

# RECLAMATION

*Managing Water in the West*

## 2016 Colorado River Annual Operating Plan

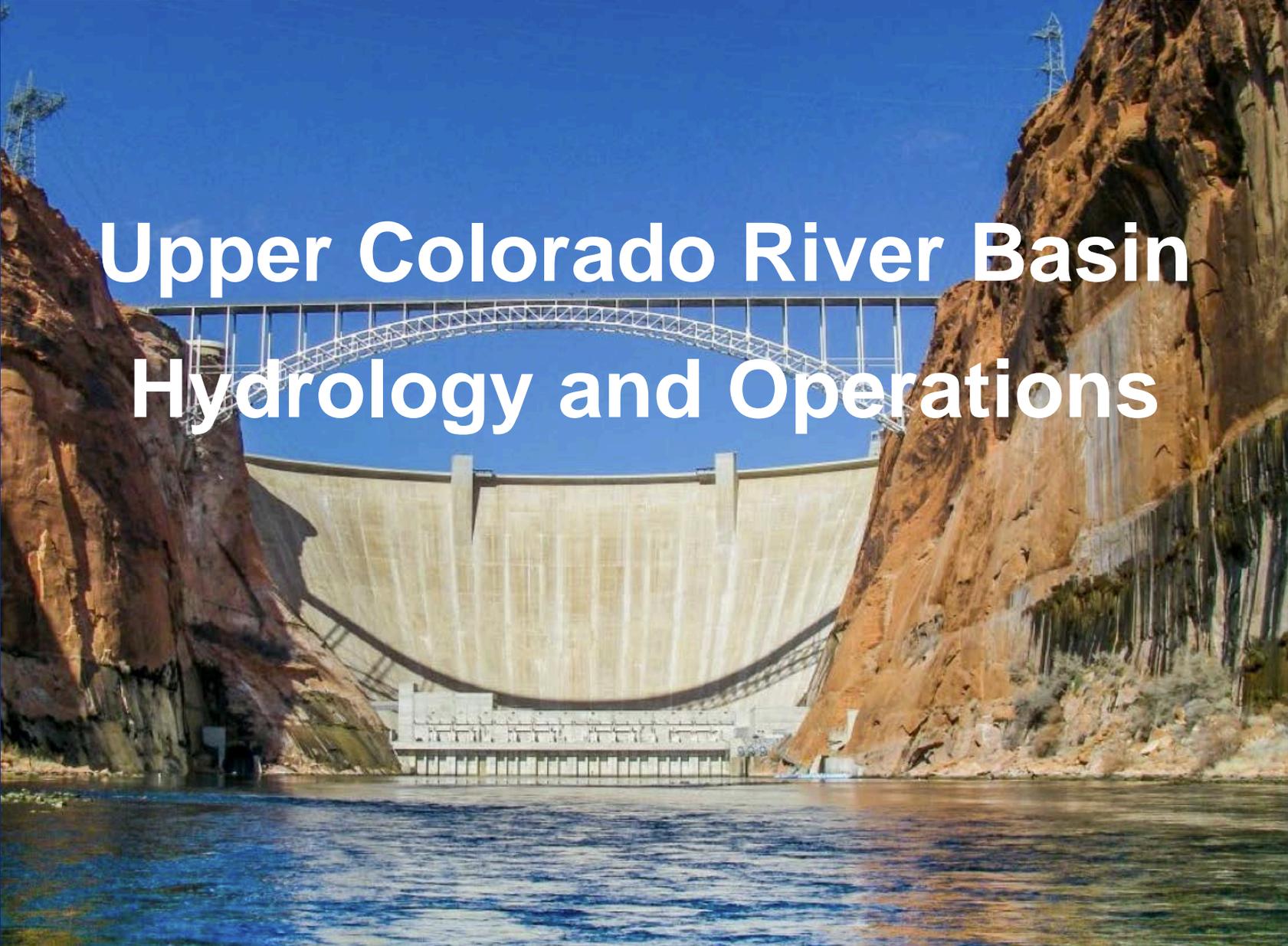
Colorado River Management Work Group  
Final Consultation  
September 2, 2015



U.S. Department of the Interior  
Bureau of Reclamation

# 2016 Colorado River AOP Final Consultation Meeting

- Welcome and Introductions – *Rob Skordas / Brent Rhees*
- Upper Basin Hydrology and Operations – *Katrina Grantz*
- Lower Basin Hydrology and Operations – *Noe Santos*
- 2016 AOP Review Process – *Steve Hvinden / Chris Cutler*
- Review of Draft 2016 AOP – CRMWG
- Conclusion and Wrap-up



