

RECLAMATION

Managing Water in the West

Flaming Gorge Technical Working Group

Proposed Flow and Temperature Objectives for 2013



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Proposed Flow and Temperature Objectives

Water Year 2013

Introduction

This proposal details the Flaming Gorge Dam 2013 operational plan and is produced pursuant to the February 2006 Record of Decision for the Operation of Flaming Gorge Dam (ROD; Reclamation 2006), the Operation of Flaming Gorge Dam Final Environmental Impact Statement (FEIS; Reclamation 2006), and 2005 Final Biological Opinion on the Operation of Flaming Gorge Dam (2005 BO; Service 2005).

The Flaming Gorge Technical Working Group (FGTWG) was established pursuant to the FEIS and ROD. The ROD clarified the purpose of the FGTWG as limited to proposing specific flow and temperature targets for each year's operations based on current year hydrologic conditions and the conditions of the endangered fish. The FGTWG was also charged with integrating, to the extent possible, any flow requests from The Upper Colorado Endangered Fish Recovery Program (Recovery Program) into the flow proposal so that Recovery Program research could also be facilitated. Members of the FGTWG include biologists and hydrologists from the Bureau of Reclamation (Reclamation), the U.S. Fish and Wildlife Service (Service), and Western Area Power Administration (Western). This group also serves as the informal consultation body for Endangered Species Act compliance as has occurred historically and as directed by the ROD.

In 2000, the Recovery Program issued Flow and Temperature Recommendations for Endangered Fishes in the Green River Downstream of Flaming Gorge Dam, (Muth et al., 2000), (Flow Recommendations). The Flow Recommendations provide the basis for the proposed action outlined described and analyzed in the FEIS. The ROD implements the proposed action by modifying the operations of Flaming Gorge Dam, to the extent possible, to assist in the recovery of endangered fishes, and their critical habitat, downstream from the dam and, at the same time, maintains and continues all authorized purposes of the Colorado River Storage Project, (Reclamation 2006).

Proposed Flow and Temperature Objectives for 2013

Proposed 2013 Spring Flow Objectives

For the purposes of implementing the ROD in 2013, an evaluation has been made of the current hydrologic conditions in the Upper Green River (*i.e.* above Flaming Gorge Dam) and Yampa River Basins. The evaluation centered on the historical unregulated inflow statistics for Flaming Gorge Dam during the period from 1963 through 2012. Based on these statistics and the May 1, 2013 final forecast of 480,000 acre-feet for Flaming Gorge, the hydrologic classification will be moderately dry (70% to 90% exceedance) for spring 2013. The combined April through July forecast of the Yampa River at

Maybell and Little Snake at Lily is 778,000 acre-feet. This forecast would fall into the moderately dry hydrologic classification of the ROD.¹

Reclamation received and provided to the FGTWG a memorandum dated February 26, 2013, from the Director of the Recovery Program providing the Research Request for 2013 Green River Spring Flows (2013 Spring Flow Request). The 2013 Spring Flow Request is that the FGTWG implement the *Study Plan to Examine the Effects of Using Larval Sucker Occurrence in the Green River as a Trigger for Flaming Gorge Dam* (Larval Trigger Study Plan *ad hoc* Committee 2012) (LTSP) and is described in further detail in the Recovery Program Research Request section of this document.

The May final forecasts for both the Upper Green and Yampa River Basin are in the moderately dry hydrologic classification. The Upper Green and Yampa River Basins are anticipated to continue to receive smaller amounts of precipitation through mid-May. Reclamation recommends operating within the official moderately dry hydrologic classification. The LTSP outlines peak flows under the moderately dry classification measured at Jensen, Utah above 8,300 cfs for a period between 7 to 14 days during larval drift. According to the LTSP, these flows will provide connection at the Stewart Lake, Above Brennan and Old Charley Wash floodplains. Reclamation recommends shortening the moderately dry duration during larval drift and decreasing Flaming Gorge Dam releases to base flow levels if peak flows resulting from the combination of Yampa River flows and Flaming Gorge releases no longer provide connection or benefit to razorback sucker and the targeted floodplain gates are closed.

