

COLORADO RIVER

COMPACTS, CURRENT CONDITIONS, AND FORECASTS

Are we in trouble yet?

Club 20 Water Committee
March 1, 2018

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Alternate Colorado Commissioner, Upper Colorado River Commission

Some Key Provisions of the Colorado River Compact

Article III(a)

Apportions to Upper Basin and Lower Basin
7.5 million acre-feet per year in perpetuity.

Article III(c)

Defines obligations of Upper and Lower
Basins for deliveries to Mexico.

Article III(d)

Upper Division will not deplete
flows at Lee Ferry below an
aggregate of 75 million acre-feet
over any period of ten consecutive
Years.

Article VIII

Present perfected rights are
unimpaired.

Maintaining Article III(d) Flows at Lee Ferry

Navajo Reservoir



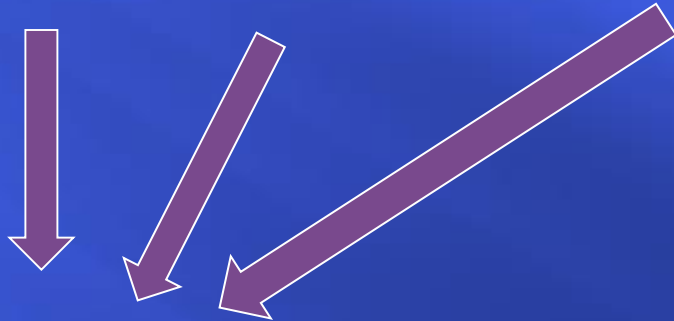
Flaming Gorge
Reservoir



Aspinall Unit
(Blue Mesa Reservoir)



30.6 million acre-feet
total storage



Lake Powell

Objective
Annual Release:
8.23 million acre-
feet



Lake Mead

Subject to
balancing
criteria
under 2007
Interim
Guidelines

Coordinated Operations Lake Powell and Lake Mead

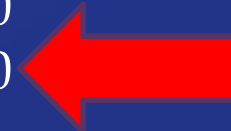
| Lake Powell | | | Lake Mead | | |
|---------------------------|--|---------------------------------|------------------------------|--|---------------------------------|
| Elevation (feet) | Operation According to the Interim Guidelines | Live Storage (maf) ¹ | Elevation (feet) | Operation According to the Interim Guidelines | Live Storage (maf) ¹ |
| 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) | Upper Elevation Balancing Tier² 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.) ² | Domestic Surplus or ICS Surplus Condition Deliver > 7.5 maf | 22.9 (approx.) ² |
| 3,575 | Mid-Elevation Release Tier Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf | 9.5 | 1,145 | Normal or ICS Surplus Condition Deliver ≥ 7.5 maf | 15.9 |
| 3,525 | Lower Elevation Balancing Tier Balance contents with a min/max release of 7.0 and 9.5 maf | 5.9 | 1,105 | Shortage Condition Deliver 7.167 ⁴ maf | 11.9 |
| 3,490 | | 4.0 | 1,075 | Shortage Condition Deliver 7.083 ⁵ maf | 9.4 |
| 3,370 | | 0 | 1,050 | Shortage Condition Deliver 7.0 ⁶ maf Further measures may be undertaken ⁷ | 7.5 |
| | | | 1,025 | | 5.8 |
| | | | 1,000 | | 4.3 |
| | | | 895 | | 0 |

Historic Flow at Lee Ferry (acre-feet)

Article III(d)

Upper Division will not
deplete flows at Lee Ferry
below an aggregate of
75 million acre-feet
over any period of
ten consecutive years.

| Year | Annual | 10 year ag. |
|------|------------|-------------|
| 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 | 8,269,000 | 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 | 9,158,000 | 91,670,000 |