# Upper Colorado River Basin Hydrology and Operations

RECLAMATION

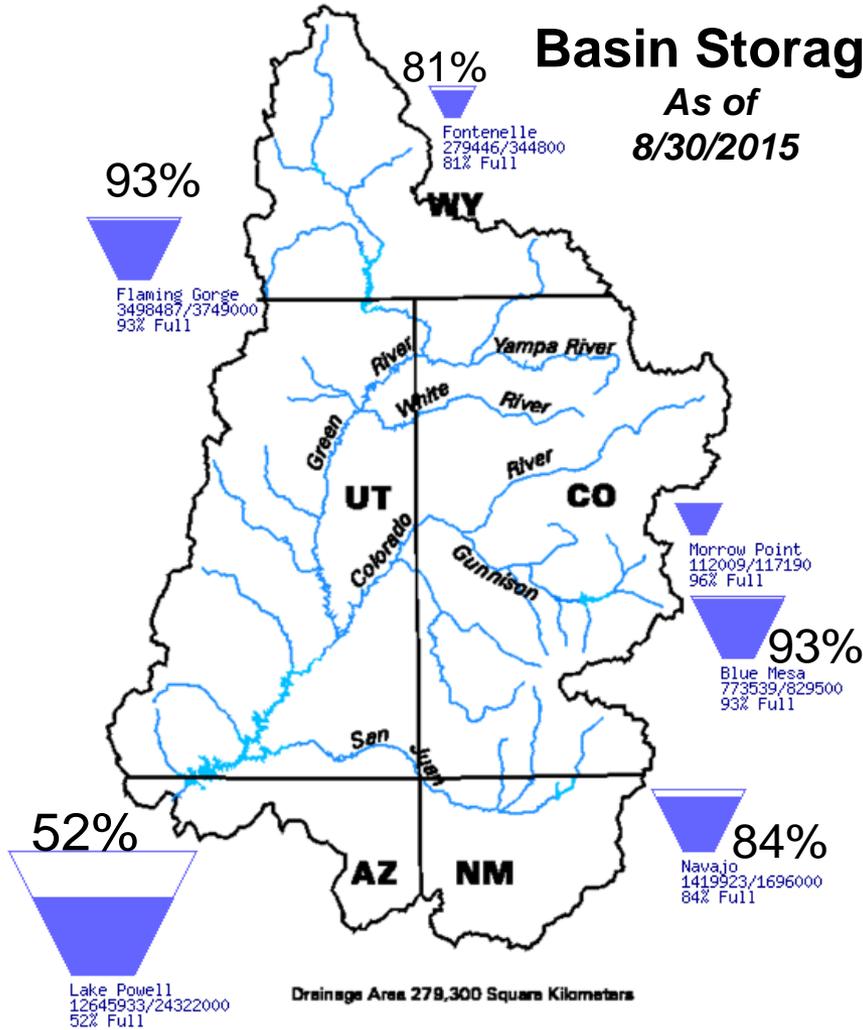
# Upper Basin Storage

Data Current as of:  
08/30/2015

## Upper Colorado River Drainage Basin

### Basin Storage

As of  
8/30/2015



## April to July 2015 Observed Inflow

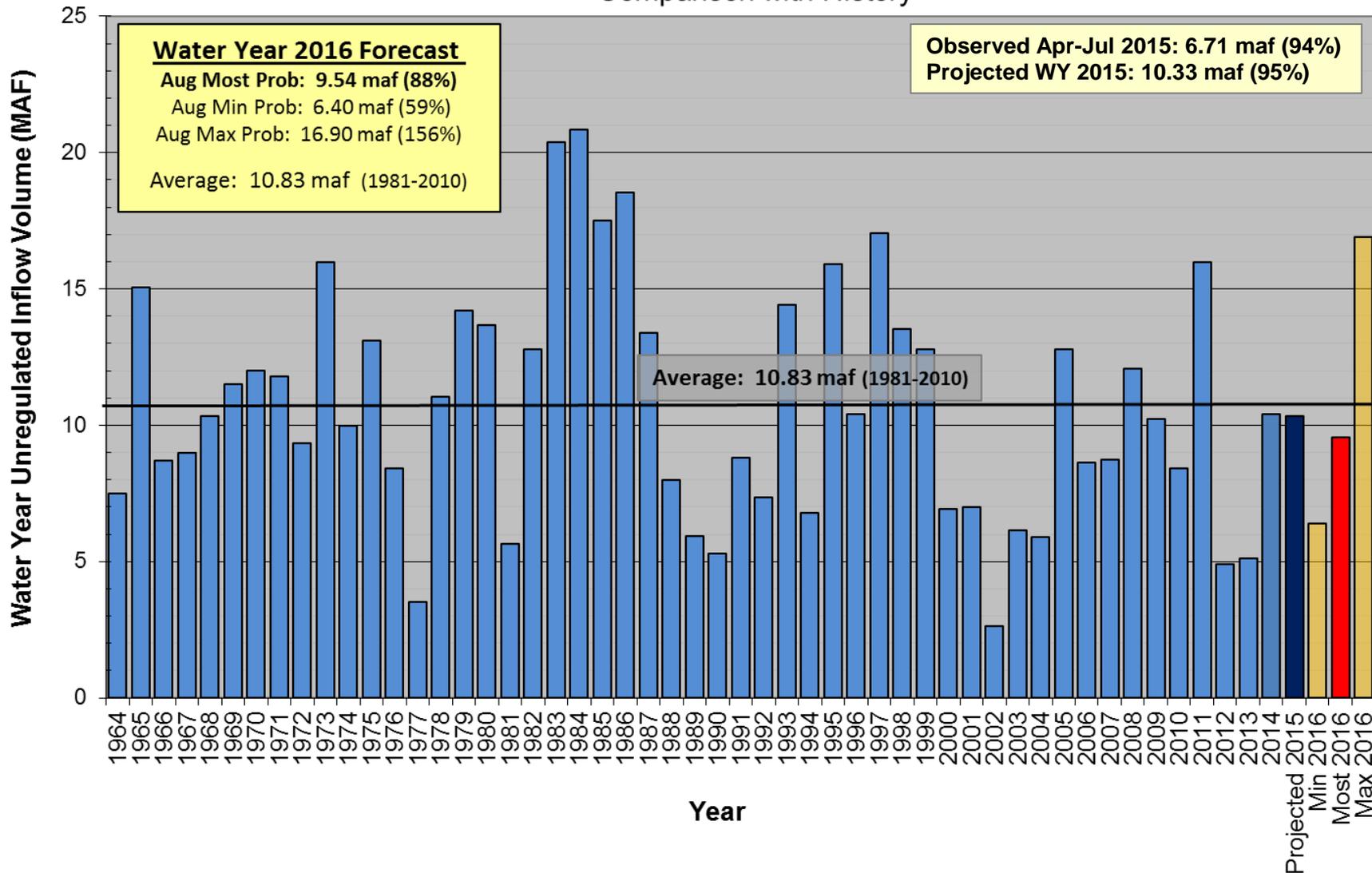
Reservoir	Apr-Jul Observed (KAF)	Percent of Average <sup>1</sup>
Fontenelle	768	106%
Flaming Gorge	1,036	106%
Blue Mesa	708	105%
Navajo	619	84%
Powell	6,714	94%

<sup>1</sup> Percent of average based on period 1981-2010.

# Lake Powell Unregulated Inflow

## Water Year 2016 Forecast (issued Aug 3)

### Comparison with History



# Projected Operations Water Years 2015 and 2016

RECLAMATION

# Lake Powell & Lake Mead Operational Table

## Operational Tiers for Water Year/Calendar Year 2015

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

**Diagram not to scale**

<sup>1</sup> Acronym for million acre-feet

<sup>2</sup> This elevation is shown as approximate as it is determined each year by considering several factors including Lake Powell and Lake Mead storage, projected Upper Basin and Lower Basin demands, and an assumed inflow.

<sup>3</sup> Subject to April adjustments which may result in a release according to the Equalization Tier

<sup>4</sup> Of which 2.48 maf is apportioned to Arizona, 4.4 maf to California, and 0.287 maf to Nevada

<sup>5</sup> Of which 2.40 maf is apportioned to Arizona, 4.4 maf to California, and 0.283 maf to Nevada

<sup>6</sup> Of which 2.32 maf is apportioned to Arizona, 4.4 maf to California, and 0.280 maf to Nevada

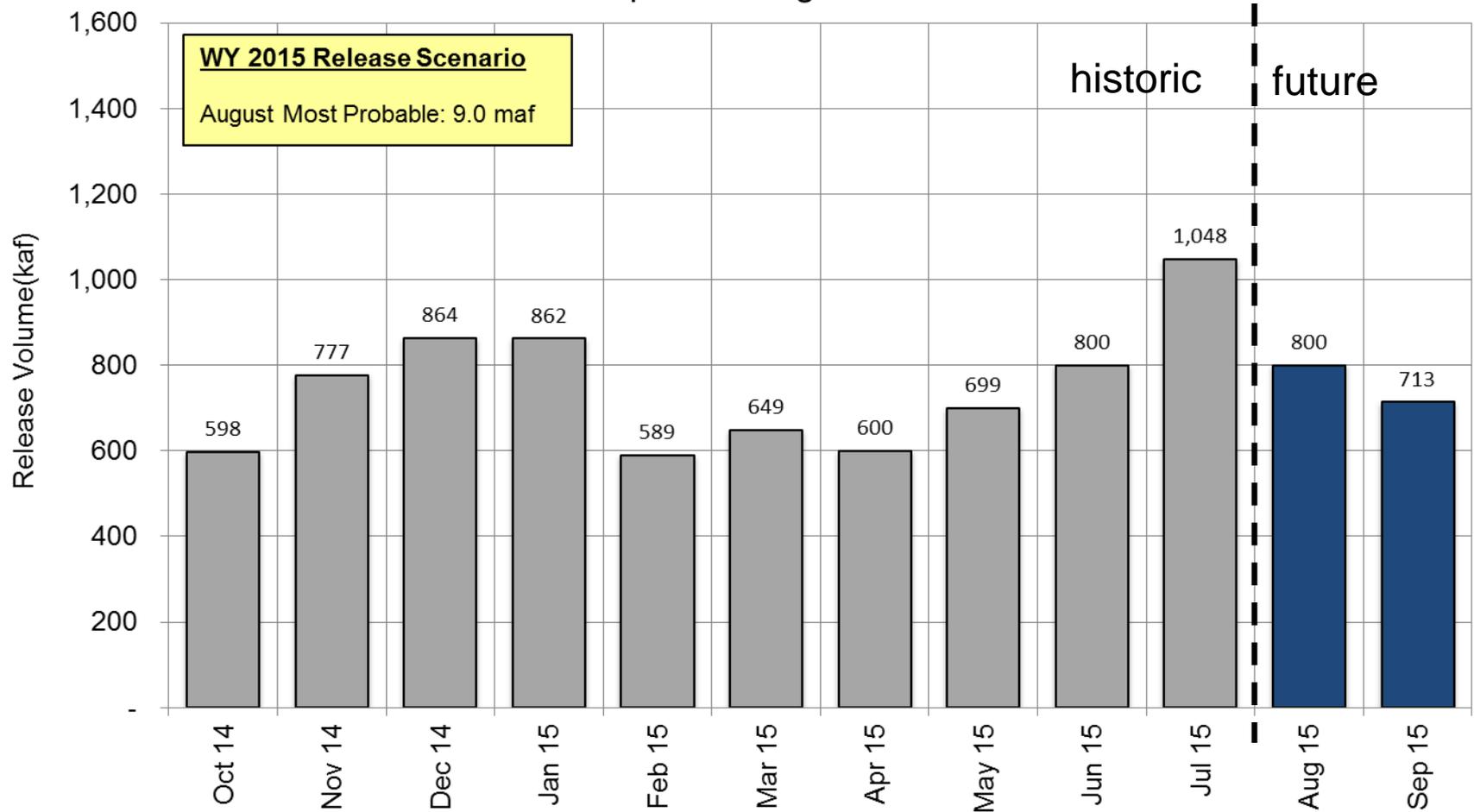
<sup>7</sup> Whenever Lake Mead is below elevation 1,025 feet, the Secretary shall consider whether hydrologic conditions together with anticipated deliveries to the Lower Division States and Mexico is likely to cause the elevation at Lake Mead to fall below 1,000 feet. Such consideration, in consultation with the Basin States, may result in the undertaking of further measures, consistent with applicable Federal law.

