RECLAMATION

Managing Water in the West

Annual Report of Operations For Flaming Gorge Dam Water Year 2016

U.S. Department of the Interior
Bureau of Reclamation

August 2017

Table of Contents

Appendices

Annual Report of Operations for Flaming Gorge Dam

Water Year 2016

Introduction

This report details the operations of Flaming Gorge Dam during water year 2016[1], and is produced pursuant to the February 2006 Record of Decision for the Operation of Flaming Gorge Dam (ROD)[2], the Operation of Flaming Gorge Dam Final Environmental Impact Statement (FEIS)[3] and 2005 Final Biological Opinion on the Operation of Flaming Gorge Dam (2005 BO)[4]. This is the 11th year of operations of Flaming Gorge Dam under the ROD and this report is the 11th annual report produced as described in the ROD.

Flaming Gorge Dam, located on the upper main-stem of the Green River in northeastern Utah about 200 miles east of Salt Lake City, is an authorized storage unit of the Colorado River Storage Project. The Green River system is part of the upper Colorado River basin in Utah, Colorado, and Wyoming. Below Flaming Gorge, the Green River supports populations of four endangered native fishes. Operation of Flaming Gorge Dam influences downstream flow and temperature regimes and the ecology of the Green River, including native fishes. Downstream of Flaming Gorge Dam the Green River is joined by the Yampa, White and Duchesne Rivers, portions of which have all been designated as critical habitat under provisions of the Endangered Species Act of 1973 (Muth, *et al*., 2000).

The Upper Colorado River Endangered Fish Recovery Program (Recovery Program) was initiated in 1988 by the signing of a cooperative agreement amongst the states of Colorado, Wyoming, and Utah, the Secretary of Interior and the Administrator of the Western Area Power Administration (WAPA). The goal of the Recovery Program is to recover the endangered fish species while allowing for the continued operation and development of water resources in the Upper Colorado River Basin. The Recovery Program is the forum for discussion of endangered fish response to Flaming Gorge Dam operations and for identification of endangered fish research needs.

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 described and analyzed in the FEIS. The ROD implements the proposed

[1] A water year begins October 1 and ends September 30.
[2] Record of Decision Operation of Flaming Gorge Dam Final Environmental Impact Statement (February 2006)
[3] Operation of Flaming Gorge Dam FINAL Environmental Impact Statement (September 2005)
[4] 2005 Final Biological Opinion on the Operation of Flaming Gorge Dam

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). Table 2.1 in the FEIS summarizes the Flow Recommendations and can be found in Appendix B.

The ROD directs Reclamation to operate to achieve, to the extent possible, the Flow Recommendations as described in the FEIS (Reclamation 2006). The Flow Recommendations divide the Green River below Flaming Gorge Dam into three river reaches. Reach 1 begins directly below the dam and extends to the confluence with the Yampa River. Reach 2 begins at the Yampa River confluence and continues to the White River confluence. Reach 3 is between the White River and Colorado River confluences (Muth et. al 2000).

Operational Decision Process for Water Year 2016

The Flaming Gorge Technical Working Group (FGTWG) was established pursuant to the environmental commitments of the FEIS and terms and conditions of the BO as recommended in the Flow Recommendations. [5] The ROD clarified the purpose of the FGTWG as 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 received by Reclamation from the Recovery Program into the flow proposal so that Recovery Program research could also be facilitated. This process concurrently fulfills the informal consultation and coordination requirements of the ESA for the action agencies as committed to in the ROD.

Members of the FGTWG include biologists and hydrologists from Reclamation, the U.S. Fish and Wildlife Service (Service), and WAPA. Each year, FGTWG's recommendation is presented to the Flaming Gorge Working Group (Working Group), along with any flow requests or operational requests proposed by other federal or state agencies or stakeholders. The Working Group was formed in 1993 to provide interested parties with an open forum to express their views and interests in the operations of Flaming Gorge Dam. The Working Group meets biannually, at a minimum, and functions as a means of providing information to and gathering inputs from stakeholders and interested parties on dam operations, other resource concerns and research flows.

In 2016, the operational process developed in 2006 was used for making operational decisions at Flaming Gorge Dam. This process was developed based on descriptions provided in the FEIS (Section 1.5) and the ROD (Sections III, VI, and VII; Reclamation, 2005, Reclamation 2006). A detailed description of this process can be found in Appendix A. The implementation of the four steps of the process in 2016 is described below:

[5] FGTWG meeting summaries and documents are also available at: http://www.usbr.gov/uc/water/crsp/wg/fg/twg/twgSummaries.html.

Step 1: Flow Requests for Research, and Other Federal, State and Stakeholder Input

Reclamation received a memorandum on April 22, 2016 (2016 Spring Flow Request, Appendix C) from the Director of the Recovery Program stating the Recovery Program's research request for 2016 Green River spring flows. The 2016 Spring Flow Request was received after Reclamation commented on the draft through the Recovery Program process. Reclamation had concerns regarding the ability to implement the requested research releases under the current National Environmental Policy Act (NEPA) coverage (Appendix D). It referenced the final *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* (*ad hoc* Committee, March 2012; LTSP).[6] The Recovery Program's 2016 Spring Flow Request was to establish a release regime that would facilitate further research under the LTSP. The LTSP primary research objective is the request that "Reclamation use the occurrence of razorback sucker larvae in channel margin habitats (as determined by real-time monitoring) as the 'trigger' to determine when peak releases should occur from Flaming Gorge Dam."

The Recovery Program requested that the FGTWG consider and propose matching 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 to study and how the results would be evaluated. Additionally, the 2016 Spring Flow Request's primary objective was 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. The 2016 Spring Flow Request supported operations consistent with the 2005 BO and ROD.

The Recovery Program further "expanded its request to explore two additional experimental flow scenarios based on recent research: a) elevated summer base flows in most average and drier year hydrologic conditions to improve survival of Age-0 Colorado pikeminnow (*Ptychocheilus lucius*) (Bestgen and Hill 2015a); and b) future considerations for an experimental spike flow in the early summer (post peak) to negatively affect early life stages of nonnative smallmouth bass (*Micropterus dolomieu*) (Bestgen and Hill 2015b)" (2016 Spring Flow Request). The Recovery Program acknowledged that Reclamation communicated concerns regarding environmental compliance for the new flow requests and expressed desire to continue working into the future to implement experimental plans associated with the proposed flow requests.

The experimental timetable for the LTSP 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 and Yampa River Basins; therefore, it may not be possible to complete the experiment in six consecutive years.

[6] 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).

On May 27, 2016, Reclamation received a spring and base flow request from the Service (Appendix E). The Service supported the Recovery Program research request dated April 22, 2016. The Service acknowledged the potential tradeoff between timing of releases for experiments and meeting the Reach 2 targets outlined in the ROD between the spring and base flow periods. The Service supported Reclamation approving the Recovery Program's 2016 Spring Flow Request, and affirmed that doing so would meet Reclamation's responsibility to meet the ROD objectives in 2016. Their specific spring peak request for to "[t]ime spring bypass flow releases (up to 8,600 cfs) for up to seven to ten days (subject to modification based on actual hydrology) from Flaming Gorge to correspond with the presence of wild produced razorback sucker larvae according to the LTSP in order to improve entrainment success." (USFWS 2016 Flow Request)

The Service further requested that Reclamation "enhance summer base flows in Reach 2 of the Green River by maintaining ≥ 2,100 cfs through September 30, 2016." (USFWS 2016 Flow Request) The intent of the request was to improve backwater habitat conditions for young-of-year Colorado pikeminnow and negatively impact nonnative fish species.

