Modeling and Analysis Work Group #3

January 26, 2021

Meeting Logistics Summary

- Roll Call
  - Members will unmute and acknowledge their attendance when their name is called.
- Modeling and Analysis Workgroup Members
  - Use the WebEx “raise hand” feature to request to speak or ask questions.
  - Wait to be recognized before speaking to ensure clear communication and remain muted when not speaking.
- Livestream Attendees
  - Electronic public comment forms are available at cap-az.com/ARC for anyone wishing to submit a comment or question during the meeting.
  - All submissions will be addressed during the Call to the Public at the end of the meeting, unless relevant to a specific topic in the presentation.
- Modeling and Analysis Workgroup and ARC Information
  - Meeting materials have been posted on the ADWR and CAP ARC pages: cap-az.com/ARC or new.azwater.gov/ARC.

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Meeting Agenda

- Welcome and Introductions
- Colorado River System Update
- 7.D. Review Update
- MAWG Recap from Nov 10 MAWG Meeting
- Overview of River Operations in CRSS
- Overview of CRSS Demands/Depletions
- Next Steps
- Call to the Public

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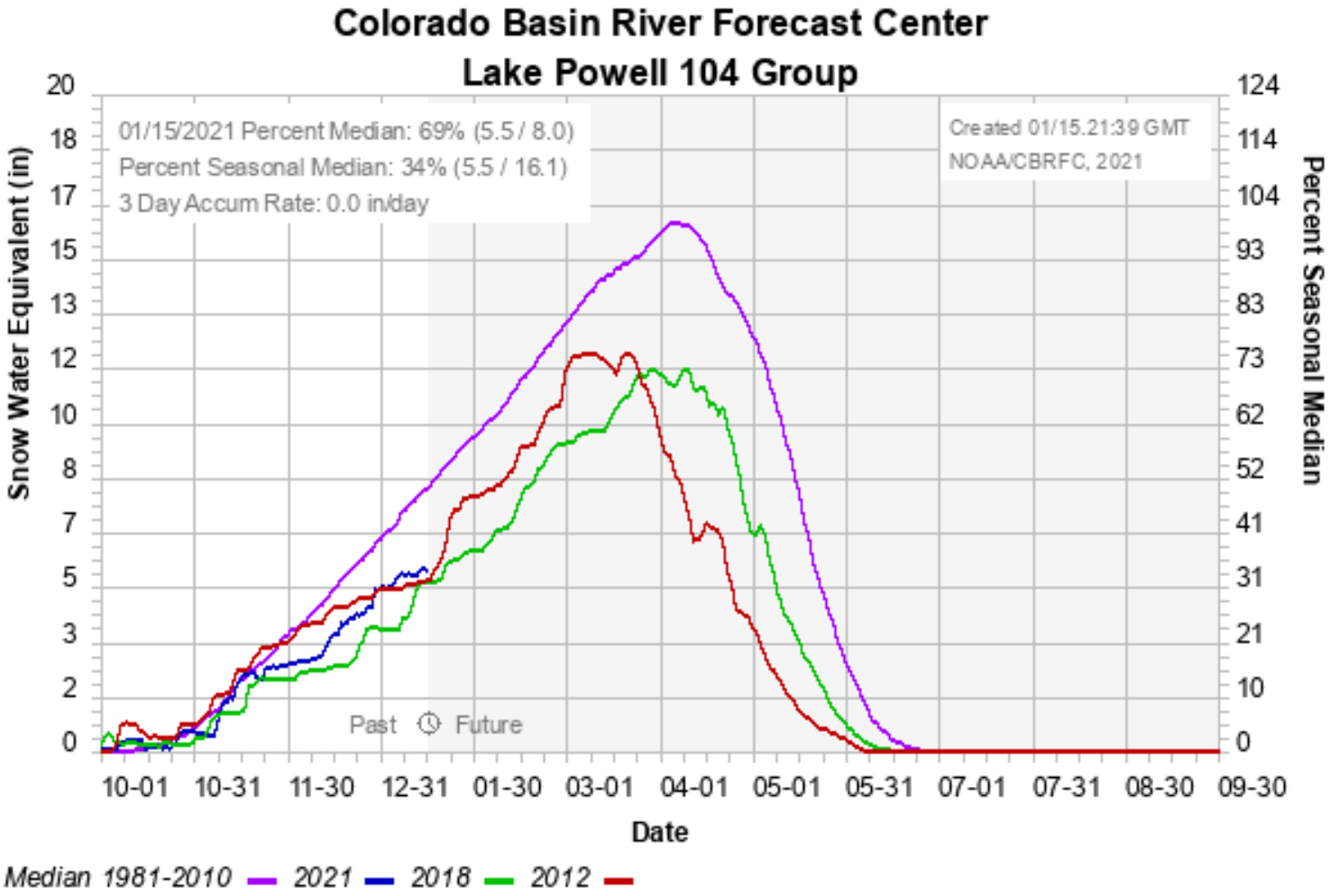
Colorado River System Update



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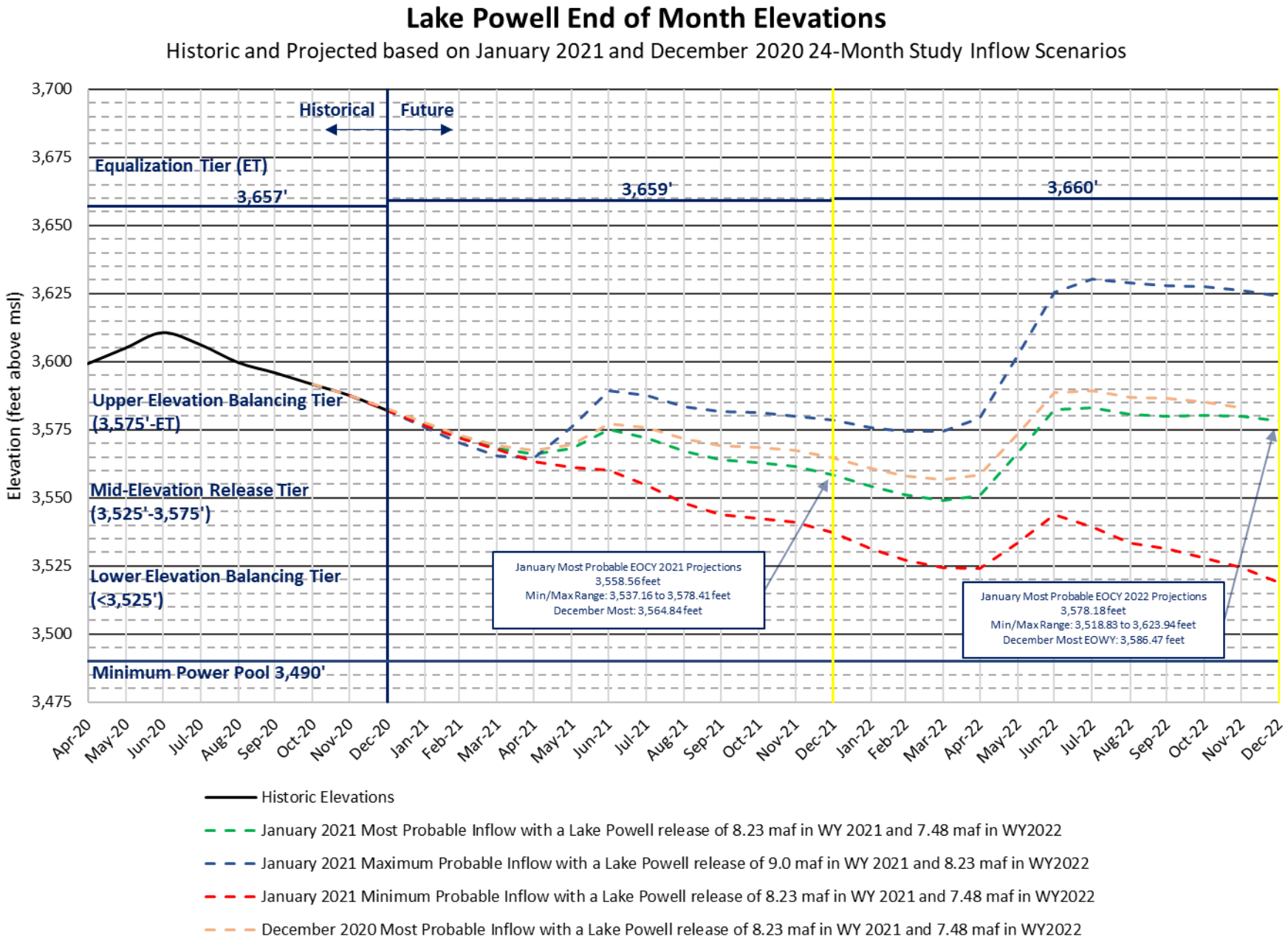
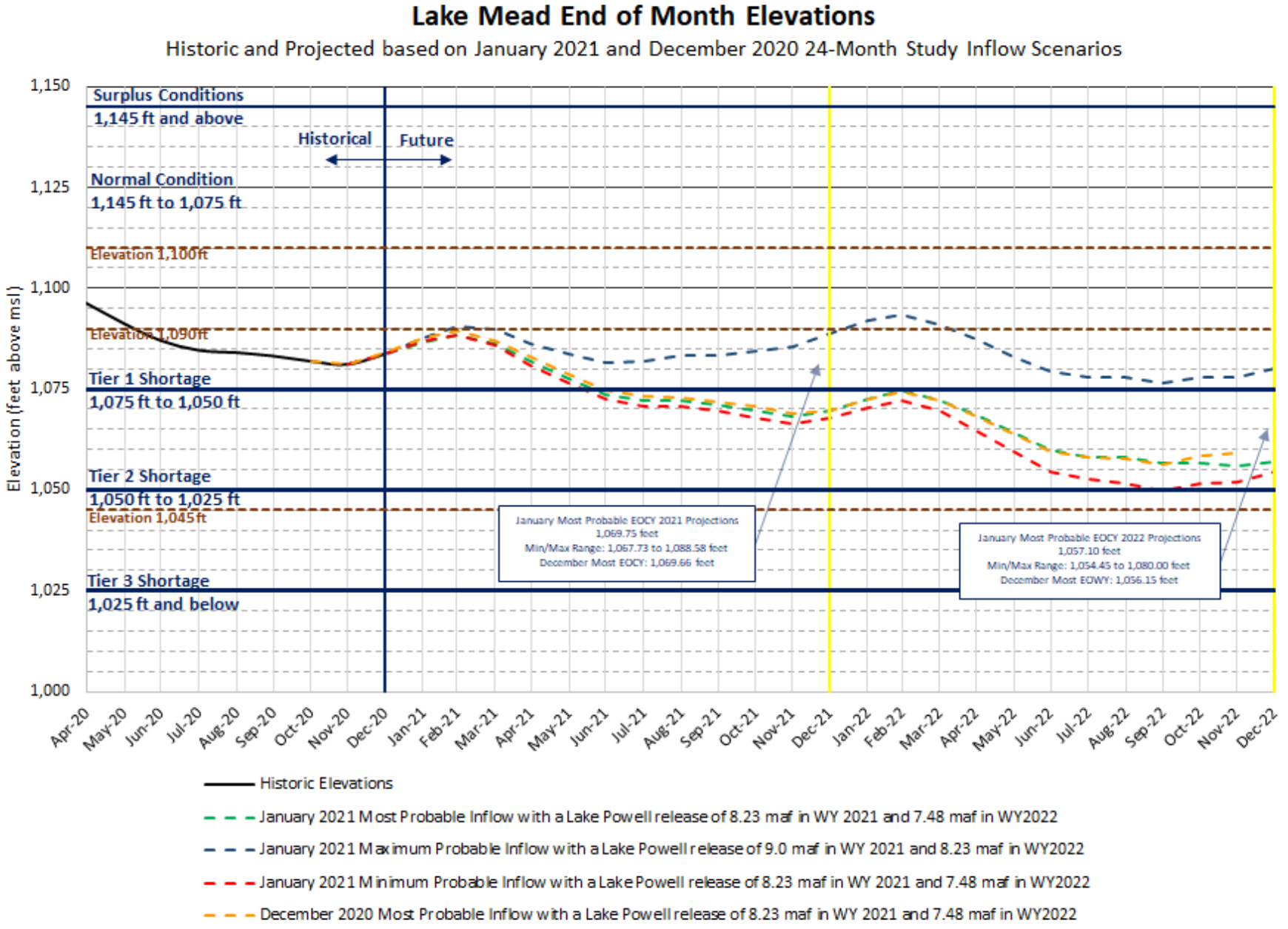
Colorado River System



