# Glen Canyon Dam Technical Work Group
## Agenda Item Information
## February 25, 2015

Agenda Item

Basin Hydrology, Operations and 2016 Hydrograph Development

Action Requested

Information item only

Presenter

Katrina Grantz, Hydraulic Engineer, Bureau of Reclamation, Upper Colorado Region

Previous Action Taken

By AMWG:

- ✓ At the August 2014 AMWG meeting, AMWG recommended to the Secretary of the Interior her approval of the DOI-DOE Proposed Hydrograph for Water Year 2015.

Relevant Science

N/A

Background Information

The presentation is intended to provide pertinent information to AMWG members on the current water supply and forecasted hydrologic conditions within the Upper Colorado River Basin. The presentation will focus on projected reservoir conditions and operations at Lake Powell/Glen Canyon Dam for the remainder of water year 2015 and provide a general outlook for 2016. The presentation will cover the range of potential releases in the current and upcoming water years. Such information is provided to assist the AMWG in developing recommendations to the Secretary on the operation of Glen Canyon Dam for water years 2015 and 2016.

The second portion of the presentation will cover a brief review of the 2015 Hydrograph and an overview of the upcoming 2016 Hydrograph development process. In cooperation with the other federal agencies, Reclamation is beginning the development of Interior's recommendation for the 2016 Hydrograph. This recommendation will be based upon information used to develop the 2015 Hydrograph and any new ideas that may become known through discussions. Reclamation will review the Hydrograph information and analyses with the TWG and Interior will provide a recommendation for the AMWG's consideration later this year.

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*Managing Water in the West*

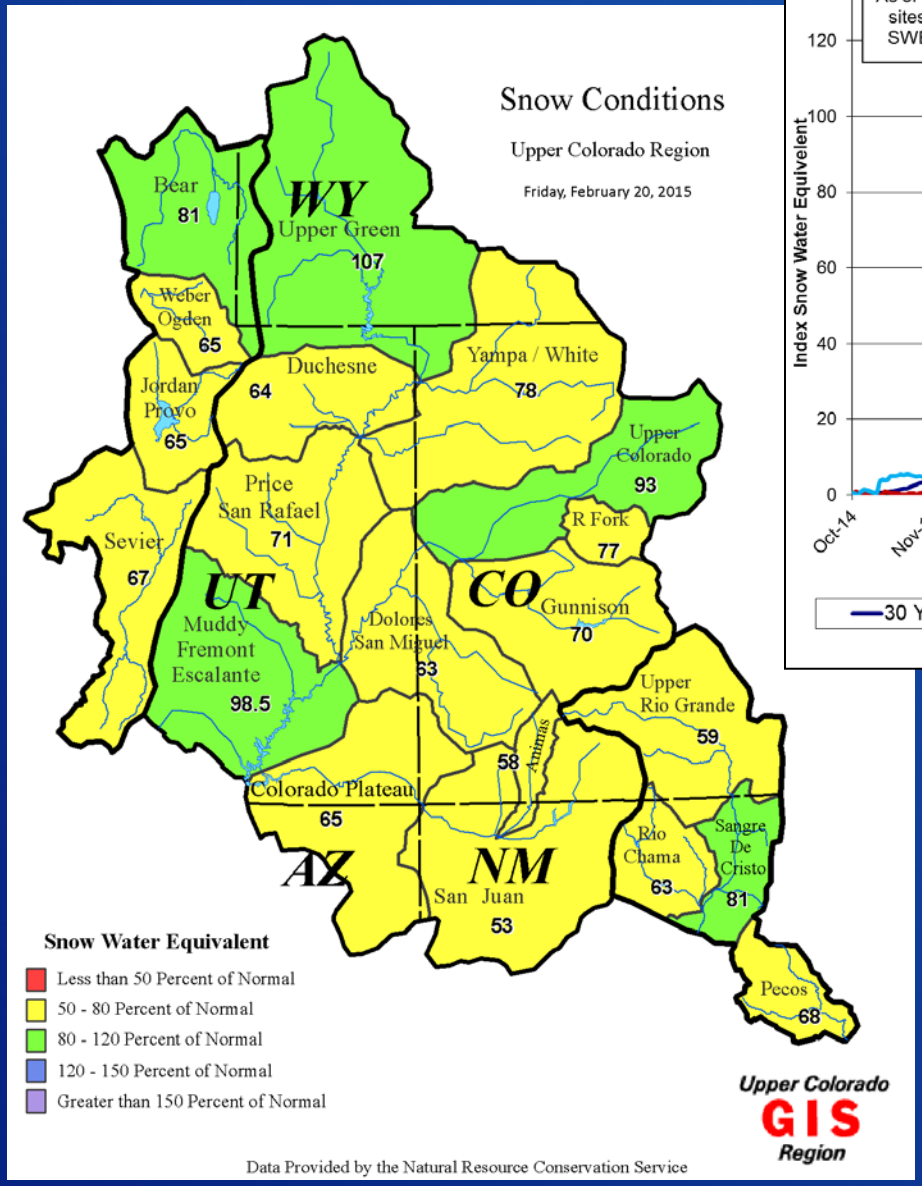
# Basin Hydrology, Operations and 2016 Hydrograph