Step 2: Development of Spring Proposal

The FGTWG met on March 9, 2016, to begin the development of a flow proposal for the spring of 2016. The intent of the flow proposal was to integrate the flow request from the Recovery Program into a flow regime consistent with the ROD. The flow proposal for 2016 described three possible flow regimes that were consistent with the ROD and FEIS. Depending upon the outcome of hydrologic conditions during spring runoff, the intent was to achieve one of these proposed flow regimes. January through May of water year 2016 was characterized by moderately dry conditions in the Upper Green and average (below median) conditions in the Yampa River Basins, respectively. Significant precipitation in May and early June increased the hydrologic classification to average (below median).

On June 9, 2016, the FGTWG met to discuss the spring and current base flow hydrology. In order to reach desired reservoir elevations by May 1, 2017, the formal recommended summer base flow for targets at Jensen for the summer base flow season was calculated to be 2,000 to 2,200 cfs. The Recovery Program and U.S. Fish and Wildlife Service requested increased releases to target up to 2,275 cfs at the USGS Jensen streamgage to extend the releases through October 2016, if possible.

Step 3: Solicitation of Comments

On April 19, 2016, Reclamation presented the 2016 FGTWG flow proposal to the Working Group and solicited comments. The presentation at the Working Group meeting clearly described the FGTWG proposed flow regime for the Green River, the intended operation of Flaming Gorge Dam for the spring and summer of 2016. Meeting minutes were recorded and written comments were solicited by Heather Patno, Co-Chair of the Working Group.[7]

[7] Working Group Meeting notes are also available at https://www.usbr.gov/uc/water/crsp/wg/fg/pdfs/FGWG%20Notes%2006232016.pdf and https://www.usbr.gov/uc/water/crsp/wg/fg/pdfs/fg.wgmt.08302016.notes.pdf.

Reclamation received comments from the public during the 2016 decision-making process and these comments are available for review in Appendix F.

Step 4: Final Decision

The hydrologic classifications for the Upper Green Basin and Yampa River Basin were was in the moderately dry hydrologic category. The ROD allows for flexibility to operate one classification lower or two classifications higher than indicated while being prepared to adjust if conditions warrant. Reclamation reviewed the FGTWG proposal and decided to implement the LTSP recommendations for moderately dry hydrologic conditions and operate Flaming Gorge Dam to increase releases once biologists determine razorback sucker larvae were in the system and ready to be entrained. The Recovery Program targeted Stewart Lake, Johnson Bottom, Above Brennan, and Old Charley Wash (as available) as the research floodplains of interest. Reclamation decided to utilize full powerplant and bypass capacity to evacuate above average inflows in conjunction with Yampa River flows to meet floodplain connection at 18,600 cfs for as long as possible.

Basin Hydrology and Operations

Progression of Inflow Forecasts

Snowpack conditions in the Upper Green River and Yampa River Basins varied significantly throughout the snow accumulation season (November 2015 through April 2016). The Upper Green River Basin snowpack condition was below median on January 1, 2016, at 92 percent of median.[8] On April 1, 2016, snowpack conditions in the Upper Green River Basin had remained fairly steady with snowpack at 107 percent of median, with average conditions through April maintaining snowpack at 100 percent of median by May 1, 2016. The Yampa River Basin snowpack condition was around median on January 1, 2016, at 101 percent of median. On April 1, 2016, snowpack conditions in the Yampa River Basin had also maintained at 104 percent of median, and had increased slightly to 115 percent of median by May 1, 2016. The Flaming Gorge Reservoir unregulated inflow volume forecast on May 1, 2016, was 79 percent of average. Significant storm activity and rainfall precipitation increased the observed unregulated inflow volume to 107 percent of average.

The Colorado Basin River Forecast Center (CBRFC), beginning in January every year and continuing through June, issues a monthly forecast of the total volume of anticipated unregulated inflow for the April through July period in thousands of acre-feet (kaf). The progression of Flaming Gorge Reservoir unregulated inflow and the Yampa River forecasts over the 2016 water supply season are shown in Table 1.

[8] In water year 2013, the Natural Resources Conservation Service (NRCS) implemented percent of median as the standard measure of snow water equivalent (SWE) based on the 1981-2010 period of record.

Table 1 – Progression of CBRFC Unregulated Inflow[9] Volume Forecasts for the April through July Water Supply Period

Forecast Issuance Month	Flaming Gorge Reservoir		Yampa River at Deerlodge Park, CO	
	Volume (1000 AF)	% of Average	Volume (1000 AF)	% of Average
January	700	72	1130	89
February	685	70	1200	94
March	660	67	1030	81
April	740	76	1130	89
May	770	79	1250	99
June	1060	108	1650	130
July	1065	109	---	---
Actual	**1,047**	**107**	**1468**	**115**

Summary of Flaming Gorge Operations

Releases from Flaming Gorge were consistent during the base flow season from October 1, 2015 through May 31, 2016, when releases increased after detection of larval razorback sucker and the beginning of spring operations. Releases were 2,200 cfs from October through mid-February 2016, when releases were decreased to minimum 800 cfs.

The Utah Division of Wildlife Resources (UDWR) requested a modification from normal operations on April 18 and 19, 2016, in order to conduct their spring fishery assessment Releases were maintained at 800 cfs before and after completion of the spring assessment in anticipation of spring runoff.

Prior to completion of the LTSP 2012, Flaming Gorge Dam releases under the Flow Recommendations were increased to coincide with the peak and immediate post-peak of the Yampa River spring peak flows to create a spring peak in the Green River at Jensen. Spring runoff in the Yampa River Basin generally produces two distinct peaks (flows above 10,000 cfs) as low elevation snow melts first followed by the mid-level and higher elevation snowmelt. Reclamation responded to the Recovery Program's request and agreed to support research under the LTSP and time releases from Flaming Gorge Dam to coincide with the presence of wild razorback sucker larvae in the Green River system.

Larvae were detected on May 28, 2016, and in response to the LTSP parameters and in consideration of Memorial Day, Flaming Gorge releases were increased to powerplant capacity of 4,600 cfs with an additional bypass release of 2,000 cfs on May 31, 2016. Colorado Basin River Forecast Center deterministic forecasts for the Green River at Jensen, Utah, indicated potential for minor flooding with full bypass releases. Reclamation responded to the issues by keeping releases at 6,600 cfs (4,600 cfs powerplant capacity and

[9] Unregulated inflow is defined as the actual inflow to the reservoir corrected for change in storage and evaporation in reservoirs upstream. In the case of Flaming Gorge Reservoir, unregulated inflow accounts for change in storage and evaporation at Fontenelle Reservoir only.

2,000 cfs bypass) during high Yampa River flows, prior to increasing to 8,600 cfs (4,600 cfs powerplant capacity and 4,000 cfs bypass) for a total of 31 days above powerplant capacity, and 19 days at full bypass. Increased precipitation and forecasts moved the operational hydrologic classification from moderately dry to average (below median). The LTSP average (below median) flow range targets in the Jensen-Ouray reach of the Green River are between 14,000 cfs to 18,600 cfs for one to 14 days. Releases from Flaming Gorge Dam were kept at 8,600 cfs to meet the average (below median) flow target and decrease reservoir elevation from the unexpected precipitation events during larval presence with the Yampa River flows around 12,000 cfs. Yampa River flows at the Deerlodge gage peaked at 16,050cfs on May 17, 2016 and were on the descending limb of the hydrograph during the LTSP spring release. The rainfall events in late May and June extended the spring peak release with the second peak of Deerlodge flows reaching 12,710 cfs on June 7, 2016. The USGS streamgage at the Green River at Jensen, Utah, measured a peak flow of 20,500 cfs on June 12, 2016, during larval drift when Flaming Gorge was releasing the peak of 8,600 cfs.