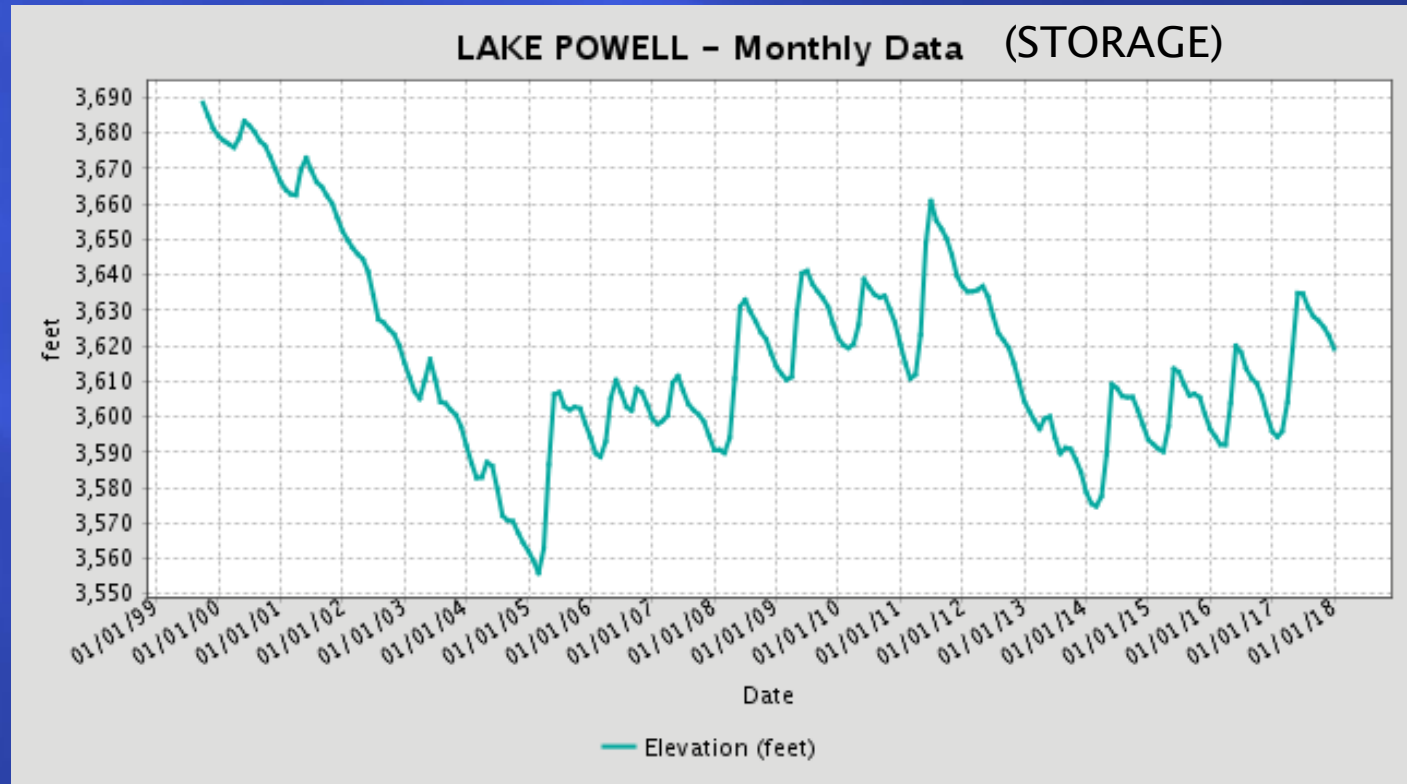
Lake Powell Inflows and Storage

Percentage of 30-year average

(1971-2000: 12.04 maf)