<sup>1</sup> Lake Powell and Lake Mead operational tier determinations were based on August 2014 24-Month Study projections and documented in the 2015 AOP.

RECLAMATION

# Projected Lake Powell Monthly Release Volume Distribution

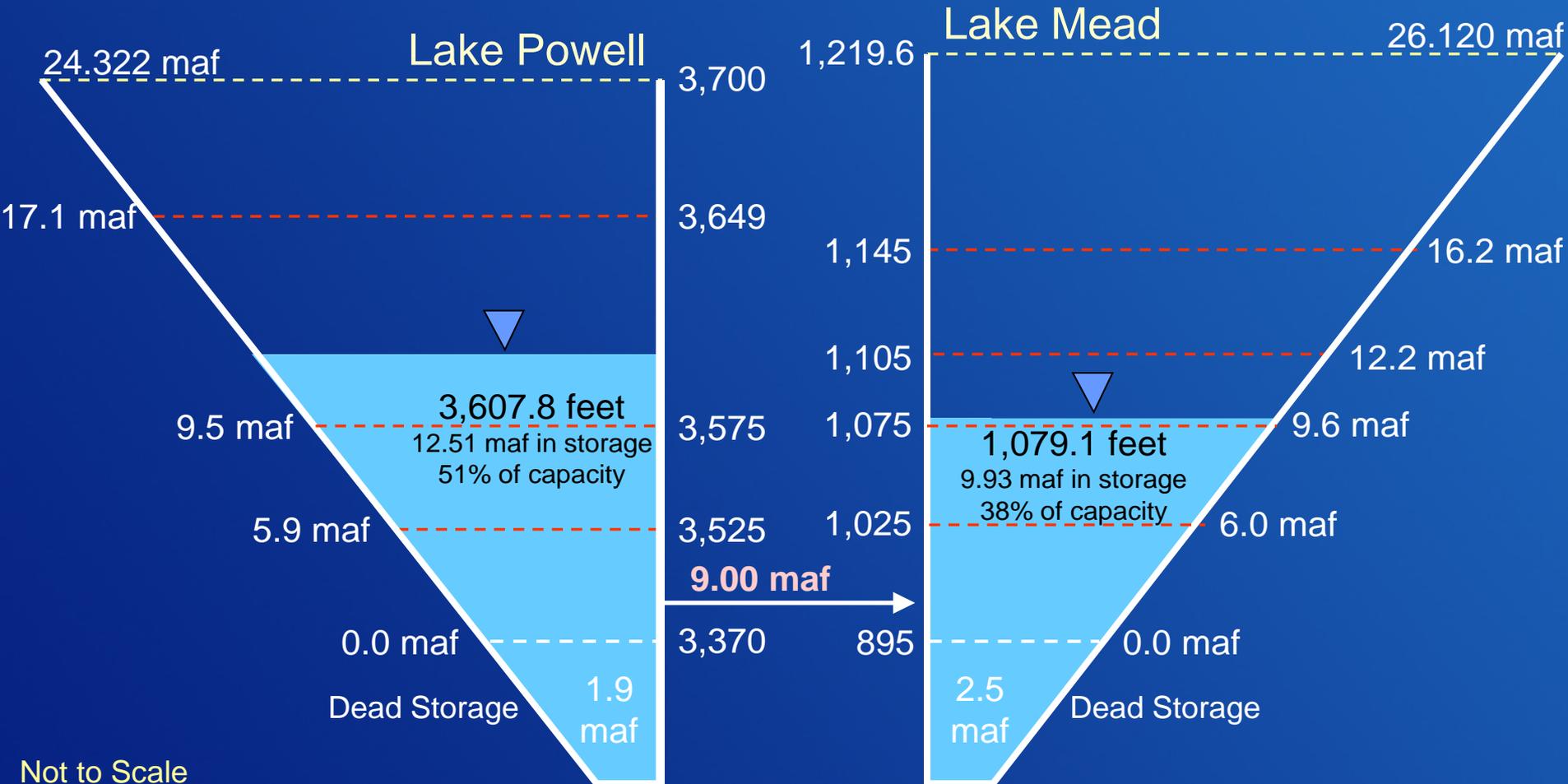
Release Scenario for Water Year 2015  
Updated August 2015



# End of Water Year 2015 Projections

August 2015 24-Month Study Most Probable Inflow Scenario<sup>1</sup>

Projected Unregulated Inflow into Powell<sup>1</sup> = 10.33 maf (95% of average)