The hydrologic conditions during spring 2016 consisted of median snow accumulation with lack of late season precipitation resulting in below average snowpack and early melt. Snowpack runoff in hydrologically similar years ranged from 79 to 147 percent of average (Upper Green 1995, 2005; Yampa 2000, 2010). Spring rainfall significantly increased total runoff to 107 percent of average volume into Flaming Gorge and 115 percent of average on the Yampa River. The ROD hydrologic classification for the Upper Green and Yampa River were in the moderately dry classification. After releases for the LTSP concluded, releases were decreased to base flow releases of 1,800 cfs at the request of the Recovery Program and Service from August through September. Flows at Jensen met or exceeded targets in Reach 2 for the ROD Flow Recommendation of one-day peak duration at 18,600 cfs and the LTSP moderately wet peak of $\geq$ 20,300 cfs and the average (above median) target between 18,600 to 20,300 cfs for a total of 7 to 14 days, all of which occurred during larval drift.

Flaming Gorge Reservoir elevation decreased a total of 7.96 feet (ft) from the maximum elevation of 6032.07 ft on June 2, 2016, to the annual minimum elevation of 6024.11 ft on February 25, 2016.

Flaming Gorge Dam releases (blue line), and flows for the Yampa River (green line) and Jensen (orange line) are illustrated in Figure 1. The graph illustrates the differences between ROD peak releases timed with the peak and immediate post peak of the Yampa River and those under the Larval Trigger Study Plan timed with the emergence of razorback sucker larvae in the Green River.

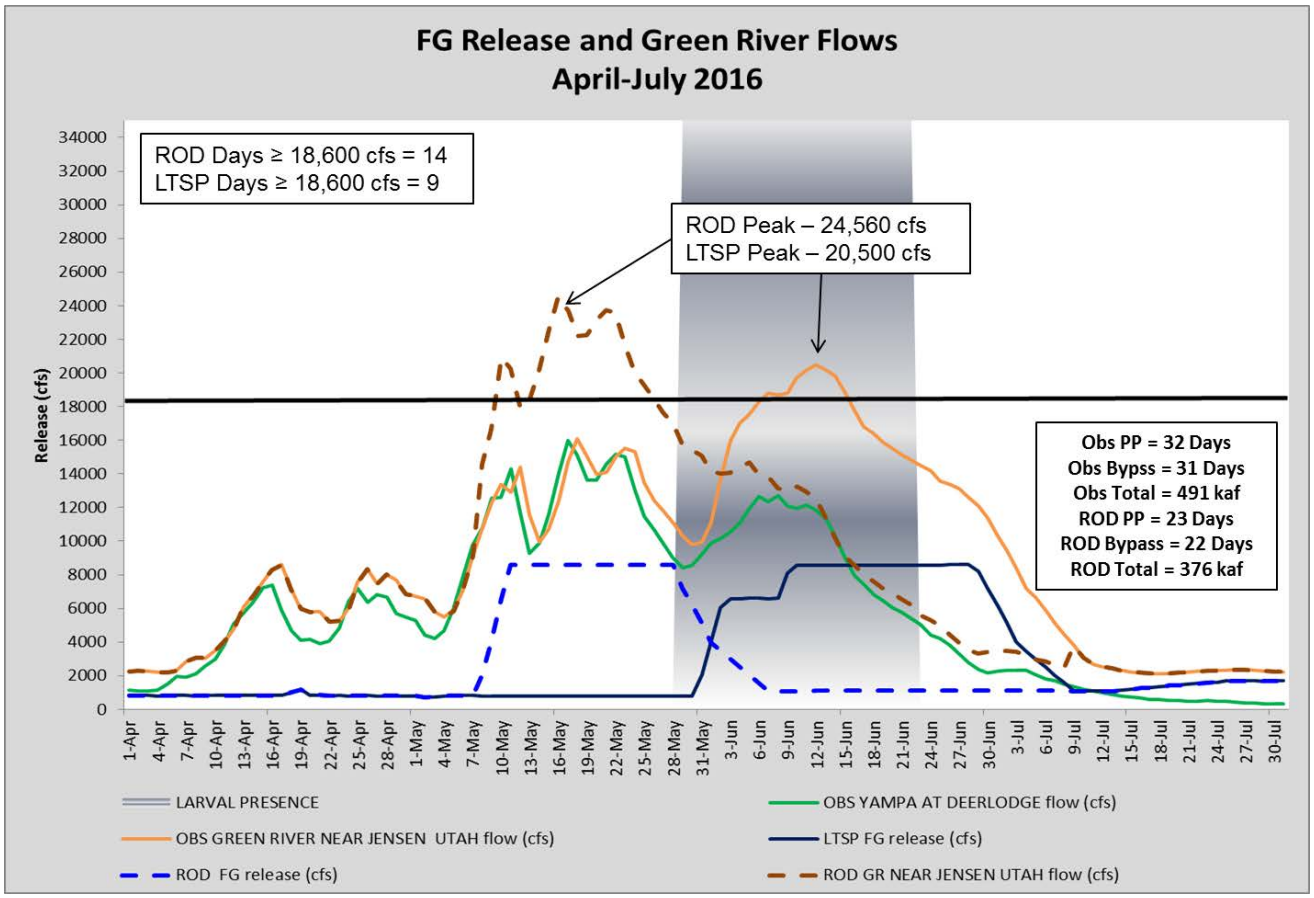


Figure 1 – Spring 2016 Flaming Gorge Spring Releases and Flows Measured at Yampa River at Deerlodge and Green River at Jensen.

Spillway Inspection

The 2005 BO directs Reclamation to provide the results of its annual spillway inspections. During these inspections, inspectors operate gates 1 and 2 through a one-foot open and close cycle during which time it notes any unusual or excessive noise or vibration. The spillway inspection occurred on May 5, 2016, at reservoir elevation 6026.52 ft. gates 1 and 2 are both opened one foot at an average rate of one foot per minute. The total volume released was approximately 1 acre-foot.

Flow Objectives Achieved in Water Year 2016

The ROD directs Reclamation to operate to achieve, to the extent possible, the Flow Recommendations as described in the FEIS (Reclamation 2006). The Flow

Recommendations divide the Green River below Flaming Gorge Dam into three river reaches. Reach 1 begins directly below the dam and extends to the confluence with the Yampa River. Reach 2 begins at the Yampa River confluence and continues to the White River confluence. Reach 3 is between the White River and Colorado River confluences. (Muth et. al 2000)

The Flow Recommendations use five different categories to classify both spring and base flow water year conditions and the Reach 1, 2, and 3 targets associated with that classification (Appendix B). Reach 1 targets are, for the most part, release patterns from Flaming Gorge Dam needed to achieve target peak and base flows identified in Reaches 2 and 3. Reach 2 targets are measured at Jensen, Utah, and Reach 3 targets, measured at Green River, Utah, are largely dependent on flows targets for Reach 2 and runoff patterns of tributaries. The Flow Recommendations acknowledged that Reach 3 base flows will be subject to natural variation in tributary flows, and this variation should not be compensated for by Flaming Gorge Dam releases, (Muth, *et al*., 2000).

