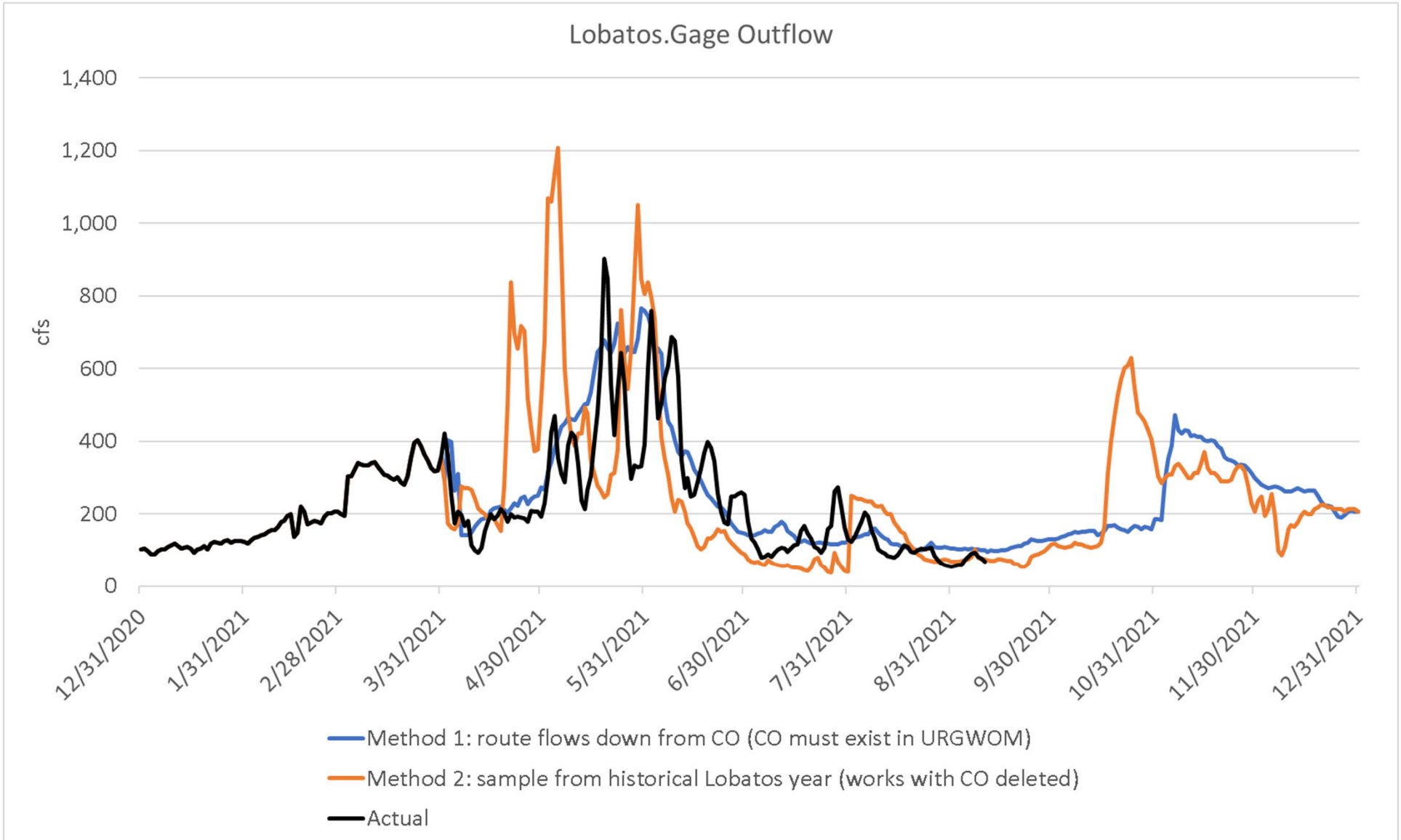
Lobatos Hydrograph (with Colorado Disabled):