Colorado River System



Reclamation 7.D. Review Report

Final Report published on December 18, 2020

7.D. Review: Effectiveness of the Guidelines

Effectiveness

Effectiveness of Guidelines with respect to Purpose

- **Improve Reclamation's mgmt.**: Having objective operational criteria for the full range of reservoir elevations improved Reclamation's management of the Colorado River, but drought necessitated DCPs and additional voluntary actions.
- **Provide predictability**: Structuring deliveries around specific Lake Mead elevations improved predictability for Lower Division states and provided a common framework for appreciation of future risk
- **Provide flexibility for meeting water use needs**:
  - The Guidelines provided a framework on which to build additional flexibilities and conservation opportunities through the Upper and Lower Basin DCPs
  - The ICS mechanism provided Lower Division states flexibility in meeting water use needs, played a critical role in avoiding low Lake Mead levels (nearly 3.2 maf saved), and provided a foundation for the concept of DCP contributions
  - Adding additional parties/exhibits proved challenging and may have limited ICS participation

Adherence of Guidelines to Common Themes

- **Encourage conservation**: robust conservation through the ICS mechanism (the foundation of a similar mechanism for Mexico) and facilitation of other conservation activities; aspects of the ICS mechanism were limiting
- **Plan for shortages**: clearly defined shortage criteria provided the ability to plan for shortages and additional mitigation activities as risk of reaching critically low reservoir elevations increased
- **Closer coordination**: through close coordination of Lake Powell and Mead, several experiences stand out:
  - Predominance of balancing and equalization releases highlights the increased link between Upper and Lower Basin activities
  - Severe, prolonged drought undermined two objectives: minimizing shortages in the Lower Basin and avoiding risk of curtailment in the Upper Basin; the DCPs were necessary to address increasing risk of reservoirs reaching critically low elevations
- **Preserve flexibility**: the Guidelines provided flexibility and stability to support subsequent operational decisions
- **Long but not permanent period**: in effect through 2026, providing 19 years of operational experience
- **Feds facilitate, not dictate**: Basin States agreed to mandatory consultation and negotiation before litigation; collaboration activated by Guidelines underpinned complementary activities and supports long-term stable management

Reclamation 7.D. Review Report

- Reclamation **concludes the guidelines were largely effective as measured against both their purpose and common themes**.
- Despite the effectiveness of the ’07 I.G., **additional action was needed to reduce the risk of Mead and Powell reaching critically low elevations**.
- Commenters noted:
  - Need for improved consultation in the future
  - Need to consider broader range of resource impacts
  - Desire to improve modeling considerations including climate

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MAWG#2 November 10, 2020 Summary

- MAWG will be developing Initial Conditions Scenarios as the basis to compare depth, duration, frequency and timing of shortages:
  - Arizona's Colorado River supply, On-River priorities, and CAP priority pools
- Key drivers in the scenarios include: hydrology, user demands and reservoir operations,
- Currently, there are 6 available hydrologies in CRSS median annual natural inflow to Powell ranging from 14.7 maf to 12.7 maf,
- The modeling tools and inputs will evolve through applied research during the Reconsultation & ARC/MAWG efforts.

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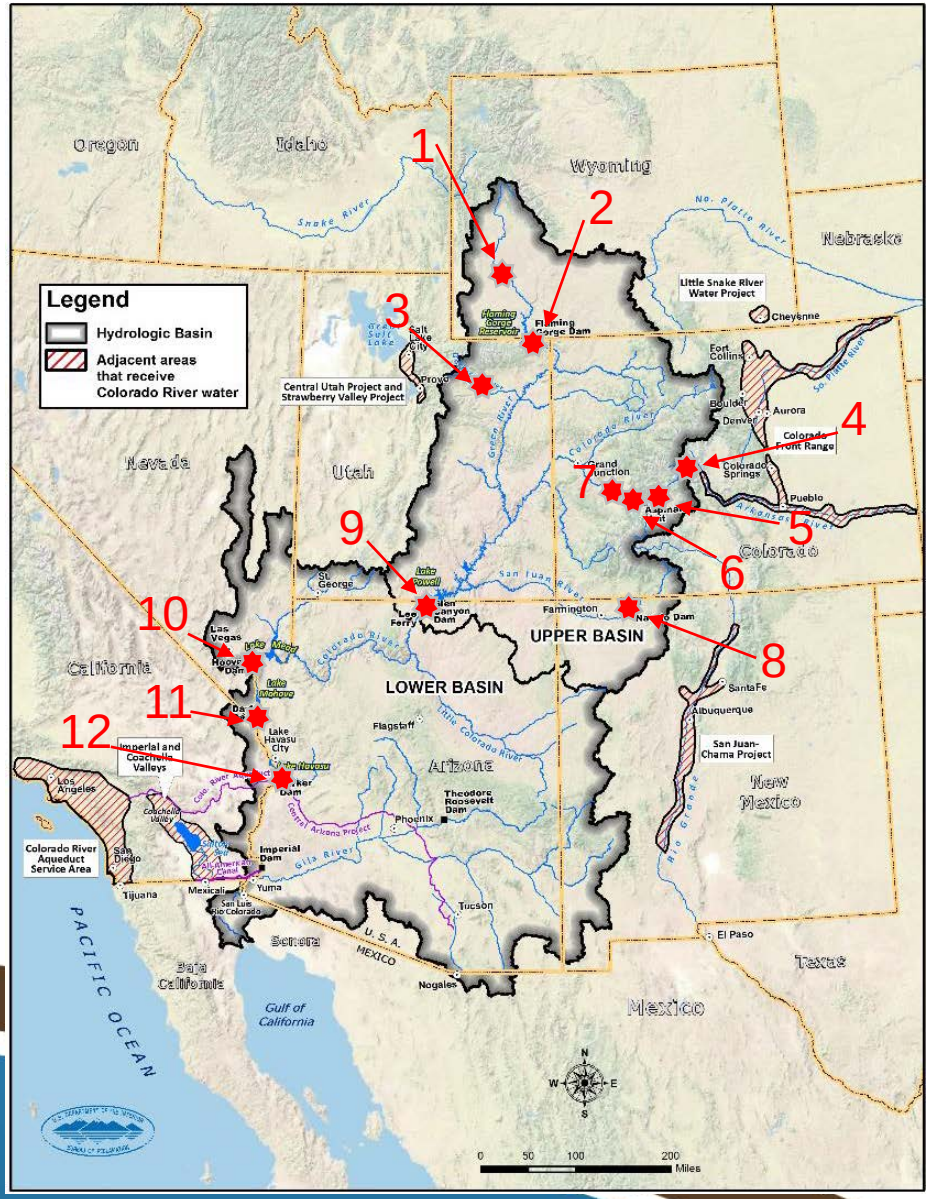
MAWG # 2 CRSS Hydrologies

		Observed	Pluvial Removed	Stress Test	Paleo Resample	Downscale GCM	Paleo Cond.
Category		Observed	Observed	Observed	Surrogate	Synthetic	Hybrid
Duration (# Records)		113	88	31	1,244	112	+500
Annual at Powell (MAF)	**Min**	5.38	5.38	6.02	2.32	3.94	5.44
	10%	9.50	9.22	9.35	10.10	9.12	9.55
	Avg.	14.76	13.92	13.14	14.65	13.91	14.78
	Median	14.51	13.60	12.72	14.83	12.73	14.58
	90%	21.01	19.98	18.92	18.97	20.34	21.76
	Max	24.36	24.36	21.69	24.31	43.93	25.43
Use		"Official" Model	Sensitivity analysis with Mexico	DCP and 5 year table	Sensitivity analysis '07 Guidelines	2012 Basin Study	Sensitivity analysis '07 Guidelines

Colorado River Basin Reservoirs



1. Fontenelle
2. Flaming Gorge
3. Starvation
4. Taylor Park
5. Blue Mesa
6. Morrow Point
7. Crystal
8. Navajo
9. Powell (Glen Canyon)
10. Mead (Hoover)
11. Mohave (Davis)
12. Havasu (Parker)

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Operating Rules

Upper Basin Reservoirs Above Lake Powell

- Release water sufficient to meet monthly storage targets (rule curves) and downstream demands, within defined minimum and maximum releases
- Operations reflect operational policies as described in their Record of Decision

Lakes Powell and Mead:

- Coordinated operations rules defined in 2007 Interim Guidelines and DCP

Lakes Havasu and Mohave:

- Release water sufficient to meet monthly storage targets (rule curves) and downstream demands, within defined minimum and maximum releases

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CRSS Reservoir Calculation

$$Outflow = \left(\frac{Storage_{t-1} - Storage_t + inflow + side\ inflow}{\Delta t}\right) - evaporation$$
$$-bank\ storage_{flow} - seepage + precipitation_{flow}$$

- Not all reservoirs have all components in the model
- Any terms not defined in CRSS automatically are inserted as a zero

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Coordinated Operation of Lake Powell and Lake Mead

- Lake Powell

  Section XI.G.6. of the ROD sets forth the strategy for coordinating the operations of Lake Powell and Lake Mead to achieve equalization or balancing of storage in Lake Powell and Lake Mead

- Lake Mead

  Section XI.G.2. of the ROD states that “the Secretary shall use the August 24-Month Study projections for determining Lake Mead operation as….Normal Condition, Surplus Conditions (four categories), or Shortage Conditions (three levels).