Further, the FEIS summarizes the Flow Recommendations further and indicates that Flaming Gorge Dam cannot equally achieve targets for all three reaches simultaneously because of the reliance on tributary flows. The intent of the Action Alternative is first to meet the recommended objectives for Reach 2 and then, if necessary, make adjustments to releases so that the recommended objectives for Reach 1 could also be met. It is assumed that the flow objectives in Reach 3 are met whenever the flow objectives in Reach 2 are met. (Reclamation, 2005) Information contained in this report related to Reach 3 is for information purposes only and in no way implies a requirement for Reclamation to meet Reach 3 targets under the ROD.

After achievement of the spring flow objectives in Reach 1 and Reach 2, flows are gradually reduced to achieve base flow levels by no later than the date specified in the Flow Recommendation. Base flows in Reaches 1 and 2 are generally 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.

The Flow Recommendations state that during the August through November base-flow period, the daily flows should be within ±40 percent of mean base flow and during the December through February base-flow period, the daily flows should be within ±25 percent of the mean base flow.

Additionally, the Flow Recommendations state that the mean daily flows should not exceed 3 percent 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. On the basis of the stage-flow relationship near Jensen, the maximum stage change that could occur with this level of flow variability over the summer through autumn period would be about 0.4 meters. Flow variability during the winter (December through February) would produce a maximum stage change of about 0.2 meters. This recommendation is based on the fact that the average depth of backwaters occupied by Colorado pikeminnow larvae in Reach 2 is 0.3 m. By restricting within-day variation in flow, conditions critical for young of year fish in backwater habitats should be protected. (Muth, *et al*., 2000).

Table 2 –April – July Forecasts and Spring and Base Flow Hydrologic Classifications

Year	May 1st A-J Unreg Inflow Forecast (1000 AF)	Spring Hydrologic Classification	Observed A-J Unreg Inflow (1000 AF)	Base Flow Hydrologic Classification
2006	1,100	Average (Abv Median)	724	Moderately Dry
2007	500	Moderately Dry	370	Dry
2008	820	Average (Blw Median)	728	Moderately Dry
2009	890	Average (Blw Median)	1,197	Average (Abv Median)
2010	515	Moderately Dry	705	Moderately Dry
2011	1,660	Moderately Wet	1,925	Wet
2012	630	Moderately Dry	570	Moderately Dry
2013	480	Moderately Dry	361	Dry
2014	1,320	Average (Abv Median)	1,159	Average (Blw Median)
2015	570	Moderately Dry	1,035	Average (Blw Median)
2016	770	Moderately Dry	1,047	Average (Blw Median)

Spring Flow Objectives

The spring hydrologic classification is based on the CBRFC May final forecast of April-July unregulated inflow volume into Flaming Gorge Reservoir. The May final forecast for water year 2016 was 770,000 acre-feet (AF) and resulting spring hydrologic classification was moderately dry.[10] The recommended peak-flow magnitudes designated under the ROD for Reaches 1, 2, and 3 were 4,600 cfs, 8,300 cfs, and 8,300 cfs, respectively.

The Reaches 1, 2 and 3, Flow Recommendation spring objectives and the desired frequency of achievement are described in Tables 3, 4 and 5. Water year 2016 is the 11th year of

[10] Hydrologic classifications are based on Pearson III percentile exceedance volumes for the period of record beginning in 1963 through the previous year hydrology. This calculation results in annual variations in exceedance ranges.

operations under the ROD and is the 11th year for establishing the long-term frequencies of these spring flow objectives.

Table 3 – Reach 1 ROD Flow Objectives Achievements in 2016

Spring Peak Flow Objective∓	Hydrologic Classification	Desired Frequency Percent of Achievement	Achieved in 2016	Achievement Rate to Date (Cumulative Frequency %)*
Peak >= 8,600 cfs for at least 1 day	Wet	10 %	Yes	27 %
Peak >= power plant capacity for at least 1 day	Dry	100%	Yes	100 %

∓ Reach 1 release objectives are based on the flows needed to achieve recommended duration of bankfull and overbank flows in Reaches 2 and 3.
*Based on 11 years of operation under the ROD and spring hydrologic classification (2006-2016)

Table 4 – Reach 2 ROD Flow Objectives Achievements in 2016

Spring Peak Flow Objective	Hydrologic Classification	Desired Frequency Percent of Achievement	Achieved in 2016	Achievement Rate to Date (Cumulative Frequency %)*
Peak >= 26,400 cfs for at least 1 day	Wet	10 %	No	9 %
Peak >= 22,700 cfs for at least 2 weeks	Wet	10 %	No	9 %
Peak >= 18,600 cfs for at least 4 weeks	Wet	10 %	No	9 %
Peak >= 20,300 cfs for at least 1 day	Moderately Wet	30 %	Yes	27 %
Peak >= 18,600 cfs for at least 2 weeks	Average (Wet)	40 %	No	18 %
Peak >= 18,600 cfs for at least 1 day	Average (Wet)	50 %	Yes	64 %
Peak >= 8,300 cfs for at least 1 day	Average (Dry)	100 %	Yes	100 %
Peak >= 8,300 cfs for at least 1week	Moderately Dry	90 %	Yes	91 %
Peak >= 8,300 cfs for at least 2 days except in extreme dry years	Dry	98 %	Yes	100 %

*Based on 11 years of operation under the ROD and spring hydrologic classification (2006-2016)

Table 5 – Reach 3 ROD Flow Objectives Achievements in 2016

Spring Peak Flow Objective	Hydrologic Classification	Desired Frequency Percent of Achievement	Achieved in 2016	Achievement Rate to Date (Cumulative Frequency %)*
Peak >= 39,000 cfs for at least 1 day	Wet	10 %	No	9 %
Peak >= 24,000 cfs for at least 2 weeks	Wet	10 %	No	9 %
Peak >= 22,000 cfs for at least 4 weeks	Wet	10 %	No	9 %
Peak >= 24,000 cfs for at least 1 day	Moderately Wet	20 %	No	27 %
Peak >= 22,000 cfs for at least 2 weeks	Average (Wet)	40 %	No	9 %
Peak >= 22,000 cfs for at least 1 day	Average (Wet)	50 %	No	36 %
Peak >= 8,300 cfs for at least 1 day	Moderately Dry	100 %	Yes	100 %
Peak >= 8,300 cfs for at least 1week	Moderately Dry	90 %	Yes	100 %
Peak >= 8,300 cfs for at least 2 days except in extreme dry years	Dry	98 %	Yes	100 %

*Based on 11 years of operation under the ROD and spring hydrologic classification (2006-2016)

Based upon a request of the Recovery Program, Reclamation decided to operate in support of the LTSP, which "includes a matrix to be used as a guide in testing hypothesis associated with the larval trigger" (*ad hoc* Committee, March 2012). Implementation of the Recovery Program's LTSP occurs over a range of peak flow magnitudes and durations. The experimental timetable is for 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, as minimally necessary to complete the study.

Water years 2012, 2013 and 2015 are included in the three years of flows below 18,600 cfs, and water years 2014 is included in the three years of flows above 18,600 cfs. Table 6 is a copy of the matrix found in Table 2 of the LTSP. It describes the flow conditions and corresponding targeted wetlands. The peak flow as measured at Jensen, Utah, targeted this year corresponded with the moderately wet peak classification and average (above median) hydrologic condition with flows between 18,600 cfs and 20,300 cfs targeted between 7 to 14 days with a peak flow of 20,300 cfs. Flows at Jensen, Utah, were above 18,600 cfs for 9

days during larval drift, which met the objective for average (above median) years outlined in the LTSP and under the average classification in the ROD.