Proposed Base Flow and Temperature Objectives for Base Flows 2013

After the spring flow objectives in Reach 1 and Reach 2 have been achieved, flows should be gradually reduced to achieve base flow levels by no later than July 1, 2013. Base flows in Reaches 1 and 2 should be managed to fall within the prescribed base flow ranges described in the Flow Recommendations based on the observed April through July unregulated inflow into Flaming Gorge Reservoir (Figures 1 and 2). Pursuant to the Flow Recommendations, during the August through November base-flow period, the daily flows should be within $\pm 40\%$ of mean base flow. During the December through February base-flow period, the daily flows should be within $\pm 25\%$ of the mean base flow. Additionally, the mean daily flows should not exceed 3% variation between consecutive days and daily fluctuations at Flaming Gorge Dam should produce no more than a 0.1 meter daily stage change at Jensen, Utah.

Additionally, the temperature of flows should be managed to be at least 18° C for 2 to 5 weeks in Upper Lodore Canyon during the beginning of the base flow period. Water temperatures in the Green River should also be managed to be no more than 5° C colder than those of the Yampa River at the confluence of the Green and Yampa Rivers for the summer period of 2013 (June through August).

¹ Appendix A illustrates the May 1, 2013, final forecast for Flaming Gorge Reservoir and the Yampa River Basin in relation to the hydrologic categories described in the Flow Recommendations.

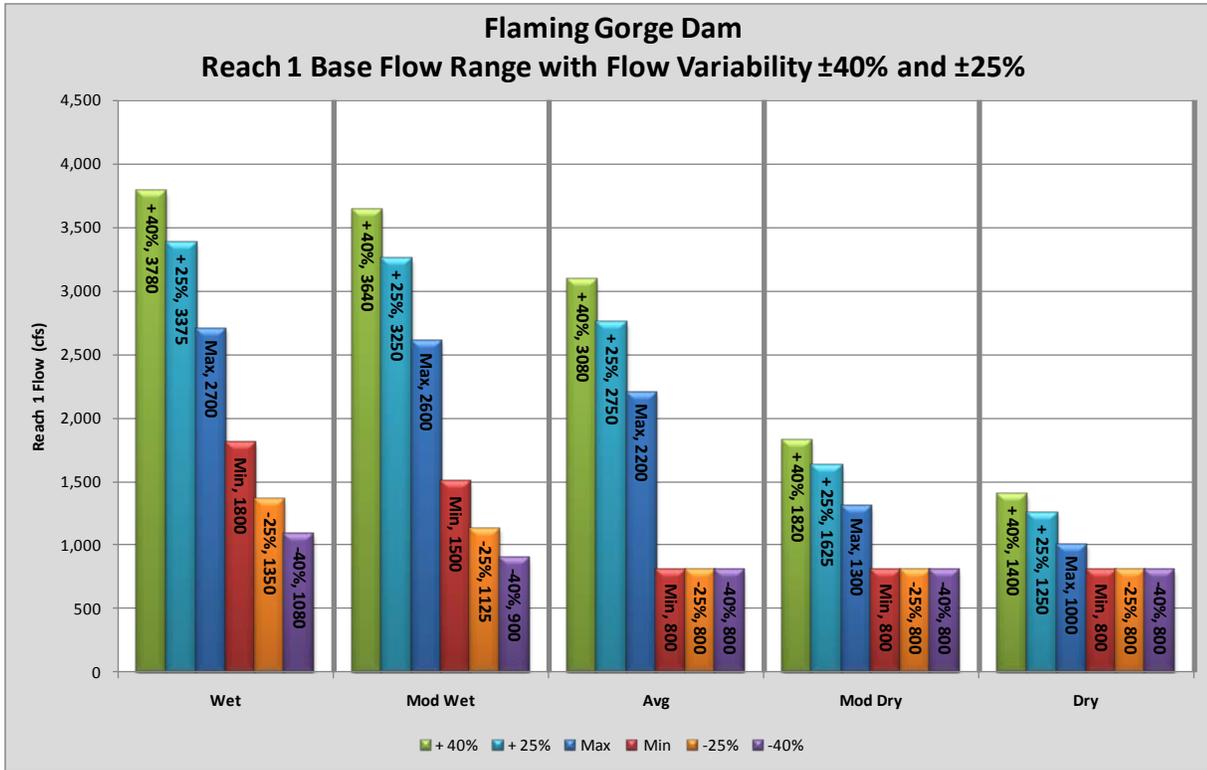


Figure 1 – Reach 1 Base Flow Ranges for each Hydrologic Classification as Outlined in the ROD.

