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

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**Agenda Item**
Basin Hydrology, Operations and 2016 Hydrograph Development

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**Action Requested**
Information item only

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

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**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.

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**Relevant Science**
N/A

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**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.
Snow Conditions

Upper Colorado River Basin Snotel Tracking
Aggregate of 116 Snotel Sites above Lake Powell

As of 02/23/2015 with 113 of 116 sites reporting, the basin wide SWE is 80 percent of median.

Snow Water Equivalent
- Less than 50 Percent of Normal
- 50 - 80 Percent of Normal
- 80 - 120 Percent of Normal
- 120 - 150 Percent of Normal
- Greater than 150 Percent of Normal

Data Provided by the Natural Resource Conservation Service
Upper Basin Storage
As of 2/24/2015

86%
Flaming Gorge
82,000/134,000
66% Full

62%
Fontenelle
214,000/344,000
66% Full

66%
Morrow Point
119,000/171,000
98% Full

65%
Blue Mesa
109,000/200,000
65% Full

45%
Navajo
109,000/150,000
65% Full

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.

http://www.usbr.gov/uc/water/basin/tc_cr.html
Lake Powell Unregulated Inflow
Apr - Jul 2015 Forecast
Issued Feb 3
Comparison with History

Apr-Jul 2015 Forecast
Feb Most Prob: 5.20 maf (73%)
Feb Min Prob: 3.40 maf (47%)
Feb Max Prob: 8.35 maf (117%)
Average: 7.16 maf (1981-2010)

Feb mid-month: 4.9 maf (68%)

April - July Unregulated Inflow Volume (MAF)

Year


RECLAMATION
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
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

- Release controlled by balancing contents up to 9.0 maf
  - Mead$_{Sep30} < 1,075$ ft and Powell$_{Sep30} >= 3,575$ ft
- Release controlled by Mead$_{Sep30}$ elevation at 1105
  - Powell$_{Sep30}$ elevation between 3,629 ft and 3,649 ft.
- Release controlled Powell$_{Sep30}$ elevation at equalization level of 3,649 ft.
- Release controlled by 2015 Equalization Level of 3,649 ft - 20 ft (3,629) (Mead below 1,105 ft)
- Restricted release due to powerplant capacity

Potential Glen Canyon Water Year Release Volume (maf)

Potential Water Year Unregulated Inflow Volume (maf)

2015 Most Probable
- WY Unreg Inflow = 8.71 maf
- Powell Release = 9.0 maf

Minimum Inflow Scenario
Maximum Inflow Scenario
Projected Lake Powell Monthly Release Volume Distribution
Release Scenarios for Water Year 2015
Updated February 2015

**WY 2015 Release Scenarios**
Probable Min*: 9.0 maf
Feb Most Probable: 9.0 maf
Probable Max*: 9.0 maf

* Probable Min and Max annual release volume is based on January Min and Max inflow forecasts.
Lake Powell End of Month Elevations
Historic and projected based on January and February 2015 modeling

Water Year 2015 projections
Most: 9.0 maf release
Max: 9.0 maf release
Min: 9.0 maf release
### Glen Canyon Power Plant Provisional Unit Outage Schedule for Water Year 2015

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<td>Capacity (kaf/month)</td>
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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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<td>Capacity (kaf/month)</td>
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<td>1,270</td>
<td>900</td>
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<td>Max (kaf) 1</td>
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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)
DOI-DOE Hydrograph Development for Water Year 2016
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
Objective: better preserve August and September sand inputs for potential HFE in November.
Typical months of higher release volumes: July and August (also Dec, Jan)
Decreasing releases in the 1,000 kaf to 800 kaf range can significantly decrease sand transport. Less difference seen at lower flow volumes.
# 2015 Hydrograph Monthly Release Objectives

<table>
<thead>
<tr>
<th>Annual Release Volume</th>
<th>June</th>
<th>August</th>
<th>September</th>
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<tbody>
<tr>
<td>less than 9.0 maf</td>
<td>600 kaf - 650 kaf</td>
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<td>9.0 maf – less than 9.5 maf</td>
<td>800 kaf</td>
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<td>9.5 maf – less than 10 maf</td>
<td>900 kaf</td>
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<td>700 kaf</td>
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<td>10 maf and greater</td>
<td>more than 900 kaf</td>
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<td>800 kaf or more</td>
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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**

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<th>Annual Release Volume</th>
<th>June</th>
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<th>September</th>
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<td>600 kaf - 650 kaf</td>
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2016 Possible Hydrograph
7.48 maf release

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

2016 Possible Hydrograph
(7.48 maf release)

Release Volume (kaf)

Typical MLFF Pattern  2016 Hydrograph
2016 Possible Hydrograph
8.23 maf release

2016 Possible Hydrograph
(8.23 maf release)
2016 Possible Hydrograph
9.0 maf release

2015 Possible Hydrograph
(9.0 maf release)

- Release Volume (kaf)
- October, November, December, January, February, March, April, May, June, July, August, September

- Typical MLFF Pattern
- 2016 Hydrograph
2016 Possible Hydrograph
11.7 maf release

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