Table 6 – 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)	Moderatel y wet	Moderately wet	Moderately wet
$x \geq 26,400$ cfs	Same as previous	Wet	Wet	Wet

(a) f = flow-through wetland, s = single-breach wetland
(b) Up to eight wetlands would be sampled in a given year with the three in the lowest flow category being sampled in all years.
(c) 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.

Base Flow Objectives

Base flows are classified based on the observed April-July unregulated inflow volume into Flaming Gorge and monthly base flow forecast from the CBRFC. The observed April-July unregulated inflow volume was 1,047,000 AF and resulting base flow hydrologic classification was average (below median). Reach 1 flows were reduced to base flows of 1,085 cfs by July 9, 2016. The observed April-July unregulated inflow volume into Flaming Gorge Reservoir, August final forecast and average daily releases needed to achieve the May 1, 2017 elevation target of 6027 feet were used to calculate the Reach 1 daily average base flow of 1,600 cfs, which is within the base flow range for the average (below median) classification as shown in Figure 2.

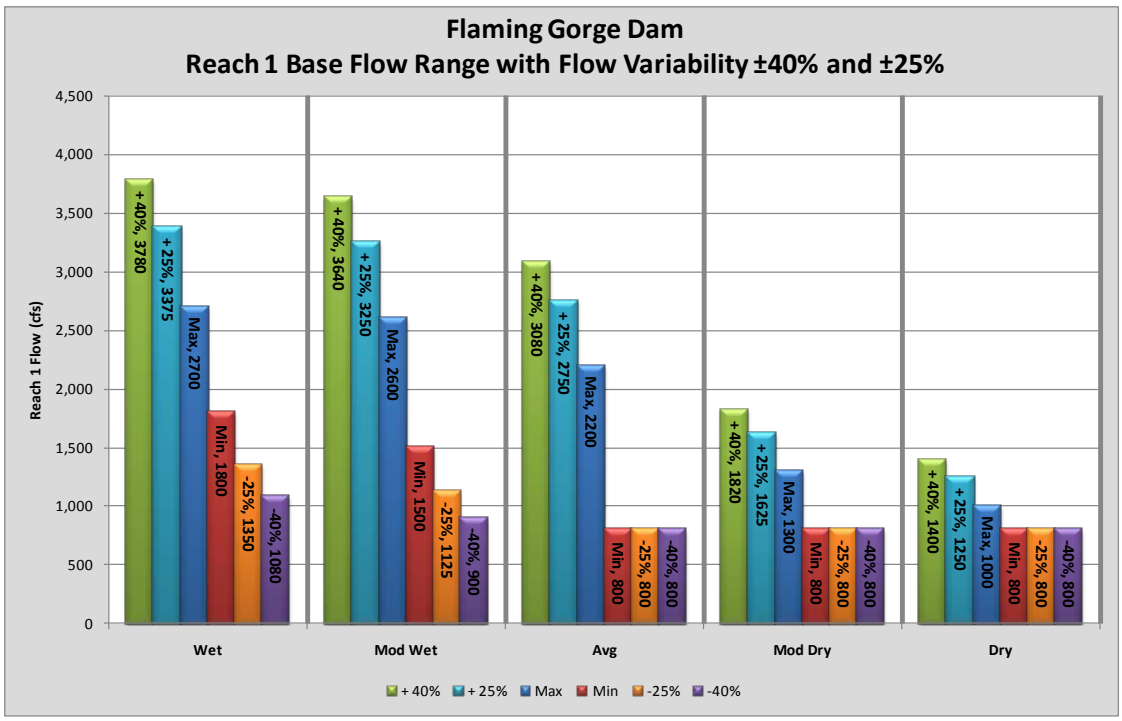


Figure 2 – Reach 1 Base Flow Ranges for each Hydrologic Classification as Outlined in the ROD.

The FGTWG and the Service requested and the FGTWG proposed flows in Reach 2 for July through September at the maximum variability of +40 percent of the dry base flow classification. Reclamation decided to implement +40 percent for Reach 1 in the average (below median) classification during July through September, and released 1,800cfs in an effort to sustain flows in Reach 2 of 2,000 to 2,200 cfs.

Observed September and October base flows in Reach 2 were within 40 percent of the established average (below median) base flow (*i.e.* between 900 cfs to 3,080 cfs), except for occasional precipitation driven events on the Yampa River which fall within the variability outlined in the ROD. Observed December through February base flows for the average (below median) classification in Reach 2 were within 25 percent of the established average (below median) base flow classification (*i.e.* between 900 cfs to 3,000 cfs). The daily fluctuations at Flaming Gorge Dam remained within the 0.1 meter daily stage change at Jensen, Utah parameters. The maximum daily stage change at Jensen was within the limits outlined in the Flow Recommendations.

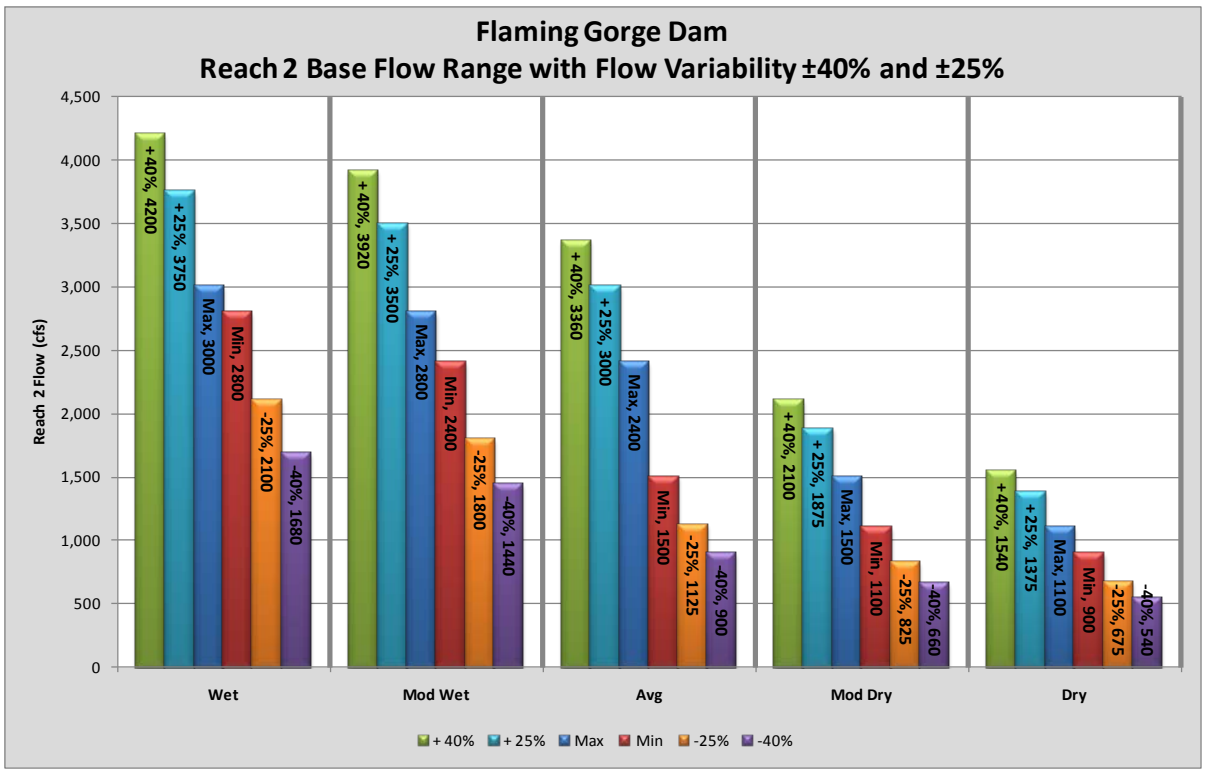


Figure 3 – Reach 2 Base Flow Ranges for each Hydrologic Classification as Outlined in the ROD.