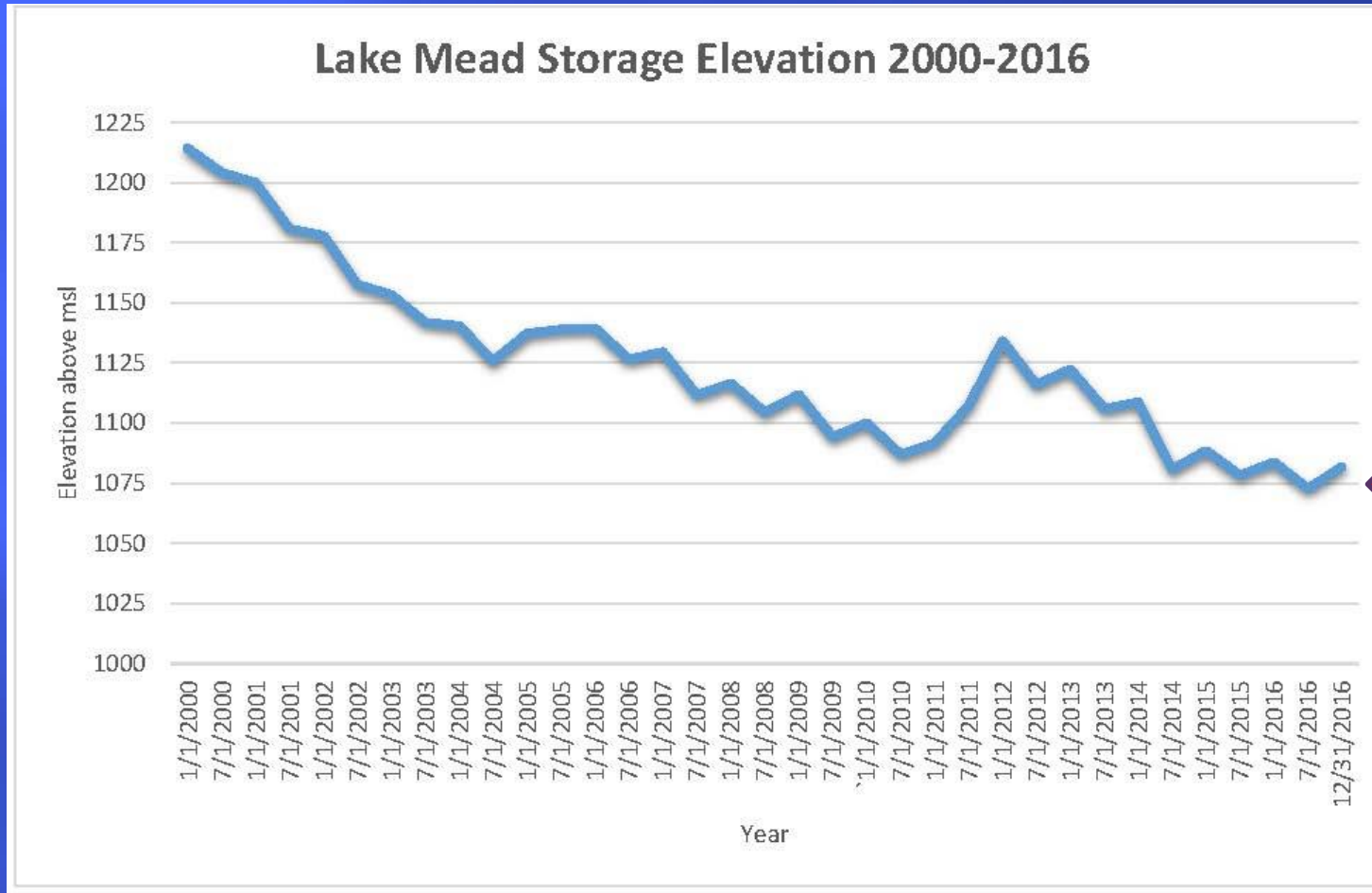
(1981-2010: 10.83 maf)