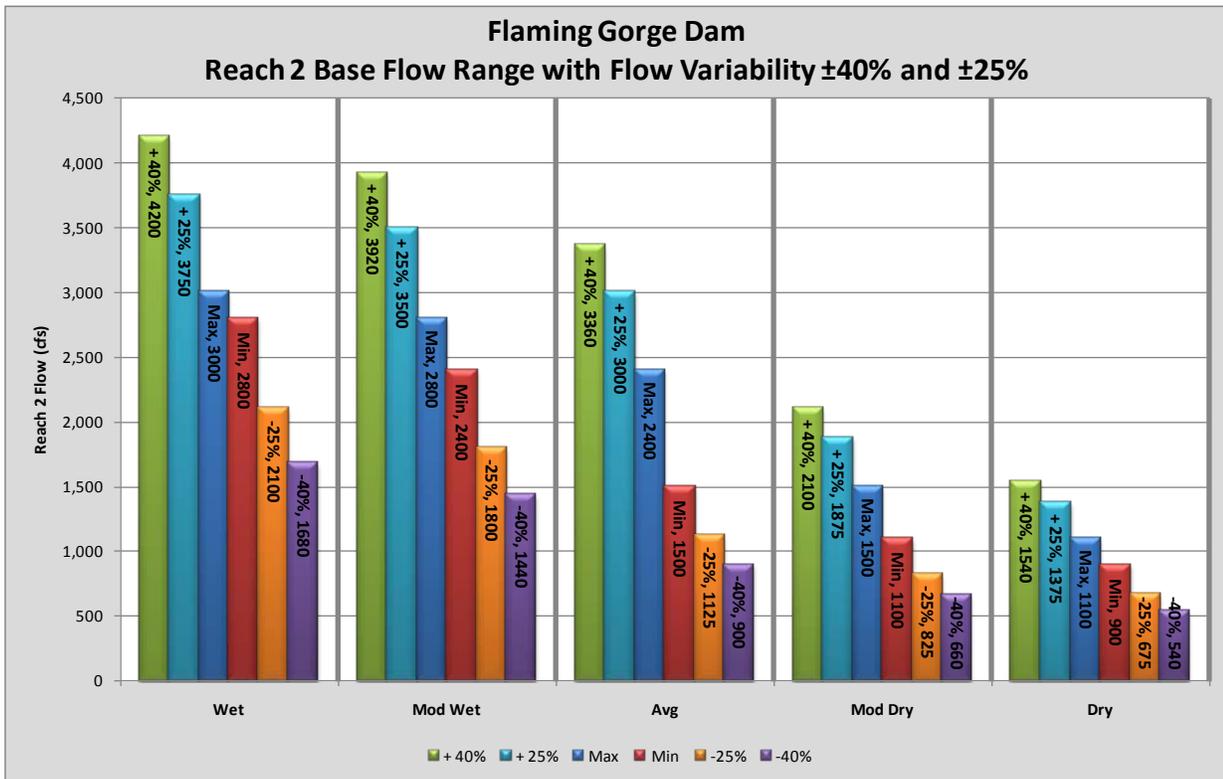


Figure 2 – Reach 2 Base Flow Ranges for each Hydrologic Classification as Outlined in the ROD.

Basin Hydrology

Green River Basin Hydrology

The May 1, 2013, final forecast of April through July unregulated inflow (current forecast) for Flaming Gorge Reservoir is 480,000 acre-feet (AF) (49% of 30-year average). This forecast falls at approximately 87% exceedance based on the historic unregulated inflow record (1963-2012). Figure 3 shows the current forecast in relation to the historic unregulated inflow volumes.