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Lake Powell and Lake Mead
Operational Diagram and Current Conditions

Operational Tiers for Water/Calendar Year 2021[1]

Lake Powell			Lake Mead		
Elevation (feet)	**Operation According to the Interim Guidelines**	**Live Storage (maf)[2]**	**Elevation (feet)**	**Operation According to the Interim Guidelines**	**Live Storage (maf)[2]**
3,700	**Equalization Tier** Equalize, avoid spills or release 8.23 maf	**24.3**	**1,220**	**Flood Control Surplus or Quantified Surplus Condition** Deliver > 7.5 maf	**25.9**
3,636 - 3,666 (2008-2026)		**15.5 - 19.3** (2008-2026)	**1,200** (approx.)[3]		**22.9** (approx.)[3]
	Upper Elevation Balancing Tier[4] Release 8.23 maf if Lake Mead < 1,075 feet, balance contents with a min/max release of 7.0 and 9.0 maf			**Domestic Surplus or ICS Surplus Condition** Deliver > 7.5 maf	
			1,145		**15.9**
3,579.55' as of 1/15/21			**1,105**	**Normal or ICS Surplus Condition** Deliver ≥ 7.5 maf	**11.9**
3,575		**9.5**			1,084.90' as of 1/15/21
3,558.56' 12/31/21 (est.)			**1,075**		**9.4** 1,069.75' 12/31/21 (est.)
	Mid-Elevation Release Tier Release 7.48 maf, if Lake Mead < 1,025 maf, release 8.23 maf			**Shortage Condition** Deliver 7.167[5] maf	
			1,050		**7.5**
				Shortage Condition Deliver 7.083[6] maf	
3,525		**5.9**	**1,025**		**5.8**
	Lower Elevation Balancing Tier Balance contents with a min/max release of 7.0 and 9.0 maf			**Shortage Condition** Deliver 7.0[7] maf Further measures may be undertaken[8]	
3,490		**4.0**	**1,000**		**4.3**
3,370		**0**	**895**		**0**

General Operating Rules – Lake Mead

- Lake Mead – Hoover Dam
- Meet required downstream demands in Normal, Surplus, and Shortage years
  - Normal downstream demands include up to:
    - California 4.4 MAF
    - Arizona 2.8 MAF
    - Nevada 0.3 MAF
    - Mexico 1.5 MAF
    - Regulation of Lakes Mohave and Havasu
    - System gains and losses
  - Demands can be modified based on Surplus or Shortage
- Flood Control Operations
- CRSS calculates EOY Mead elevations, determining the operating mode for each year of CRSS model

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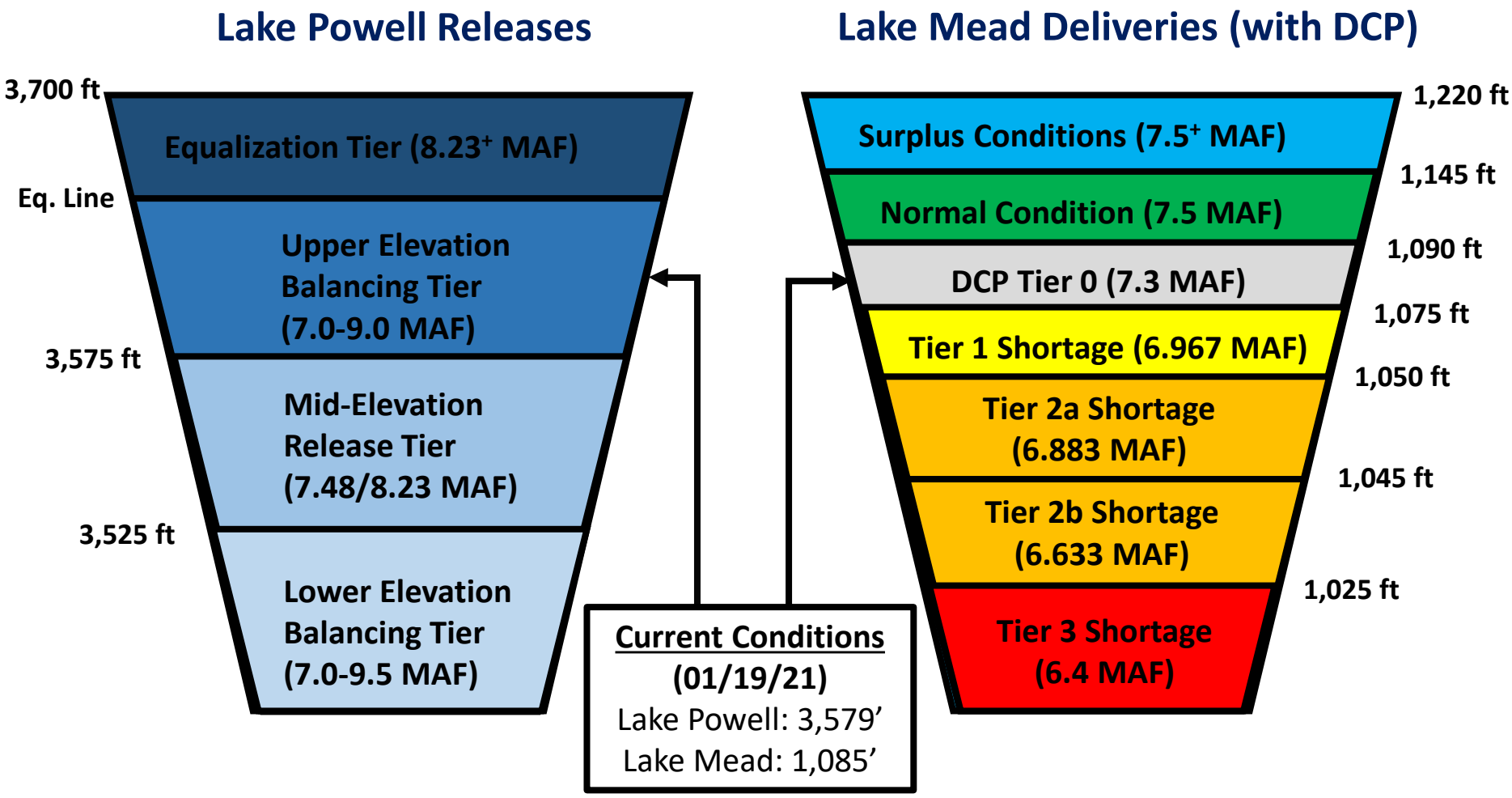
Powell and Mead Operations



Determinations:

August 24-Month Study: Mead Condition (Calendar Year: January-December)
Powell Release (Water Year: October-September)

April 24-Month Study: Powell Release Adjustment Under Upper Elevation Balancing Tier (April-September)

Lower Elevation Balancing Tier

August 24-Month Study ⇨ End of Month December (End of Year) Projection

Lake Powell Elevation < 3,525 feet

→ Lake Powell Release → Balance Lake Powell and Lake Mead Storage

Lake Powell Release $_{MIN}$ = 7.0 MAF

Lake Powell Release $_{MAX}$ = 9.5 MAF

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Mid-Elevation Release Tier

August 24-Month Study ⇨ End of Month December (End of Year) Projection

Lake Powell Elevation < 3,575 feet

Lake Powell Elevation ≥ 3,525 feet

Lake Mead Elevation ≥ 1,025 feet

→ Lake Powell Release = 7.48 MAF

August 24-Month Study ⇨ End of Month December (End of Year) Projection

Lake Powell Elevation < 3,575 feet

Lake Powell Elevation ≥ 3,525 feet

Lake Mead Elevation < 1,025 feet

→ Lake Powell Release = 8.23 MAF

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Upper Elevation Balancing Tier

August 24-Month Study ⇨ End of Month December (End of Year) Projection

Lake Powell Elevation < Lake Powell Equalization Elevation (Water Year)

Lake Powell Elevation ≥ 3,575 feet

Lake Mead Elevation < 1,075 feet

→ Lake Powell Release → Balance Lake Powell and Lake Mead Storage

Lake Powell Release $_{MIN}$ = 7.0 MAF

Lake Powell Release $_{MAX}$ = 9.0 MAF

If Lake Powell Release > 8.23 MAF

The August 24-Month Study projection of End of Month December Lake Mead Elevation will be recalculated to include Lake Powell Releases > 8.23 MAF for October-December for the purposes of determining Mead conditions (surplus/normal/shortage)

April 24-Month Study ⇨ End of Month September (End of Water Year) Projection

Lake Powell Elevation > Lake Powell Equalization Elevation (Water Year)

→ Lake Powell Release → Follow Equalization Tier

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Upper Elevation Balancing Tier

August 24-Month Study ⇨ End of Month December (End of Year) Projection

Lake Powell Elevation < Lake Powell Equalization Elevation (Water Year)

Lake Powell Elevation ≥ 3,575 feet

Lake Mead Elevation ≥ 1,075 feet

→ Lake Powell Release = 8.23 MAF

April 24-Month Study ⇨ End of Month September (End of Water Year) Projection

Lake Powell Elevation > Lake Powell Equalization Elevation (Water Year)

→ Lake Powell Release → **Follow Equalization Tier**

April 24-Month Study ⇨ End of Month September (End of Water Year) Projection

Lake Powell Elevation ≥ 3,575 feet

Lake Mead Elevation < 1,075 feet

→ Lake Powell Release → Balance Lake Powell and Lake Mead Storage

Lake Powell Release $_{MIN}$ = 8.23 MAF

Lake Powell Release $_{MAX}$ = 9.0 MAF

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Equalization Tier

August 24-Month Study ⇨ End of Month December (End of Year) Projection

Lake Powell Elevation > Lake Powell Equalization Elevation (Water Year)

- 2019 Water Year Lake Powell Equalization Elevation = 3,655 feet
- 2020 Water Year Lake Powell Equalization Elevation = 3,657 feet
- 2021 Water Year Lake Powell Equalization Elevation = 3,659 feet
- 2022 Water Year Lake Powell Equalization Elevation = 3,660 feet

Lake Powell Release (Water Year)

- **Minimum release** = 8.23 MAF
- **Maximum release**:
  1. Sufficient release to avoid spills (if projected)
  2. Equalize storage between Lake Powell and Lake Mead (without dropping below the Lake Powell Equalization Elevation)

     If Lake Powell elevation = Equalization Elevation AND Lake Mead End of September Elevation (End of Water Year) < 1,105 feet

     Continue Lake Powell releases until one of the following projections occur on End of September:
     - Lake Powell and Lake Mead fully equalize
     - Lake Mead Elevation = 1,105 feet
     - Lake Powell Elevation = Lake Powell Equalization Elevation – 20 feet

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Lake Powell Equalization Line