Observed August through November base flows in Reach 3 as measured at the USGS Green River at Green River, Utah stream gage were within 40 percent of the established average base flow classification (*i.e.* between 1,060 cfs to 5,880 cfs as shown in Figure 4). Most of the observed December through February base flows in Reach 3 were within 25 percent of the established moderately dry base flow classification (*i.e.* between 1,350 cfs to 5,250 cfs).

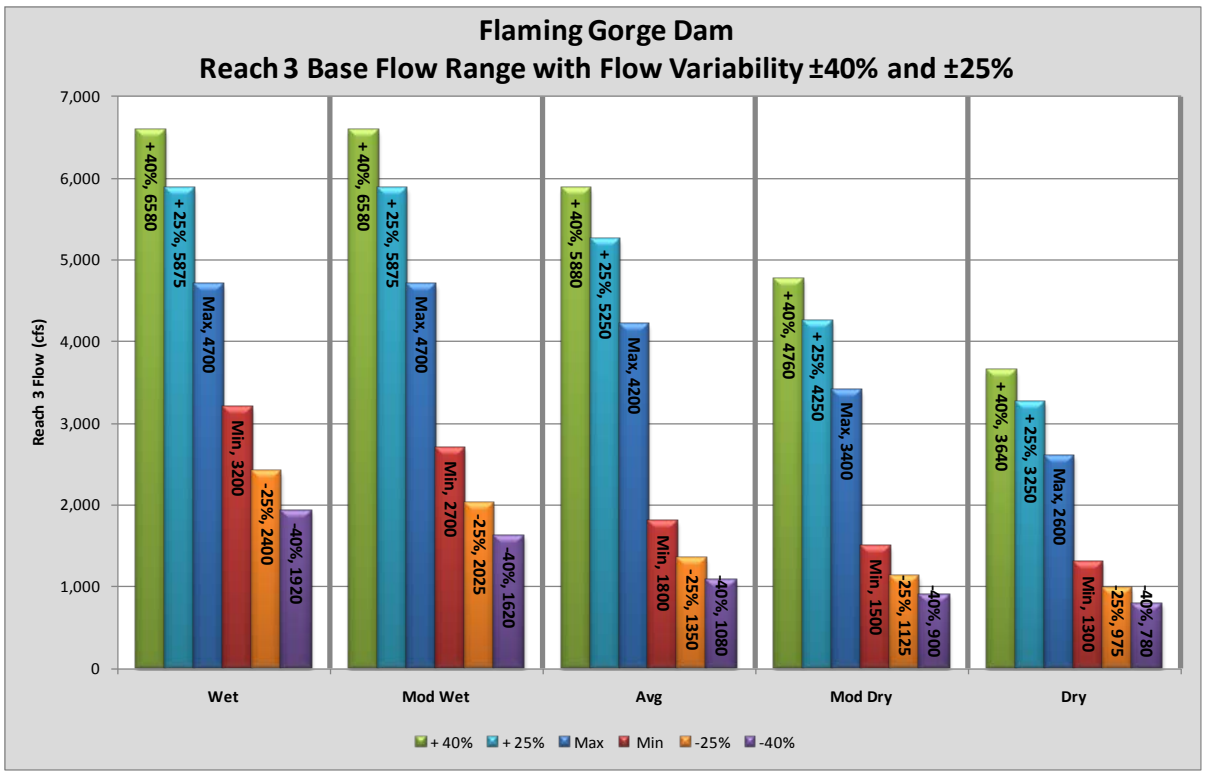


Figure 4 – Reach 3 Base Flow Ranges for each Hydrologic Classification as Outlined in the ROD.

Temperature Objectives Achieved in Water Year 2016

An operational plan for the selective withdrawal system (SWS) on Flaming Gorge Dam was completed by a subset of the Flaming Gorge Technical Work Group (FGTWG) in June 2007 and revised in June 2012. The operational plan provides guidelines for implementation of the 2006 ROD temperature objectives below Flaming Gorge Dam (Table 1). Operational guidelines direct operators to achieve maximum gate elevation (40 feet or 12.2 m below reservoir surface) by June 15 of each year in order to deliver target outflow temperatures of 59.0 – 60.8 °F (15.0-16.0 °C) during the summer months.

On June 15 of WY2016, SWS gates were elevated to 41 feet (12.5 m) below the reservoir surface, however target release temperatures were not fully achieved until about mid-July (Figure 1). On June 23, high temperature stator alarms on the dam's generators prompted operators to lower SWS gates to 45 feet (13.7 m) below the reservoir surface in an attempt to release cooler water, and one additional adjustment was made on July 1 to maintain this depth. On July 28, guide bearing alarms sounded on Unit 3, which once again prompted lowering of SWS gates associated with that unit to a depth of 50 feet (15.2 m) below the surface; the other SWS gates remained at 45 feet (13.7 m) below the surface, however.

Mean temperature of dam releases (as measured at the Greendale gauge, USGS 09234500) during June-September of WY2016 was 54.1 °F (12.3 °C; range 44.8 – 59.0 °F, 7.1 – 15.0 °C). Average daily temperatures at Gates of Lodore (USGS 404417108524900) in 2016 intermittently equaled or exceeded Reach 1 objectives (64.4 °F or 18.0 °C; Figure 1) for 22 days between July 9 and August 18. Temperatures in the Yampa and Green rivers differed by 9.0 °F (5.0 °C) or more for a total of seven (7) days after July 1 (approximate onset of base flow period for a moderately dry year; July 1-6 and July 27). Releases from Flaming Gorge Dam during the latter half of June equaled or exceeded combined powerplant and bypass releases (about 8,600 cfs, 243.5 m3/s), which entrained water from the colder strata of the reservoir and kept release temperatures low (mean 47.1 °F, 8.4 °C). As flows declined during the first week of July, dam release temperatures increased to about 53.6 °F (12.0 °C), but Green River temperatures were still more than 9.0 °F (5.0 °C) cooler than the Yampa River during that time period.

Table 7. Temperature objectives for the Green River below Flaming Gorge Dam pursuant to the 2005 EIS and 2006 ROD. Reach 1 is from the dam to the Yampa River confluence; Reach 2 is from the Yampa River to Sand Wash, UT.