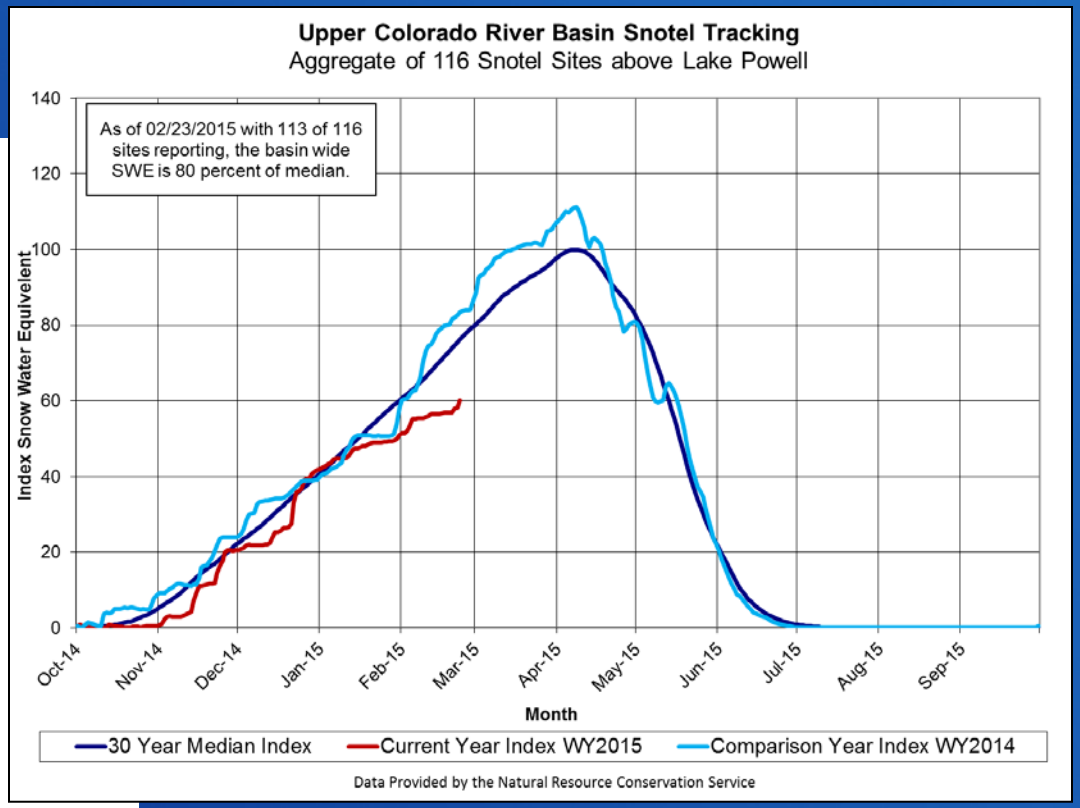
## Adaptive Management Work Group

*February 25-5, 2015*

U.S. Department of the Interior
Bureau of Reclamation

# Snow Conditions

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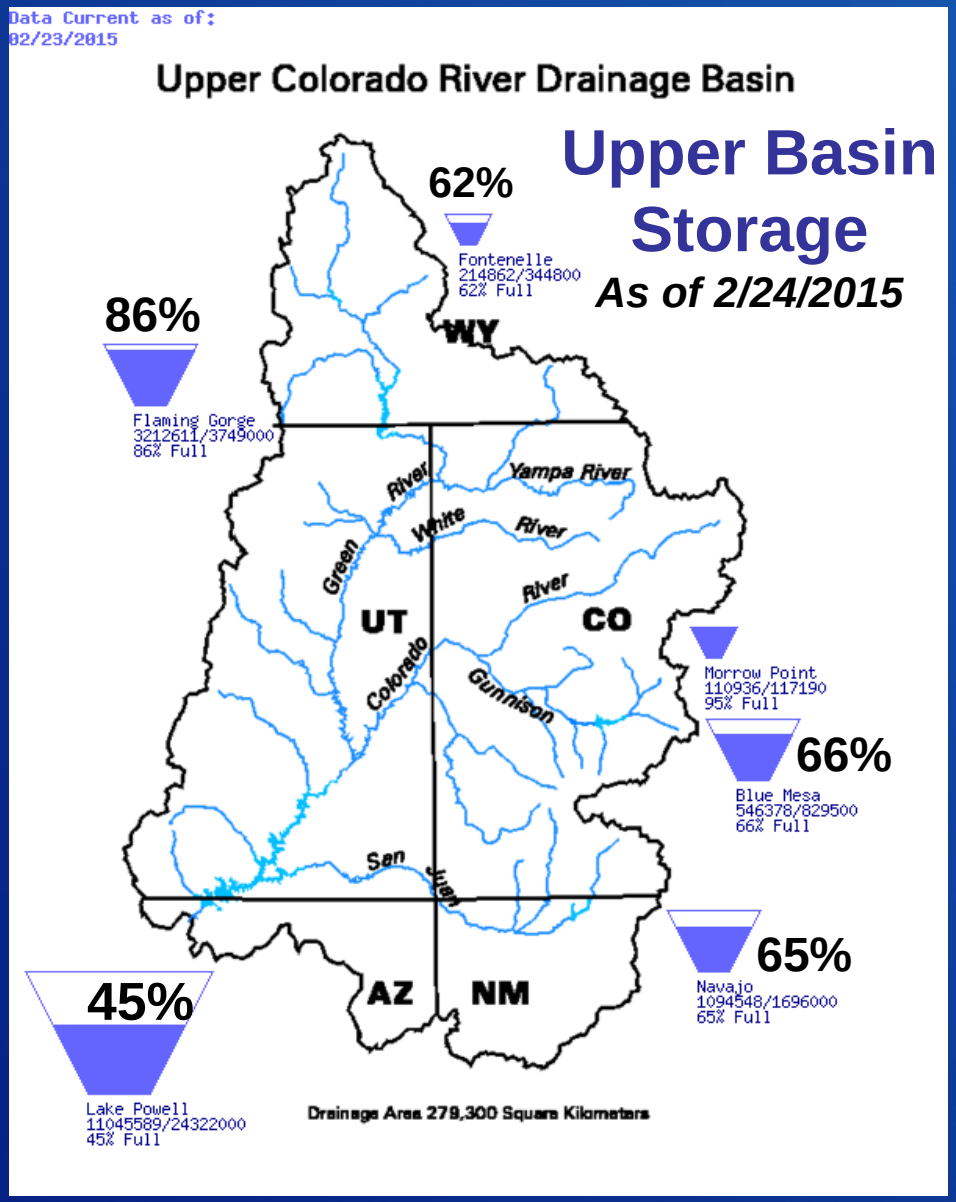


http://www.usbr.gov/uc/water/basin/tc_cr.html

## 2015 April – July Forecast
*issued Feb 2*

| Reservoir | A-J Forecast (KAF) | Percent of Average[1] |
|---|---|---|
| Fontenelle | 725 | 100% |
| Flaming Gorge | 875 | 89% |
| Blue Mesa | 620 | 92% |
| Navajo | 400 | 54% |
| Powell | 5,200 | 73% |

[1] percent of average based on period 1981-2010.

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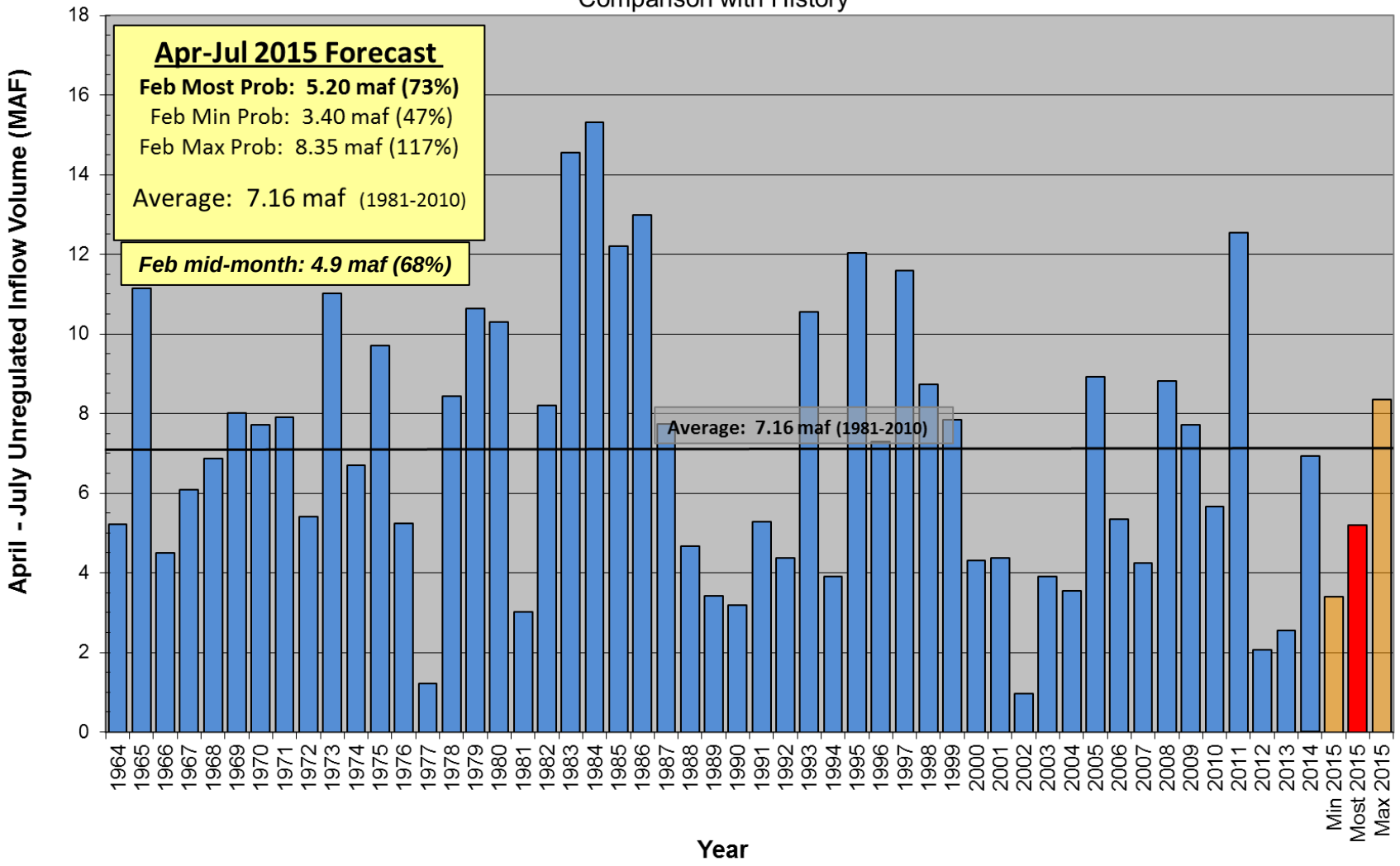
# Lake Powell Unregulated Inflow
## Apr - Jul 2015 Forecast
***Issued Feb 3***
Comparison with History

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# Lake Powell 2015 Operating Tier
## Upper Elevation Balancing

- Tier was set in August 2014
- Start with 8.23 maf release
- Use April 24-Month Study projections of end of water year storage to potentially adjust
- Balancing: 8.23 - 9.0 maf
- Equalization: > 8.23 maf

**Lake Powell**

| 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 |
| 3,636 - 3,666 (2008-2026) | **Upper Elevation Balancing Tier**[3] 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) |
| 3,575 | **Mid-Elevation Release Tier** Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf | 9.5 |
| 3,525 | **Lower Elevation Balancing Tier** Balance contents with a min/max release of 7.0 and 9.5 maf | 5.9 |
| 3,490 | | 4.0 |
| 3,370 | | 0 |