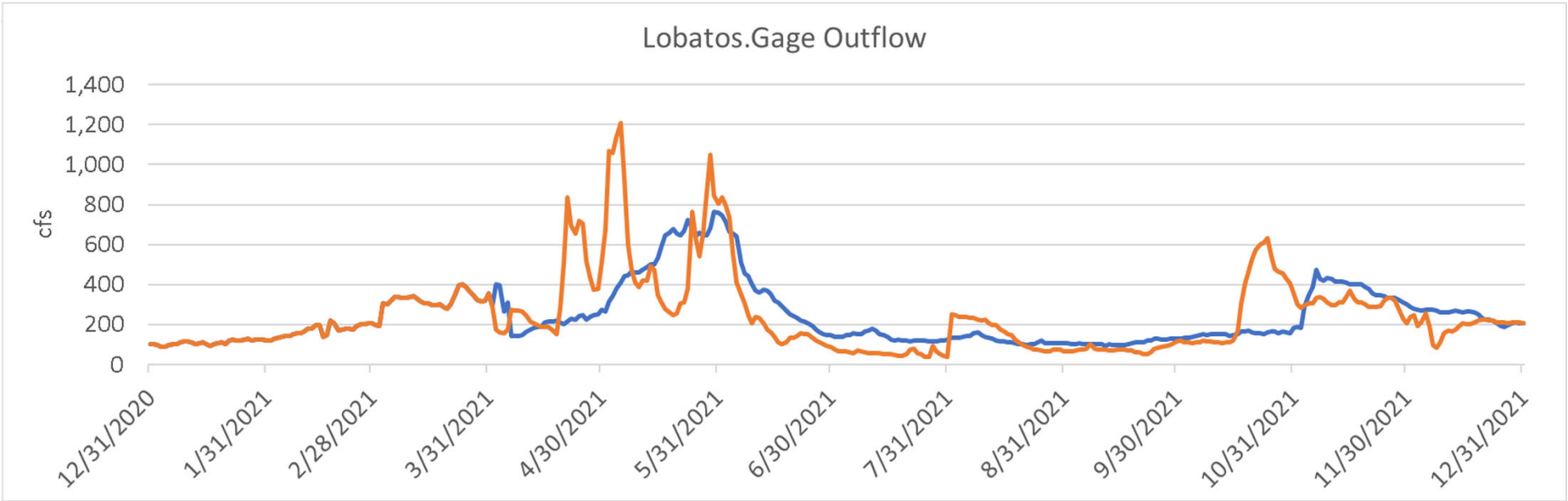
Method 1 versus Method 2

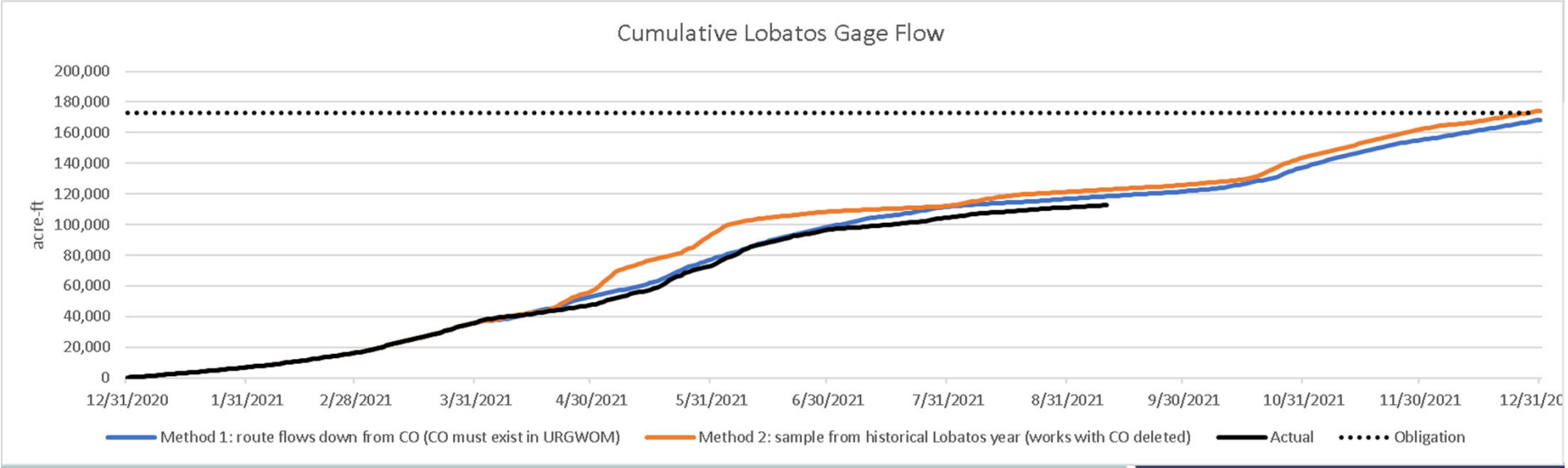


Method 1 vs. method 2

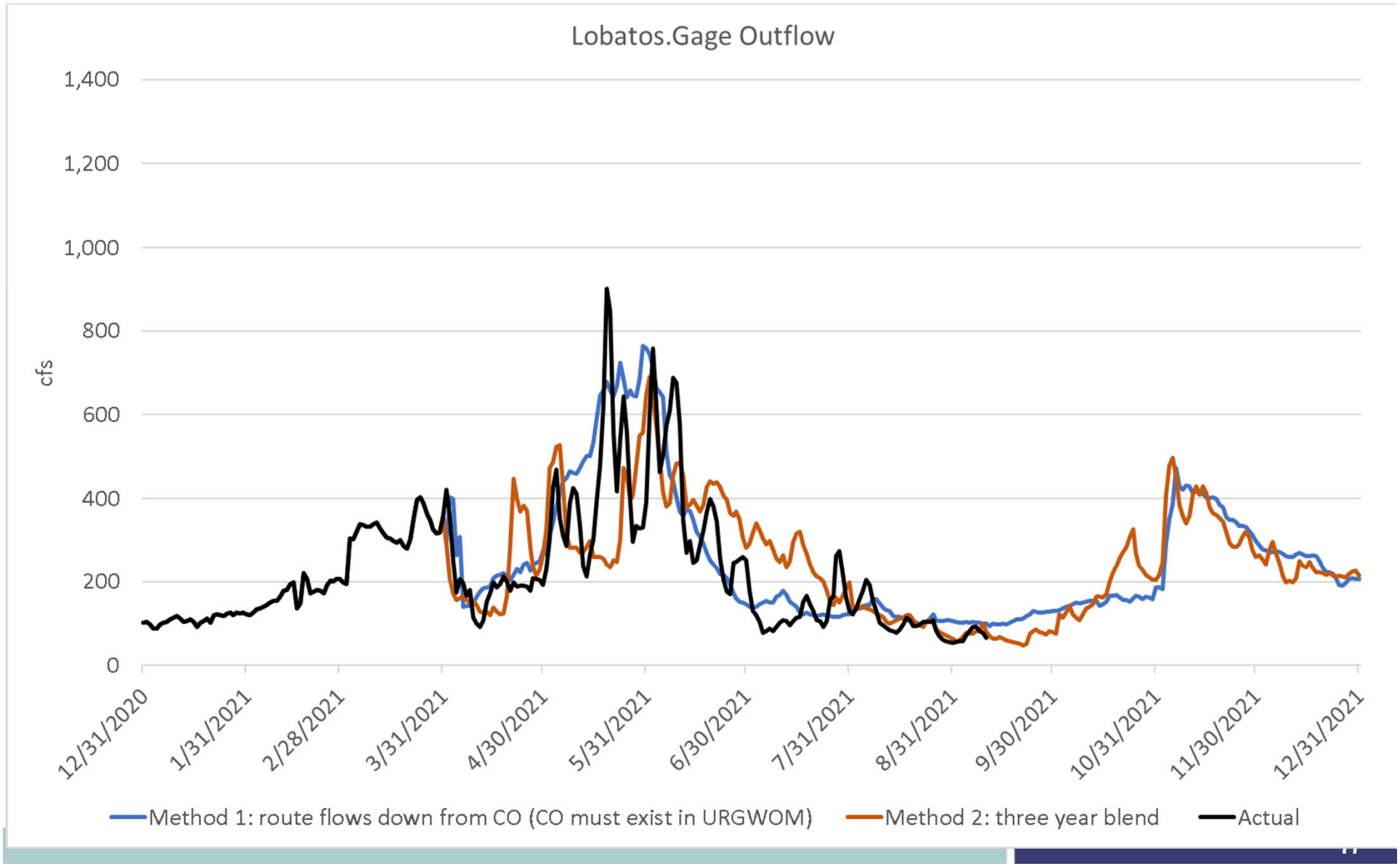


Method 1 vs. method 2



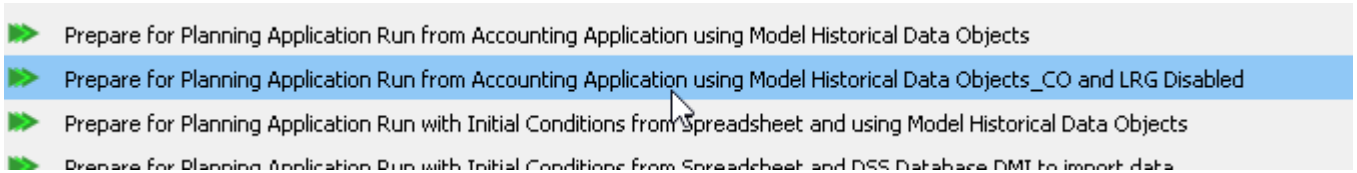


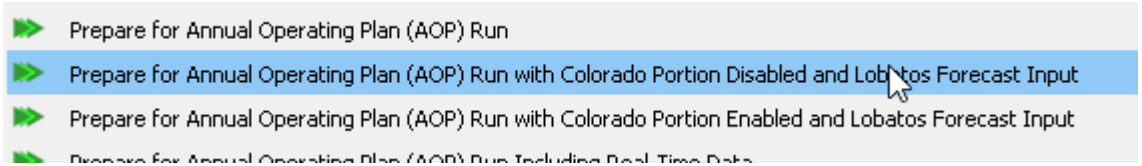
Method 1 vs. method 2



How to disable Colorado

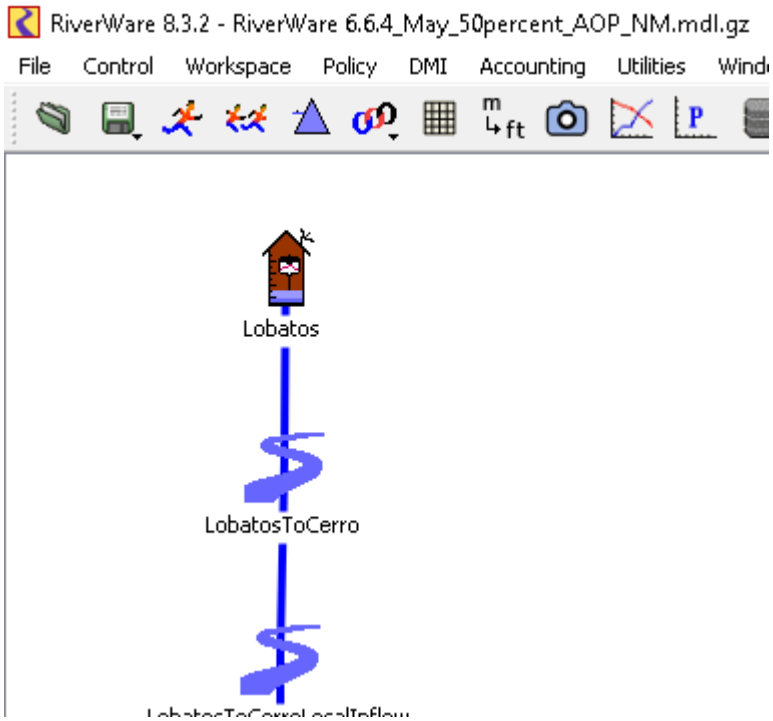
- **URGWOM can already run with Colorado disabled, in both Planning and AOP runs:**





How to delete Colorado

- Delete every object above Lobatos (like the 2015 AOP run, before Colorado portion was added). Only difference is that in 2015, a Lobatos forecast had to be INPUT (but now it can be estimated by URGWOM).
  - Will need to edit/remove many data objects, DMIs, and DSS file

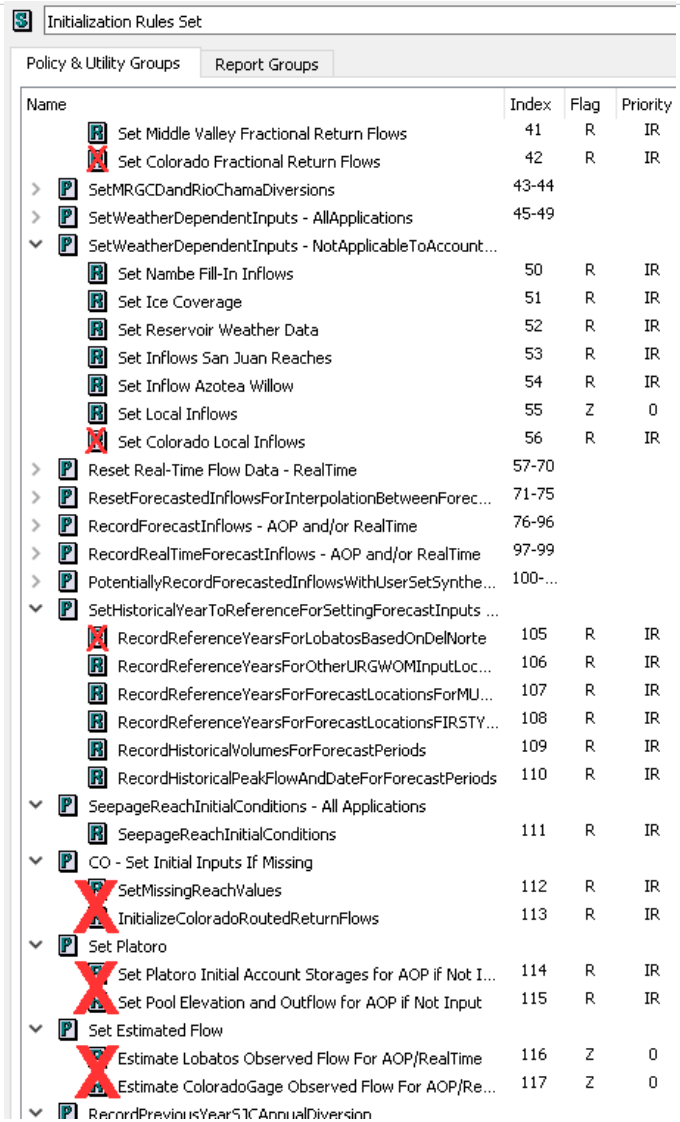


How to delete Colorado

- Delete 40 rules (rules 227- 266)

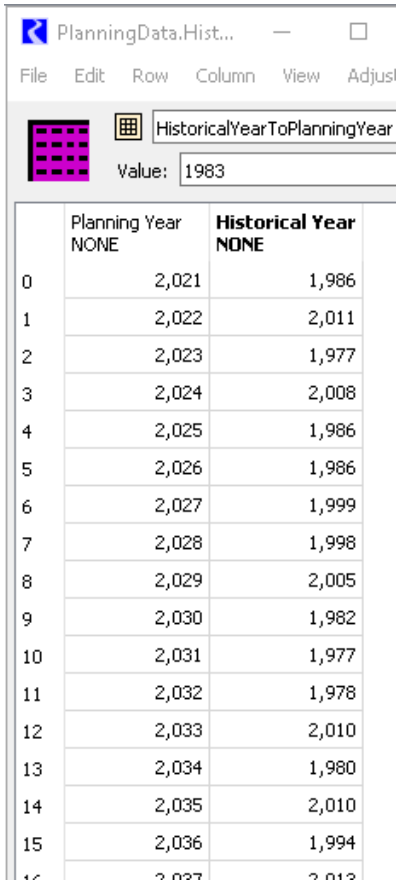
How to delete Colorado

- Delete 9 Initialization Rules
  - Will need to edit many other initialization rules



Planning Runs with CO disabled or deleted

- Planning Run can function right now if CO is disabled. Lobatos samples gage data from the input years:



	Planning Year NONE	**Historical Year NONE**
0	2,021	1,986
1	2,022	2,011
2	2,023	1,977
3	2,024	2,008
4	2,025	1,986
5	2,026	1,986
6	2,027	1,999
7	2,028	1,998
8	2,029	2,005
9	2,030	1,982
10	2,031	1,977
11	2,032	1,978
12	2,033	2,010
13	2,034	1,980
14	2,035	2,010
15	2,036	1,994

Planning Runs with CO disabled or deleted

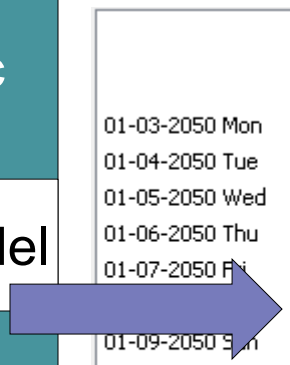
- NMISC and BOR would like a different option for Planning Runs (Rio Grande Basin Study):
- Input hydrologic traces for the Rio Grande and Conejos Index Gages in Colorado. Even if these gages were deleted from the model, we could input these data on data objects:

100s of hydrologic Traces from:

1) USGS PRMS model

2) NCAR LOCA data

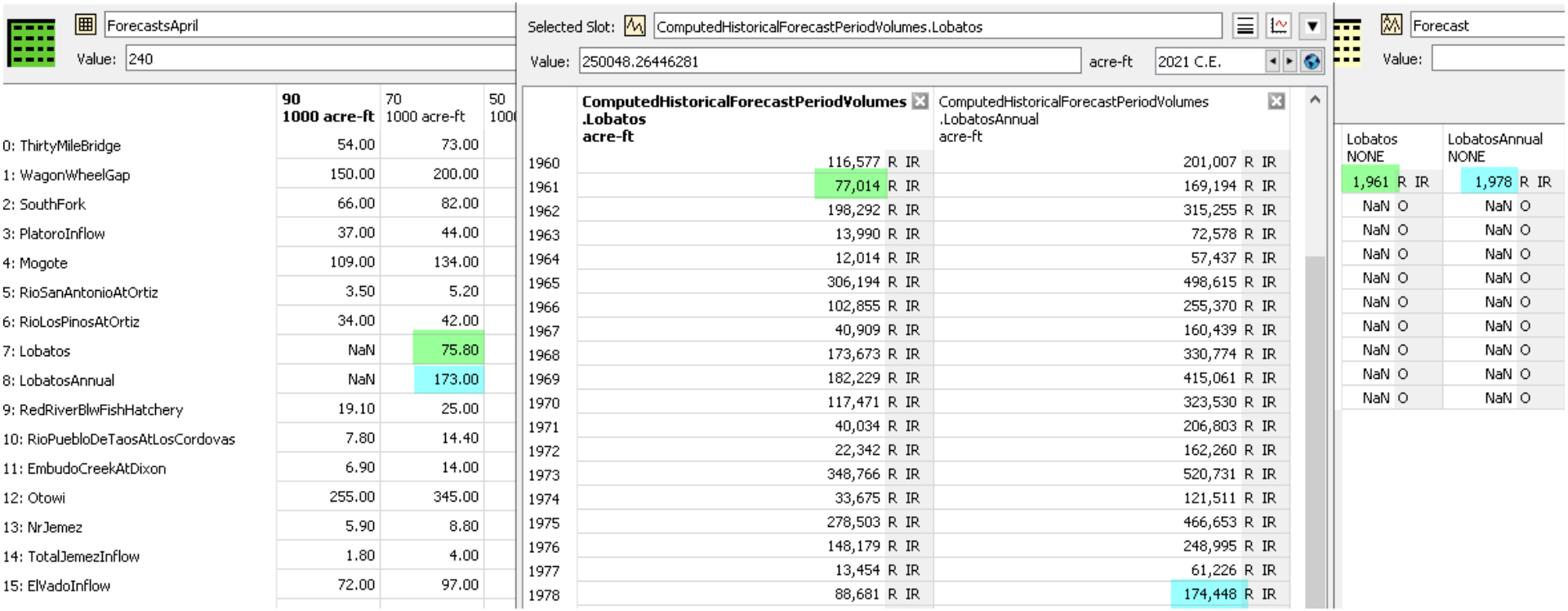
3) BCSD GCM data run through VIC



	DailyInflowForecasts .DelNorte cfs	DailyInflowForecasts .Mogote cfs	DailyInflowForecasts .RioLosPinosAtOrtiz cfs	DailyInflowForecasts .RioSanAntonioAtOrtiz cfs
01-03-2050 Mon	161.67 I	31.00 I	12.17 I	1.57 I
01-04-2050 Tue	158.33 I	27.00 I	11.83 I	1.67 I
01-05-2050 Wed	161.67 I	26.67 I	10.50 I	1.50 I
01-06-2050 Thu	161.67 I	28.00 I	10.17 I	1.30 I
01-07-2050 Fri	155.00 I	33.00 I	10.50 I	1.40 I
	161.00 I	32.00 I	10.50 I	1.53 I
01-09-2050 Sun	163.33 I	31.67 I	11.17 I	1.57 I
01-10-2050 Mon	170.00 I	32.00 I	11.50 I	1.50 I
01-11-2050 Tue	171.67 I	36.00 I	12.83 I	1.50 I
01-12-2050 Wed	173.33 I	32.00 I	13.17 I	1.47 I
01-13-2050 Thu	168.33 I	30.33 I	14.83 I	1.33 I
01-14-2050 Fri	163.33 I	31.33 I	14.17 I	1.20 I

Planning Runs with CO disabled or deleted

- Once we have flow data for these index gages, we can come up with the Lobatos delivery obligation each year, match that obligation with a historical year's delivery, and deliver that amount at Lobatos (with the hydrograph shaped based on the historical year), just like a do in AOP runs



ForecastsApril
Value: 240

	90 1000 acre-ft	70 1000 acre-ft	50 100
0: ThirtyMileBridge	54.00	73.00	
1: WagonWheelGap	150.00	200.00	
2: SouthFork	66.00	82.00	
3: PlatoroInflow	37.00	44.00	
4: Mogote	109.00	134.00	
5: RioSanAntonioAtOrtiz	3.50	5.20	
6: RioLosPinosAtOrtiz	34.00	42.00	
7: Lobatos	NaN	75.80	
8: LobatosAnnual	NaN	173.00	
9: RedRiverBlwFishHatchery	19.10	25.00	
10: RioPuebloDeTaosAtLosCordovas	7.80	14.40	
11: EmbudoCreekAtDixon	6.90	14.00	
12: Otowi	255.00	345.00	
13: NrJemez	5.90	8.80	
14: TotalJemezInflow	1.80	4.00	
15: ElVadoInflow	72.00	97.00	

Selected Slot: ComputedHistoricalForecastPeriodVolumes.Lobatos
Value: 250048.26446281 acre-ft 2021 C.E.

	ComputedHistoricalForecastPeriodVolumes .Lobatos acre-ft	ComputedHistoricalForecastPeriodVolumes .LobatosAnnual acre-ft
1960	116,577 R IR	201,007 R IR
1961	77,014 R IR	169,194 R IR
1962	198,292 R IR	315,255 R IR
1963	13,990 R IR	72,578 R IR
1964	12,014 R IR	57,437 R IR
1965	306,194 R IR	498,615 R IR
1966	102,855 R IR	255,370 R IR
1967	40,909 R IR	160,439 R IR
1968	173,673 R IR	330,774 R IR
1969	182,229 R IR	415,061 R IR
1970	117,471 R IR	323,530 R IR
1971	40,034 R IR	206,803 R IR
1972	22,342 R IR	162,260 R IR
1973	348,766 R IR	520,731 R IR
1974	33,675 R IR	121,511 R IR
1975	278,503 R IR	466,653 R IR
1976	148,179 R IR	248,995 R IR
1977	13,454 R IR	61,226 R IR
1978	88,681 R IR	174,448 R IR

Forecast
Value:

Lobatos NONE	LobatosAnnual NONE
1,961 R IR	1,978 R IR
NaN O	NaN O
NaN O	NaN O
NaN O	NaN O
NaN O	NaN O
NaN O	NaN O
NaN O	NaN O
NaN O	NaN O
NaN O	NaN O
NaN O	NaN O

Conclusion

1. Colorado can be deleted, but leaves us without one of the options for shaping the Lobatos hydrograph in AOP runs
2. URGWOM will need to be edited to meet the Lobatos obligation every year in a Planning Run