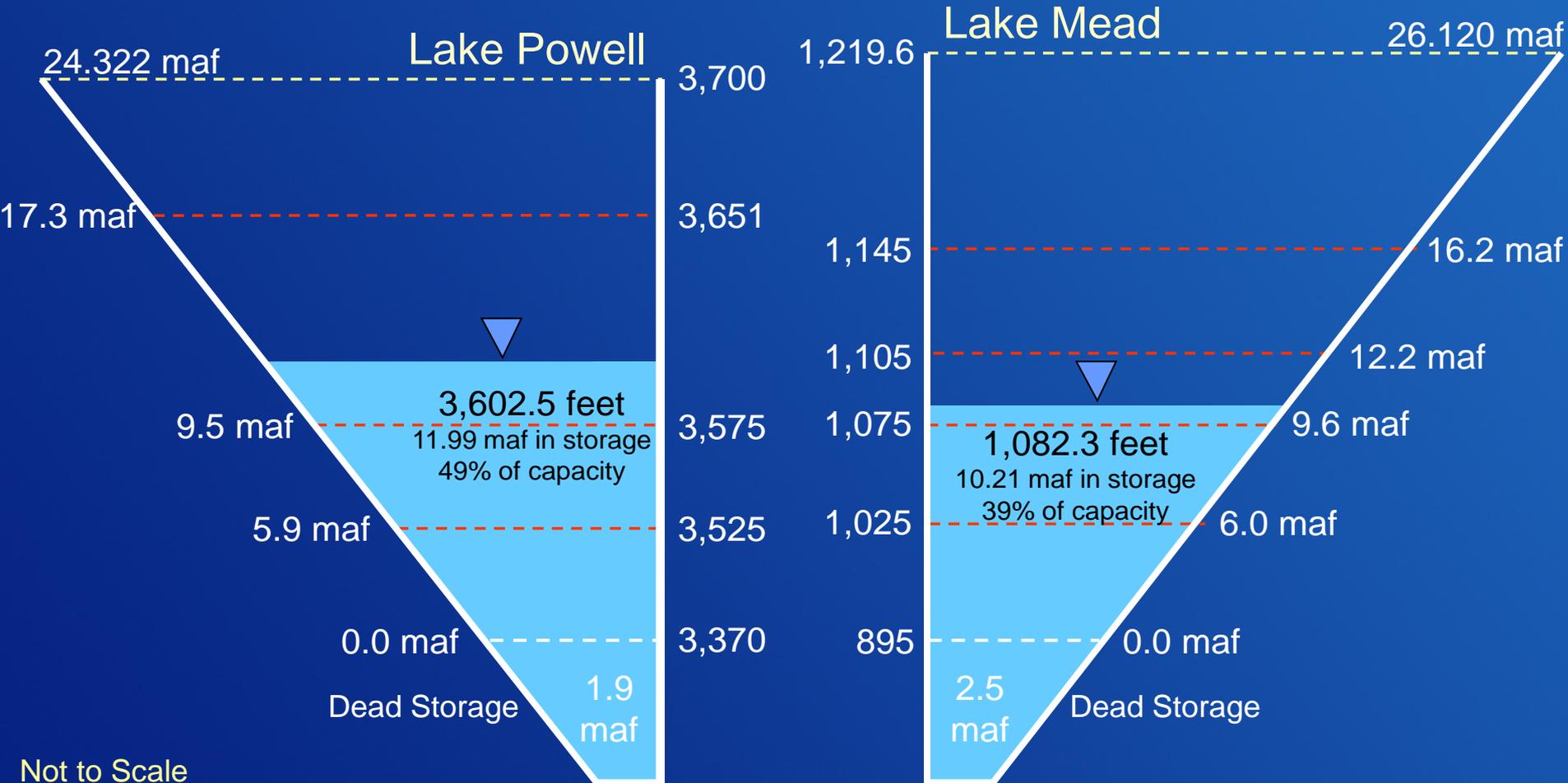
Not to Scale

<sup>1</sup> WY 2015 unregulated inflow into Lake Powell is based on the CBRFC outlook dated 8/3/15.

# End of Calendar Year 2015 Projections

August 2015 24-Month Study Most Probable Inflow Scenario<sup>1</sup>

Based on a 9.00 maf release pattern from Lake Powell in Water Year 2016

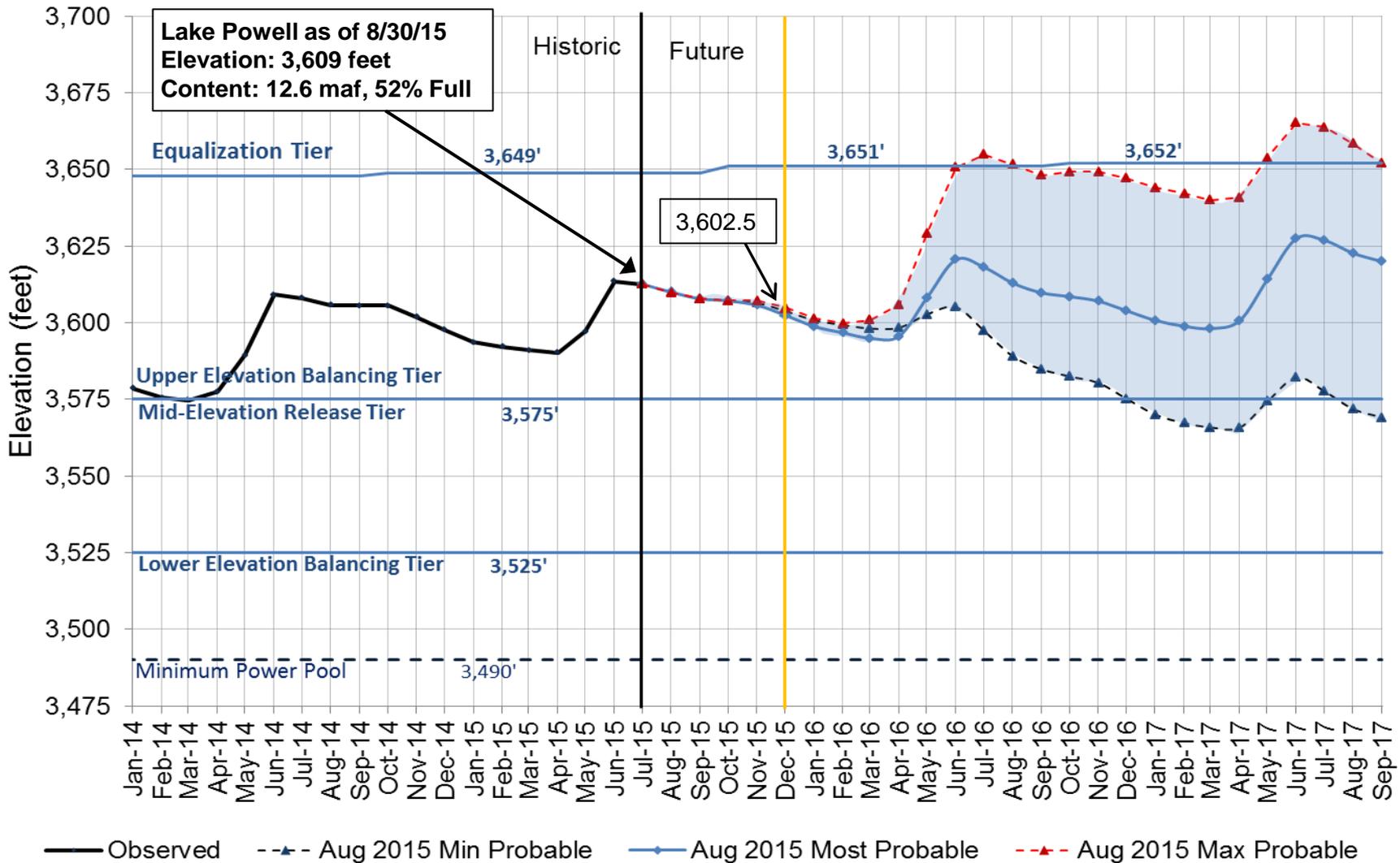


Not to Scale

<sup>1</sup> WY 2015 unregulated inflow into Lake Powell is based on the CBRFC outlook dated 8/3/15.