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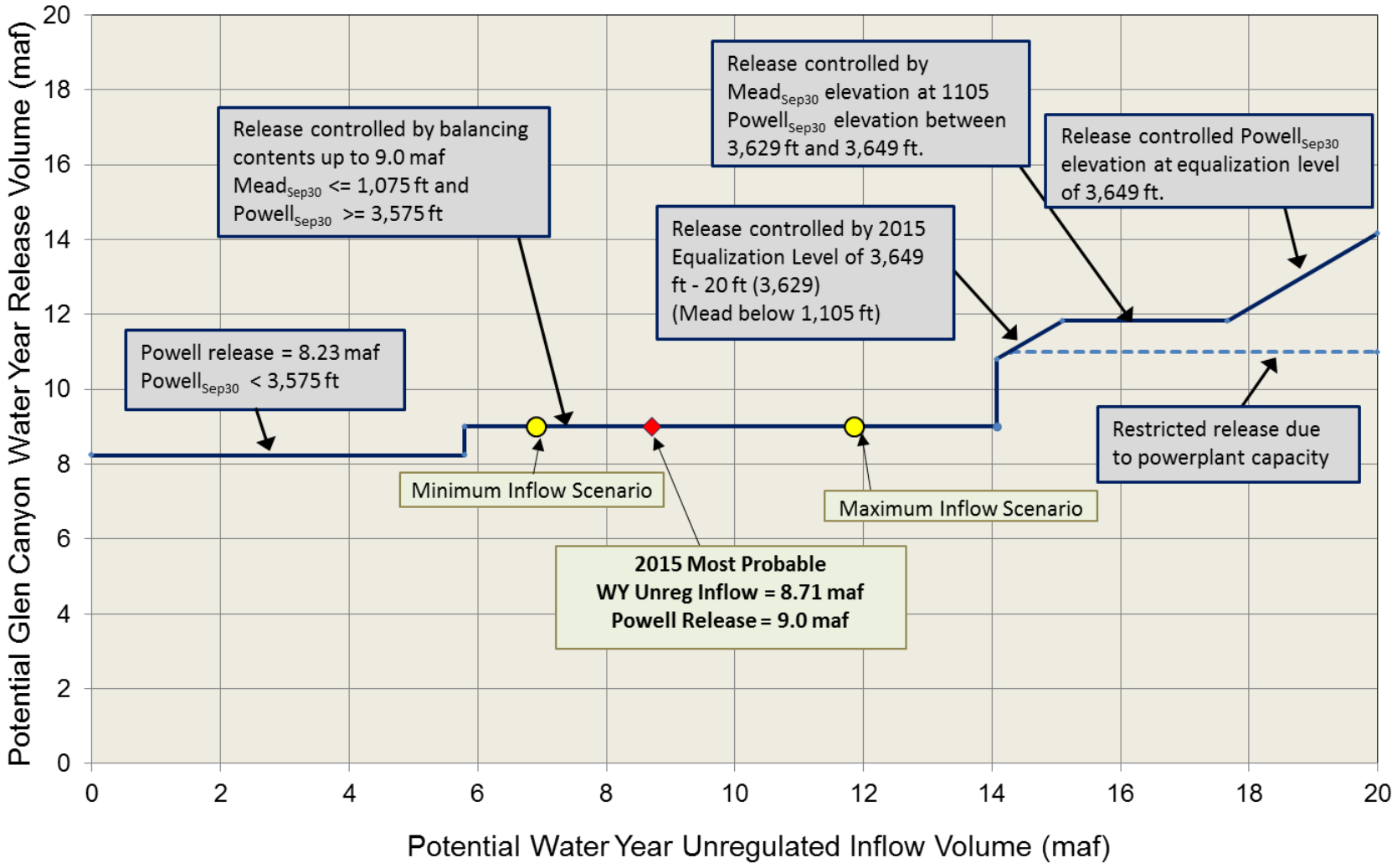
# Potential Lake Powell Release Scenarios

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

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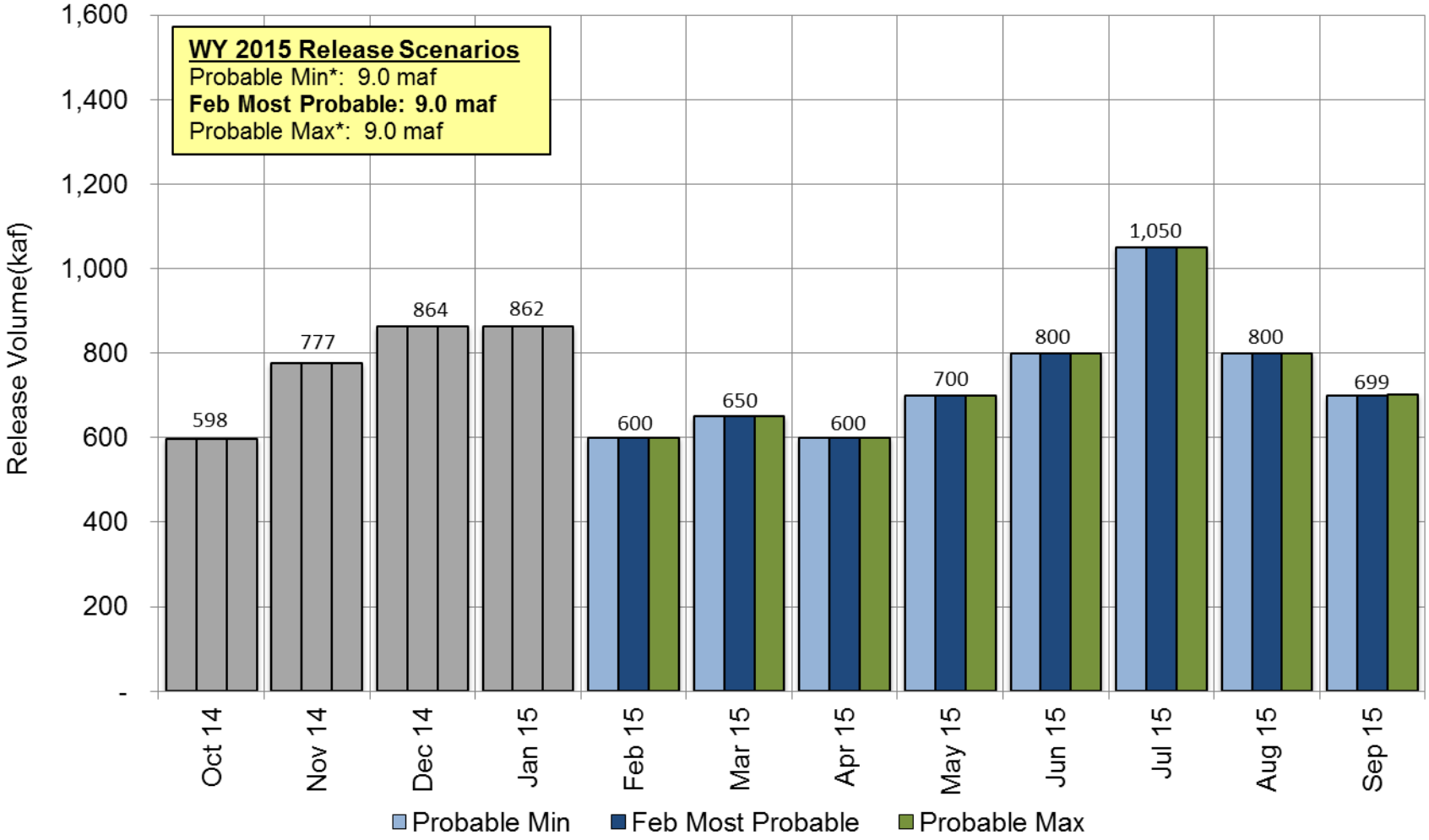
# Projected Lake Powell Monthly Release Volume Distribution