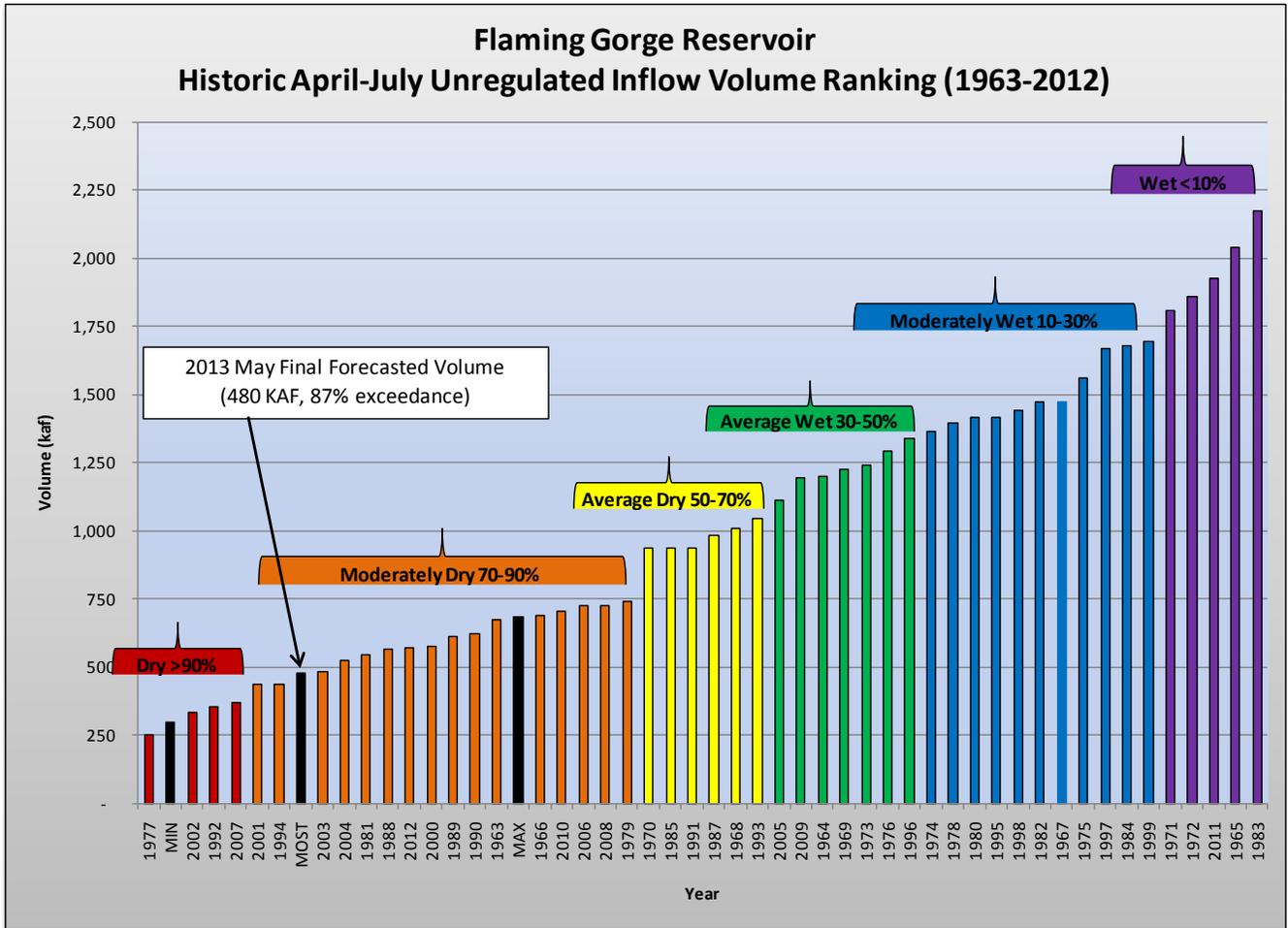


Figure 3 – Flaming Gorge Reservoir May final forecast and ranked historic unregulated April through July inflow volume for years 1963-2012.

As of May 1, 2013, Flaming Gorge Reservoir had a water surface elevation of approximately 6020.5 feet above sea level. There is approximately 3.000 million acre-feet of live storage (79% storage capacity) in Flaming Gorge and approximately 0.75 million acre-feet of space.

Yampa River Basin Hydrology

The combined current forecast for the Little Snake at Lily plus Yampa River at Maybell is 778,000 AF (61% of 30-year average). This forecast falls at approximately 84% exceedance based on a ranking of the historic record (1922-2012). Figure 4 below shows the current forecast in relation to historic flow volumes.