Lake Powell Equalization Elevation Table		
Water Year	**Elevation (feet)**	**% of Capacity**
2008	3,636	64%
2009	3,639	65%
2010	3,642	67%
2011	3,643	67%
2012	3,645	68%
2013	3,646	69%
2014	3,648	70%
2015	3,649	70%
2016	3,651	71%
2017	3,652	72%
2018	3,654	73%
2019	3,655	73%
2020	3,657	74%
2021	3,659	76%
2022	3,660	76%
2023	3,662	77%
2024	3,663	78%
2025	3,664	78%
2026	3,666	79%

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Coordinated Operations: 602(a) Storage and Release Criteria

- Section 602(a) of the 1968 Colorado River Basin Project Act identifies an amount of storage required in Upper Basin reservoirs to ensure that the Upper Basin can meet its Compact delivery obligation to the Lower Basin without impairing Upper Basin consumptive use
- Amount of storage is based upon the following factors:
  - Critical period hydrology: 1953 to 1964 – 12.173 MAF
  - 10-year average Upper Basin depletion
  - Upper Basin reservoir power pools – 5.179 MAF
  - **Minimum objective release from Lake Powell to Lake Mead – 8.23 MAF**
- **Requires "equalization" of storage**

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602(a) Storage/Equalization Line*

- For the interim period in the 2007 Interim Operating Guidelines, the 602(a) storage requirement is met by the Lake Powell "Equalization"
- The Lake Powell "Equalization" is a compromise regarding the interpretation of how the 602(a) storage and release requirements are calculated and implemented
- In order to accommodate projected increases in Upper Basin depletions and meeting release requirements from Powell to Mead, the "Equalization" line increases annually in the Guidelines and in CRSS

*This methodology does not represent Arizona's legal position regarding the application of 602(a)

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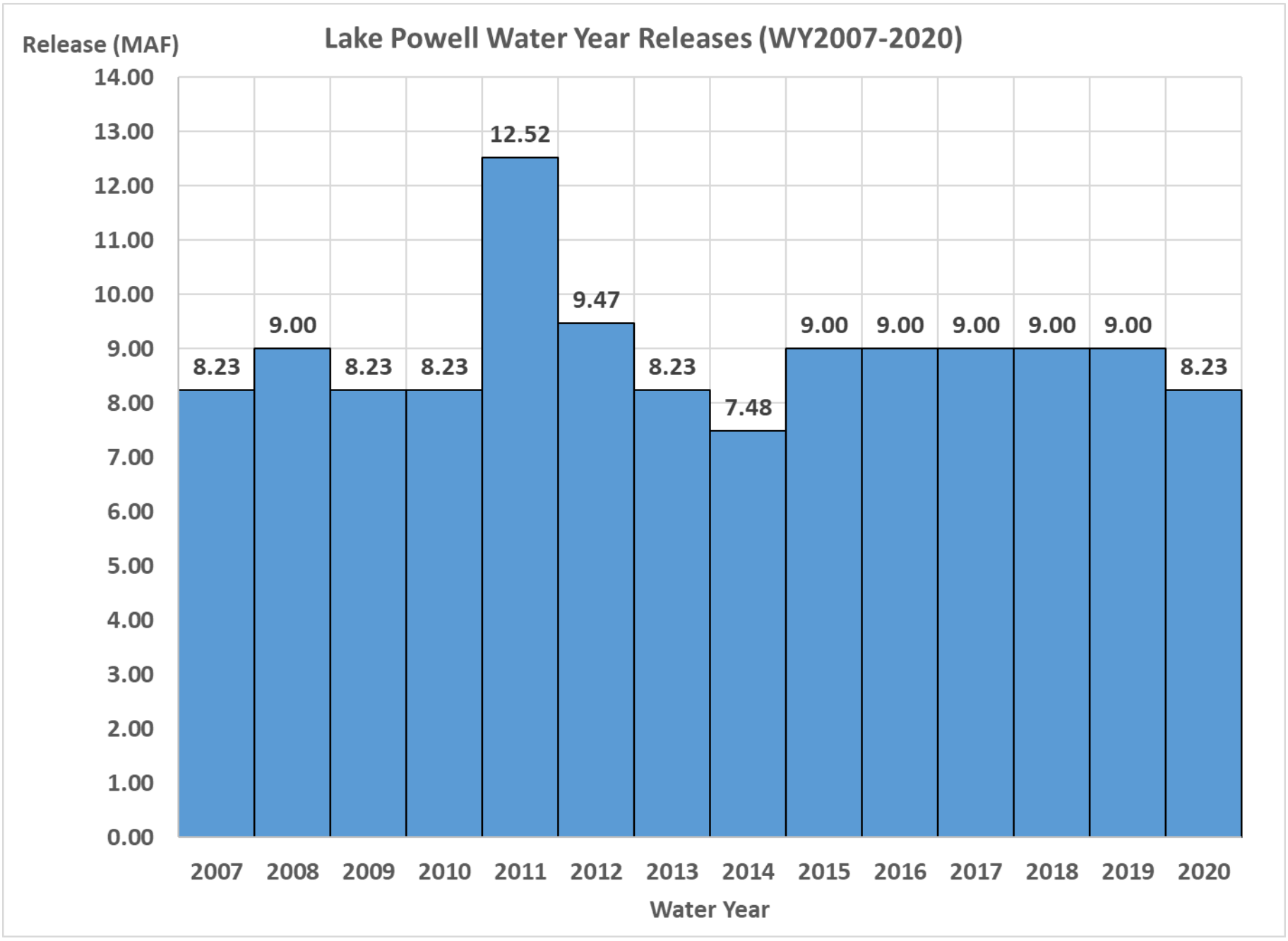
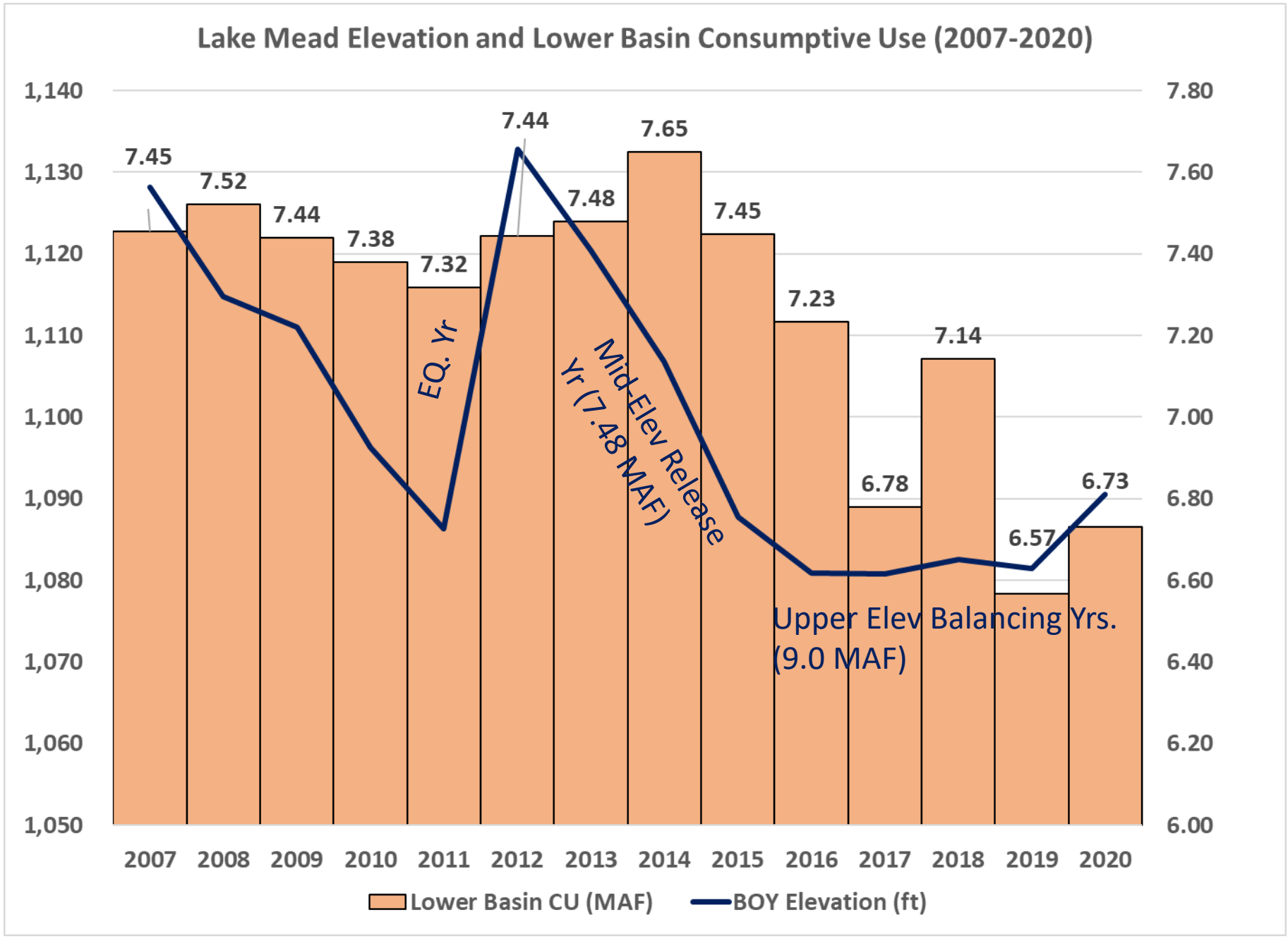

Lake Powell Water Year Releases (WY2007-2020)
Release (MAF)
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
8.23
9.00
8.23
8.23
12.52
9.47
8.23
7.48
9.00
9.00
9.00
9.00
9.00
8.23
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Water Year


Lake Mead Elevation and Lower Basin Consumptive Use (2007-2020)
1,140
1,130
1,120
1,110
1,100
1,090
1,080
1,070
1,060
1,050
7.80
7.60
7.40
7.20
7.00
6.80
6.60
6.40
6.20
6.00
7.45
7.52
7.44
7.38
7.32
7.44
7.48
7.65
7.45
7.23
7.14
6.78
6.57
6.73
EQ. Yr
Mid-Elev Release Yr (7.48 MAF)
Upper Elev Balancing Yrs. (9.0 MAF)
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Lower Basin CU (MAF)
BOY Elevation (ft)

Summary of Lake Powell and Lake Mead Coordinated Operations

Year	Lake Powell Operations (WY)				Lake Mead Operations (CY)
	Operating Tier	April Adjustment	Release Volume (maf)	Equalization Volume (maf)	Operating Condition
2008	Upper Elevation Balancing	Equalization	8.98	0.75	Normal/ICS Surplus
2009	Upper Elevation Balancing	None	8.24 [1]	-	Normal/ICS Surplus
2010	Upper Elevation Balancing	None	8.23	-	Normal/ICS Surplus
2011	Upper Elevation Balancing	Equalization	12.52	4.29 [2]	Normal/ICS Surplus
2012	Equalization	N/A	9.47	1.23 [3]	Normal/ICS Surplus
2013	Upper Elevation Balancing	None	8.23	-	Normal/ICS Surplus
2014	Mid-Elevation Balancing	None	7.48	-	Normal/ICS Surplus
2015	Upper Elevation Balancing	Balancing	9.00	-	Normal/ICS Surplus
2016	Upper Elevation Balancing	Balancing	9.00	-	Normal/ICS Surplus
2017	Upper Elevation Balancing	Balancing	9.00	-	Normal/ICS Surplus
2018	Upper Elevation Balancing	Balancing	9.00	-	Normal/ICS Surplus
2019	Upper Elevation Balancing	Balancing	9.00	-	Tier 0
2020	Upper Elevation Balancing	None	8.23	-	Tier 0
2021	Upper Elevation Balancing	None	8.23	-	Tier 0
2022	Mid-Elevation Balancing	None	7.48	-	Tier 1 Shortage

"ICS Surplus": In years in which Lake Mead's elevation is projected to be above elevation 1,075 feet on January 1, a Flood Control Surplus has not been determined, and delivery of ICS has been requested, the Secretary may determine an ICS Surplus Condition in lieu of a Normal Condition or in addition to other operating conditions that are based solely on the elevation of Lake Mead.