Release Scenarios for Water Year 2015

Updated February 2015




** Probable Min and Max annual release volume is based on January Min and Max inflow forecasts*

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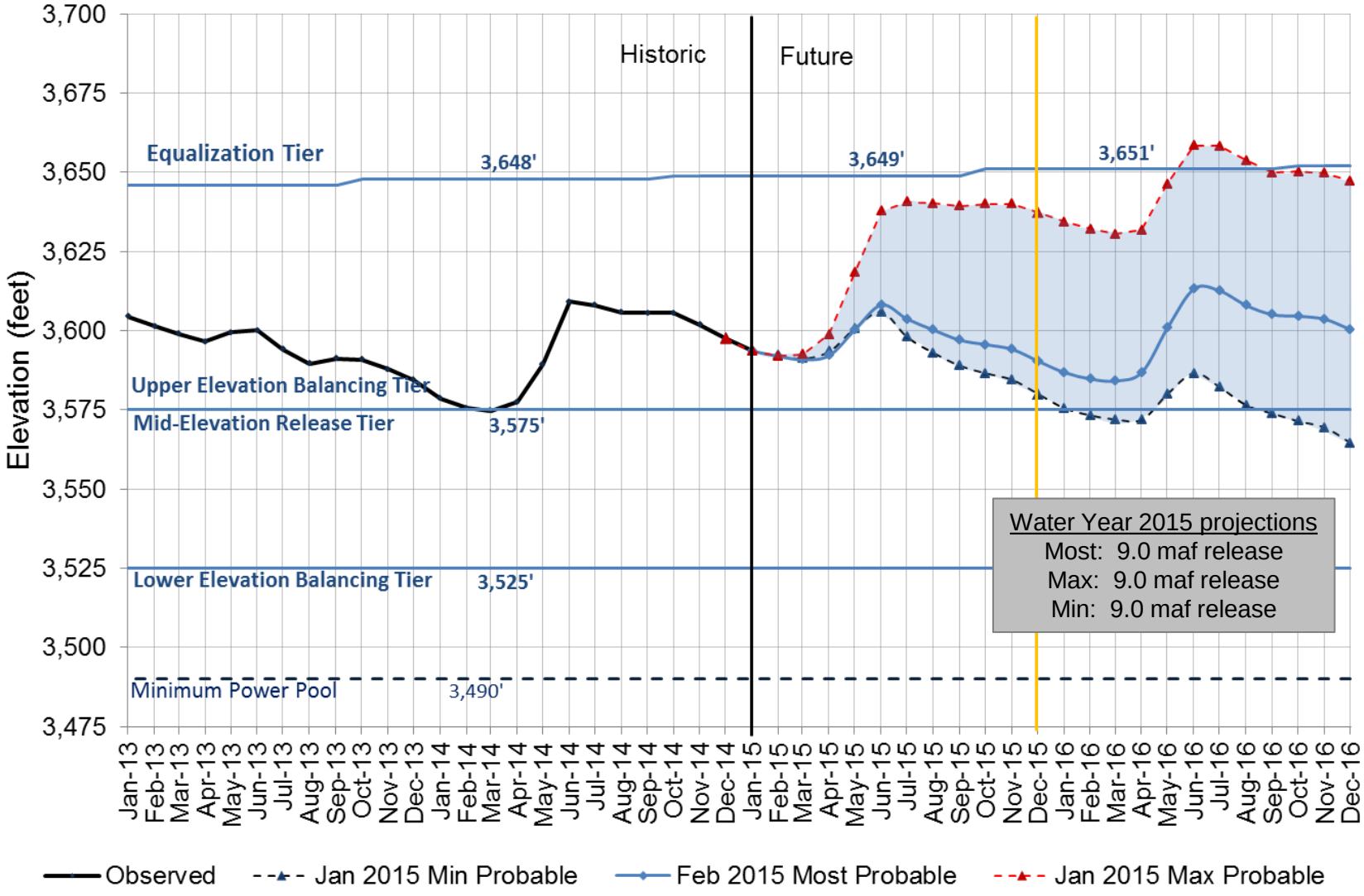
# Lake Powell End of Month Elevations

Historic and projected based on January and February 2015 modeling

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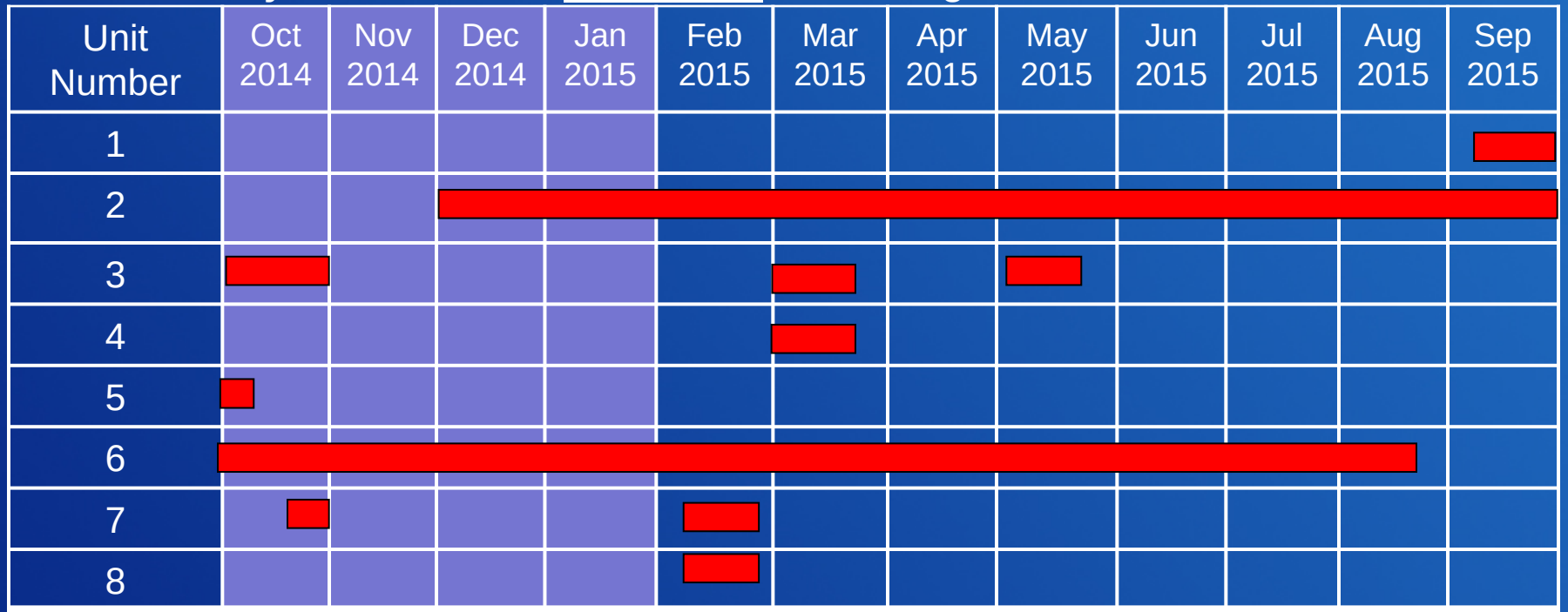
# Glen Canyon Power Plant Provisional Unit Outage Schedule for Water Year 2015



| Unit Number | Oct 2014 | Nov 2014 | Dec 2014 | Jan 2015 | Feb 2015 | Mar 2015 | Apr 2015 | May 2015 | Jun 2015 | Jul 2015 | Aug 2015 | Sep 2015 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units Available | 5 | 7 | 6 | 6 | 4 / 6 | 4 / 6 | 6 | 6 / 5 | 6 | 6 | 6 / 7 | 6 | |
| Capacity (cfs) | 14,400 | 21,500 | 18,000 | 18,000 | 11,400 / 18,000 | 11,300 / 18,000 | 18,000 | 18,000 / 14,500 | 18,000 | 18,000 | 18,000 / 21,400 | 17,700 | |
| Capacity (kaf/month) | 910 | 1,280 | 1,110 | 1,110 | 690 | 750 | 1,070 | 980 | 1,070 | 1,110 | 1,170 | 1,190 | |
| Max (kaf) [1] | -- | -- | -- | -- | 600 | 650 | 600 | 700 | 800 | 1,050 | 800 | 699 | 9.0 |
| Most (kaf) [2] | 598 | 776 | 864 | 862 | 600 | 650 | 600 | 700 | 800 | 1,050 | 800 | 699 | 9.0 |
| Min (kaf) [1] | -- | -- | -- | -- | 600 | 650 | 600 | 700 | 800 | 1,050 | 800 | 699 | 9.0 |

1 Projected release, based on January 2015 Min and Max Probable Inflow Projections and 24-Month Study model runs

2 Projected release, based on February 2015 Most Probable Inflow Projections and 24-Month Study model runs

(updated 2-17-2015)

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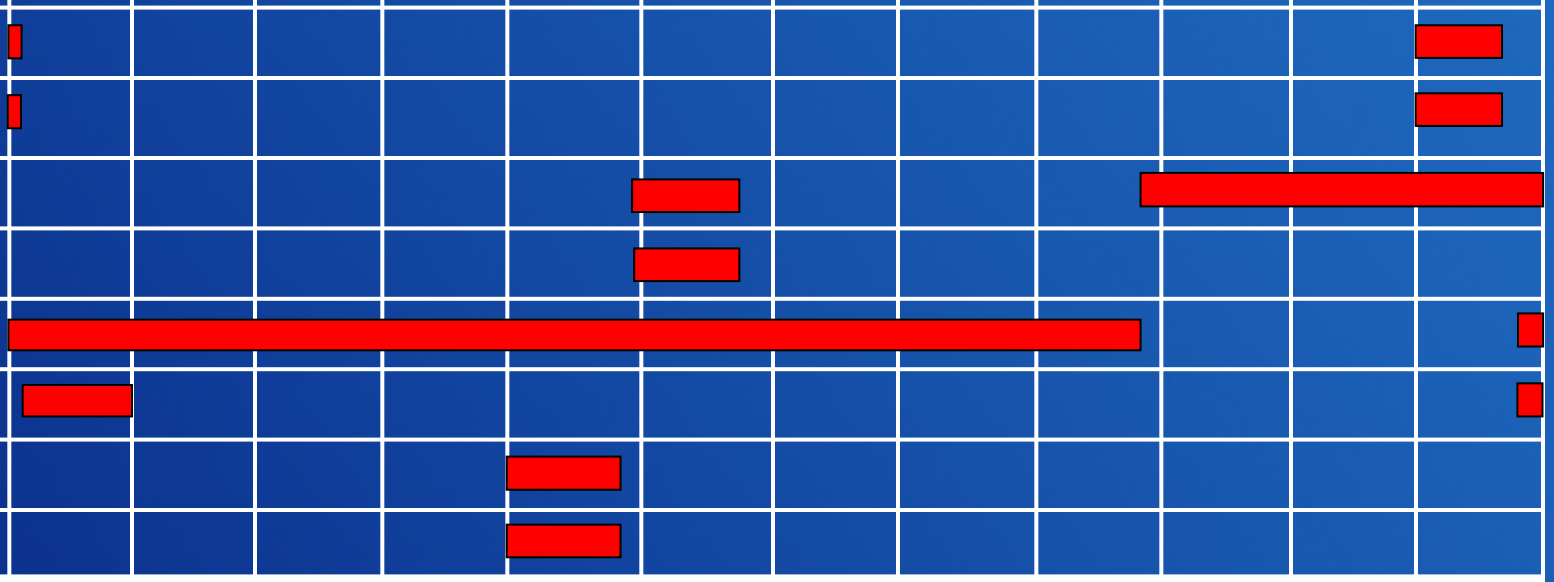
# Glen Canyon Power Plant Provisional Unit Outage Schedule for Water Year 2016