- 2000 – 7.32 maf (62%)
- 2001 – 6.96 maf (59%)
- 2002 – 3.06 maf (25%)
- 2003 – 6.36 maf (51%)
- 2004 – 6.13maf (49%)
- 2005 – 12.62 maf (105%)
- 2006 – 8.77 maf (71%)
- 2007 – 8.23 maf (68%)
- 2008 – 12.36 maf (102%)
- 2009 – 10.36 maf (92%)
- 2010 – 8.74 maf (73%)
- 2011 – 16.79 maf (142%)
- 2012 – 4.91 maf (45%)
- 2013 – 5.12 maf (47%)
- 2014 – 10.38 maf (96%)
- 2015 – 10.7 maf (94%)
- 2016 – 9.62 maf (89%)
- 2017 – 11.9 maf (110%)
- 2018 – 6.09 maf (56%)*



* Most probable as of February, 2018

Lower Basin

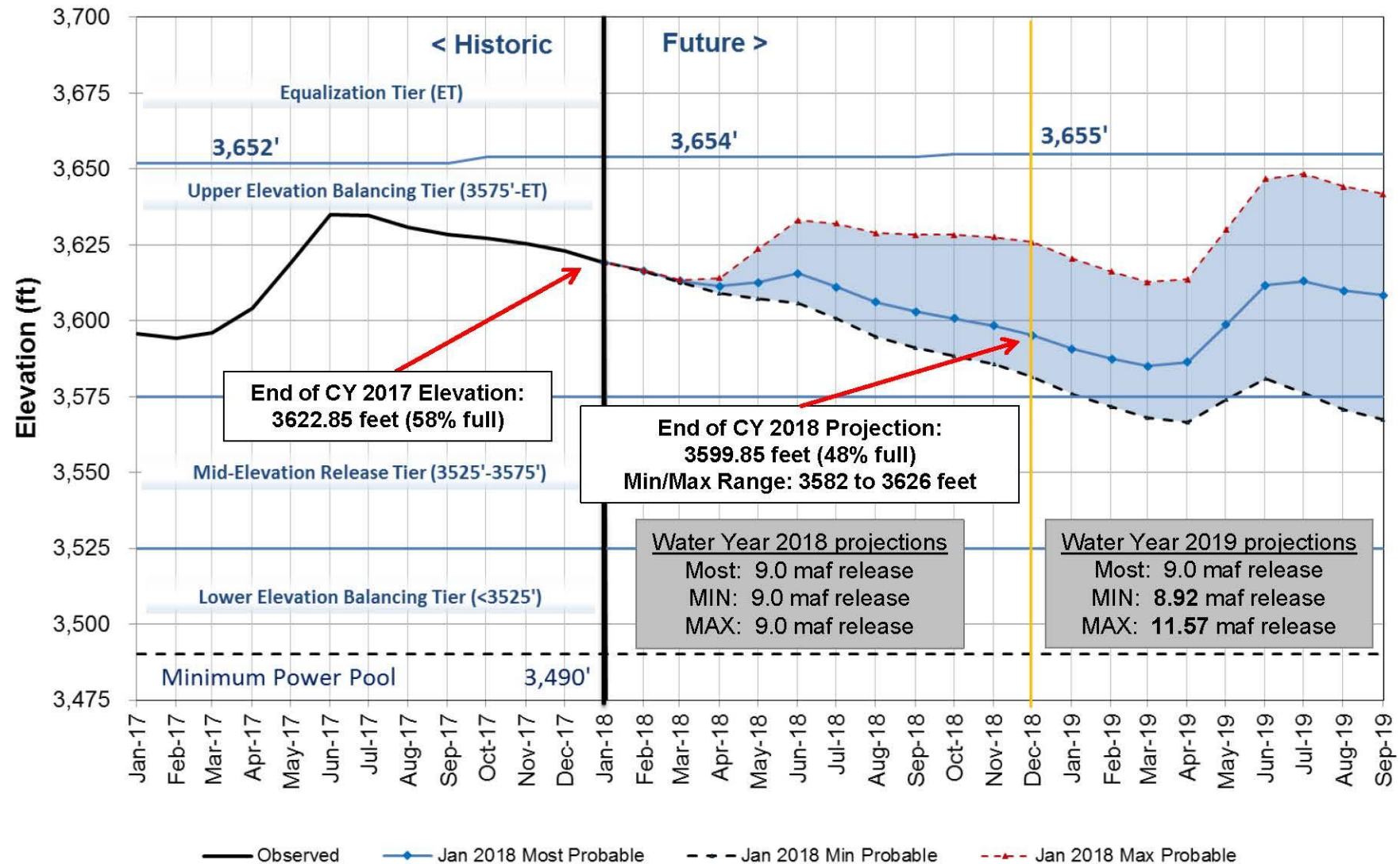


Critical elevation: 1,075

March 1 elevation: 1,088.25

Lake Powell End of Month Elevations

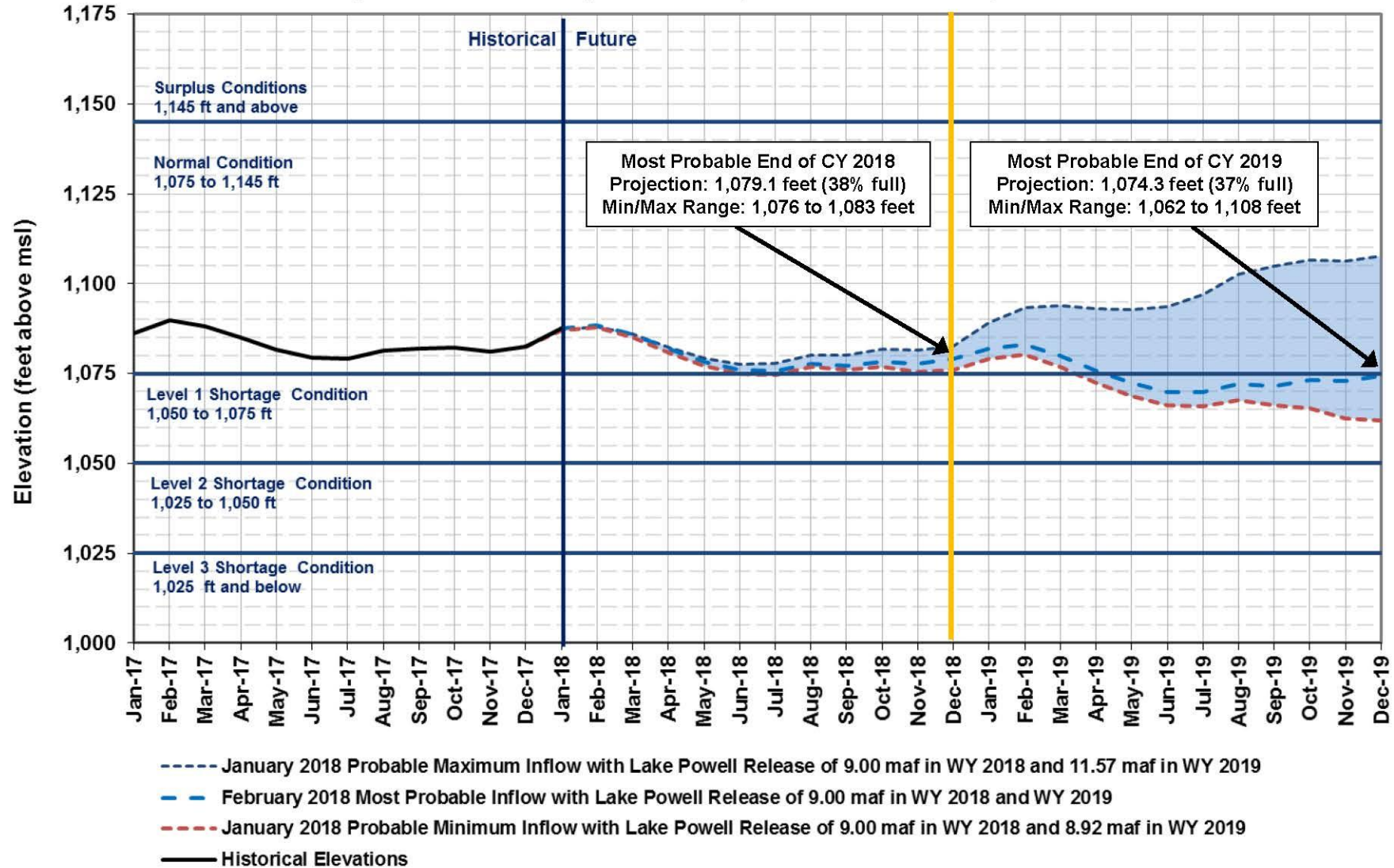
Historic and Projected based on January and February 2018 Modeling