# Lake Powell End of Month Elevations

## Historic and projected based on August 2015 modeling



# Lake Powell & Lake Mead Operational Table

Operational Tiers for Water/Calendar Year 2016 determined with the August 2015 24-Month Study

Lake Powell			Lake Mead		
Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf) <sup>1</sup>	Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf) <sup>1</sup>
3,700	<b>Equalization Tier</b> Equalize, avoid spills or release 8.23 maf	24.3	1,220	<b>Flood Control Surplus or Quantified Surplus Condition</b> Deliver > 7.5 maf	25.9
3,636 - 3,666 (2008-2026)	<b>Upper Elevation Balancing Tier<sup>3</sup></b> Release 8.23 maf; if Lake Mead < 1,075 feet, balance contents with a min/max release of 7.0 and 9.0 maf	15.5 - 19.3 (2008-2026)	1,200 (approx.) <sup>2</sup>	<b>Domestic Surplus or ICS Surplus Condition</b> Deliver > 7.5 maf	22.9 (approx.) <sup>2</sup>
			1,145		
3,575	<b>3,602.46 ft</b> <b>Jan 1, 2016 projection</b>	9.5	1,105	<b>Normal or ICS Surplus Condition</b> Deliver ≥ 7.5 maf	11.9
3,525	<b>Mid-Elevation Release Tier</b> Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf	5.9	1,075	<b>Shortage Condition</b> Deliver 7.167 <sup>4</sup> maf	9.4
			1,050		
3,490	<b>Lower Elevation Balancing Tier</b> Balance contents with a min/max release of 7.0 and 9.5 maf	4.0	1,025	<b>Shortage Condition</b> Deliver 7.083 <sup>5</sup> maf	5.8
3,370			1,000		
		0	895		0

**Diagram not to scale**

<sup>1</sup> Acronym for million acre-feet

<sup>2</sup> This elevation is shown as approximate as it is determined each year by considering several factors including Lake Powell and Lake Mead storage, projected Upper Basin and Lower Basin demands, and an assumed inflow.

<sup>3</sup> Subject to April adjustments which may result in a release according to the Equalization Tier

<sup>4</sup> Of which 2.48 maf is apportioned to Arizona, 4.4 maf to California, and 0.287 maf to Nevada

<sup>5</sup> Of which 2.40 maf is apportioned to Arizona, 4.4 maf to California, and 0.283 maf to Nevada

<sup>6</sup> Of which 2.32 maf is apportioned to Arizona, 4.4 maf to California, and 0.280 maf to Nevada

<sup>7</sup> Whenever Lake Mead is below elevation 1,025 feet, the Secretary shall consider whether hydrologic conditions together with anticipated deliveries to the Lower Division States and Mexico is likely to cause the elevation at Lake Mead to fall below 1,000 feet. Such consideration, in consultation with the Basin States, may result in the undertaking of further measures, consistent with applicable Federal law.



# Projected Lake Powell Operating Tiers

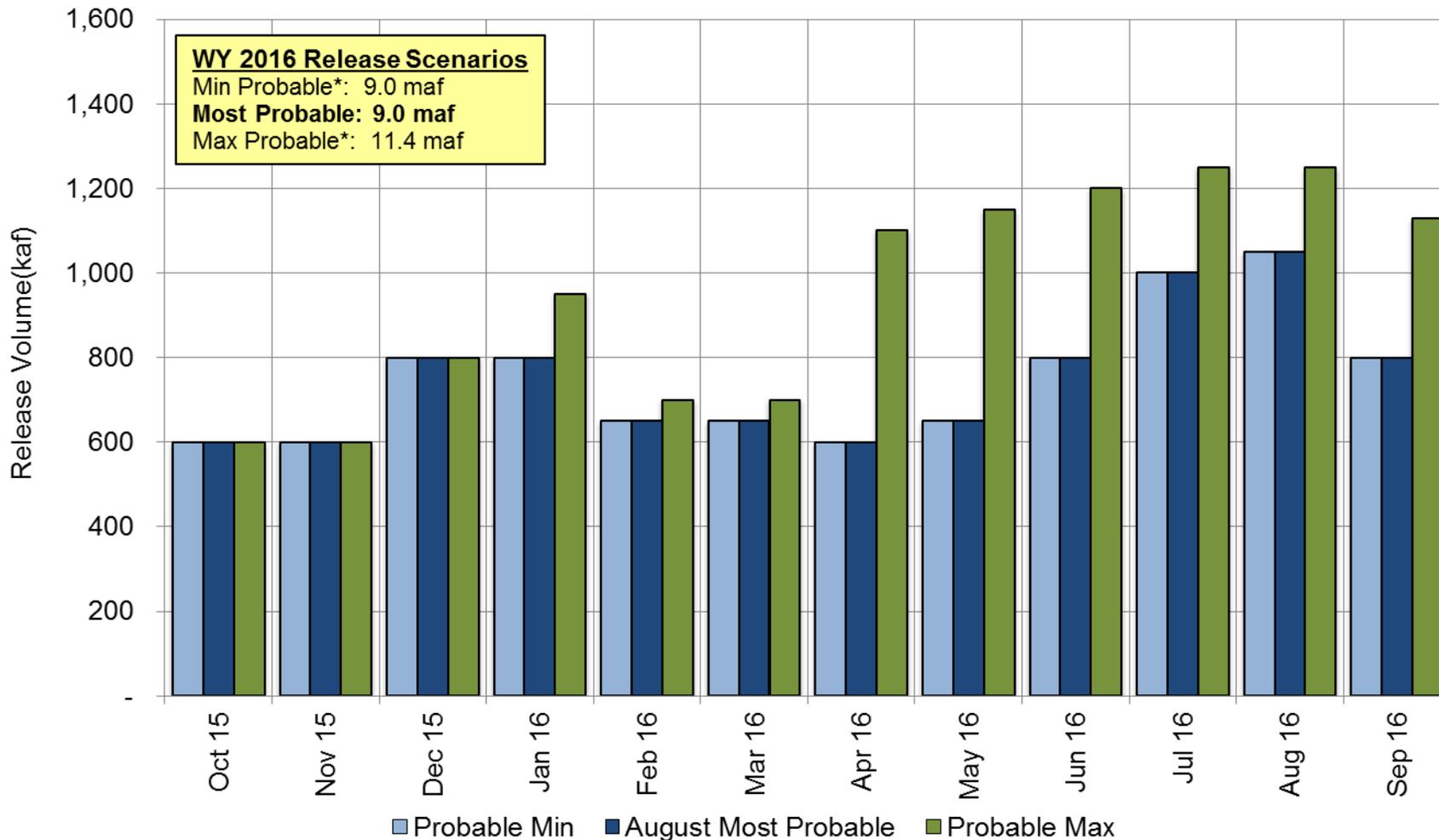
Based on August 2015 24-Month Study

<b>Powell Inflow Scenario</b>	<b>WY 2016 Release Projection</b>
<b>Probable Minimum</b>	<b>Upper Elevation Balancing Tier</b> w/ Projected April shift to Balancing  9.0 maf release
<b>Most Probable</b>	<b>Upper Elevation Balancing Tier</b> w/ Projected April shift to Balancing  9.0 maf release
<b>Probable Maximum</b>	<b>Upper Elevation Balancing Tier</b> w/ Projected April shift to Equalization  11.4 maf release