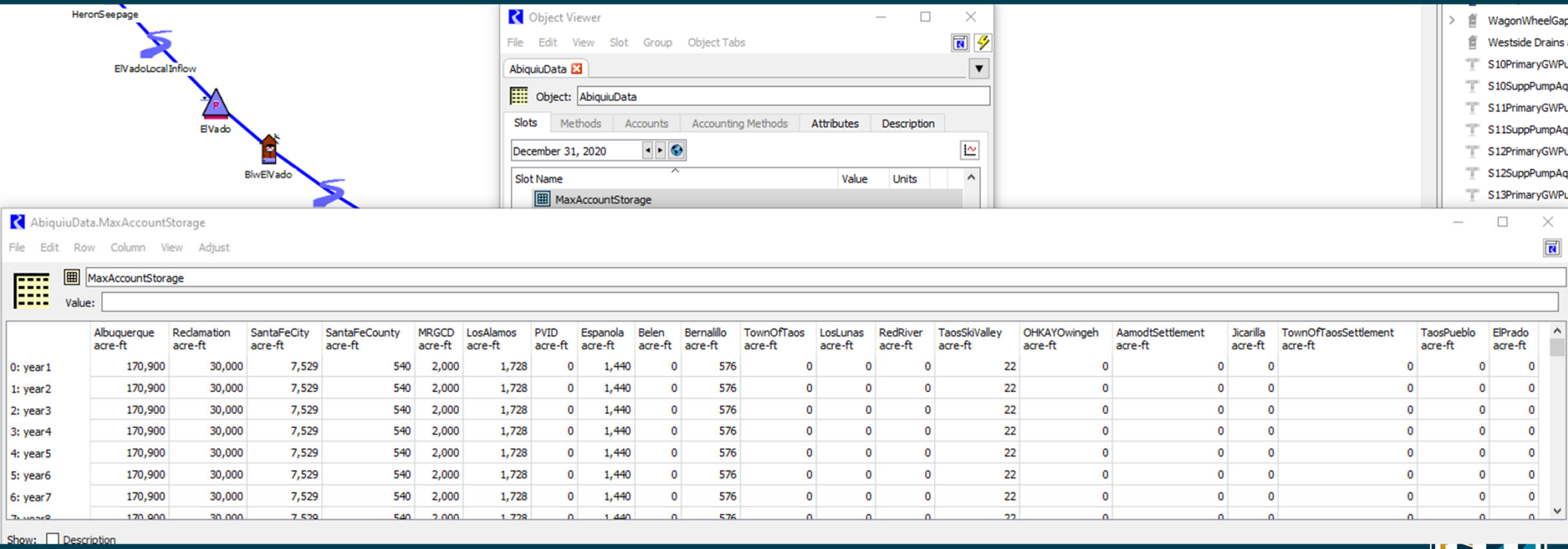
BUREAU OF RECLAMATION

Updates to URGWOM

BUREAU OF RECLAMATION

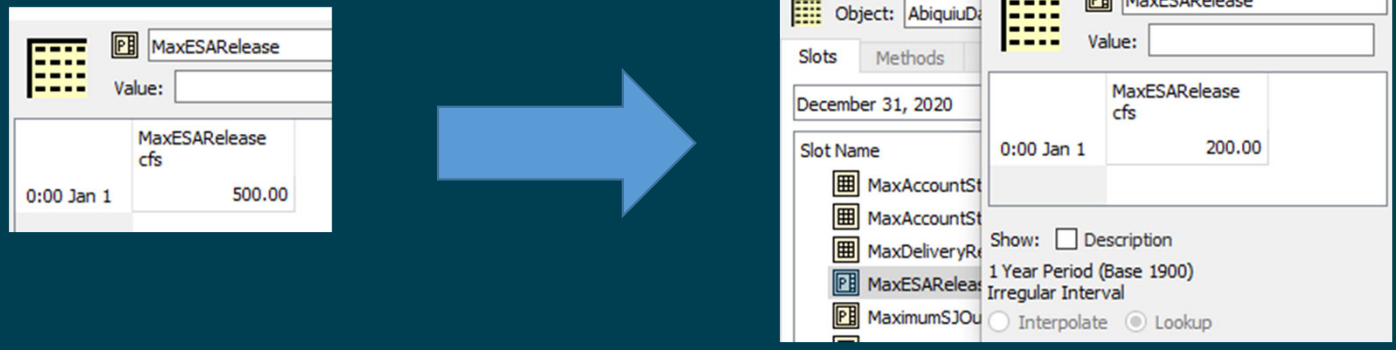
URGWOM_8.3_08-18-21

Modified Max Account Storage

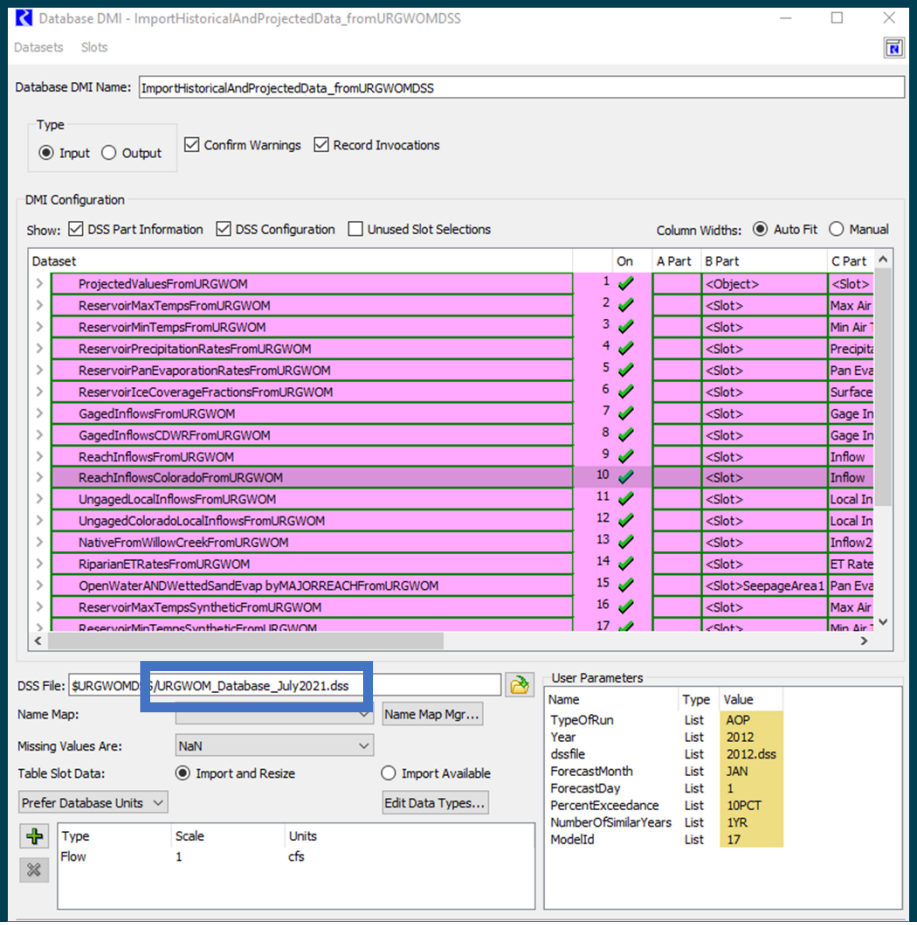


	Albuquerque acre-ft	Reclamation acre-ft	SantaFeCity acre-ft	SantaFeCounty acre-ft	MRGCD acre-ft	LosAlamos acre-ft	PVID acre-ft	Espanola acre-ft	Belen acre-ft	Bernalillo acre-ft	TownOfTaos acre-ft	LosLunas acre-ft	RedRiver acre-ft	TaosSkiValley acre-ft	OHKAYOwingeh acre-ft	AamodtSettlement acre-ft	Jicarilla acre-ft	TownOfTaosSettlement acre-ft	TaosPueblo acre-ft	ElPrado acre-ft
0: year1	170,900	30,000	7,529	540	2,000	1,728	0	1,440	0	576	0	0	0	22	0	0	0	0	0	0
1: year2	170,900	30,000	7,529	540	2,000	1,728	0	1,440	0	576	0	0	0	22	0	0	0	0	0	0
2: year3	170,900	30,000	7,529	540	2,000	1,728	0	1,440	0	576	0	0	0	22	0	0	0	0	0	0
3: year4	170,900	30,000	7,529	540	2,000	1,728	0	1,440	0	576	0	0	0	22	0	0	0	0	0	0
4: year5	170,900	30,000	7,529	540	2,000	1,728	0	1,440	0	576	0	0	0	22	0	0	0	0	0	0
5: year6	170,900	30,000	7,529	540	2,000	1,728	0	1,440	0	576	0	0	0	22	0	0	0	0	0	0
6: year7	170,900	30,000	7,529	540	2,000	1,728	0	1,440	0	576	0	0	0	22	0	0	0	0	0	0

Reduced Max ESA Release

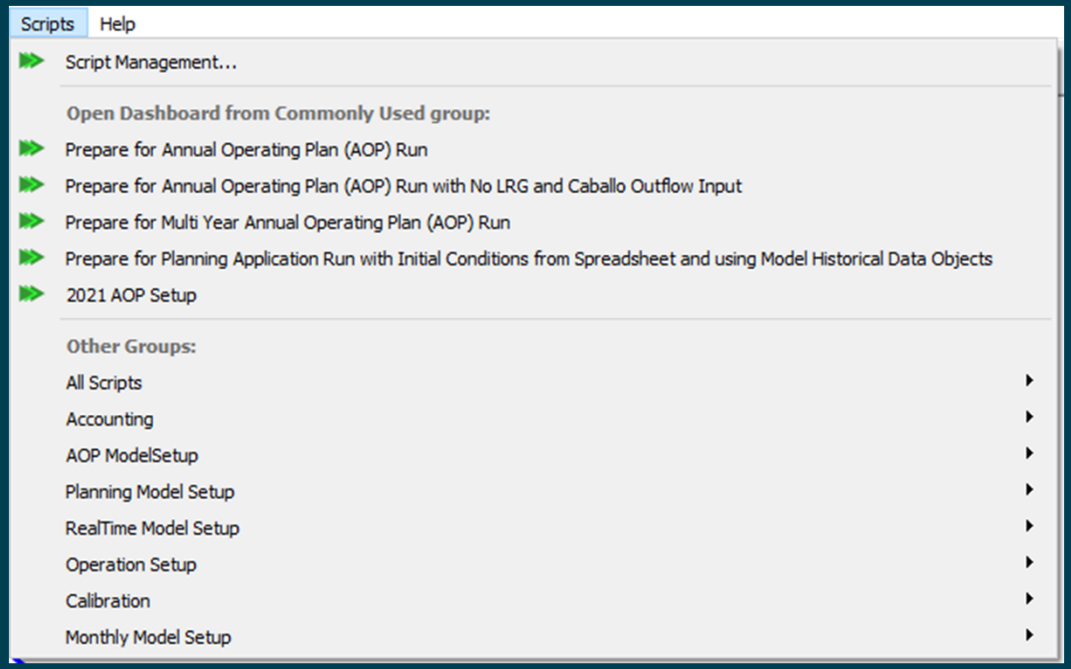


Changed DMIs to use updated DSS



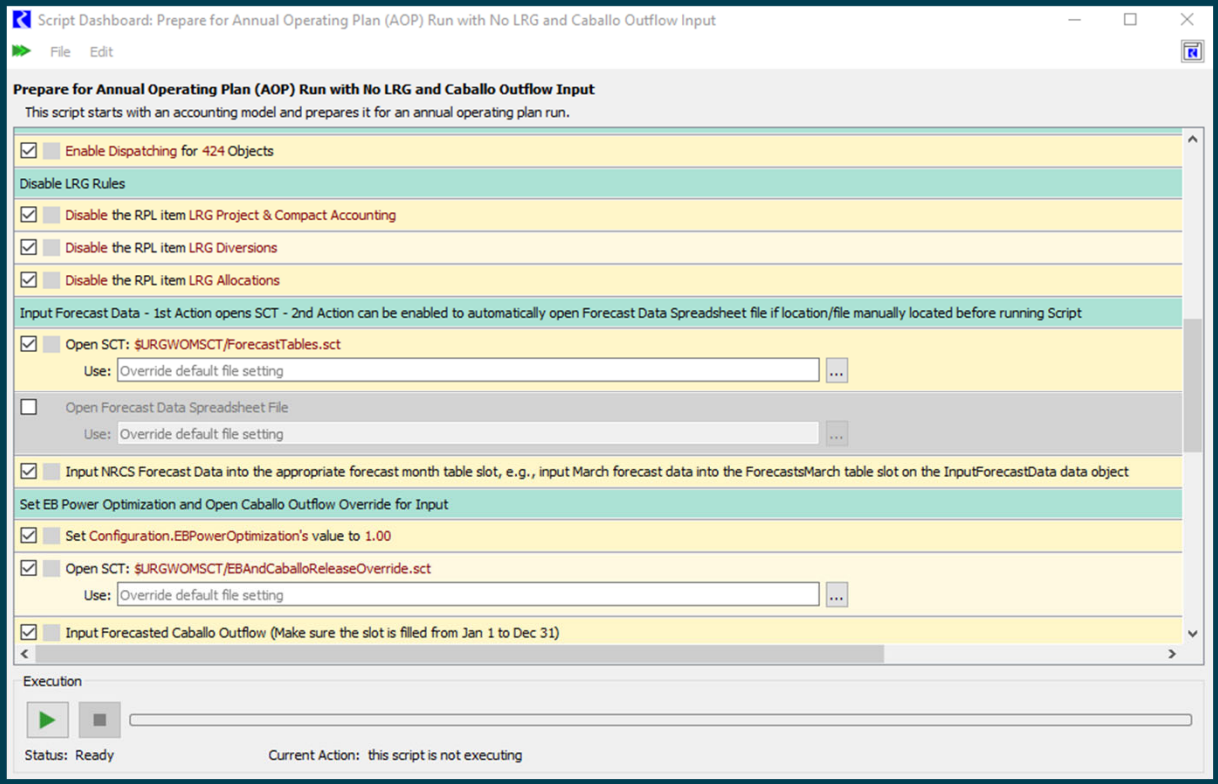
Modified Script Layout

If there are any changes that anyone would like to see, please let me know.



Added New AOP Script

- No LRG required
- Uses EBPowerOptimizations which requires input for flows in Caballo override release
- Saved ~6,000 KB of size and ~1 min faster to run



Side Note: Created another AOP Script

- This script is the same as above but disables CO and lets the model calculate the water needed to get to Lobatos, skipping all the diversions and the water rights solver.
- Reduces the model run time a further 50 seconds (170 sec total for September AOP run, ~40% faster than with CO and LRG) and size by ~1,500 KB (could be more if the CO data was separated out when being brought in, but I don't believe it is worth the effort)
- This script will be added (or replace the above script) in the next update

BUREAU OF RECLAMATION

URGWOM_8.3_08-27-21

Implemented Nick's Fix to CO Portion

AOP Run Conclusion

Hydros Consulting

- Once all of these proposed changes are made, the Annual Compact Obligation will arrive at Lobatos, as Marc had mentioned.
- URGWOM seems to model everything as accurately as possible, given data availability
- However, the model user may choose to manually input their own inflow hydrographs, for many reasons, e.g.,
  1) They don't agree with the timing of the URGWOM-computed hydrograph, since the pattern is based on a historical year
  2) They don't agree with URGWOM's assumptions that CO will meet the compact requirement. They may want smaller Inflows.
  3) They may not agree with URGWOM's assumptions that many of the Colorado local inflows are based on the upstream Del Norte forecast
  4) They may not agree with URGWOM's assumption that all CO diverters try to divert 100% of their water right from April 1 – Oct 31 (except when curtailed by compact restrictions)

Modified MRG Targets

MiddleValleyTargets.MinTargetFlows

File Edit Row Column View Adjust

MinTargetFlows

Value:

	Central Dry cfs	Central Normal cfs	Central Wet cfs	Isleta Dry cfs	Isleta Normal cfs	Isleta Wet cfs	SanAcacia Dry cfs	SanAcacia Normal cfs	SanAcacia Wet cfs	SanMarcial Dry cfs	SanMarcial Normal cfs	SanMarcial Wet cfs
0:00 Jan 1	100.00	100.00	100.00	40.00	40.00	40.00	40.00	40.00	40.00	0.00	0.00	0.00