| Unit Number | Oct 2015 | Nov 2015 | Dec 2015 | Jan 2016 | Feb 2016 | Mar 2016 | Apr 2016 | May 2016 | Jun 2016 | Jul 2016 | Aug 2016 | Sep 2016 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units Available | 6 | 7 | 7 | 7 | 5 | 5 / 7 | 7 | 7 | 7 | 7 | 7 | 5 | |
| Capacity (cfs) | 18,100 | **21,500** | **21,500** | **21,500** | **14,900** | **14,900 / 21,500** | **21,500** | **21,500** | **21,500** | **21,400** | **21,400** | **14,300** | |
| Capacity (kaf/month) | 1,100 | 1,280 | 1,280 | 1,270 | 900 | 960 | 1,280 | 1,280 | 1,290 | 1,270 | 1,270 | 940 | |
| Max (kaf) [1] | 600 | 600 | 850 | 950 | 800 | 900 | 1,000 | 1,100 | 1,200 | 1,300 | 1,300 | 1,061 | **11.7** |
| Most (kaf) [2] | 600 | 600 | 800 | 800 | 650 | 650 | 600 | 650 | 800 | 1,000 | 1,050 | 800 | **9.0** |
| Min (kaf) [1] | 600 | 600 | 800 | 800 | 600 | 600 | 600 | 600 | 650 | 850 | 900 | 630 | **8.23** |

**(updated 2-17-2015)**

1 **Projected release, based on January 2015 Min and Max Probable Inflow Projections and 24-Month Study model runs**

2 **Projected release, based on February 2015 Most Probable Inflow Projections and 24-Month Study model runs**

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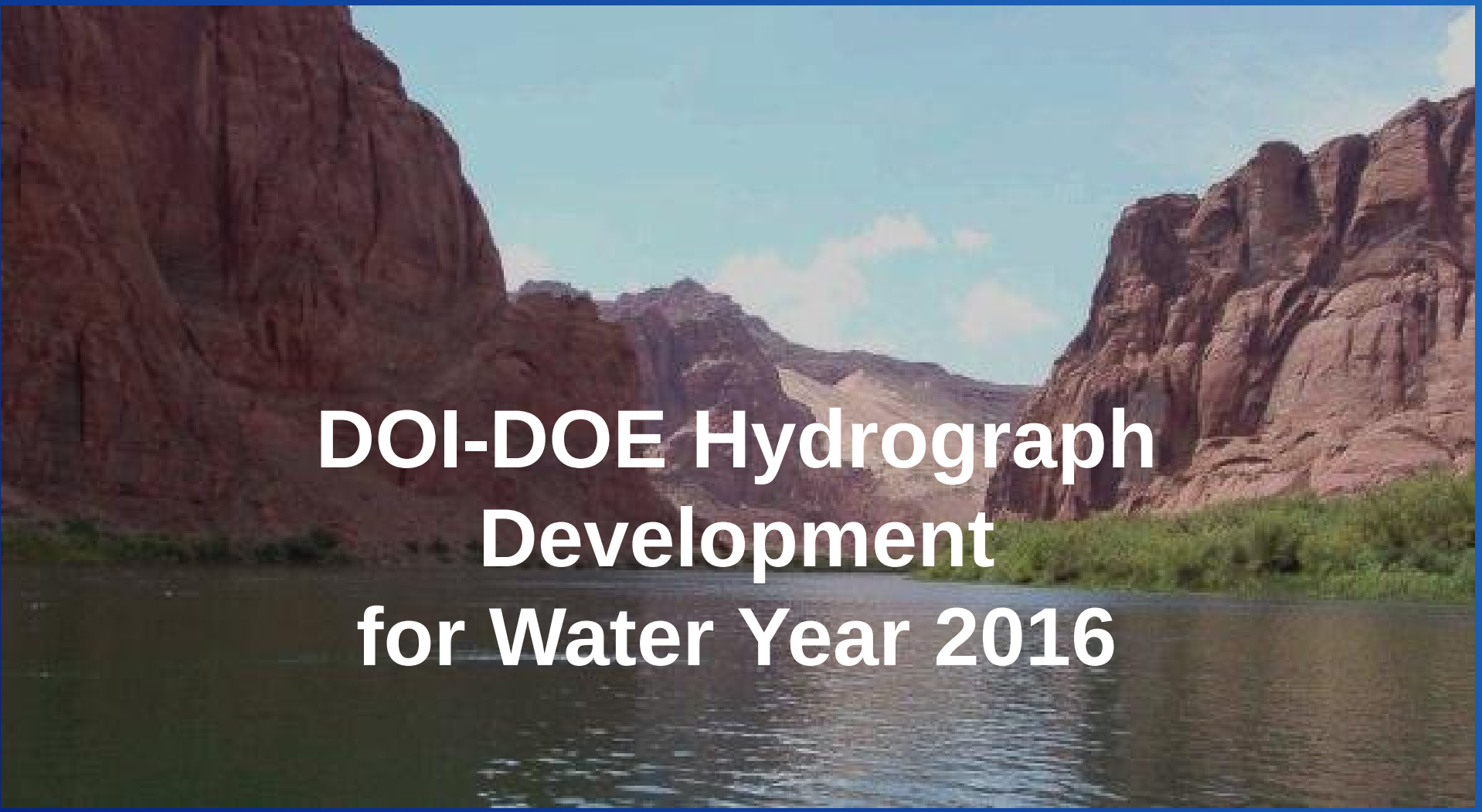

# DOI-DOE Hydrograph Development for Water Year 2016



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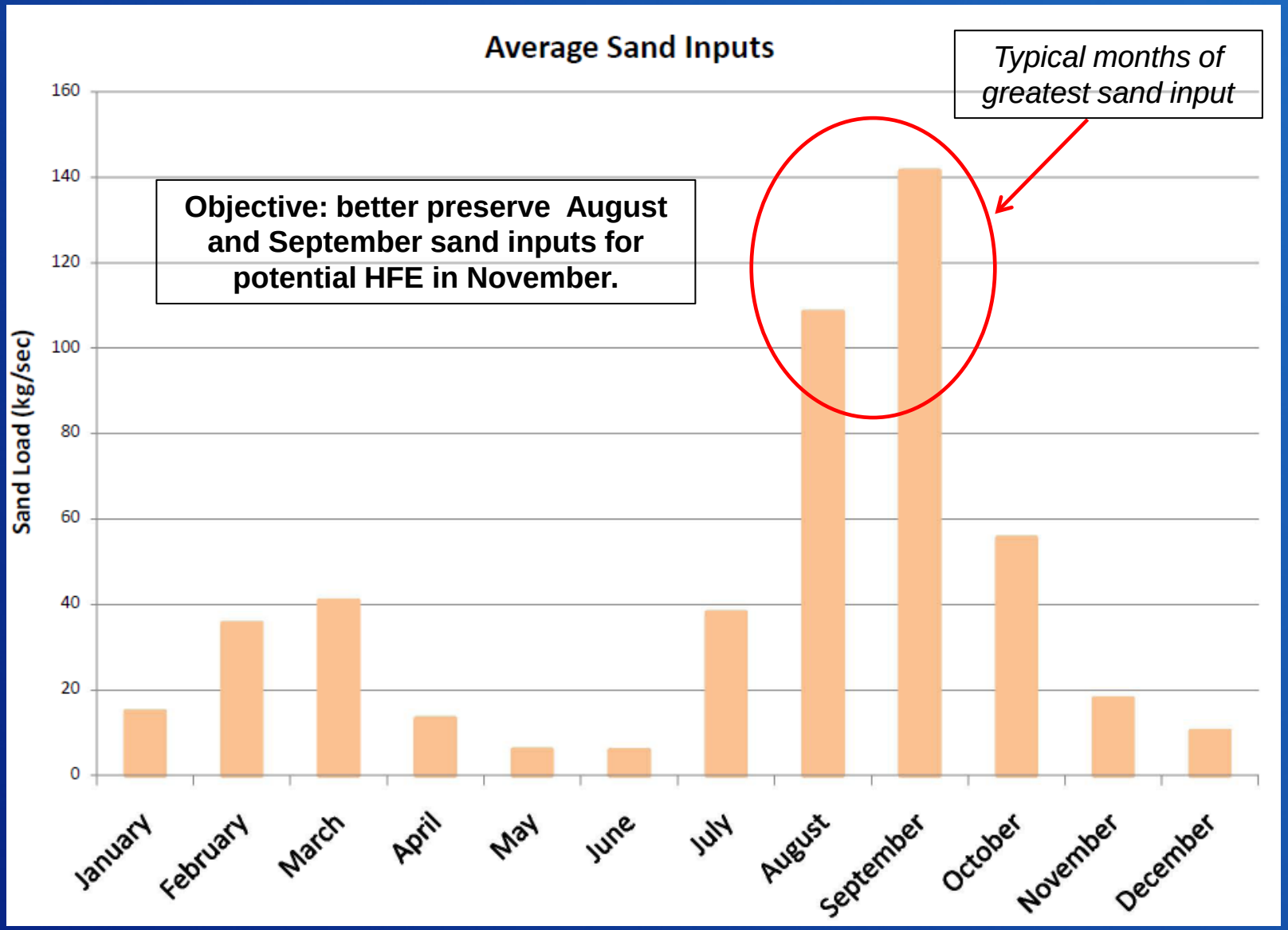
# 2016 Hydrograph Concepts