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BREAK

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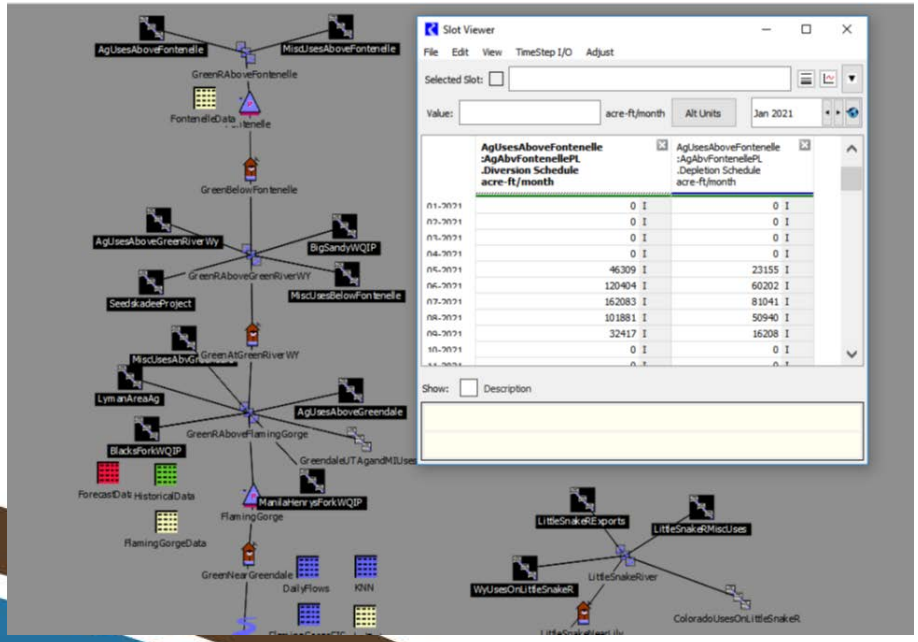
CRSS – Demand Schedules

Depletion schedules are inputs to model

- Demands are input for the 115 diversion points
- Schedules are created to cover the length of the model run
- Diversion points are linked at the model nodes, where the mass balance equations for the river flows are calculated.



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Upper Basin Demand Schedules

- 1999 UCRC schedule – used in the 2007 Interim Guidelines FEIS
- 2007 UCRC schedule – used in official CRSS projections and many other projects since 2008 - 2020
- 2012 Basin Study demand scenarios – developed 6 different demand scenarios. Current Projected (A) Scenario has often been used in current projects.
- 2016 UCRC schedule – current official model

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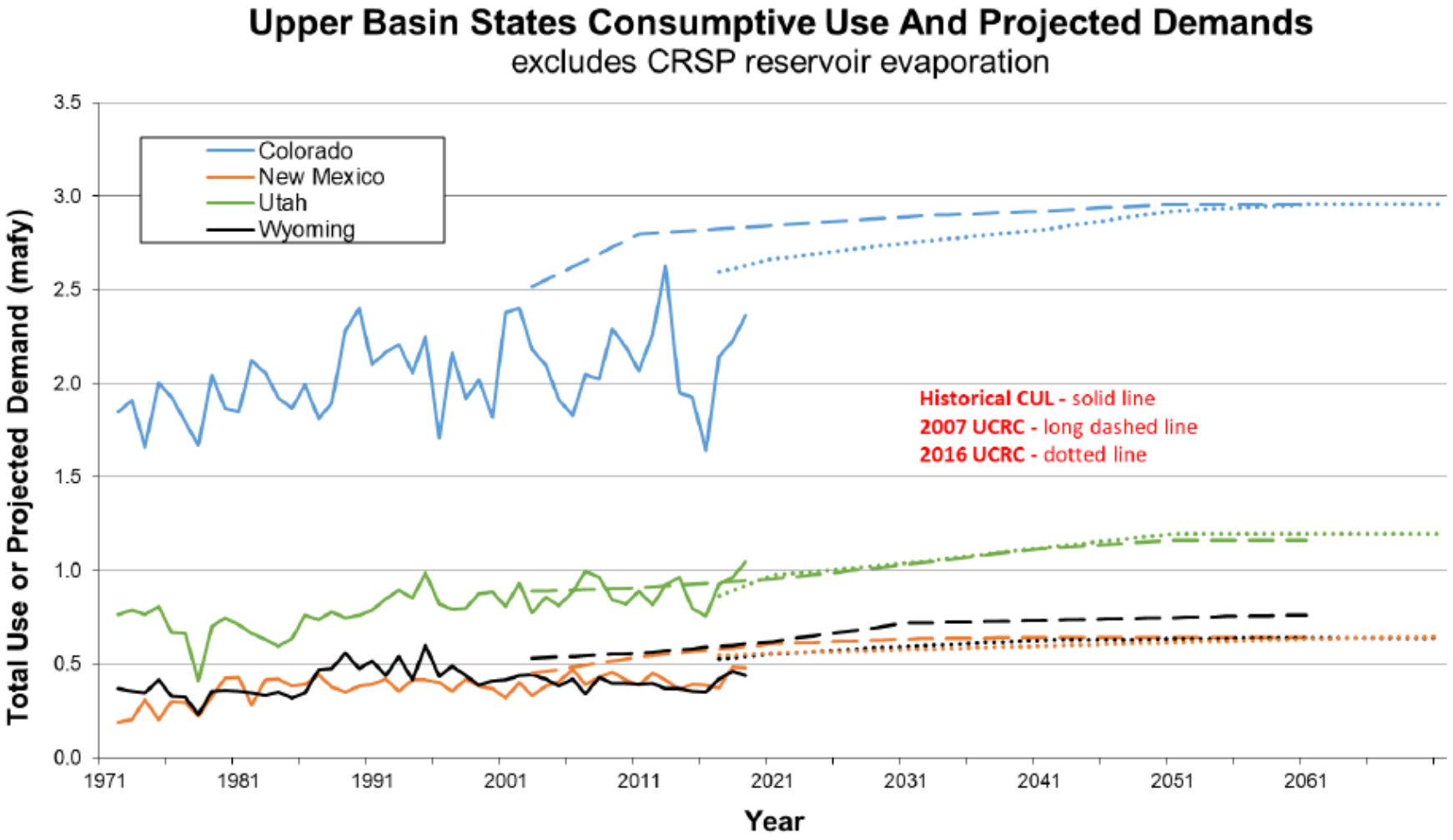