MiddleValleyTargets.MinTargetFlows

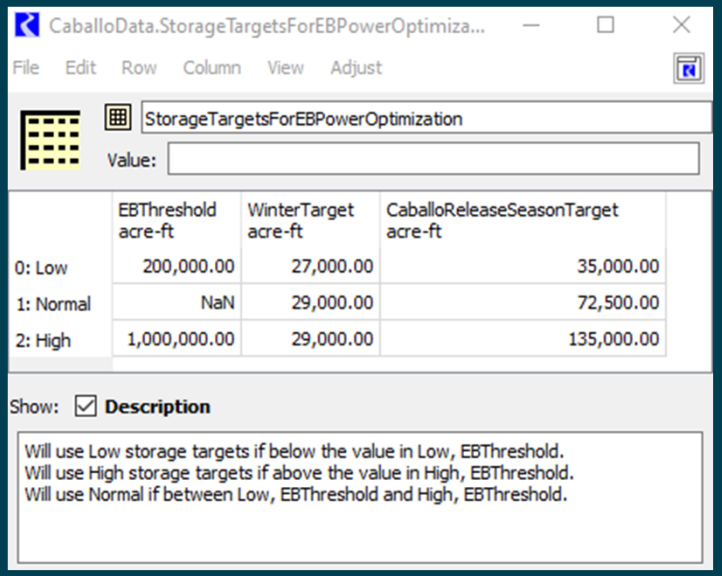
File Edit Row Column View Adjust

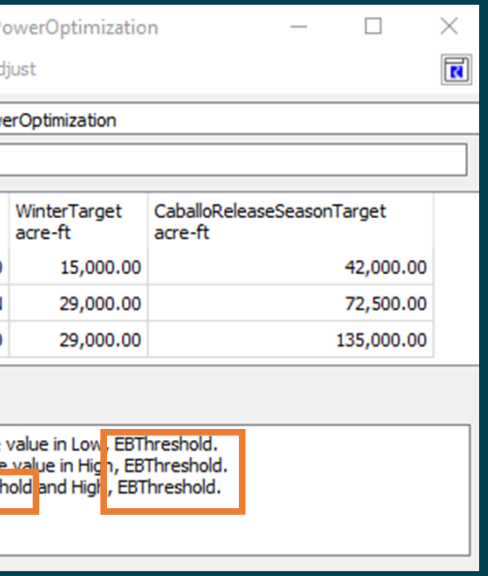
MinTargetFlows

Value:

	Central Dry cfs	Central Normal cfs	Central Wet cfs	Isleta Dry cfs	Isleta Normal cfs	Isleta Wet cfs	SanAcacia Dry cfs	SanAcacia Normal cfs	SanAcacia Wet cfs	SanMarcial Dry cfs	SanMarcial Normal cfs	SanMarcial Wet cfs
0:00 Jan 1	80.00	100.00	100.00	20.00	30.00	40.00	10.00	15.00	20.00	0.00	0.00	0.00

Modified Caballo Storage Targets under Power Optimization





Note to self: Change EBThreshold to UsableStorageThreshold in description

BUREAU OF RECLAMATION

Was this useful and do you want this for future meetings?

BUREAU OF RECLAMATION

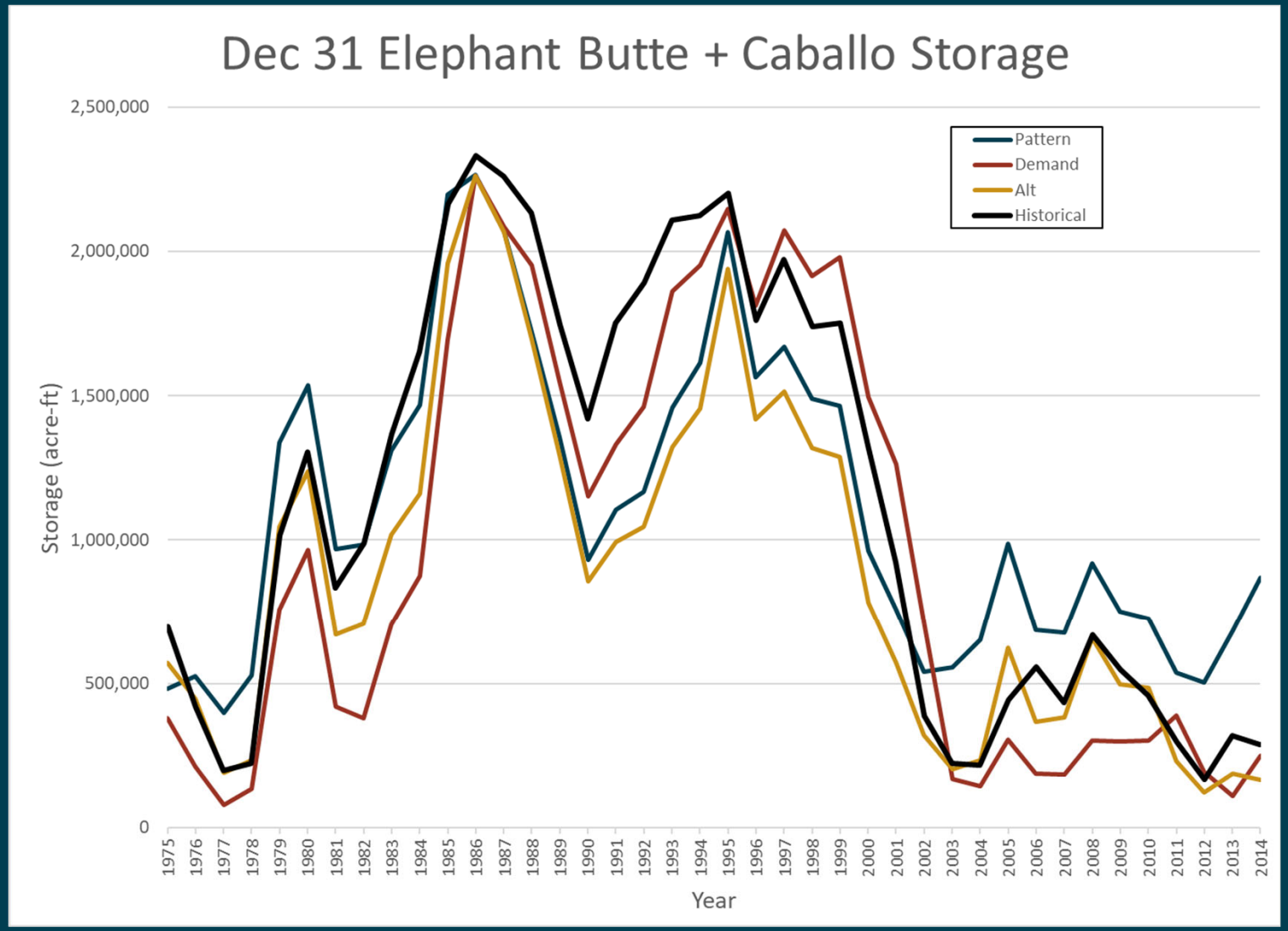
Comparing Demand, Pattern, and Alternative LRG Releases