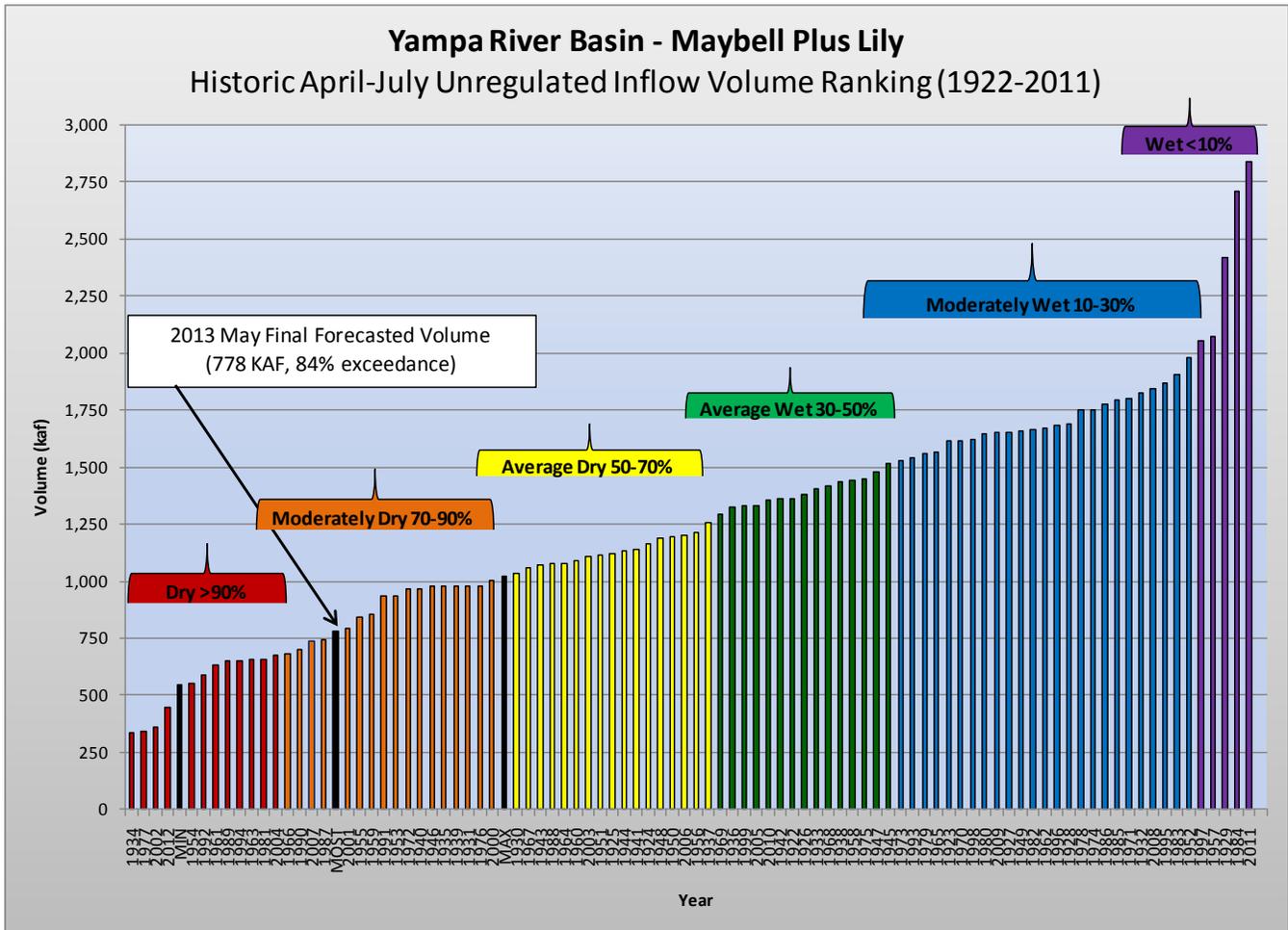


Figure 4 – Yampa River Basin (Maybell plus Lily) current forecast and ranked historic unregulated April through July inflow volume for years 1922-2012.

Hydrologic conditions in the Yampa River Basin are moderately dry and spring runoff conditions will likely have a significant effect on the efficiency of the 2013 spring peak.

Probabilities of Flow Events for Spring 2013

The Flaming Gorge unregulated inflow and Yampa River forecasts are moderately dry and trending solidly toward dry. Conditions this year are uncannily similar to 2012, except with drier antecedent soil conditions and lower reservoir storage. An analysis was completed to assist in the determination of appropriate flow objectives for spring and summer 2013. The ten most similar historic years for the

Yampa River Basin (Maybell plus Lily) compared to the current forecast (Table 1) were analyzed assuming a normal distribution.

The Yampa most probable flow volume of 778,000 AF is close to 2001. Table 2 presents the percent exceedance of cumulative days greater than or equal to various flow levels at Yampa River (Maybell plus Lily). The current analysis indicates that it is unlikely Yampa River flows above 10,000 cfs will be achieved this year.