# Potential Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2016

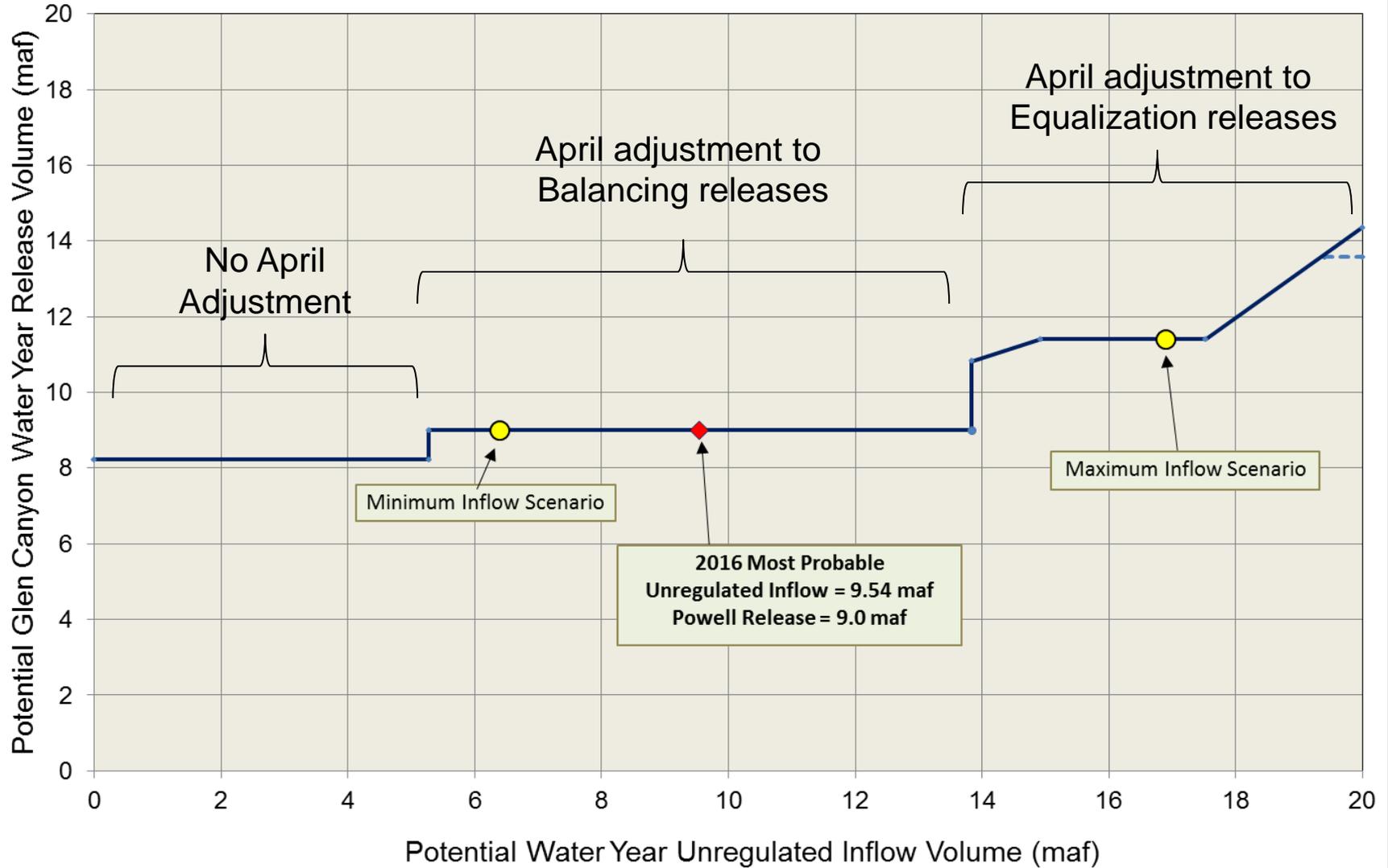
Updated August 2015



\* Probable min and max annual release volume is based on August probable min and max inflow forecasts

# Potential Lake Powell Release Scenarios

Water Year 2016 Release Volume as a Function of Unregulated Inflow Volume  
based on August 2015 24-Month Study Conditions



An aerial photograph of the Hoover Dam and Hoover Dam Bypass Bridge. The dam is a large concrete structure with a curved face, situated in a deep canyon. The bridge is a long, multi-span concrete arch bridge crossing the river. The surrounding landscape is rugged and rocky, with some winding roads and power lines visible. The text "Lower Colorado River Basin Hydrology and Operations" is overlaid in white on the image.

# Lower Colorado River Basin Hydrology and Operations

RECLAMATION

# Colorado River Basin Storage (as of August 30, 2015)

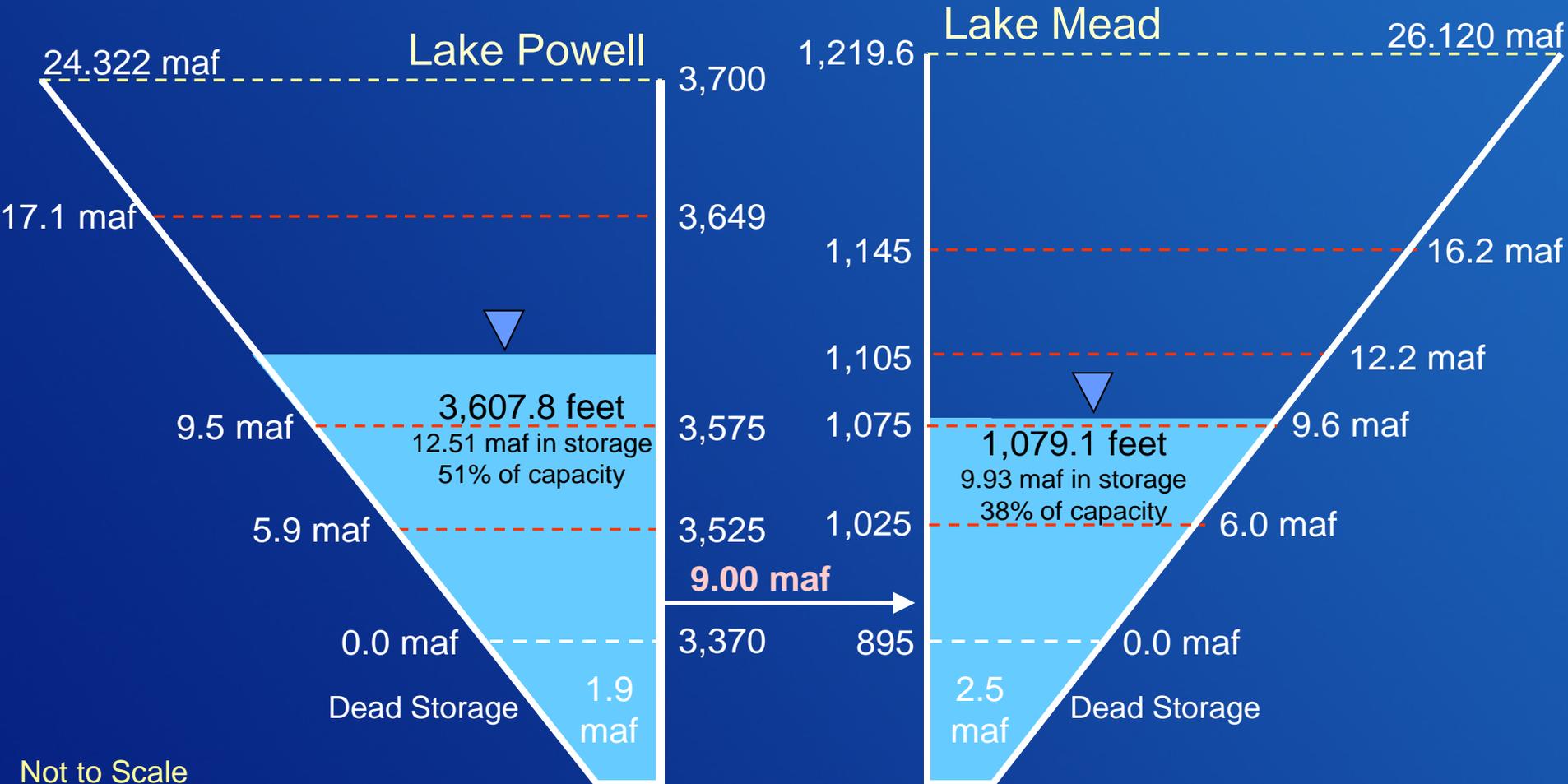
<b>Reservoir</b>	<b>Percent Full</b>	<b>Storage (maf)</b>	<b>Elevation (feet)</b>
Lake Powell	52%	12.6	3,609.2
Lake Mead	38%	9.9	1,078.2
Total System Storage*	52%	30.9	NA