- Objective– retain sand inputs high in the system in anticipation of a potential HFE

- Target lower August through September releases
- Avoid shifting “extra” water to June (which cools temperatures at the mouth of the LCR)
- Move water from August to other equal value months for hydropower (Dec/Jan)
- Learn from past years’ experience



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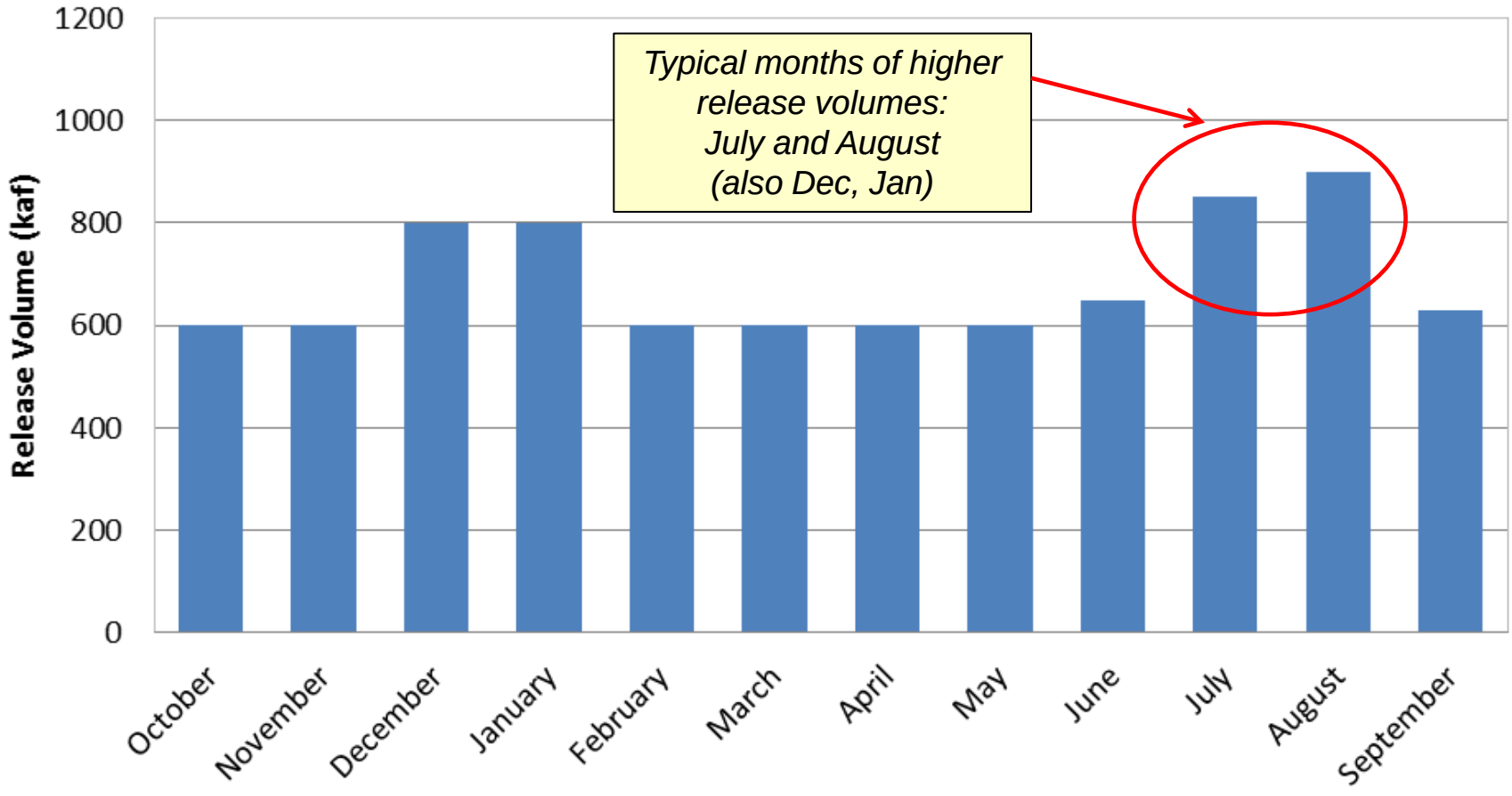
# Typical Annual Release Pattern

## 8.23 maf year



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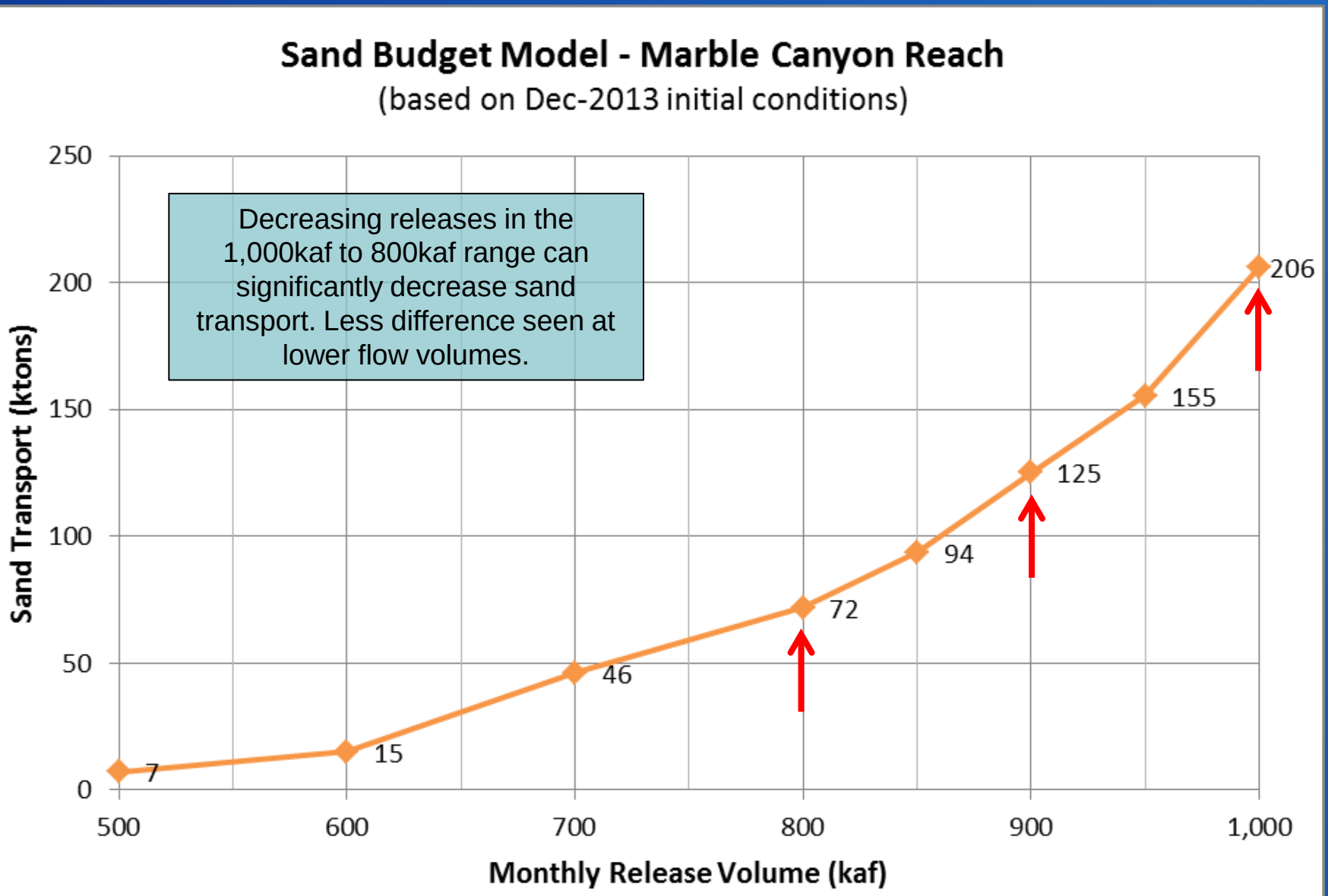