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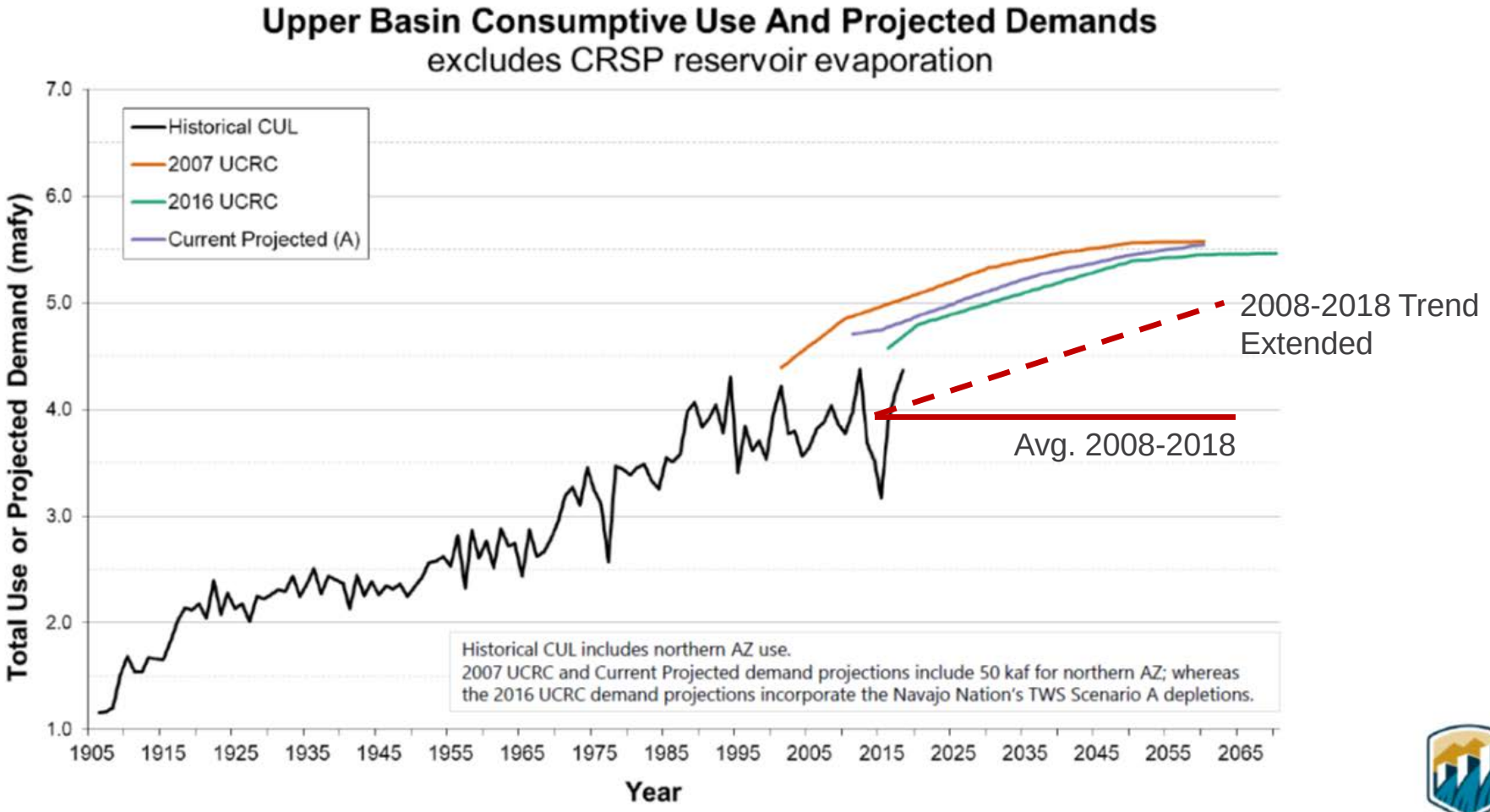
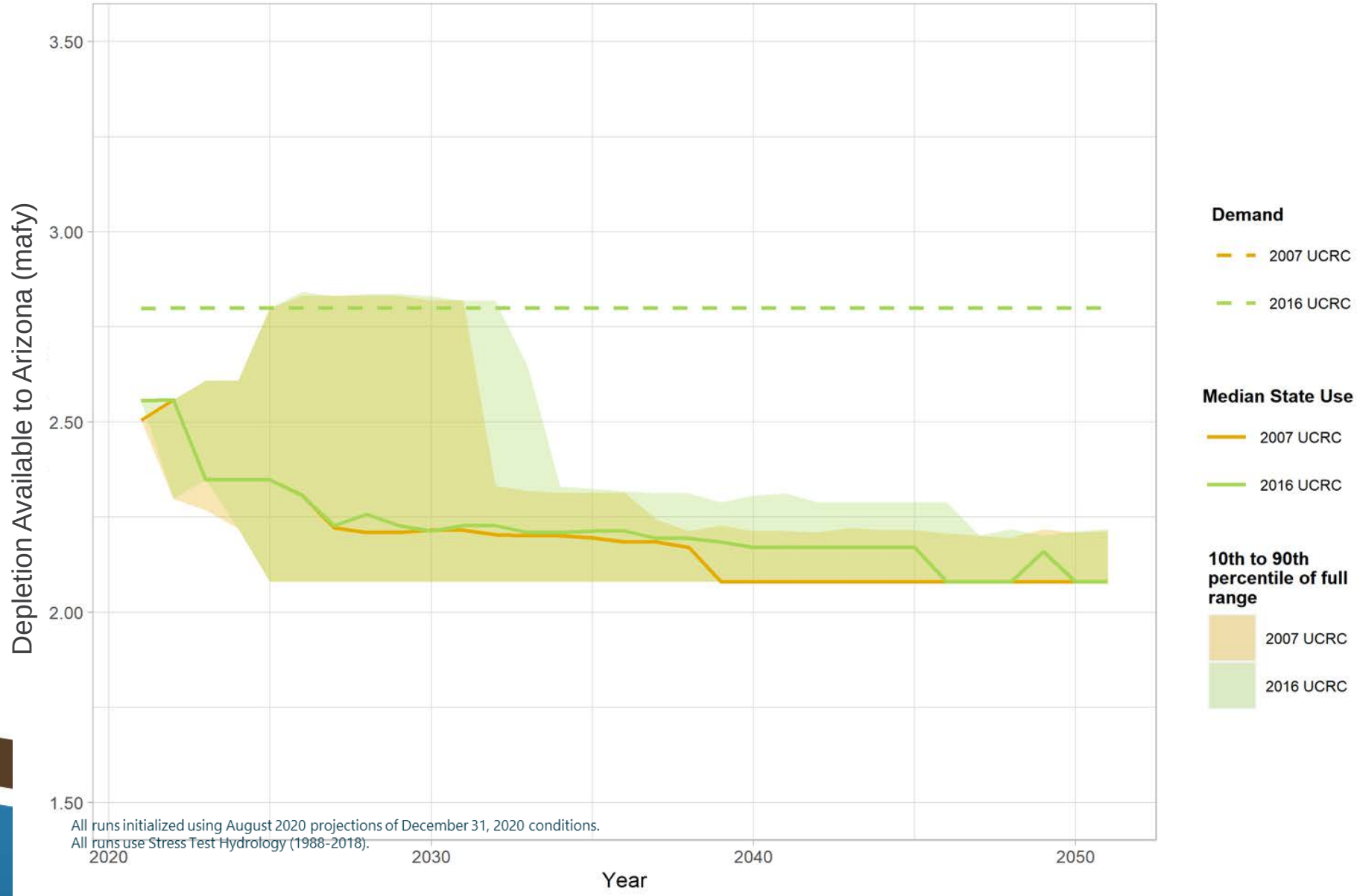
Comparison of UB Demand Schedules



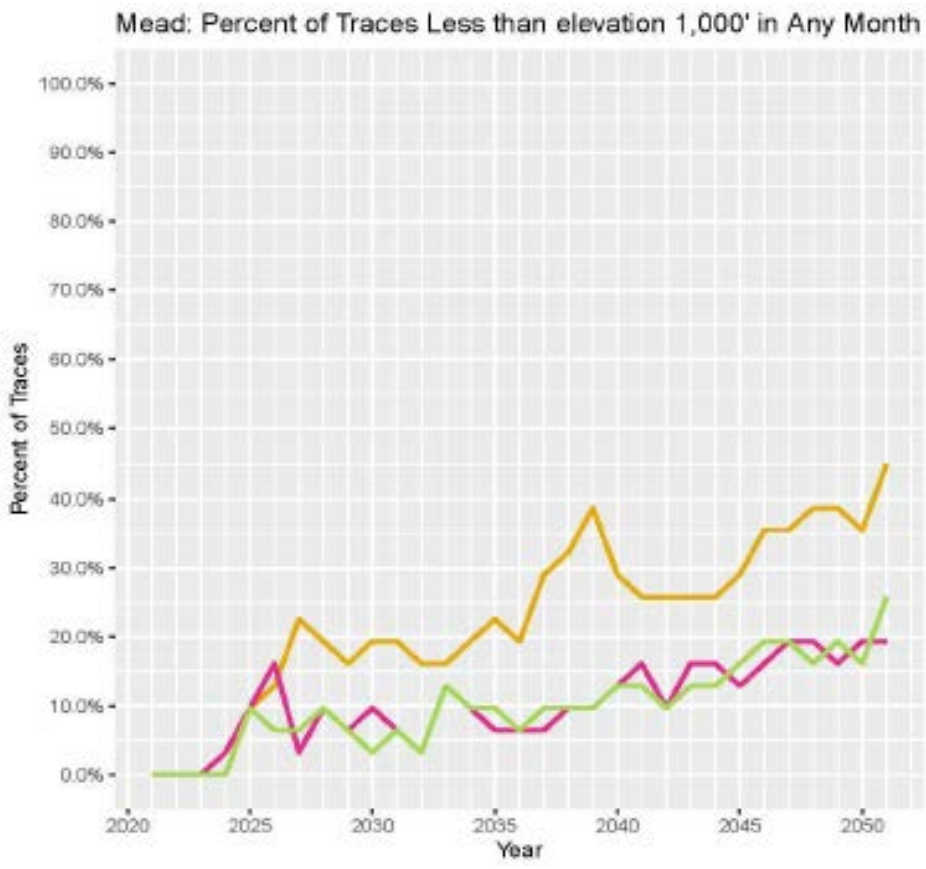
Comparison of UB Demand Schedules (excludes CRSP evaporation)

Name	2020 (MAF)	2030 (MAF)	2040 (MAF)	2050 (MAF)	2060 (MAF)
1999	4.85	5.03	5.15	5.32	5.43
2007 UCRC	5.08	5.33	5.46	5.56	5.57
Basin Study (Current Projected)	4.87	5.11	5.30	5.45	5.55
2016 UCRC	4.80	5.01	5.22	5.42	5.48
Guideline Period Trend Extended	4.25	4.46	4.67	4.88	5.09
Average 2008 - 2018	3.92	NA	NA	NA	NA

Influence of 2016 UB Demands –Arizona Available Supply



Influence of 2016 UB Demands – Mead Elevation Impacts



Scenario

- 2007 UCRC
- 2016 UCRC
- Current Projected

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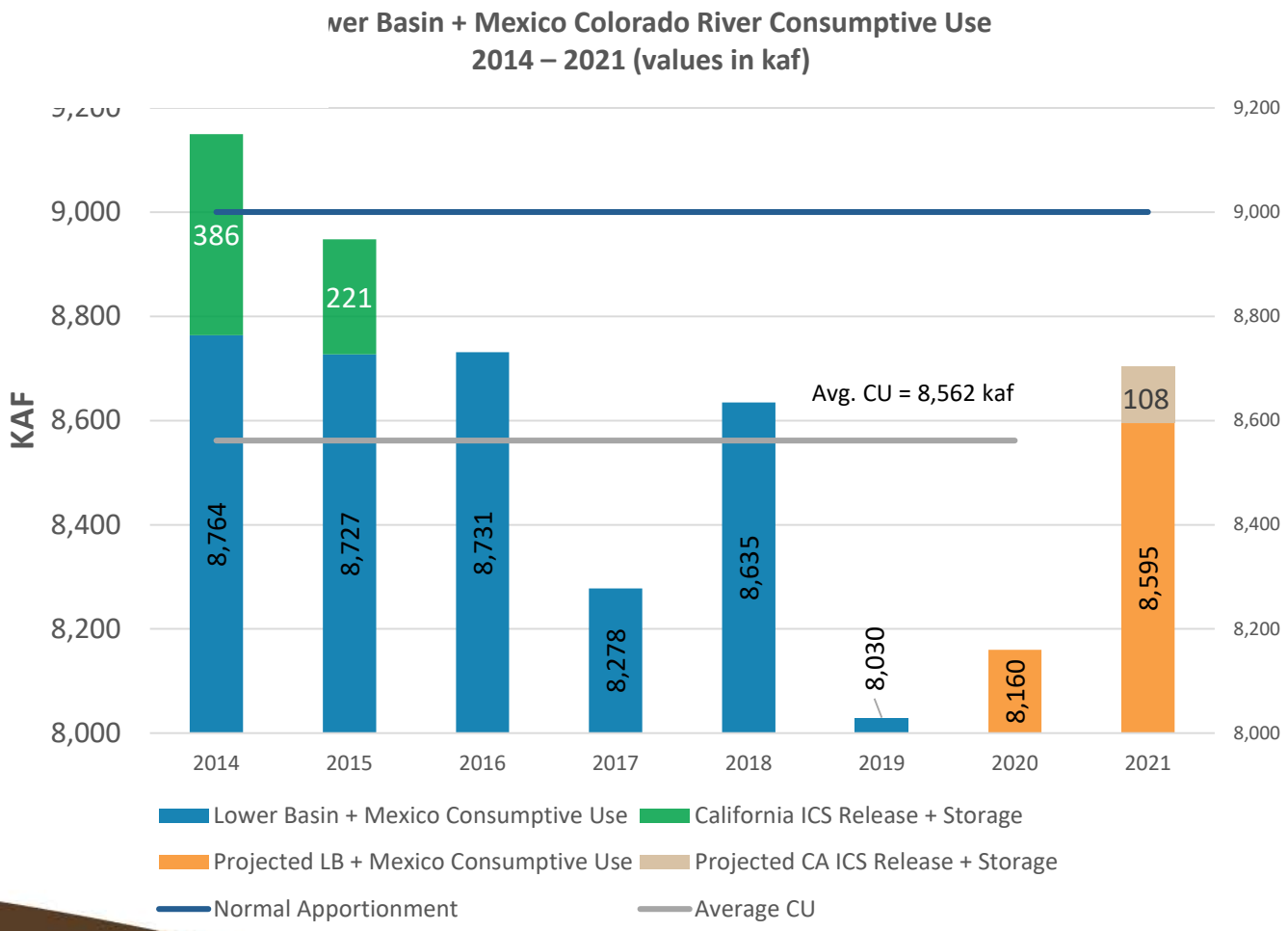
Lower Basin Demand Schedules