Temperature Objectives	Reach	Desired Frequency %	Achieved in 2016
Temperatures ≥ 64.4 °F (18.0 °C) for 3-5 weeks from June (average-dry years) or August (moderately wet-wet years) to March 1	1	100%	Yes
Green River should be no more than 9.0 °F (5.0 °C) colder than the Yampa River during the base flow period	2	100%	No (seven days above objective)

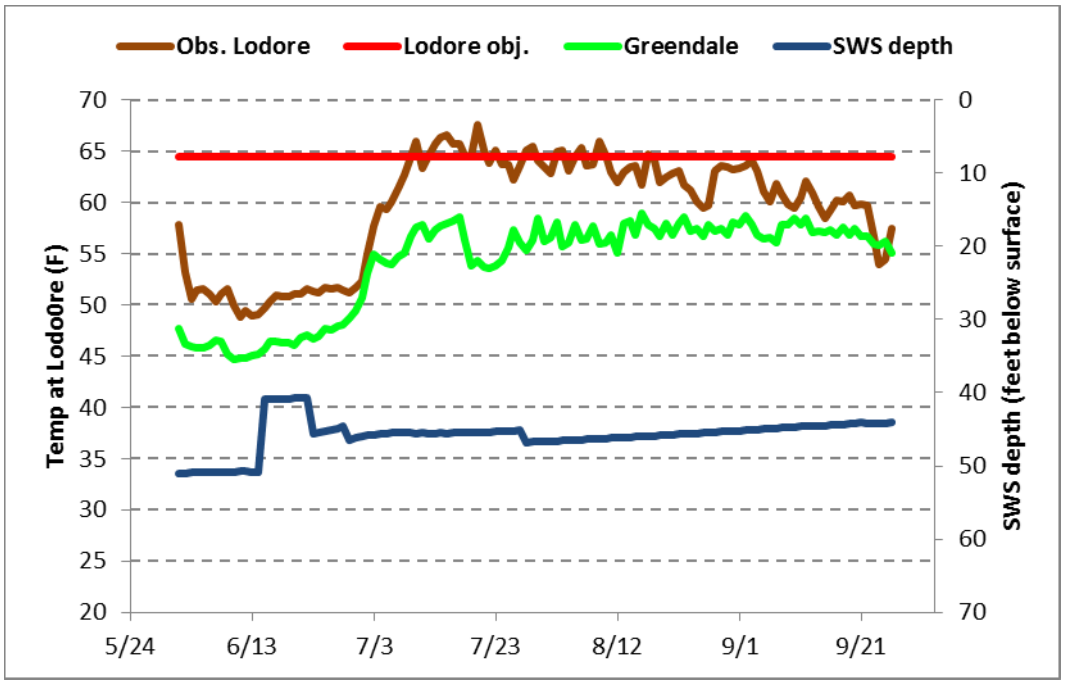


Figure 5 – Average daily temperatures recorded at the Gates of Lodore gage (brown series), Greendale gage (green series), Reach 1 (Gates of Lodore) objective (red line), and SWS gate depth (m) below reservoir surface (blue series, second axis), June-September 2016. SWS gate depths are the average of three units.

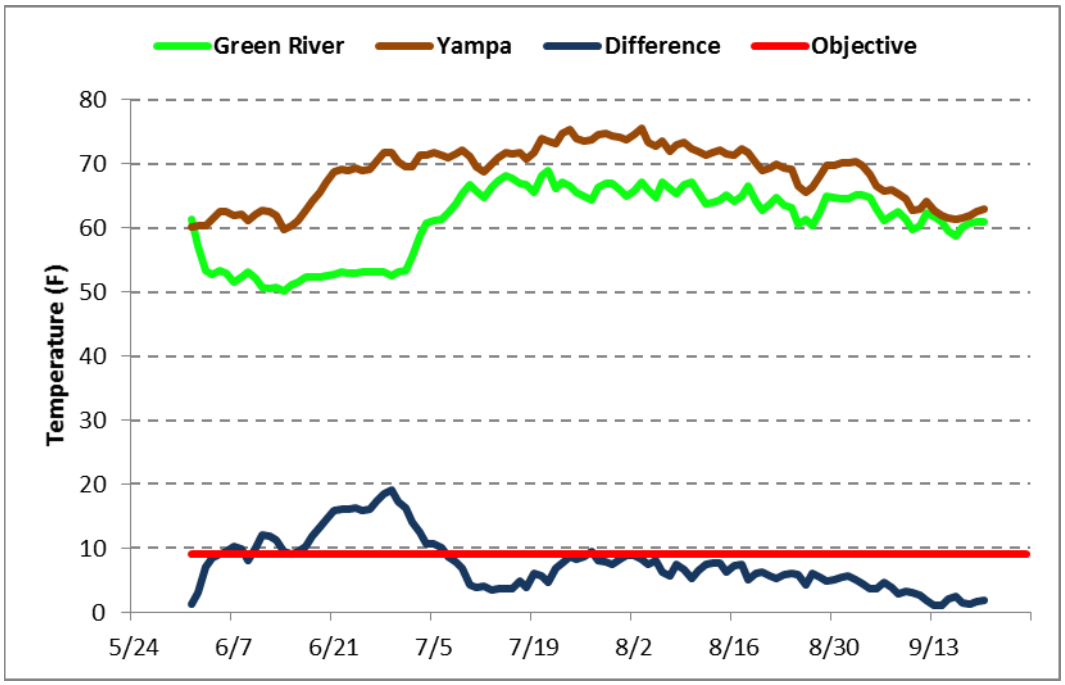


Figure 4 – Temperature of the Green River (green series) at the Yampa River confluence and of the Yampa River (brown series), the difference between the two

rivers (blue line), and the maximum temperature difference specified in the 2006 ROD (red line), June-September 2016.

Recommendations

In 2016, Reclamation operated Flaming Gorge Dam and Reservoir in compliance with the 2006 ROD and, to the extent possible, meet the goals and objectives of the Flow Recommendations and the LTSP. This was the fifth year implementing the LTSP. While Reclamation has normally increased Flaming Gorge Dam releases in the spring to match the peak and immediate post-peak of the Yampa River, in 2016 it increased releases after the Yampa River had peaked and was on the descending limb of the hydrograph. Reclamation met the average Reach 2 peak magnitude flow target of 18,600 at Jensen, Utah. Flows at Jensen, Utah in 2016 were above 18,600 cfs for a total of nine days during larval drift, which conformed to the duration requirements for average (above median) years outlined in Table 2 of the LTSP (Table 6 in this document; 7-14 days between 18,600 and 20,300 cfs as measured at Jensen, Utah).

Coordination among Reclamation, the Recovery Program, the Service and UDWR occurred regularly and was used to determine the timing of the peak release in 2016 in support of the LTSP. The significant spring precipitation necessitated longer duration peak releases than anticipated, which prompted considerable public concern and question. It is recommended that an additional Flaming Gorge Working Group meeting in March or June be considered.

Literature Cited

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

Bureau of Reclamation. 2016. Flaming Gorge Technical Working Group Proposed Flow and Temperature Objective for 2016. U.S. Department of the Interior, Bureau of Reclamation, Upper Colorado Region, 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. April 27, 2016. Memorandum to Brent Rhees and Heather Patno. Recovery Program Research Request for 2016 Green River Spring Flows. U.S. Fish and Wildlife Service, Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

U.S. Fish and Wildlife Service. 2005. Final Biological Opinion on the operation of Flaming Gorge Dam (Consultation # 6-UT-05-F-006). U.S. Department of the Interior, Fish and Wildlife Service, Utah Field Office, West Valley City, Utah.