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# 2015 Hydrograph
## Monthly Release Objectives

| Annual Release Volume | June | August | September |
|---|---|---|---|
| less than 9.0 maf | 600 kaf - 650 kaf | 800 kaf | 600 kaf |
| 9.0 maf – less than 9.5 maf | 800 kaf | | 700 kaf |
| 9.5 maf – less than 10 maf | 900 kaf | | 700 kaf |
| 10 maf and greater | more than 900 kaf | | 800 kaf or more |

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# 2016 Projected Annual Release

(Based on January and February 2015 modeling)

- **Min probable**: 8.23 maf release

  (increasing likelihood with decreasing hydrology)
- **Most probable**: 9.0 maf release

  (Upper Elevation Balancing, between 8.23 and 9.0 maf)
- **Max probable**: ~11.7 maf release

  (with April adjustment to equalization)

# 2016 Hydrograph
## Initial Thoughts / Discussions

| Annual Release Volume | June | August | September |
|---|---|---|---|
| less than 9.0 maf | 600 kaf - 650 kaf | 800 kaf | 600 kaf |
| 9.0 maf – less than 9.5 maf | 800 kaf | 850 kaf | 700 kaf |
| 9.5 maf – less than 10 maf | 900 kaf | 900 kaf | 700 kaf |
| 10 maf and greater | 900 kaf or more | 900 kaf or more | 800 kaf or more |

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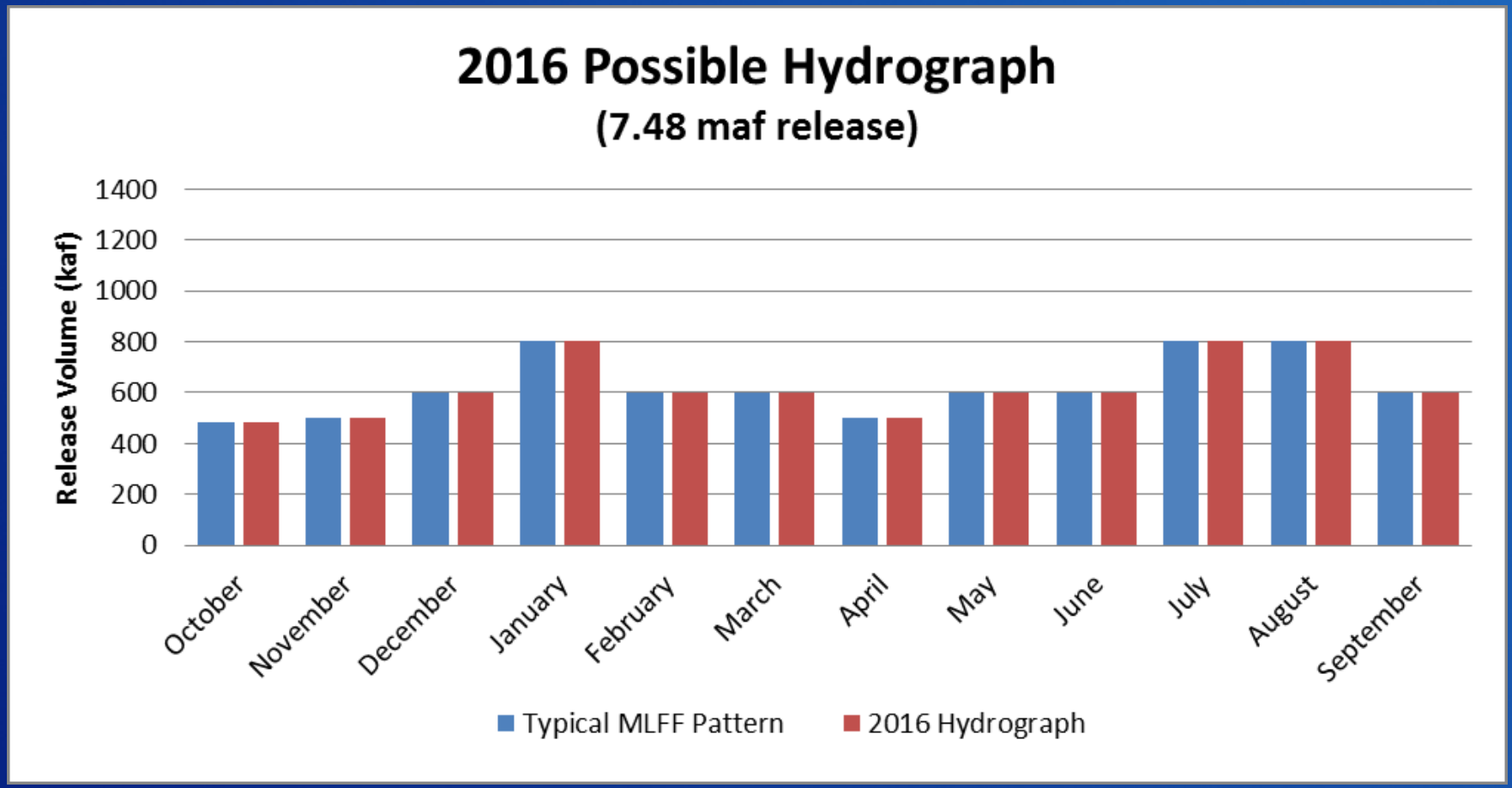
# 2016 Possible Hydrograph
## 7.48 maf release

Release is already low in June, Aug and Sep, no difference

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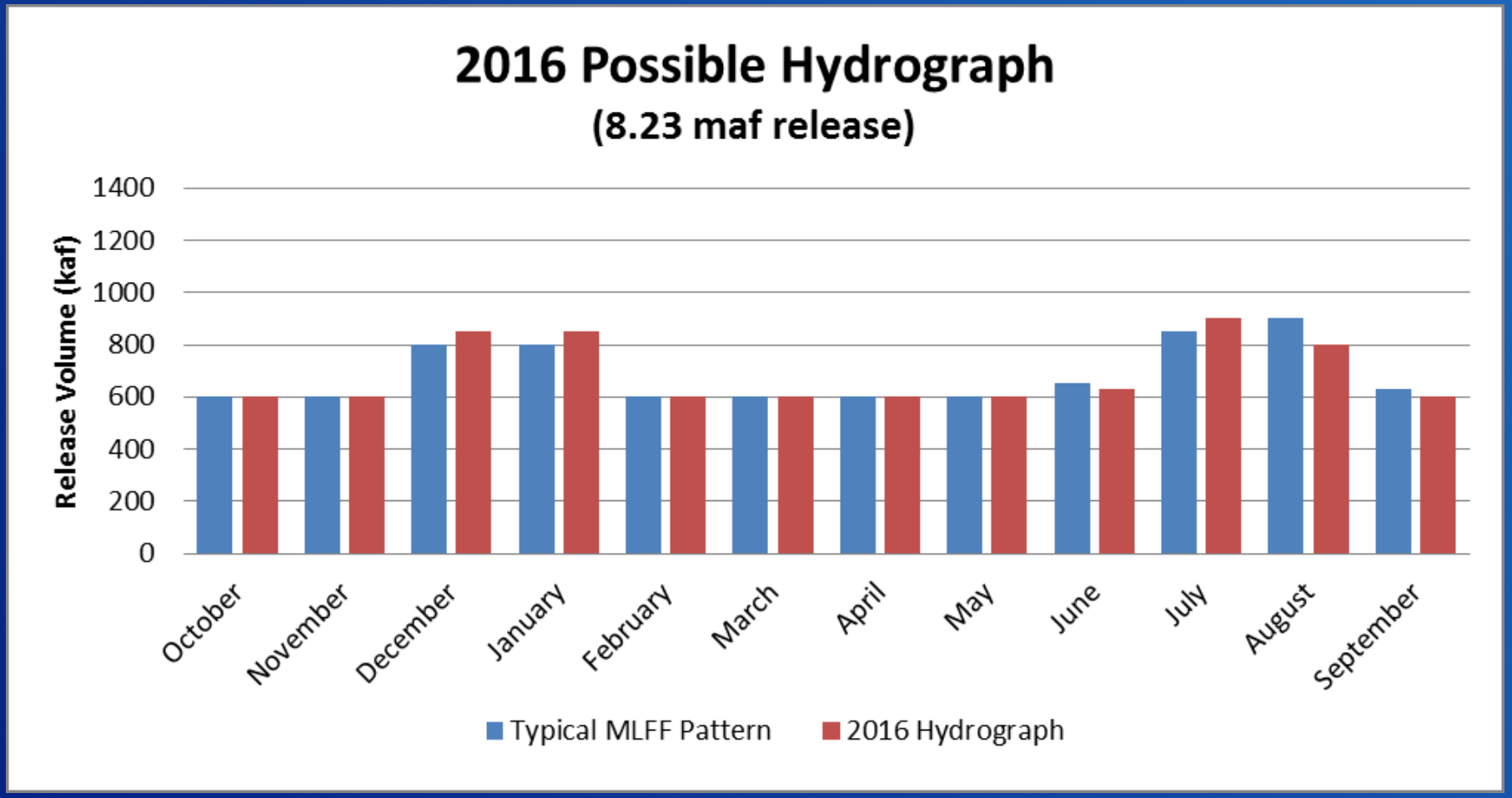
# 2016 Possible Hydrograph
## 8.23 maf release

