Agenda Item
Basin Hydrology and Operations

Action Requested
✓ Information item only.

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

Previous Action Taken
N/A

Relevant Science
N/A

Background Information
The presentation is intended to provide pertinent information to AMWG members on 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 2014 and provide a general outlook for 2015.

The presentation will cover the implementation of the *Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations of Lake Powell and Lake Mead*, the planned releases from Lake Powell in water year 2014 and the range of potential releases in water year 2015. Such information is provided to assist the AMWG in developing recommendations to the Secretary on the operation of Glen Canyon Dam for water years 2014 and 2015.
Glen Canyon Dam Adaptive Management Work Group  
Agenda Item Information  
May 27, 2014

Agenda Item  
Development of Water Year 2015 Hydrograph

Action Requested
✓ This is an information item.

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

Previous Action Taken
✓ By AMWG:
At the August 2013 AMWG meeting, the following motion was passed:

AMWG recommends to the Secretary of the Interior his approval of the DOI-DOE Proposed Hydrograph for Water Year 2014 as follows:

- **Annual Release Volumes** will be determined in compliance with the 2007 Interim Guidelines (in consultation with the Basin States as appropriate).
- **Monthly Release Volumes** are anticipated to shift depending upon: (1) the Annual Release Volume, and (2) the magnitude of a potential High Flow Experiment in the fall of 2013.
- Monthly Release Volumes may vary within the targets identified below. Any remaining monthly operational flexibility will be used for existing power production operations under the Modified Low Fluctuating Flow (MLFF) alternative selected by the 1996 ROD and contained in the 1995 FEIS and in compliance with all applicable NEPA compliance documents (HFE EA, NNFC EA, 2007 IG).
- **Release objective for June 2014** is 600 kaf to 650 kaf.
- **Release objective for August 2014** is 800 kaf.
- **Release objective for September and October 2014** is 600 kaf to 630 kaf (or less).
- **Monthly Release Volumes** will generally strive to maintain 600 kaf levels in the spring/fall timeframe and 800 kaf in December/January and July/August timeframe.

- Additionally, the Bureau of Reclamation will continue to apply best professional judgment in conducting actual operations and in response to changing conditions throughout the water year. Such efforts will continue to be undertaken in coordination with the DOI/DOE agencies, and after consultation with the Basin States as appropriate, to consider changing conditions and adjust projected operations at Glen Canyon Dam in a manner consistent with the objectives of these parameters as stated above and pursuant to the Law of the River.

Relevant Science  
N/A
Development of 2015 Hydrograph, continued

Background Information
The presentation will include a brief review of the 2014 hydrograph development and an overview of the ongoing 2015 hydrograph development process.

In cooperation with the other federal agencies, Reclamation is continuing the development of Interior’s recommendation for the 2015 Hydrograph. This recommendation will be based upon the scenarios analyzed for the 2014 Hydrograph. Reclamation will review the analyses with the TWG and Interior will provide a recommendation for the AMWG’s consideration later this year.
Basin Hydrology, Operations and 2015 Hydrograph

Adaptive Management Work Group

May 27, 2014
• Upper Colorado River Basin Hydrology

• Glen Canyon Dam Operations (WY 2014 and 2015)
Upper Basin Hydrology

Snowpack peaked at 111% on April 7, 2014

As of May 21st, approximately half of this season's snow remains

Lake Powell Unregulated Inflow
Apr - Jul 2014 Forecast (issued May 2)
Comparison with History

**April - July Forecast**
May Most Prob: 7.55 maf (105%)
May Min Prob: 6.30 maf (88%)
May Max Prob: 9.46 maf (132%)

Average: 7.16 maf (1981-2010)
WY2014 Operations under Interim Guidelines
determined in August 2013 24-Month Study

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<tr>
<th>Scenario</th>
<th>Operational Tier</th>
<th>Annual Release Volume</th>
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* Note that in the Mid-Elevation Release Tier, there is no provision for an April adjustment to the operating tier.
Projected Lake Powell Monthly Release Volume Distribution
May 2014 Release Projections
Water Year 2014

WY 2014 Release: 7.48 maf
For all inflow scenarios
Water Year 2015 Operating Tier will be determined in August 2014.
Lake Powell End of Month Elevations
Historic and projected based on April and May modeling

- **Equalization Tier**: 3,646' Historic, 3,649' Future
- **Upper Elevation Balancing Tier**: 3,575' Historic, 3,575' Future
- **Mid-Elevation Release Tier**: 3,525' Historic, 3,525' Future
- **Lower Elevation Balancing Tier**: 3,525' Historic, 3,525' Future
- **Minimum Power Pool**: 3,490' Historic, 3,490' Future

**WY2015 release projections**
- **Min**: 9.0 maf release
- **Most**: 9.0 maf release
- **Max**: 11.4 maf release

Legend:
- **Observed**
- **Apr 2014 Min Probable**
- **May 2014 Most Probable**
- **Apr 2014 Max Probable**
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1 Projected release, based on April 2014 Min and Max Probable Inflow Projections and 24-Month Study model runs
2 Projected release, based on May 2014 Most Probable Inflow Projections and 24-Month Study model runs