- Lower Division States are at full use of their apportionment
- CRSS uses schedules developed for 2007 Interim Guidelines EIS by Lower Division States

California	Nevada	Arizona
4.4 maf total apportionment QSA implementation through 2036 and extended	300 kaf total apportionment 2016 Revision: • Recent demands are below 300 kaf in the near term (~2027) • Demands above 300 kaf post 2027. Demands above apportionment are only met via ICS or domestic/flood control surplus	2.8 maf total apportionment Current On-River P1-4 uses are approximately 1.1 maf On-River P1-4 uses were projected to grow in CRSS schedules CAWCD assumed to divert remaining available supply

Lower Basin Water Use



- Since 2014, average CU in LB has been about 400 kaf lower than apportionment
  - System conservation
  - Intentionally Created Surplus (ICS)
- Prior to this time period, CU was about 300 kaf higher

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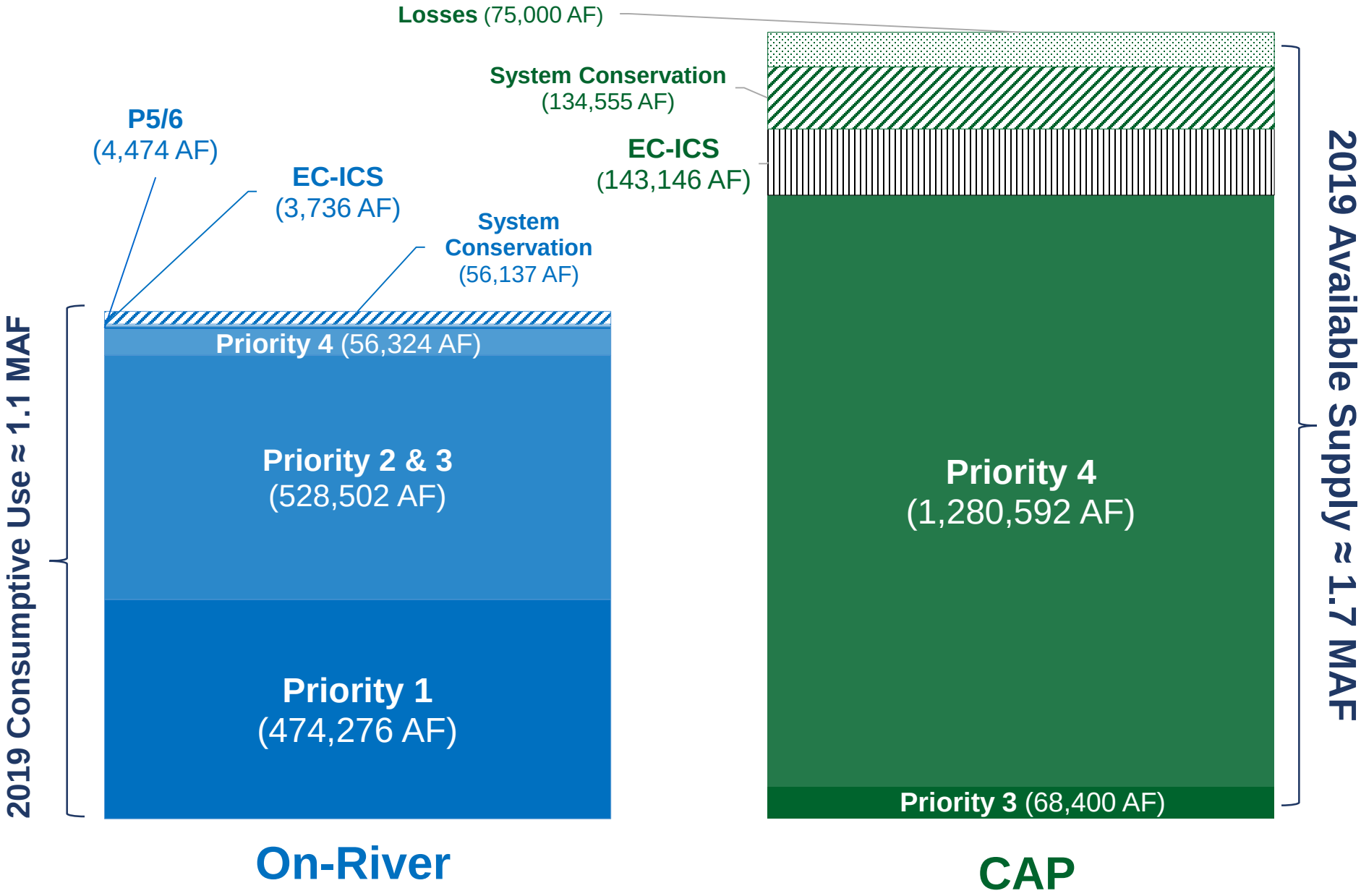
Arizona's 2019 Uses



System Conservation: Actual vs. Modeled for ‘07 Guidelines

- No System Conservation was anticipated in the ‘07 Guidelines
- Over 1.5 MAF of System Conservation will be created by the end of 2022
- Almost entirely from Arizona projects

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Arizona System Conservation Assumptions

Near Term: 2021-2022

- CRIT System Conservation - 50 KAF in 2021 and 2022
- US Contribution - ~33 KAF/yr in 2021 and 2022
  - 13,933 AF in 2021 and 2022 through Fort McDowell Yavapai Nation
  - 6,925 AF in 2021 and 2022 through Mohave Valley Irrigation and Drainage District
  - 12.2 KAF in 2021 and 2022 through extension of 242 Wellfield operation

2023 and later

- US ***assumed*** to contribute 66 KAF in 2023 and 2024
- 100 KAF/yr 2025 and through the modeling period

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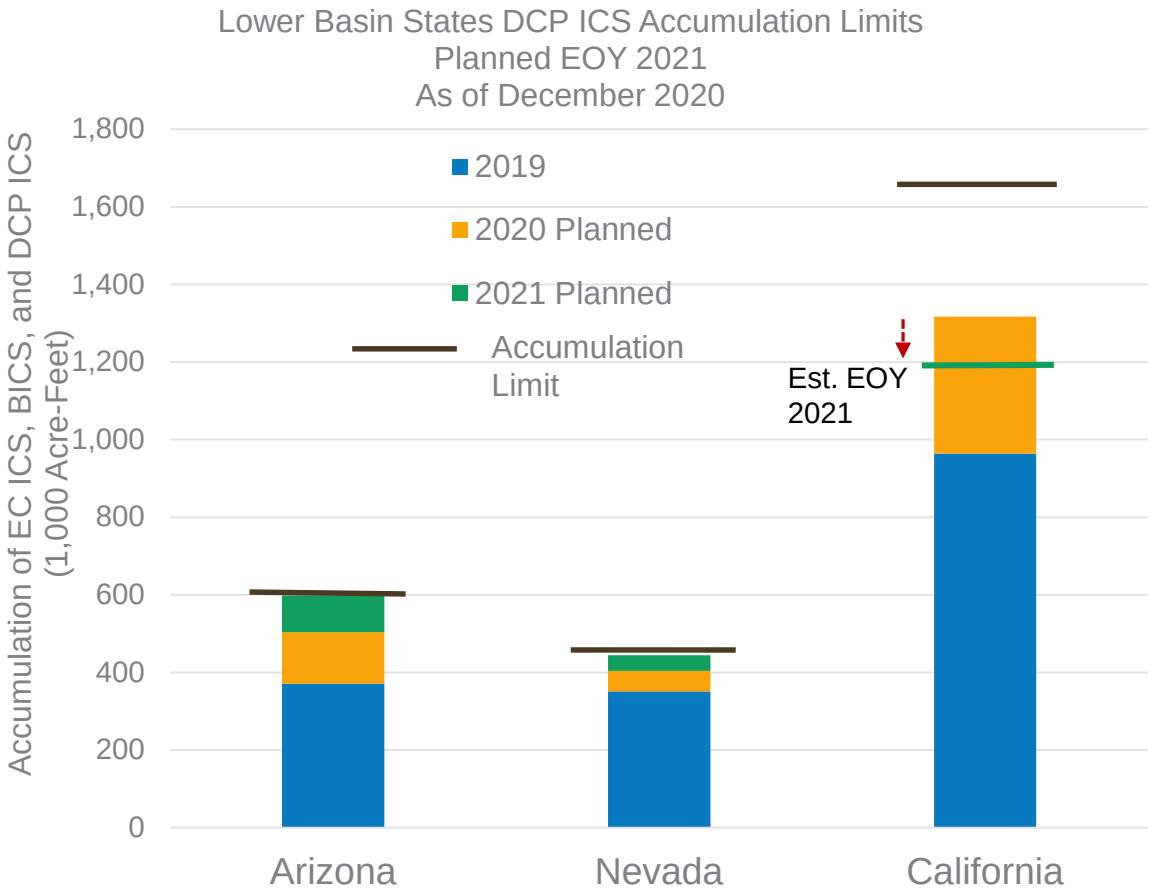
Planned ICS Accumulation Limits

- Accumulation Limit applies to EC ICS, BICS, and DCP ICS
- Current Limits:
  - CA – 1,650 KAF
  - NV – 450 KAF
  - AZ – 600 KAF
- By end of 2021, AZ and NV may be at limit
- CA could be at limit by end of 2022



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ICS CRSS Assumptions - Arizona

ICS Creation

- 2021: ICS creation will reflect submitted planned schedule:
  - Up to 60.5 KAF by CAWCD
  - 40 KAF by GRIC
  - 4.7 KAF by CRIT
- 2022-Extended: Arizona ICS account fills. Assume zero additional ICS creation assumed once Arizona account fills.

ICS Delivery

- 2021: No ICS delivery
- 2022-2025: assume ICS delivery of DCP mitigation of 60 KAF/yr (if Mead between 1,025'-1,075')
- 2026-Extended: ICS delivery of CAWCD ICS credits through 2036. If T1-T2, Federal ICS credits delivered as State and Federal firming.

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ICS CRSS Assumptions - California

ICS logic for California simulates hydrology conditions within the State, using Lake Powell inflows as surrogate for MWD State Water Project supplies.