Table 1
Yampa River (Maybell plus Lily) – April through July Unregulated Volume
Ten Similar Years to the May 1, 2013 Final Forecast
Thousand Acre-Feet (KAF)

Year	April-July Unreg Inflow Volume (KAF)
MIN	546
2004	678
1966	679
1990	703
2007	736
1987	746
MOST	778
2001	790
1955	845
1959	852
1991	934
1953	938
MAX	1,020

Table 2
Spring 2013 – Days above Specific Flow Thresholds in the Yampa River (Maybell plus Lily)
Based on the May 1, 2013, Final Forecast
Percent Exceedance (%)

May Final Forecast	% Exceed	Days above 4,000 cfs	Days above 5,000 cfs	Days above 6,000 cfs	Days above 7,000 cfs	Days above 8,000 cfs	Days above 9,000 cfs	Days above 10,000 cfs
YAMPA	25%	44	35	24	15	8	5	2
	50%	40	31	19	12	3	0	0
	75%	33	17	11	5	1	0	0
	90%	30	14	8	3	0	0	0

Recovery Program Research Request

Reclamation received and provided to the Flaming Gorge Technical Working Group (FGTWG) a memorandum dated February 26, 2013, from the Director of the Upper Colorado River Endangered Fish Recovery Program (Recovery Program) providing the Recovery Program's Research Request for 2013 Green River Spring Flows (2013 Spring Flow Request).

The Recovery Program requests that the FGTWG implement the LTSP by matching Recovery Program research needs identified in the LTSP with the best available spring flow forecast information to develop a specific Reach 2 floodplain connection scenario. The LTSP describes a range of floodplain scenarios that they would like to study and how they would evaluate the results. Additionally, the 2013 Spring Flow Request's primary objective is to build on past research to benefit the razorback sucker population throughout the Green River by timing the river-floodplain connection with the presence of wild-produced razorback sucker larvae. (2013 Spring Flow Request) The 2013 Spring Flow Request supports operations consistent with the 2005 BO and ROD.

The 2013 Spring Flow Request references research regarding the magnitude and period of inundation at the Stewart Lake site. Stewart Lake was limited last spring due to sedimentation in the inlet channel that occurred during the high flows of 2011. During summer 2012, UDWR excavated the inlet channel to restore connection conditions more consistent with those described for this site in the LTSP. Also, personnel from Western Area Power Administration (Western), Argonne National Laboratories (funded by Western), and the Recovery Program surveyed Reach 2 levee breach elevations in Autumn 2012 to better assess connection flows for future LTSP experimentation. The Recovery Program is hopeful the results of those surveys are available to the Recovery Program and the FGTWG this spring. (2013 Spring Flow Request)

The experimental timetable is to achieve three years of flows at Jensen, Utah, below 18,600 cfs, and three years above 18,600 cfs, with connecting flows in each of these years of at least seven days duration. However, spring peak flow magnitudes will be driven by hydrologic conditions in the Upper Green River Basin; therefore, it may not be possible to complete the experiment in six consecutive years. (2013 Spring Flow Request)

Table 3 is a copy of the matrix found in Table 2 of the LTSP. It describes the flow conditions and corresponding wetlands.

Table 3 – LTSP TABLE 2. Matrix to Be Used in Studying the Effectiveness of a Larval Trigger

Peak Flow (x) as Measured at Jensen, Utah	Potential Study Wetlands ^(a,b)	Number of Days (x) Flow Exceeded and Corresponding Hydrologic Conditions ^(c)		
		$1 \leq x < 7$	$7 \leq x < 14$	$x \geq 14$
$8,300 \leq x < 14,000$ cfs	Stewart Lake (f), Above Brennan (f), Old Charley Wash (s)	Dry	Moderately dry	Moderately dry and average (below median)
$14,000 \leq x < 18,600$ cfs	Same as previous plus Thunder Ranch (f), Bonanza Bridge (f), Johnson Bottom (s), Stirrup (s), Leota 7 (s)	Average (below median)	Average (below median)	Average (below median)
$18,600 \leq x < 20,300$ cfs	Same as previous	Average (above median)	Average (above median)	Average (above median)
$20,300 \leq x < 26,400$ cfs	Same as previous plus Baeser Bend (s), Wyasket (s), additional Leota units (7a and 4), Sheppard Bottom (s)	Moderately wet	Moderately wet	Moderately wet
$x \geq 26,400$ cfs	Same as previous	Wet	Wet	Wet
<p>f = flow-through wetland, s = single-breach wetland Up to eight wetlands would be sampled in a given year with the three in the lowest flow category being sampled in all years. Refer to Table [4] for exceedance percentages and peak flow recommendations for each hydrologic condition. Note that the hydrologic conditions presented are the driest that could support a particular combination of peak flow magnitude and duration. For any combination, wetter hydrology could also support an experiment.</p>				

Record of Decision Spring Flow Objectives

The FEIS specifically addresses the content of this operating plan in Section 2.5.3.1. The operating plan is to describe the current hydrologic classification of the Green River and Yampa River Basins, including the most probable runoff patterns for the two basins. This information has been provided above. The operating plan is also to identify the most likely Reach 2 flow magnitudes and durations that are to be targeted for the upcoming spring release. It further specifies that “[b]ecause hydrologic conditions often change during the April through July runoff period; the operations plan would contain a range of operating strategies that could be implemented under varying hydrologic conditions. Flow and duration targets for these alternate operating strategies would be limited to those described for one classification lower or two classifications higher than the classification for the current year.”