(updated 5-19-2014)
## Glen Canyon Power Plant Provisional Unit Outage Schedule for Water Year 2015

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### Units Available

- Units Available: 5, 7, 6, 6, 4, 6, 6, 6, 6, 6

### Capacity (cfs)

- October: 13,800, 20,600, 17,200, 17,200, 10,700
- November: 10,400, 17,200
- December: 17,400

### Capacity (kaf/month)

- October: 870, 1180, 1060, 1060, 630
- November: 880, 1020
- December: 930, 1060

### Max (kaf)

1. Projected release, based on April 2014 Min and Max Probable Inflow Projections and 24-Month Study model runs

### Most (kaf)

2. Projected release, based on May 2014 Most Probable Inflow Projections and 24-Month Study model runs

### Min (kaf)

- Projected release (updated 5-19-2014)

---

1 Projected release, based on April 2014 Min and Max Probable Inflow Projections and 24-Month Study model runs

2 Projected release, based on May 2014 Most Probable Inflow Projections and 24-Month Study model runs

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**RECLAMATION**
DOI-DOE Hydrograph Development for Water Year 2015
2015 Hydrograph Development

• Start 2012, 2013, and 2014 hydrograph
  – “Targeted Approach”
• Consider operating experiences and input
• Continue to work within existing environmental compliance
2015 Hydrograph Concepts

- Objective: retain sand inputs high in the system in anticipation of a potential HFE in fall 2015

- Target lower August through October 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)
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 1,000kaf to 800kaf range can significantly decrease sand transport. Less difference seen at lower flow volumes.
Temperature Considerations

• Last year FWS suggested we look at ways to improve temperatures at the mouth of the LCR early in the season (June)
• LCR temperatures were found to drop by about 0.5 deg C as releases are increased from 600 to 800 kaf
• Avoid shifting “extra” water into June
2015 Targeted Release Volumes

• **August** releases targeting 800kaf, and adjusted to account for hydrologic uncertainty:
  - January: August target is greater of 800 kaf or 10% remaining annual release volume.
  - February: August target is greater of 800 kaf or 10% remaining annual release volume.
  - March: August target is greater of 800 kaf or 12% remaining annual release volume.
  - April: August target is greater of 800 kaf or 15% remaining annual release volume.
  - May: August target is greater of 800 kaf or 20% remaining annual release volume.
  - June: August target is greater of 800 kaf or 25% remaining annual release volume.
  - July: August target is greater of 800 kaf or 40% remaining annual release volume.
  - August: Release volume established as 100% of remaining annual release volume (release could be less than 800 kaf in some cases).

• **September** releases would adjusted to the forecast as follows:
  - 600 kaf/month for annual releases below 9.0 maf
  - 700 kaf/month for annual release from 9.0 maf up to 10.0 maf
  - 800 kaf/month for annual release from 10.0 maf up to 11.0 maf
  - 900 kaf/month for annual release from 11.0 maf up to 12.0 maf
  - Up to powerplant capacity for high equalization releases

NOTE: Propose same release targets and language as 2013 hydrograph (last time GCD was in Upper Elevation Balancing Tier)
2015 Projected Annual Release
(Based on April and May 2014 modeling)

• **Min probable**: 9.0 maf release
  (Upper Elevation Balancing, with 9.0 release, but 8.23 or 7.48 are still possible if observed 2014 runoff is significantly less than forecasted)

• **Most probable**: 9.0 maf release
  (Upper Elevation Balancing, with 9.0 release)

• **Max probable**: ~11 maf release
  (Upper Elevation Balancing, with April adjustment to equalization)

• GCD Operating Tier will be determined in August
• If Upper Elevation Balancing Tier, potential for April adjustment to equalization.
2015 Possible Hydrograph
7.48 maf release

- Flows are already low – no difference from typical MLFF
2015 Possible Hydrograph
8.23 maf release

2015 Possible Hydrograph
(8.23 maf release)

- **Release Volume (kaf)**

- **Legend**
  - Blue: Typical MLFF Pattern
  - Red: 2015 Hydrograph
2015 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  2015 Hydrograph
2015 Possible Hydrograph
11 maf release

- Lots of water to move: limited flexibility, minimal difference in sand retention or temperature
2015 Hydrograph Next Steps

• Continue to coordinate with DOI-DOE Agencies
• No additional modeling is proposed
  – We have already analyzed the range of annual release volumes in past years:
    • Projected hydropower impacts: GTMax
    • Projected sediment retention: Sand Budget model
    • Projected temperature Impacts
• Present to TWG in June 2014 for review
• If acceptable, TWG will move to AMWG for recommendation to Secretary at August 2014 AMWG meeting.
Questions?

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kgrantz@usbr.gov

Hydraulic Engineer, Glen Canyon Reclamation, Upper Colorado Region
Resource Management Division
Water Resources Group