\*Total system storage was 30.2 maf or 51% this time last year

# End of Water Year 2015 Projections

August 2015 24-Month Study Most Probable Inflow Scenario<sup>1</sup>

Projected Unregulated Inflow into Powell<sup>1</sup> = 10.33 maf (95% of average)



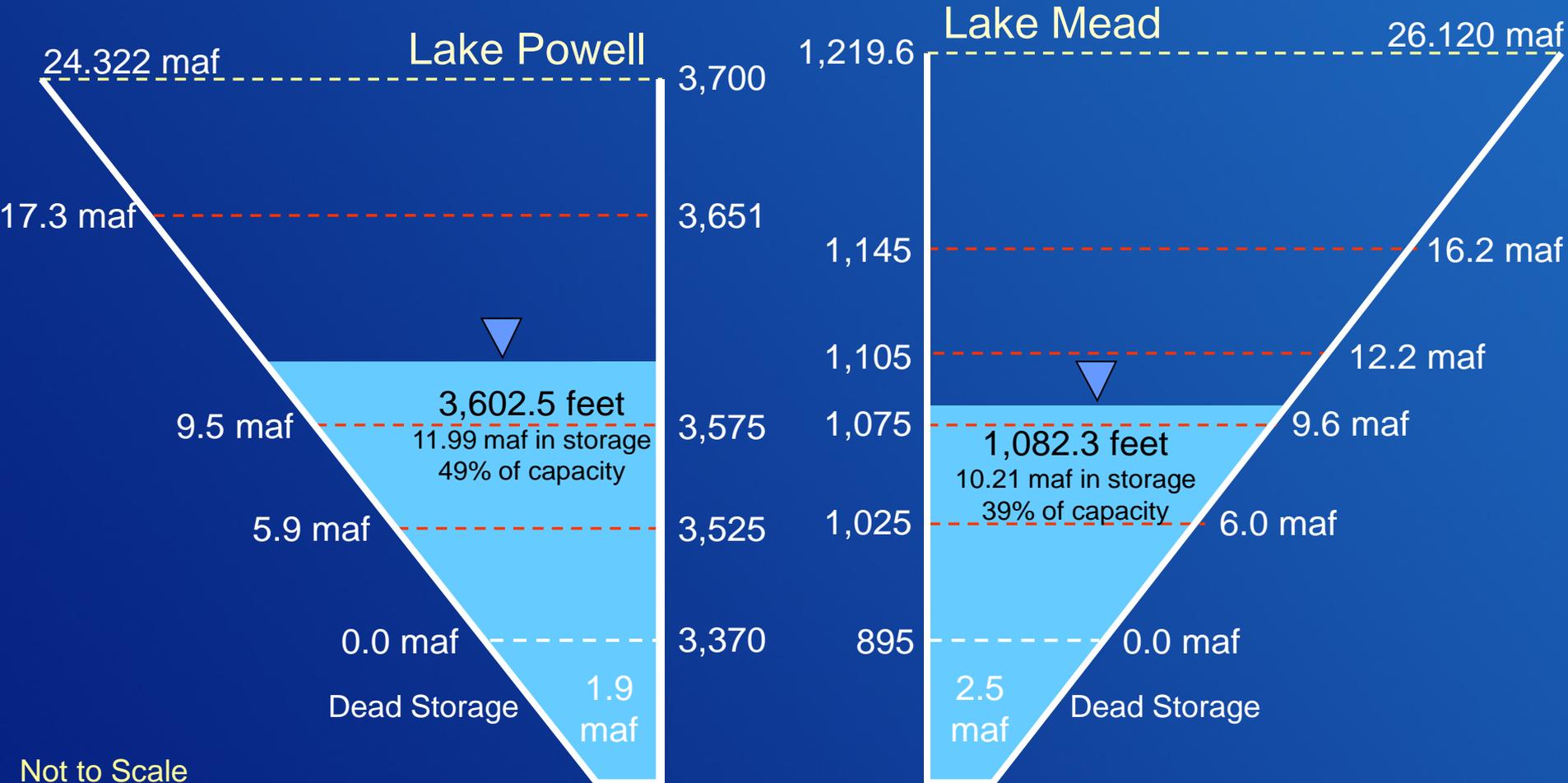
Not to Scale

<sup>1</sup> WY 2015 unregulated inflow into Lake Powell is based on the CBRFC outlook dated 8/3/15.

# End of Calendar Year 2015 Projections

August 2015 24-Month Study Most Probable Inflow Scenario<sup>1</sup>

Based on a 9.00 maf release pattern from Lake Powell in Water Year 2016



Not to Scale

<sup>1</sup> WY 2015 unregulated inflow into Lake Powell is based on the CBRFC outlook dated 8/3/15.

# Lake Powell & Lake Mead Operational Table

Operational Tiers for Water/Calendar Year 2016 determined with the August 2015 24-Month Study

Lake Powell			Lake Mead		
Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf) <sup>1</sup>	Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf) <sup>1</sup>
3,700	<b>Equalization Tier</b> Equalize, avoid spills or release 8.23 maf	24.3	1,220	<b>Flood Control Surplus or Quantified Surplus Condition</b> Deliver > 7.5 maf	25.9
3,636 - 3,666 (2008-2026)	<b>Upper Elevation Balancing Tier<sup>3</sup></b> Release 8.23 maf; if Lake Mead < 1,075 feet, balance contents with a min/max release of 7.0 and 9.0 maf	15.5 - 19.3 (2008-2026)	1,200 (approx.) <sup>2</sup>	<b>Domestic Surplus or ICS Surplus Condition</b> Deliver > 7.5 maf	22.9 (approx.) <sup>2</sup>
			1,145		
	<b>3,602.46 ft</b> <b>Jan 1, 2016 projection</b>		1,105	<b>Normal or ICS Surplus Condition</b> Deliver ≥ 7.5 maf	11.9
3,575	<b>Mid-Elevation Release Tier</b> Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf	9.5		<b>1,082.33 ft</b> <b>Jan 1, 2016 projection</b>	
			1,075	<b>Shortage Condition</b> Deliver 7.167 <sup>4</sup> maf	9.4
3,525		5.9	1,050	<b>Shortage Condition</b> Deliver 7.083 <sup>5</sup> maf	7.5
	<b>Lower Elevation Balancing Tier</b> Balance contents with a min/max release of 7.0 and 9.5 maf		1,025	<b>Shortage Condition</b> Deliver 7.0 <sup>6</sup> maf Further measures may be undertaken <sup>7</sup>	5.8
3,490		4.0	1,000		4.3
3,370		0	895		0

**Diagram not to scale**

<sup>1</sup> Acronym for million acre-feet

<sup>2</sup> This elevation is shown as approximate as it is determined each year by considering several factors including Lake Powell and Lake Mead storage, projected Upper Basin and Lower Basin demands, and an assumed inflow.