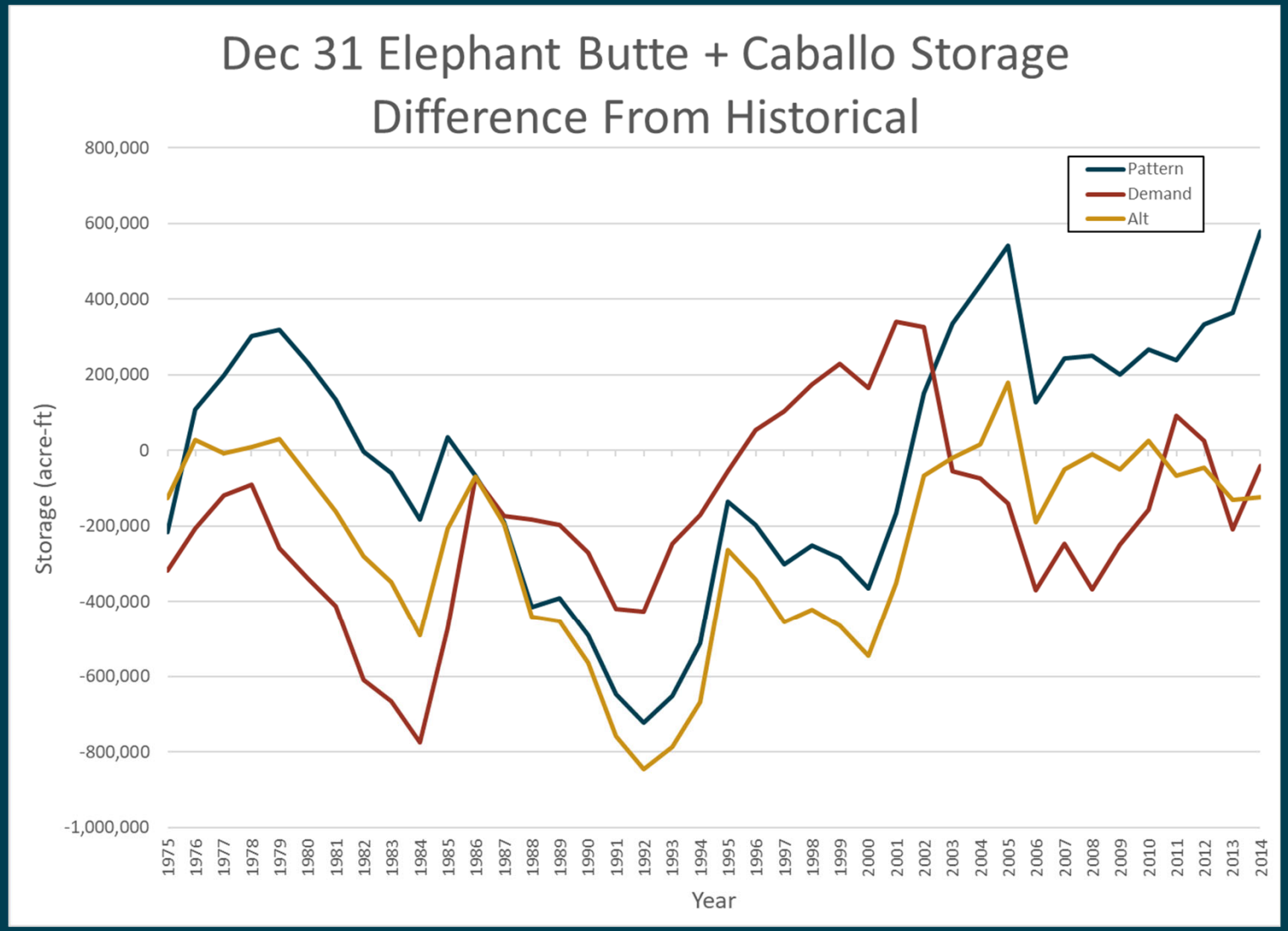
Purpose of this Analysis

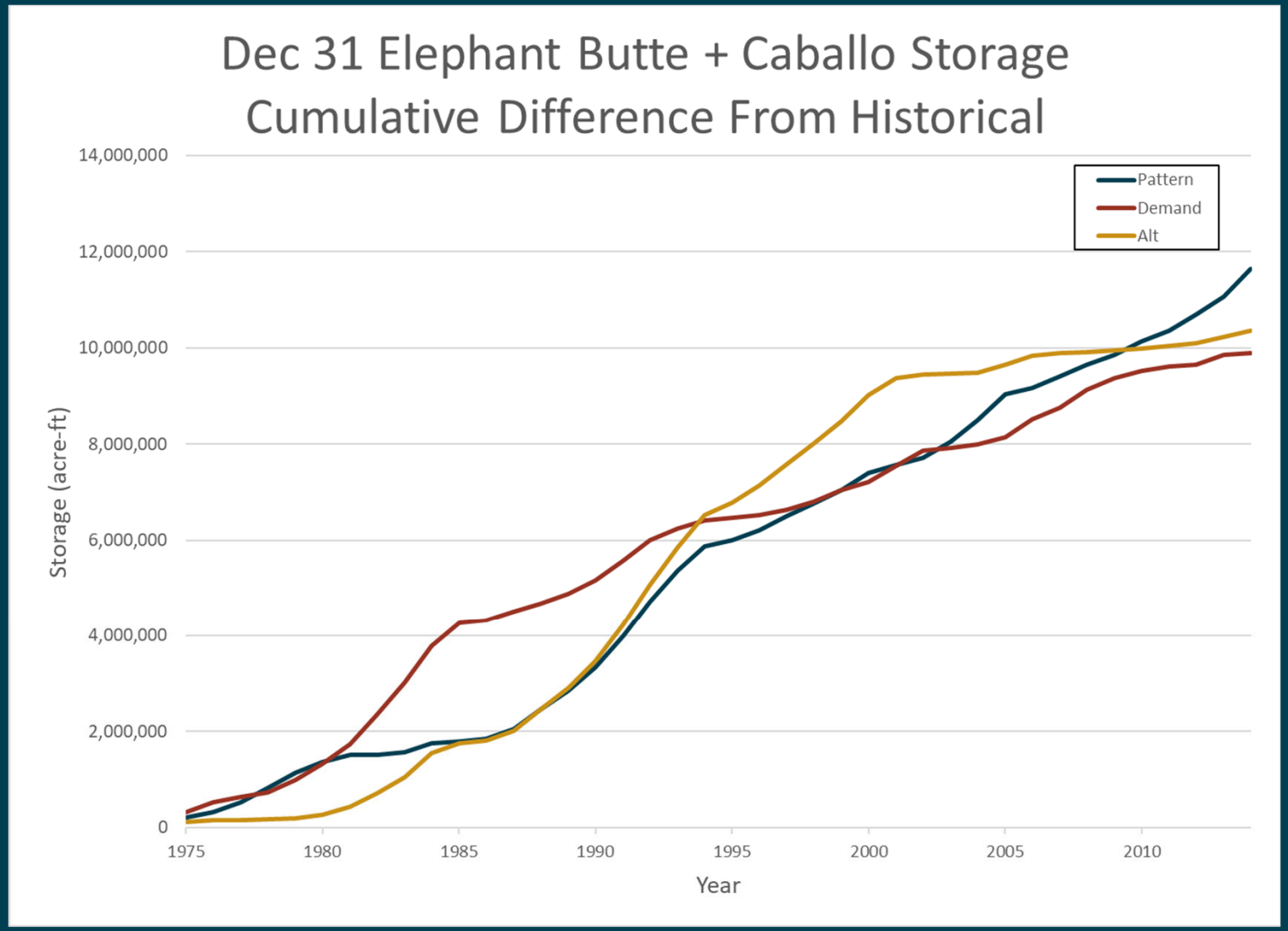
- Rio Grande Basin Study
- Nice to have a reliable method that doesn't require LRG portion of the model if data is unavailable, want quicker runs, or smaller file sizes.

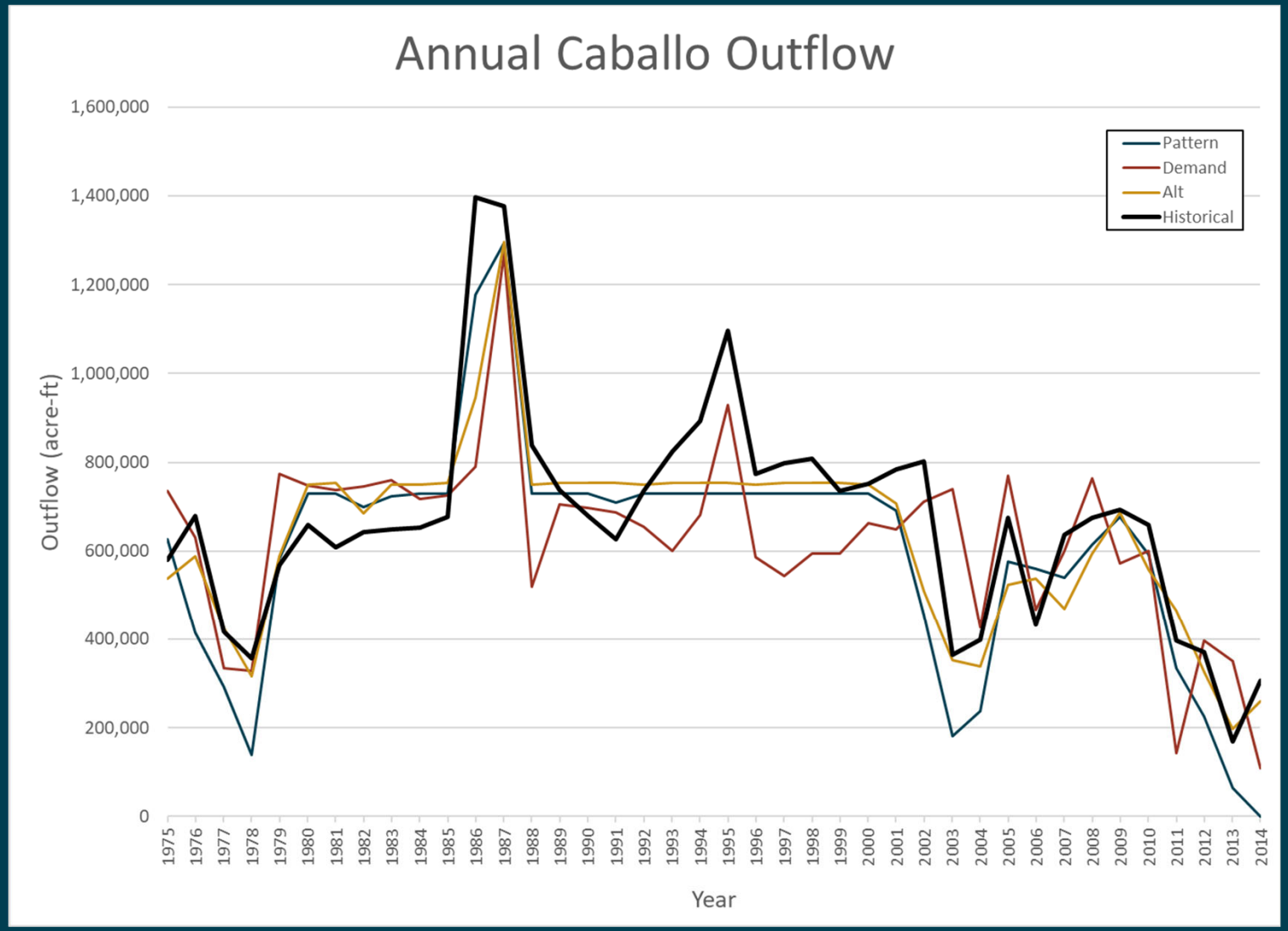
LRG Release Methods

- Pattern-Based
  - Uses dry/moderate/wet release schedule and multiplies it to "D3 Data.Total Usable Water Available for Current Year Allocation“
- Demand
  - Uses LRG diversion shortages to calculate release needed from Caballo.
- Alternative
  - Uses dry/moderate/wet release schedule and multiplies it to a linear equation that uses the correlation between EB inflow and EB and Caballo storage to Caballo release


Dec 31 Elephant Butte + Caballo Storage
Storage (acre-ft)
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Pattern
Demand
Alt
Historical
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year

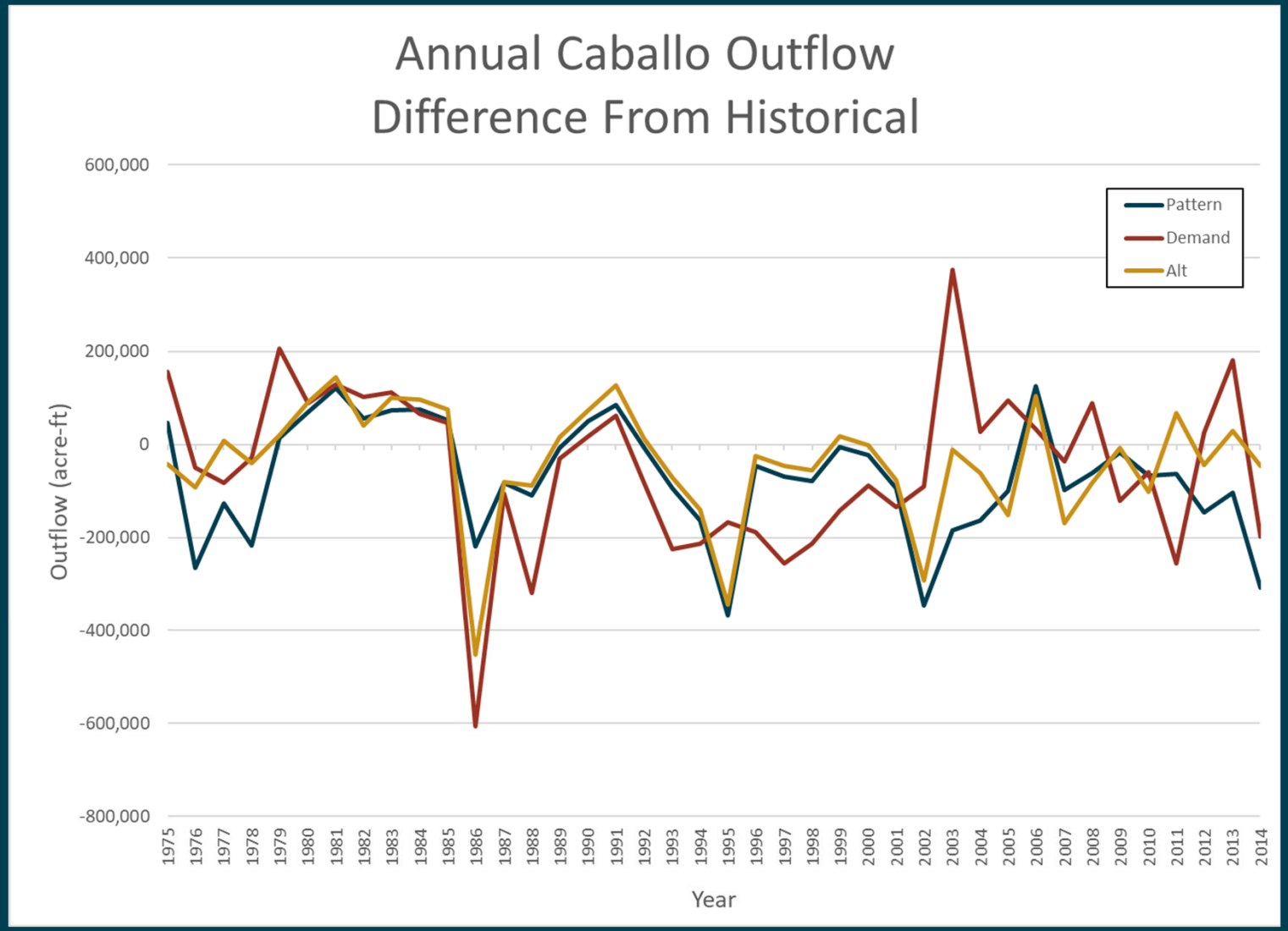

Dec 31 Elephant Butte + Caballo Storage Difference From Historical
Pattern
Demand
Alt
Storage (acre-ft)
800,000
600,000
400,000
200,000
0
-200,000
-400,000
-600,000
-800,000
-1,000,000
1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Year