RECLAMATION

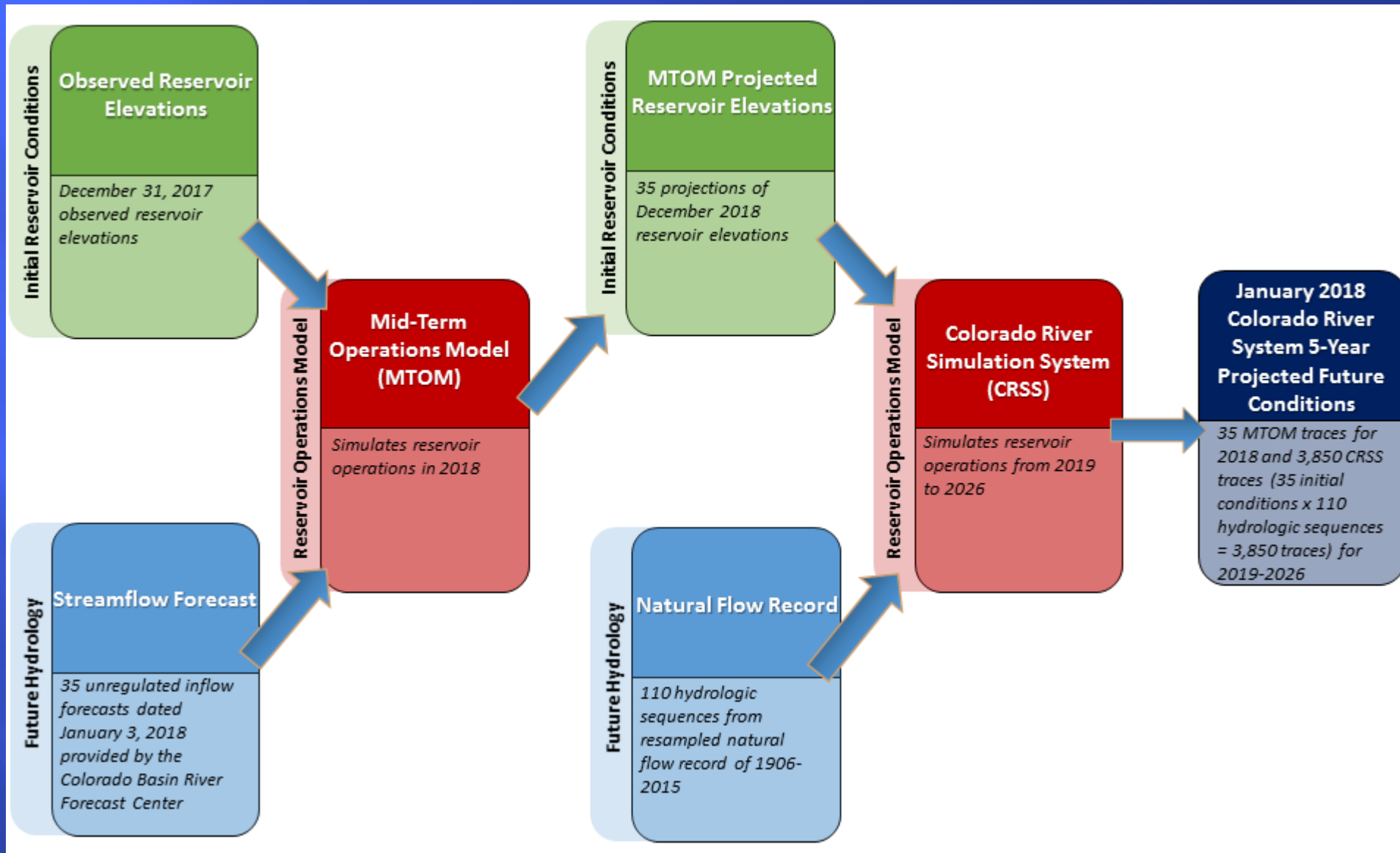
Lake Mead End of Month Elevations

Projections from January and February 2018 24-Month Study Inflow Scenarios



RECLAMATION

Modeling 5-Year Projected Future Conditions



5-Year Projected Future Conditions

Percent of Traces with Event or System Condition
Results from January 2018 MTOM/CRSS^{1,2,3,4} (values in percent)

| | Event or System Condition | 2018 | 2019 | 2020 | 2021 | 2022 |
|----------------------------------|--|------------|-----------|-----------|-----------|-----------|
| Upper Basin – Lake Powell | Equalization Tier | 3 | 8 | 19 | 20 | 23 |
| | <i>Equalization – annual release > 8.23 maf</i> | 3 | 8 | 19 | 20 | 23 |
| | <i>Equalization – annual release = 8.23 maf</i> | 0 | 0 | 0 | 0 | 0 |
| | Upper Elevation Balancing Tier | 97 | 89 | 57 | 56 | 53 |
| | <i>Upper Elevation Balancing – annual release > 8.23 maf</i> | 77 | 76 | 47 | 44 | 41 |
| | <i>Upper Elevation Balancing – annual release = 8.23 maf</i> | 20 | 13 | 9 | 11 | 11 |
| | <i>Upper Elevation Balancing – annual release < 8.23 maf</i> | 0 | 1 | 1 | 1 | 1 |
| | Mid-Elevation Release Tier | 0 | 3 | 24 | 20 | 15 |
| | <i>Mid-Elevation Release – annual release = 8.23 maf</i> | 0 | 0 | 0 | 0 | 1 |
| | <i>Mid-Elevation Release – annual release = 7.48 maf</i> | 0 | 3 | 24 | 19 | 14 |