The potential classifications for 2013 are as follows:

Moderately Dry Classification

If the April through July unregulated inflow into Flaming Gorge Reservoir remains in the range from 428,000 AF to 779,000 AF the hydrological classification would be moderately dry. The ROD spring flow objectives for moderately dry years are:

The peak flow as measured at Jensen, Utah this year would correspond with the moderately dry hydrologic condition. The LTSP outlines moderately dry flows between 8,300 cfs and 14,000 cfs at Jensen for a period between 7 to 14 days, and minimum seven-day duration. These flows provide connection at the Stewart Lake, Above Brennan and Old Charley Wash floodplains.

The ROD spring flow objectives for moderately dry years are:

Table 4 – Moderately Dry Spring Flow Objectives

Reach	Spring Peak Magnitude (cfs)	Spring Peak Duration
Reach 1	≥ 4,600 cfs	That necessary to achieve duration target in Reach 2
Reach 2	≥ 8,300 cfs	1 week (i.e. 7 days)

Flow Recommendations and FEIS

Dry Classification

Hydrologic conditions are similar to those in the spring of 2012. It is likely that hydrologic conditions into Flaming Gorge Reservoir will change before implementation of the proposed 2013 flow objectives. In the event conditions become drier and the Flaming Gorge Reservoir unregulated inflow forecast for April through July falls below 428,000 AF, the hydrological classification would be dry.

The peak flow as measured at Jensen, Utah, would correspond with the dry hydrologic condition with flows greater than 8,300 cfs for a period between 1 to 7 days, with an attempt to meet the minimum seven-day duration. These flows provide connection at the Stewart Lake, Above Brennan and Old Charley Wash floodplains.

ROD spring flow objectives for dry years are:

Table 53 – Dry Spring Flow Objectives

Reach	Spring Peak Magnitude (cfs)	Spring Peak Duration
Reach 1	≥ 4,600 cfs	That necessary to achieve duration target in Reach 2
Reach 2	≥ 8,300 cfs	2 days or more except in extremely dry years (>98% exceedance)

Flow Recommendations and FEIS

Average (Below Median) Classification

If conditions become wetter than the current forecast at Flaming Gorge Reservoir and the April through July forecast increases above 779,000 AF, the hydrological classification would be average (below median). ROD spring flow objectives for average (below median) years are:

Table 6 – Average (Below Median) Spring Flow Objectives

Reach	Spring Peak Magnitude (cfs)	Spring Peak Duration
Reach 1	≥ 4,600 cfs	That necessary to achieve duration target in Reach 2
Reach 2	≥ 8,300 cfs in 50% of average years	One week (i.e. 7 days) in 50% of average years

Flow Recommendations and FEIS

Average (Above Median) Classification

If conditions become wetter than the current forecast at Flaming Gorge Reservoir and the April through July forecast increases above 1,045,000 AF, the hydrological classification would be average (above median). ROD spring flow objectives for average (above median) years are:

Table 7 – Average (Above Median) Spring Flow Objectives

Reach	Spring Peak Magnitude (cfs)	Spring Peak Duration
Reach 1	≥ 4,600 cfs	That necessary to achieve duration target in Reach 2
Reach 2	≥ 18,600 cfs in 50% of average years	Two weeks (i.e. 14 days) in 25% of all average years

Flow Recommendations and FEIS

Literature Cited

Bureau of Reclamation. 2005. Operation of Flaming Gorge Dam Final Environmental Impact Statement. U.S. Department of the Interior, Bureau of Reclamation, Salt Lake City, Utah.

Bureau of Reclamation. 2006. Record of Decision on the operation of Flaming Gorge Dam Final Environmental Impact Statement. U.S. Department of the Interior, Bureau of Reclamation, Salt Lake City, Utah.