Dec 31 Elephant Butte + Caballo Storage
Cumulative Difference From Historical
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
Storage (acre-ft)
1975
1980
1985
1990
1995
2000
2005
2010
Year
Pattern
Demand
Alt

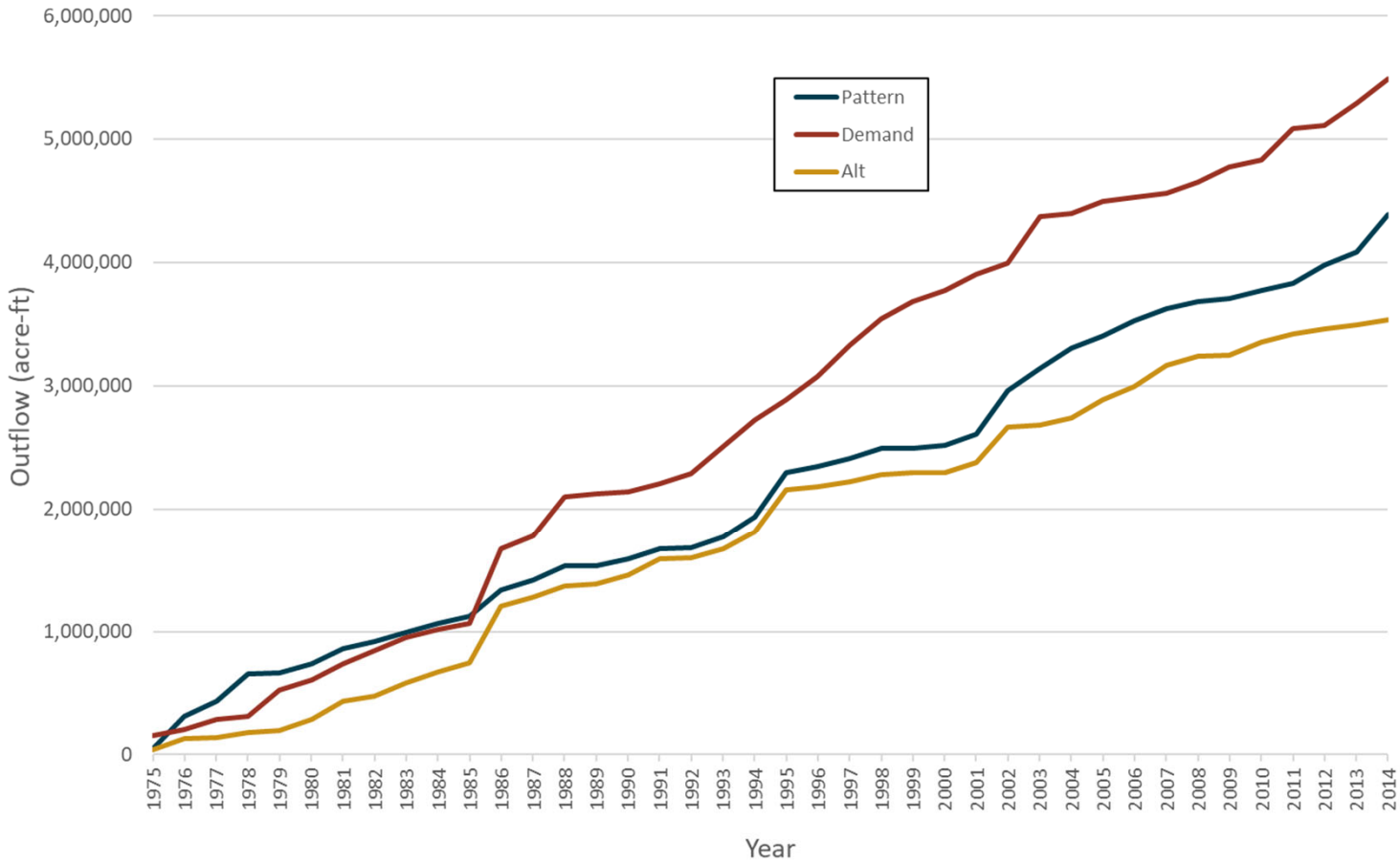

Annual Caballo Outflow
Outflow (acre-ft)
1,600,000
1,400,000
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
Pattern
Demand
Alt
Historical
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year

```
D3 Data.Total Usable Water Available for Current Year Allocation [EndOfMonth ( )]
  = IF (BeforeStopAllocationCalcDate ( )) THEN
      Max (Min ((D3 Data.Total Usable Water Available for Release [EndOfMonth ( )] - District Carryover Adjusted by Diversion Ratio ( )),
               RGPMaxAnnualRelease ( )),
           0.0000000 "acre-ft")
    ELSE
      0.0000000 "acre-ft"
    END IF
```

In 2014, there was more carryover than available water resulting in 0 “Total Usable Water Available for Current Year Allocation” which resulted in no releases for the Pattern-Based Method


Annual Caballo Outflow
Difference From Historical
600,000
400,000
200,000
0
-200,000
-400,000
-600,000
-800,000
Outflow (acre-ft)
Pattern
Demand
Alt
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year

Annual Caballo Outflow
Cumulative Difference From Historical

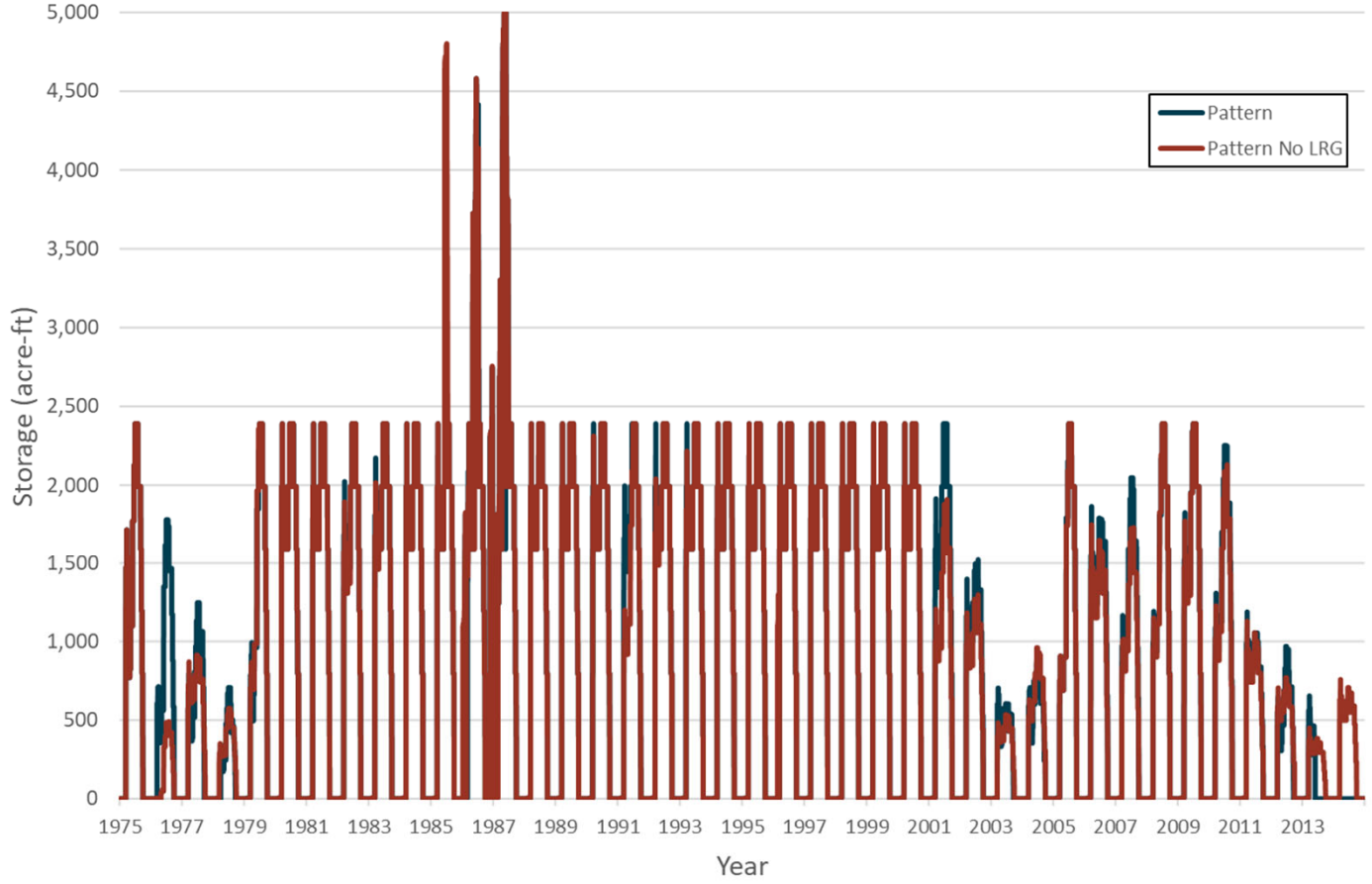


Pattern Based Release Without LRG

- Although Pattern Based release will run without LRG, it will not produce the intended results because it is tied to “D3 Data.Total Usable Water Available for Current Year Allocation” slot.
  - This slot uses accounting for EBID, EP1, and Mexico, which do not solve properly without the LRG on (without LRG on, those accounts never release water at Caballo)

*side note: for a 1975-2014 planning run you save ~140 MB by not using LRG (~580 MB with/440 MB without)