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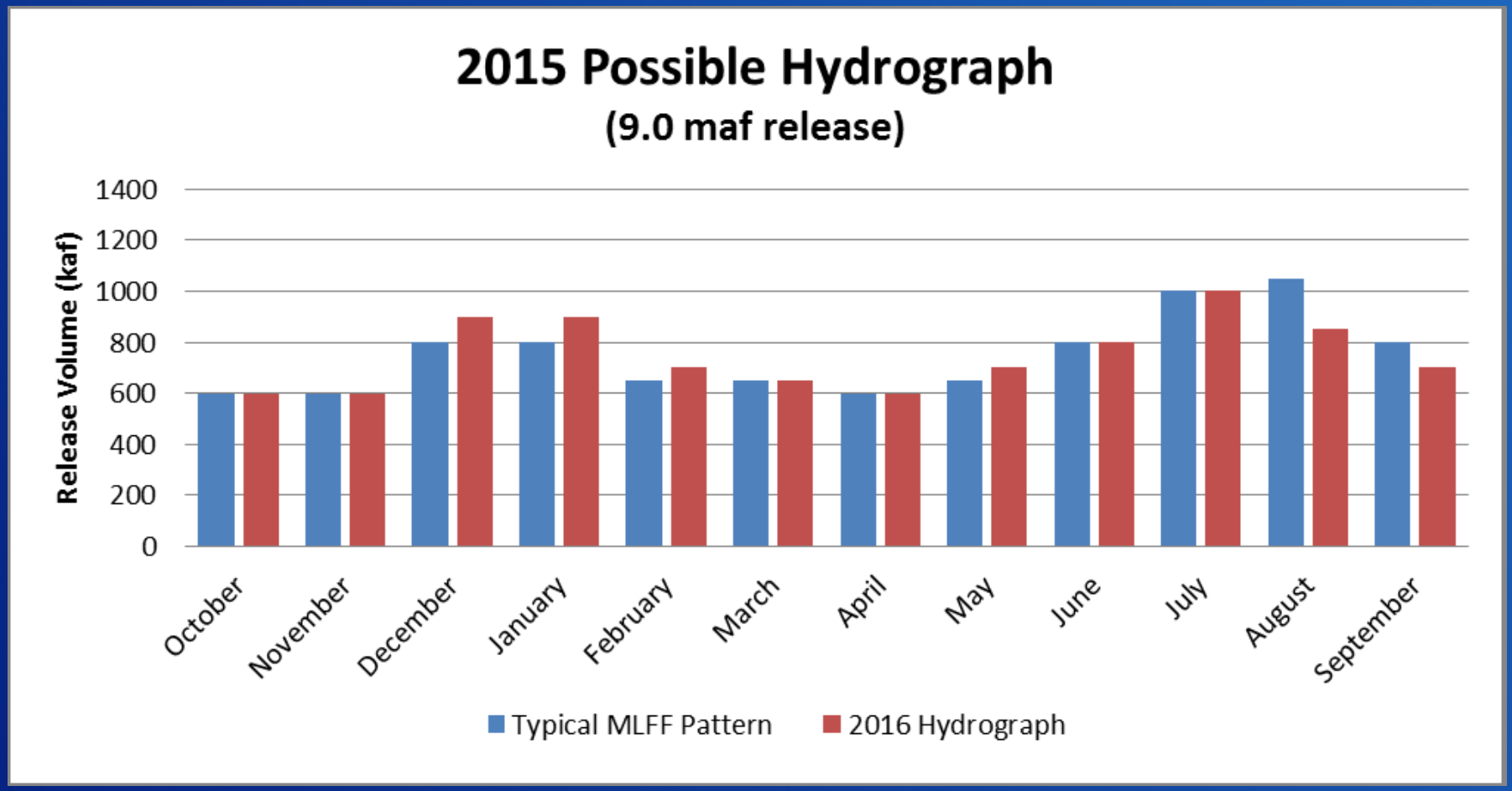
# 2016 Possible Hydrograph
## 9.0 maf release

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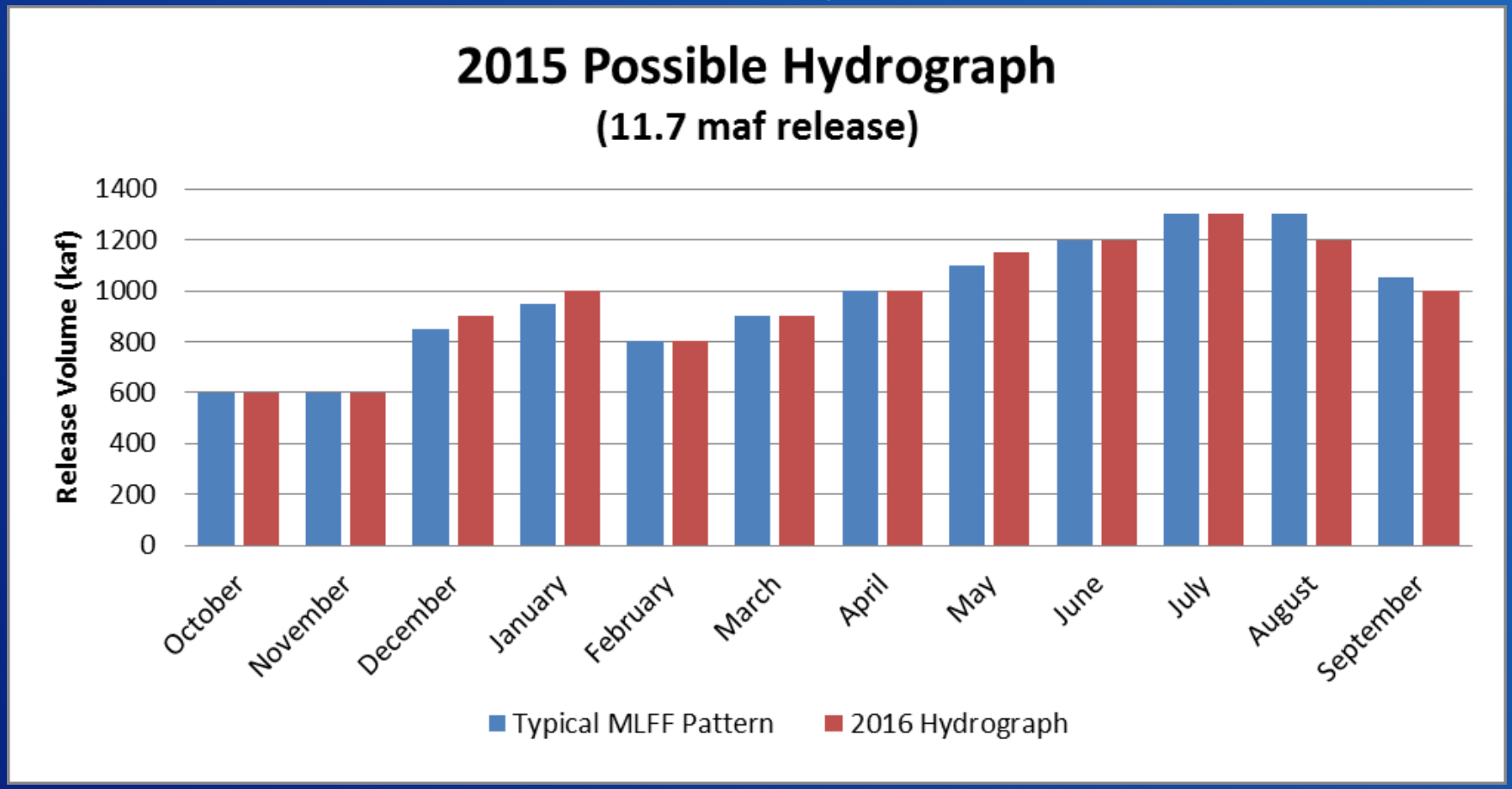
# 2016 Possible Hydrograph
## 11.7 maf release

- Lots of water to move: limited flexibility, minimal difference

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# 2016 Hydrograph Next Steps

- Continue to coordinate with DOI-DOE Agencies
- Evaluate potential impacts of hydrograph release scenarios:
  - Hydropower
  - Sediment
  - Temperature
- Present to TWG in June
- Present to AMWG in August

# Questions?

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Reclamation, Upper Colorado Region
Resource Management Division
Water Resources Group

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