<sup>3</sup> Subject to April adjustments which may result in a release according to the Equalization Tier

<sup>4</sup> Of which 2.48 maf is apportioned to Arizona, 4.4 maf to California, and 0.287 maf to Nevada

<sup>5</sup> Of which 2.40 maf is apportioned to Arizona, 4.4 maf to California, and 0.283 maf to Nevada

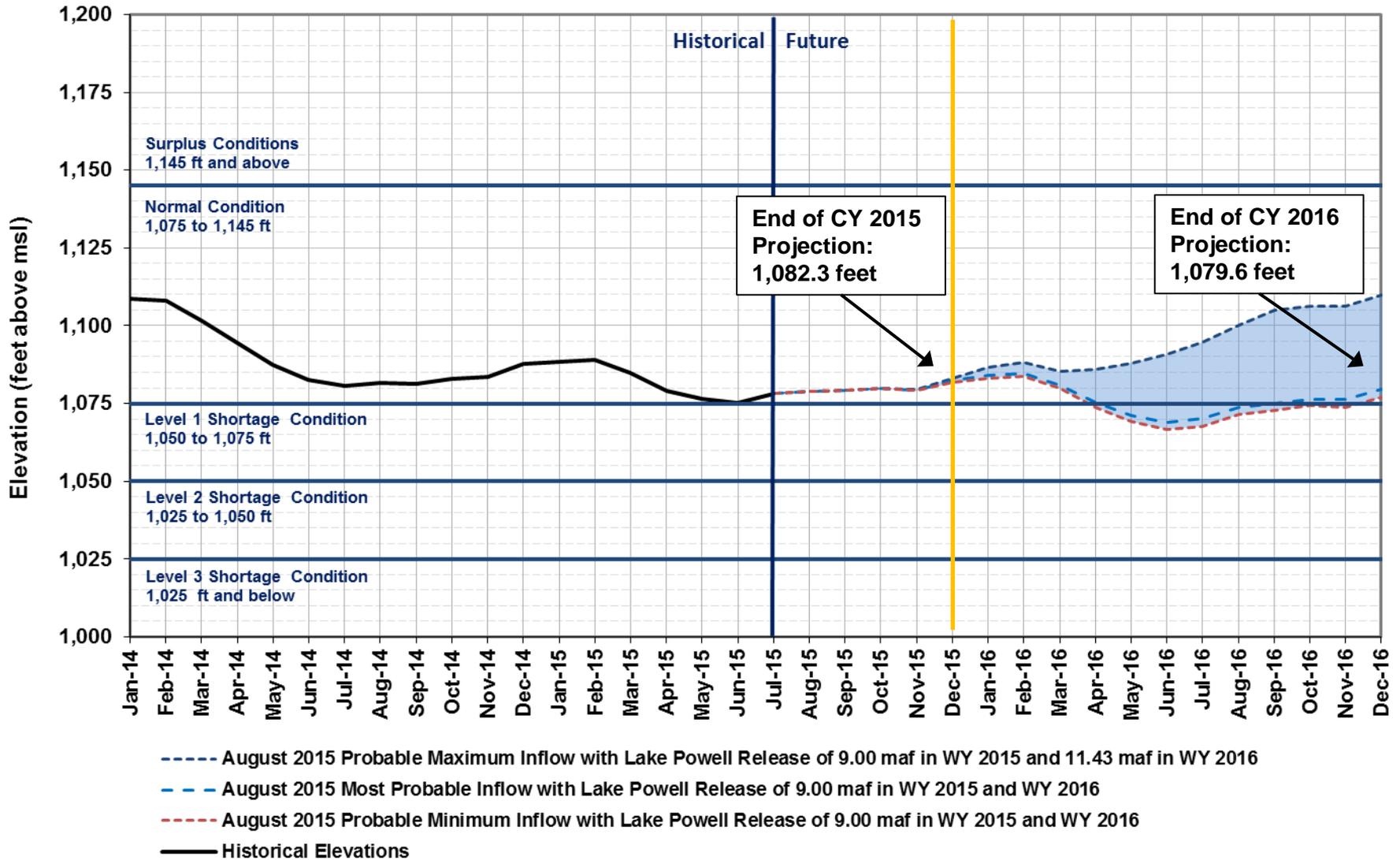
<sup>6</sup> Of which 2.32 maf is apportioned to Arizona, 4.4 maf to California, and 0.280 maf to Nevada

<sup>7</sup> Whenever Lake Mead is below elevation 1,025 feet, the Secretary shall consider whether hydrologic conditions together with anticipated deliveries to the Lower Division States and Mexico is likely to cause the elevation at Lake Mead to fall below 1,000 feet. Such consideration, in consultation with the Basin States, may result in the undertaking of further measures, consistent with applicable Federal law.



# Lake Mead End of Month Elevations

## Projections from August 2015 24-Month Study Inflow Scenarios



# Projected Lake Mead Operational Tiers

Based on August 2015 24-Month Study Inflow Scenarios

Powell Inflow Scenario	CY 2016 Jan 1, 2016 Projection	CY 2017 Jan 1, 2017 Projections
Probable Maximum	Normal - ICS Surplus Condition Elevation 1,082.33 ft	Normal - ICS Surplus Condition Elevation 1,109.78 ft
Most Probable		Normal - ICS Surplus Condition Elevation 1,079.57 ft
Probable Minimum		Normal - ICS Surplus Condition Elevation 1,076.84 ft

# Lower Basin Side Inflows – WY/CY 2015<sup>1,2</sup>

## Intervening Flow from Glen Canyon to Hoover Dam

Month in WY/CY 2015		5-Year Average Intervening Flow (KAF)	Observed Intervening Flow (KAF)	Observed Intervening Flow (% of Average)	Difference From 5-Year Average (KAF)
OBSERVED	October 2014	61	68	111%	7
	November 2014	50	44	88%	-6
	December 2014	96	56	58%	-40
	January 2015	72	73	101%	1
	February 2015	77	90	116%	13
	March 2015	61	57	94%	-4
	April 2015	76	26	34%	-50
	May 2015	49	26	53%	-23
	June 2015	23	15	65%	-8
	July 2015	67	81	120%	14
PROJECTED	August 2015	127			
	September 2015	114			
	October 2015	61			
	November 2015	50			
	December 2015	96			
<b>WY 2015 Totals</b>		<b>874</b>	<b>776</b>	<b>89%</b>	<b>-97</b>
<b>CY 2015 Totals</b>		<b>874</b>	<b>816</b>	<b>93%</b>	<b>-57</b>

<sup>1</sup> Values were computed with the LC's gain-loss model for the most recent 24-month study.

<sup>2</sup> Percents of average are based on the 5-year mean from 2010-2014.

# YAO Operations Update

- Brock Reservoir and Senator Wash  
2015 YTD accumulated storage<sup>1</sup>

–Brock 95,063 AF

–Senator Wash 82,247 AF

- Excess Flows to Mexico

2015 YTD total<sup>2</sup> 12,611 AF



<sup>1</sup> Provisional year-to-date totals through August 27, 2015

<sup>2</sup> Provisional year-to-date total through August 30, 2015

# YAO Operations Update

- Pumped drainage return flows from the Wellton-Mohawk Irrigation and Drainage District
  - Flow at station 0+00 on the Main Outlet Drain from January through June 2015 was 55,198 AF at 2,716 ppm
- Provisional drainage Flows to the Colorado River
  - From the South Gila Drainage Wells January through July 2015 was 4,414 AF at 1,617 ppm
  - From the Yuma Mesa Conduit January through July 2015 was 3,869 AF at 1,923 ppm



RECLAMATION



**2016 Colorado River  
Annual Operating Plan  
Colorado River Management Work Group  
Final Consultation  
September 2, 2015**

RECLAMATION