ICS Creation

- 2021: No ICS creation planned
- 2022-Extended: Based on hydrology conditions:
  - “Wet”- create 300 KAF
  - “Above normal”- create 150 KAF
  - “Below normal” - no creation

ICS Delivery

- 2021: Delivery of 108 KAF
- 2022-Extended: Based on hydrology conditions:
  - “Critical”- deliver 200 KAF
  - “Dry”- deliver 100 KAF
  - “Below normal” - no delivery

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ICS CRSS Assumptions - Nevada

ICS Creation

- 2021-2026: ICS limits may be exceeded, constraining creation
- 2021-Extended: 29 KAF/yr Tributary ICS can be created

ICS Delivery

- 2021-2026: No ICS delivery
- 2027-Extended: ICS delivery needed only if demands exceed apportionment and other supplies
  - First, use Tributary ICS
  - Second, deliver EC ICS and System Efficiency ICS

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ICS Activity: Actual vs. Modeled for ‘07 Guidelines

- ’07 Guidelines contemplated 2 MAF ICS would be created
- Through 2019, 3.2 MAF of ICS has been created
- Currently, the Annual Creation Limit (625 kaf/yr) has been reached in the last 2 years,
- By the end of 2021, AZ and NV are projected to be at their Accumulation Limit with the potential CA to reach this limit by end of 2022
- DCP finalized new exhibits for increased ICS participation through the increase in creation volumes and the addition of new ICS creators
- ‘07 Guidelines were silent on impact of Mexico ICS creation and accumulation

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Lake Mead Structural Deficit

- Structural Deficit = 1.2 MAF
  - 8.23 MAF to Mead + side inflows – evap losses – LB + Mexico CU – other losses
- Current structural deficit ~ 1.1 MAF due to reduced losses:
  - Brock Reservoir
  - Water ordered but not delivered

Summary of Jan 2021 "Official" CRSS assumptions

CRSS Component	"Official" Model	Notes
Hydrology	Observed	Stress Test scenario included
Demands - Upper Basin - Lower Basin	UB – 2016 UCRC LB – Full use + 2020 ICS Logic	
Operational Rules Post-2026	'07 Guidelines + DCP Extended	Powell "Equalization" line extended – increases per Guidelines trend to 3,698'
Model Duration	2060	Stress Test scenario through 2052
System Conservation	US = 100 KAF 2025	US = 100 kaf/yr extended
Mainstem AZ Demands	P1-4 full entitlement use	Currently P1-4 using ~1.1 MAF
CAP User Demands	See CAP System Model	CRSS assumes full use of available supply

CRSS Visualizations

- Key metric – supply available to AZ
  - Annual supply available to AZ
  - Magnitudes of shortages
  - Frequency of full supply vs. shortage
  - Duration of full supply or shortage conditions
- Mead elevations as indicator of operational tier
- Multiple ways to display this information
  - Time series
  - Aggregate through time
  - Single scenario analyses
  - Multiple scenario comparisons
  - Sensitivity analyses
- Commitment to share data and analysis
- Other metrics may be developed

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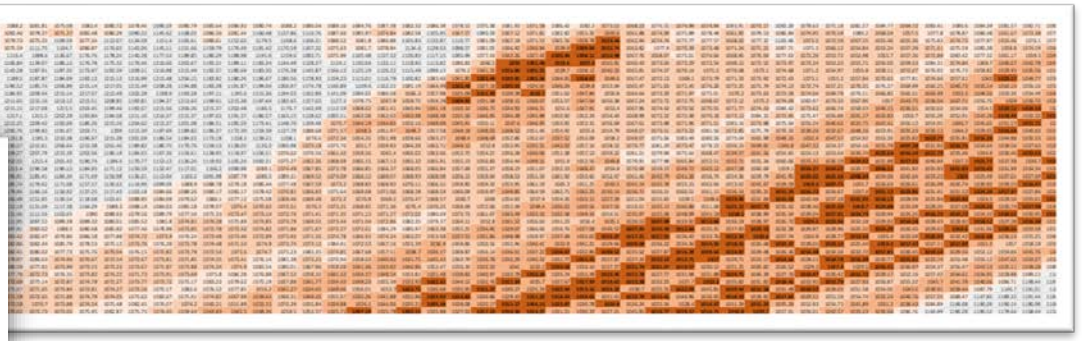
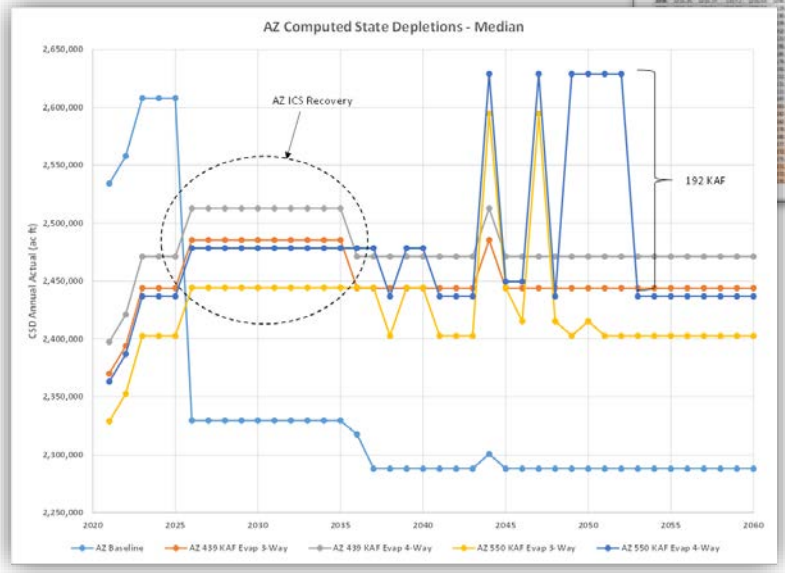
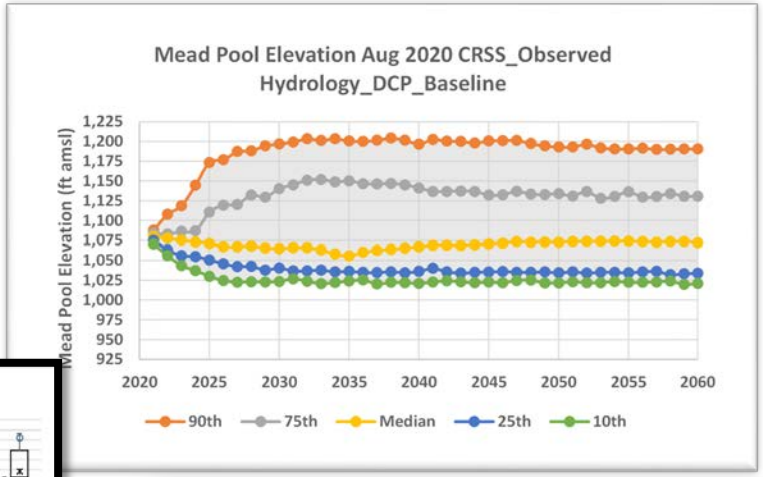
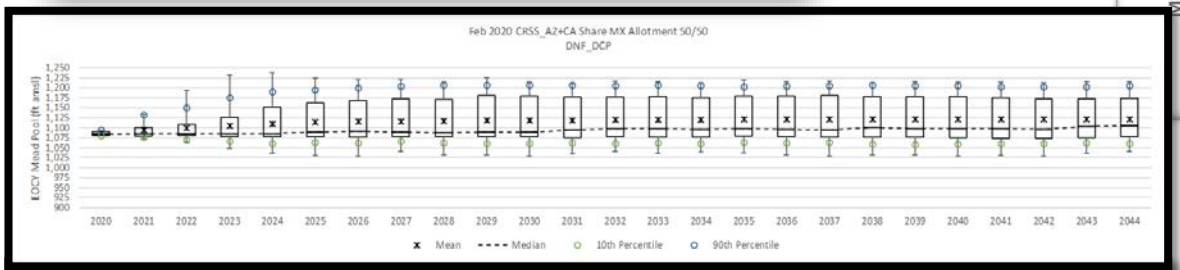
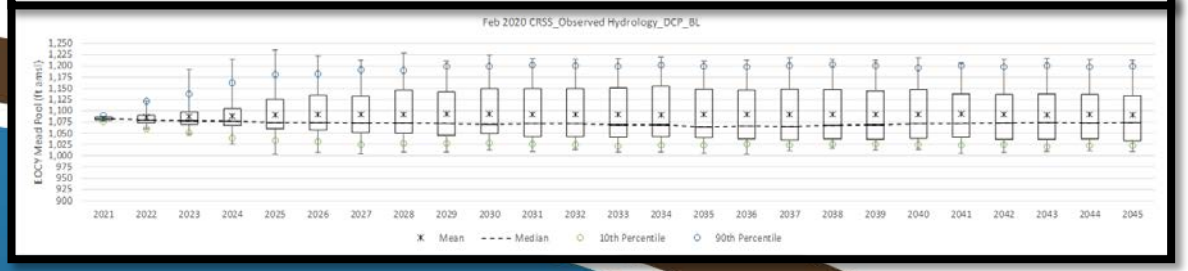
Examples of CRSS Visualizations

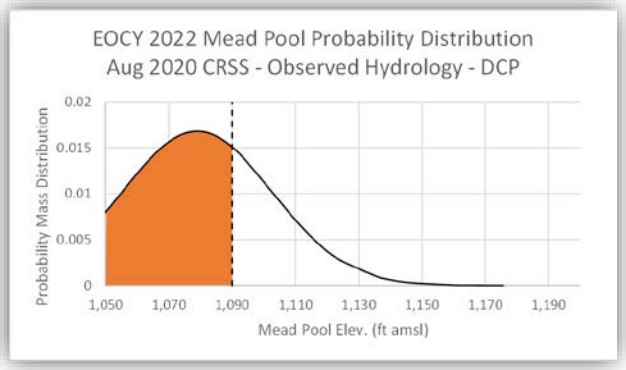












Summary

- Reservoir Operations (specifically coordinated operations of Lakes Powell and Mead) are a key driver of Lake Mead elevations.
- Average Upper Basin use over the last ten years (2008-2018) are around 3.9 maf (excluding CRSP evap)
- Multiple UB Use scenarios have been developed: 2016 UCRC schedule reaches 5.48 maf in 2060 (excluding CRSP evap)
- CRSS Projections of Lake Mead elevations are sensitive to the UB demand schedules and Lower Basin uses
- Lower Division States are at full apportionment. ICS and System conservation use behaviors impact Lake Mead elevation

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MAWG Next Steps

- March 11th - MAWG Proposed Agenda - Arizona Scale Models
  - On River – Uses, Salinity Impacts, and Models
  - CAP System – Uses, Model
- April (tbd) MAWG Proposed Agenda - Initial Conditions Scenario Development
  - Review scenario process
  - Review models and key drivers
  - Develop initial condition scenarios and key drivers
- Report to ARC Spring Meeting

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Call to the Public

Submit questions or comments using the electronic public comment form at cap-az.com/ARC.

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