| | Lower Elevation Balancing Tier | 0 | 0 | 0 | 5 | 9 |
| Lower Basin – Lake Mead | Shortage Condition – any amount (Mead ≤ 1,075 ft) | 0 | 17 | 49 | 58 | 63 |
| | <i>Shortage – 1st level (Mead ≤ 1,075 and ≥ 1,050)</i> | 0 | 17 | 48 | 43 | 39 |
| | <i>Shortage – 2nd level (Mead < 1,050 and ≥ 1,025)</i> | 0 | 0 | 1 | 15 | 18 |
| | <i>Shortage – 3rd level (Mead < 1,025)</i> | 0 | 0 | 0 | 0 | 5 |
| | Surplus Condition – any amount (Mead ≥ 1,145 ft) | 0 | 0 | 1 | 5 | 8 |
| | <i>Surplus – Flood Control</i> | 0 | 0 | 0 | 0 | 1 |
| | Normal or ICS Surplus Condition | 100 | 83 | 51 | 37 | 29 |

¹ Reservoir initial conditions based on results from 35 simulations of December 31, 2018 conditions using the Mid-term Probabilistic Operations Models. MTOM uses the January 2, 2018 Unregulated inflow forecast from the CBRFC.

² Each of the 35 initial conditions were coupled with 110 hydrologic inflow sequences based on resampling of the observed natural flow record from 1906-2015 for a total of 3,850 traces analyzed.

³ Percentages shown may not sum to 100% due to rounding to the nearest percent.

⁴ Percentages shown may not be representative of the full range of future possibilities that could occur with different modeling assumptions.

Questions?



Glen Canyon Dam - Lake Powell



Hoover Dam - Lake Mead