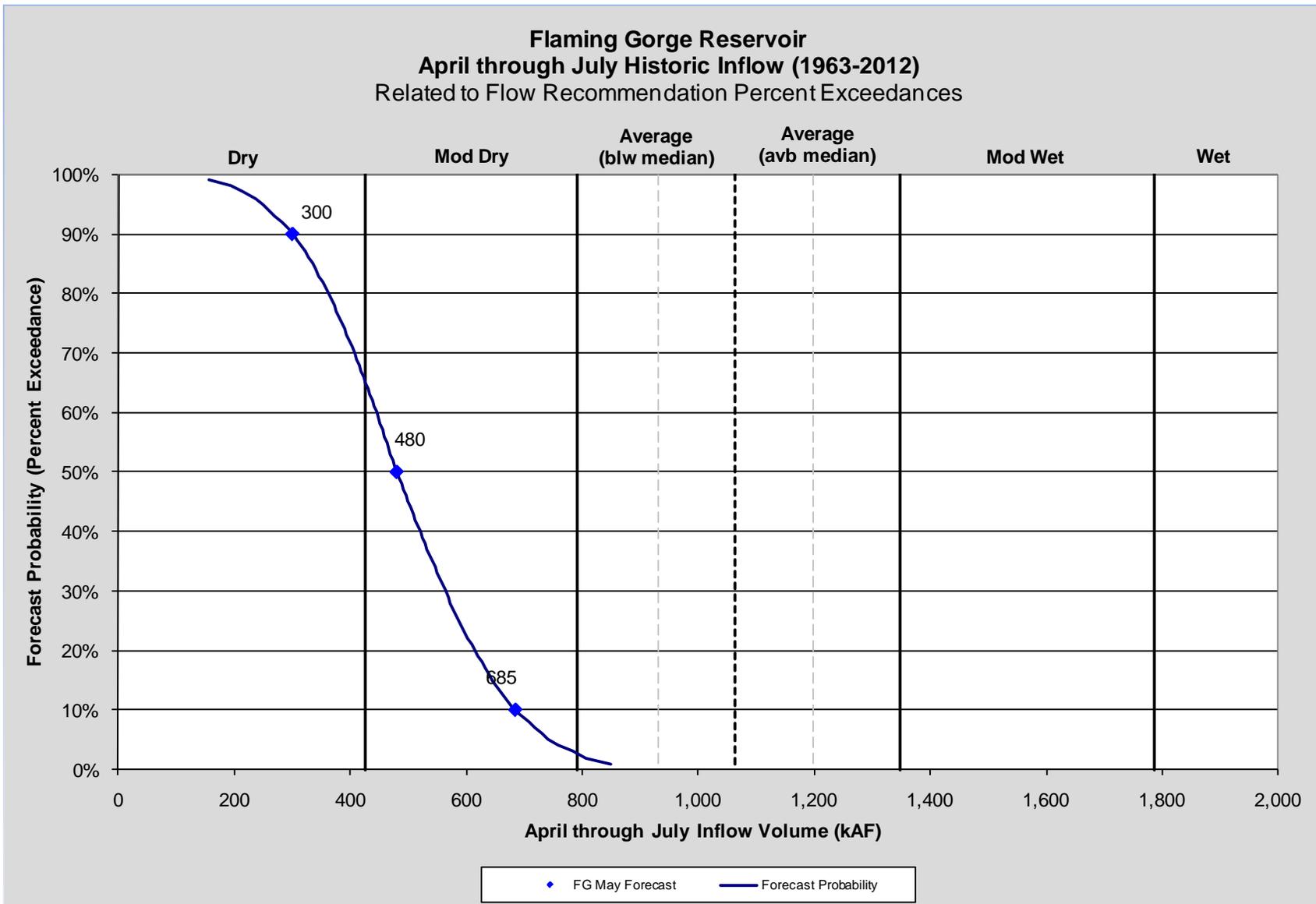
Larval Trigger Study Plan ad hoc Committee. 2012. Study Plan to Examine the Effects of Using Larval Razorback Sucker Occurrence in the Green River as a Trigger for Flaming Gorge Dam Peak Releases. U.S. Fish and Wildlife Service, Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Muth, R.T., L.W. Crist, K.E. LaGory, J.W. Hayse, K.R. Bestgen, T.P. Ryan, J.K. Lyons, and R.A. Valdez. 2000. Flow and temperature recommendations for endangered fishes in the Green River downstream of Flaming Gorge Dam. Final Report to Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Upper Colorado River Endangered Fish Recovery Program. February 26, 2013. Memorandum to Larry Walkoviak and Heather Hermansen. Recovery Program Research Request for 2013 Green River Spring Flows. U.S. Fish and Wildlife Service, Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

APPENDIX A

March 4, 2013 Final Forecasted April through July Inflow Volumes for Flaming Gorge Reservoir, Yampa River (Maybell plus Lily) and Jensen, Utah (sum of Flaming Gorge and Yampa)



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