Pattern Based Caballo Release
LRG On Compared to LRG Off



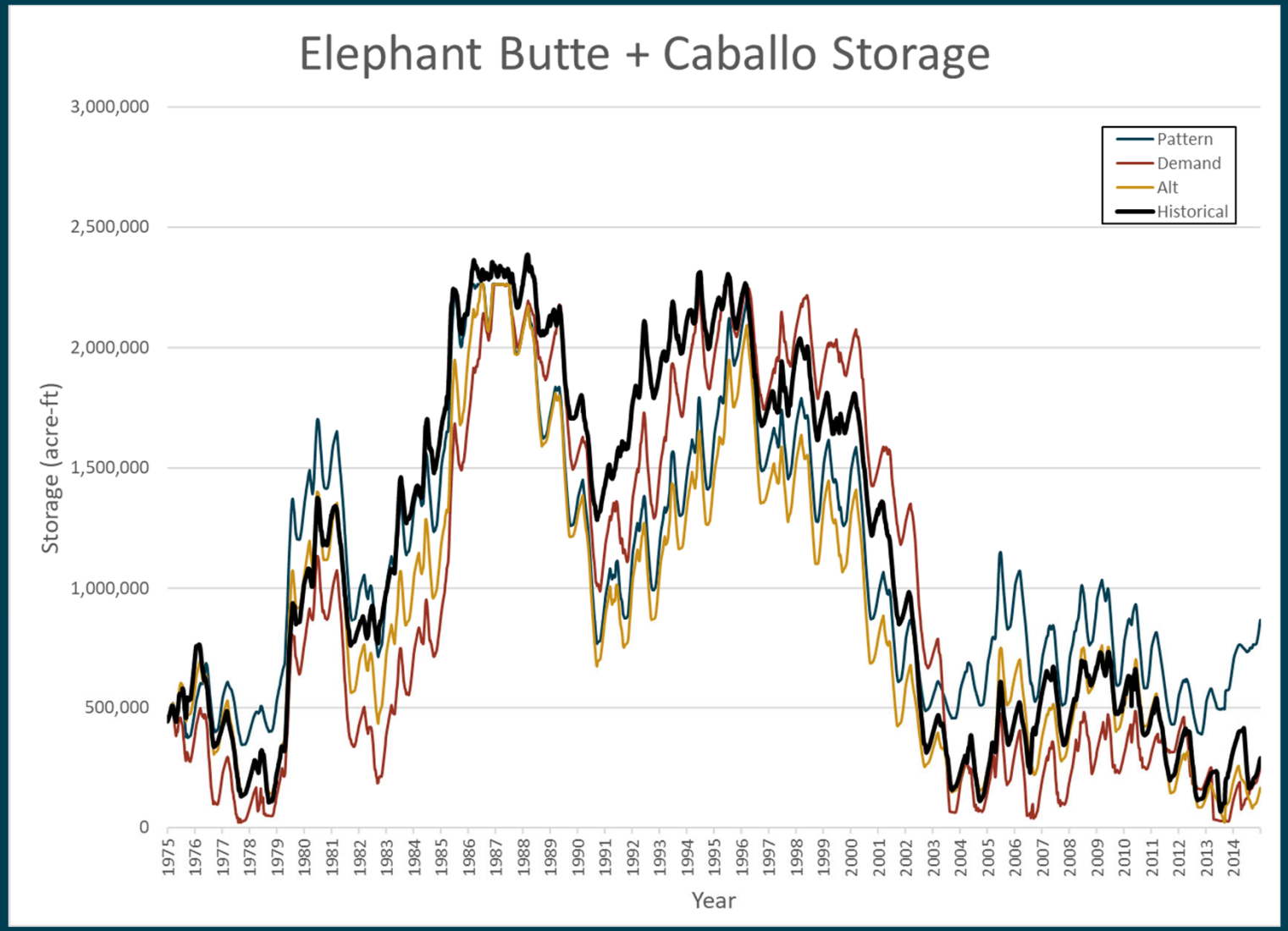
Conclusions

- Add the alternative release to allow the model to calculate Caballo release without needing LRG.
- Pattern-based release may not be suitable if LRG is turned off.
- Look into the pattern-based release and if it is correctly calculating during certain scenarios (like in 2014) when LRG is on.
  - Does the model correctly allocate to EBID and EP1 in a pattern-based release?
- If Pattern-based release can only be utilized with LRG on, is it useful to have with demand release?

Recent Thoughts on Adding Santa Fe to URWGOM

- Add Santa Fe City, but leave the BDD Pipeline and Option A and B out
  - Since BDD Pipeline is not currently operating and still being figured out on how it will be operated
  - Adding Santa Fe City should provide more realistic calls for water from Abiquiu based on their demand
    - Will also include any Article VI and VII releases
- Would have Santa Fe City off by default
- BDD Pipeline could be added later based on what decisions occur

Extras


Elephant Butte + Caballo Storage
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Storage (acre-ft)
Pattern
Demand
Alt
Historical
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
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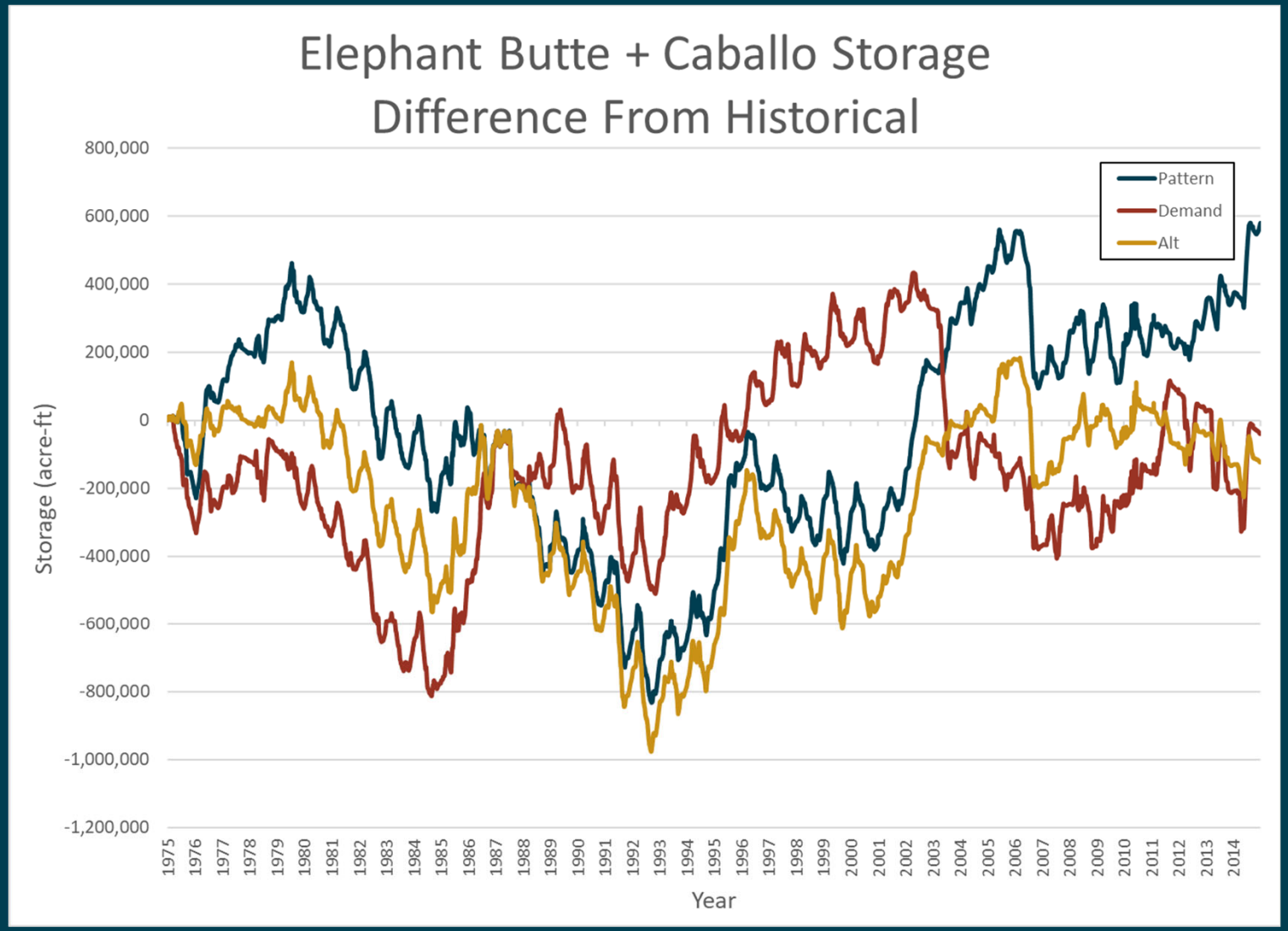
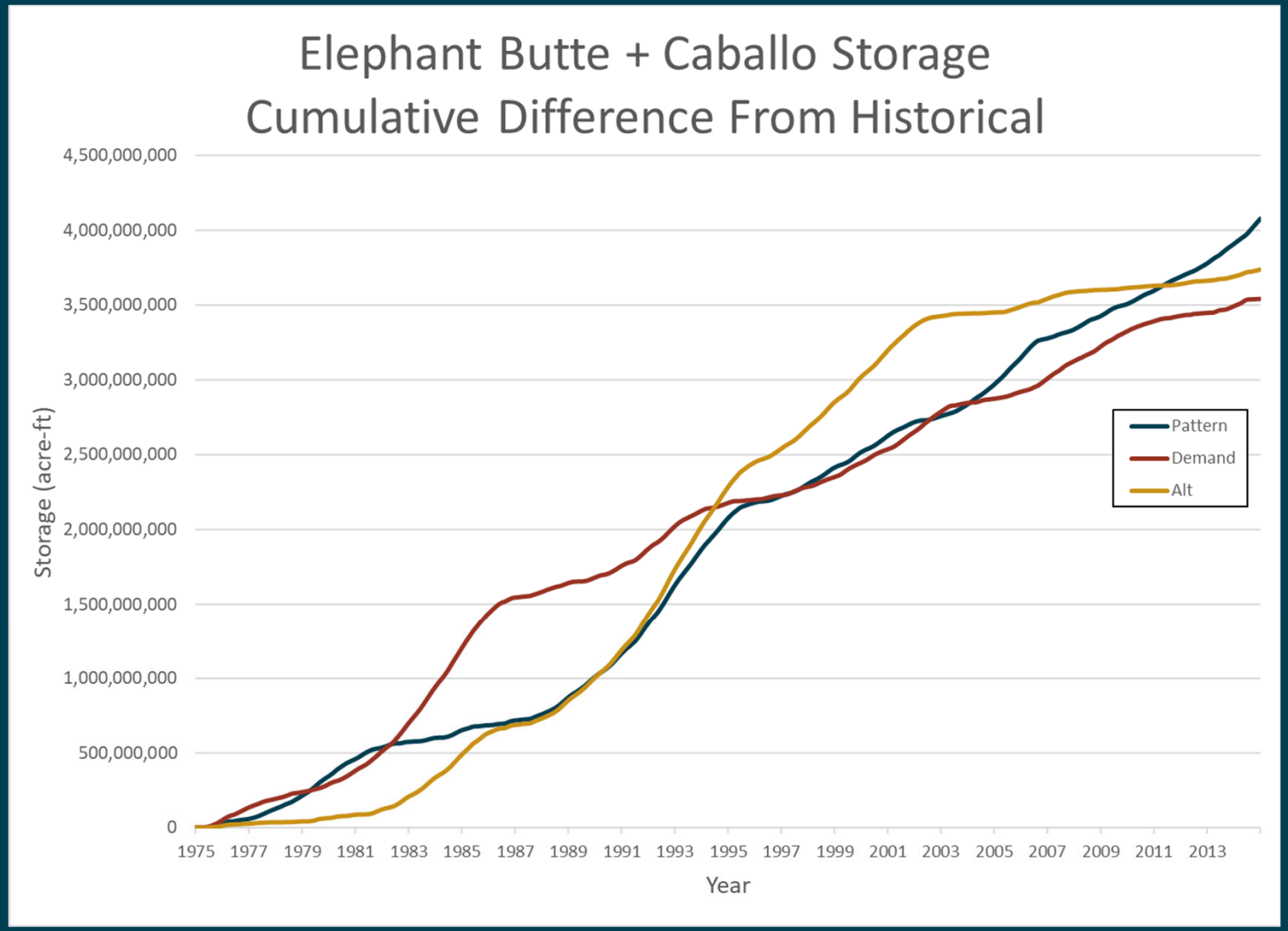
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year


Elephant Butte + Caballo Storage
Difference From Historical
Storage (acre-ft)
800,000
600,000
400,000
200,000
0
-200,000
-400,000
-600,000
-800,000
-1,000,000
-1,200,000
Pattern
Demand
Alt
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year


Elephant Butte + Caballo Storage
Cumulative Difference From Historical
Storage (acre-ft)
4,500,000,000
4,000,000,000
3,500,000,000
3,000,000,000
2,500,000,000
2,000,000,000
1,500,000,000
1,000,000,000
500,000,000
0
1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013
Year
Pattern
Demand
Alt