Appendix A

Flaming Gorge Decision Process
Intended Implementation under the 2006 Flaming Gorge Record of Decision

Overview – This document describes the four-step process the Bureau of Reclamation (Reclamation) will use to adaptively manage Flaming Gorge Dam operations and implement the 2006 Record of Decision for the Operation of Flaming Gorge Dam Final Environmental Impact Statement (ROD). These four steps are described in detail below:

1. Recovery Program
2. Flaming Gorge Technical Working Group (FGTWG)
3. Flaming Gorge Working Group (Working Group)
4. Reclamation Operational Plan

In 2000, the Upper Colorado River Endangered Fish Recovery Program (Recovery Program) issued Flow and Temperature Recommendations for Endangered Fishes in the Green River Downstream of Flaming Gorge Dam (flow recommendations). The Flow Recommendations provide the basis for the proposed action outlined in the 2005 final environmental impact statement (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.[11]

Reclamation believes that the Recovery Program remains the appropriate forum for discussion of endangered fish response to Flaming Gorge Dam operations, endangered fish research needs, and refinements to the flow recommendations. The purpose of the FGTWG would be limited to proposing annual flow and temperature recommendations as outlined in the FEIS, including research requests by the Recovery Program. The Working Group remains the forum for public information/input.

1. Recovery Program – The ROD Environmental Commitment #2 defines the science role of the Recovery Program in the adaptive management process to include design and execution of studies that monitor implementation of the flow recommendations, and testing the outcomes of such studies. This includes conducting research to answer specific questions raised by previous studies, to fill information gaps identified in the Recovery Implementation Program Recovery Action Plan and related documents, and/or to address uncertainties associated with the flow recommendations. For example, effects of specific spring flow elevations on entrainment rates of larval endangered fish and their floodplain habitats is an uncertainty which prompted the Recovery Program to request periods of steady flows during the spring 2005 runoff season. A request for such flows or release temperatures is not

[11] Reclamation, 2006, Record of Decision on the Operation of Flaming Gorge Dam Final Environmental Impact Statement.

necessarily explicit in the flow recommendations, but is necessary to fulfill adaptive management research functions that should be made no later than February of each calendar year.

Beginning each summer, the Recovery Program should begin a process to develop any desired flow request for the Green River for the following year. Maintenance schedules for the dam and powerplant are a critical part of the proposal in order to assure release capability. Reclamation will clearly communicate equipment and maintenance issues to the Recovery Program during development of any Recovery Program request. This communication should include analysis of contingency plans for maintenance issues, system emergencies, equipment failures, or changes in hydrology. The Recovery Program should issue a finalized flow request by the end of February to Reclamation, the U.S. Fish and Wildlife Service (Service), and Western Area Power Administration (WAPA).

2. <u>Flaming Gorge Technical Working Group (FGTWG)</u> - 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 Recovery Program into the flow proposal so that Recovery Program research could also be facilitated. Members of the FGTWG include biologists and hydrologists from Reclamation, the Service, and WAPA. This group also serves as the informal consultation body for Endangered Species Act compliance as has occurred historically and as directed by the ROD.

An annual meeting of the FGTWG should be held in early March to develop a proposed flow and temperature regime for the upcoming spring and base flow season (Proposal). This Proposal should achieve the flow recommendations and/or the Recovery Program flow request for the current year within the current hydrologic conditions and Reclamation's operating parameters.

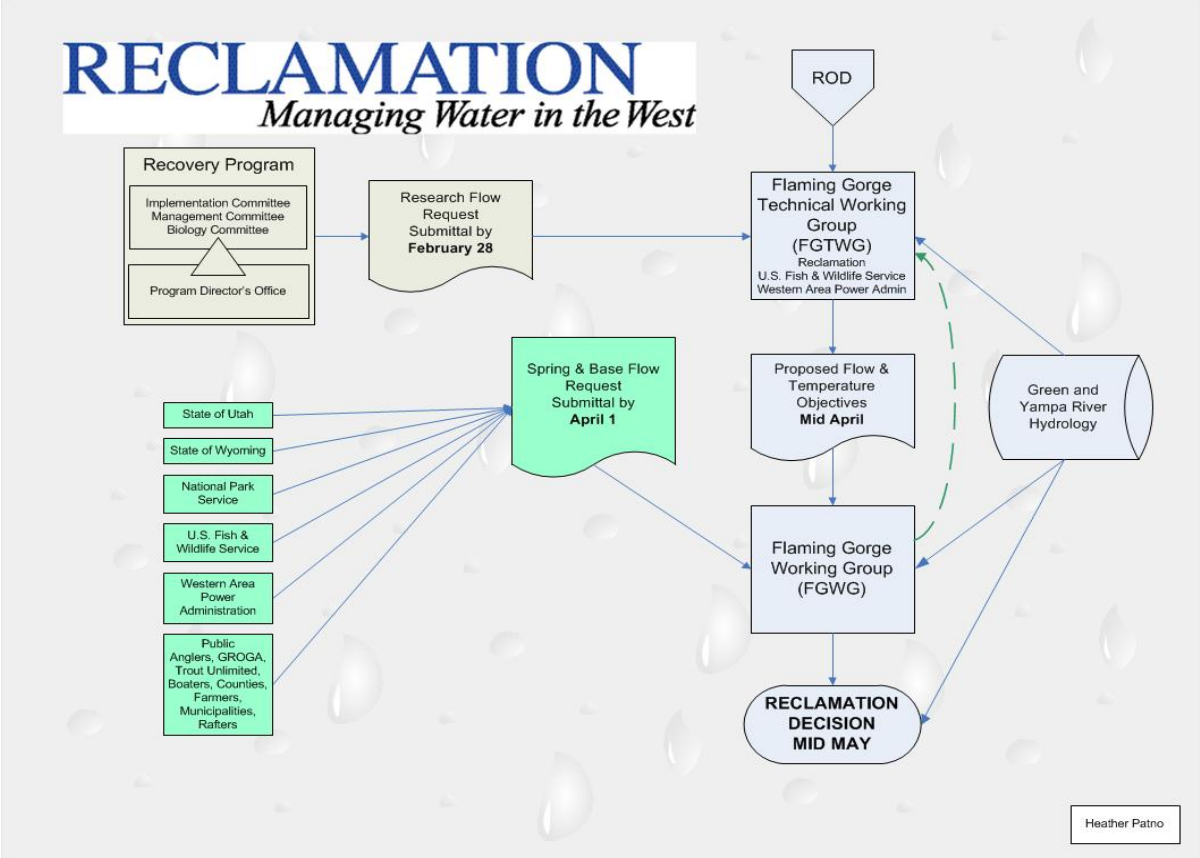
The FEIS specifically addresses and outlines the content of the Proposal. The Proposal describes the current hydrologic classification of the Green River and Yampa River Basins, including the most probable runoff patterns for the two basins. The Proposal also identifies the most likely Reach 2 flow magnitudes and durations that are to be targeted for the upcoming spring release. It further specifies that

> *Because hydrologic conditions often change during the April through July runoff period, the [Proposal] 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 (FEIS, Section 2.5.3.1).*

The FGTWG proposal should be finalized by early April in time to present to the Working Group.

3. <u>Flaming Gorge Working Group</u> – The Working Group was formed in 1993 to provide interested parties with an open forum to express their views and interests in the operations of Flaming Gorge Dam. The Working Group meets biannually (April and August) and functions as a means of providing information to and gathering input from stakeholders and interested parties on dam operations, other resource concerns and research flows. Reclamation presents the FGTWG Proposal to the Working Group during the April meeting and constitutes the public involvement and public outreach component of the adaptive management process as described in the FEIS (Sections 4.20, 4.21).

4. <u>Operational Plan</u> - Reclamation makes the final decision on how to operate Flaming Gorge Dam based on hydrologic conditions, the FGTWG flow proposal, and input from the public received via the Flaming Gorge Working Group.



Appendix B

Flaming Gorge Final Environmental Impact Statement

Table 2.1: Recommended Magnitudes and Durations Based on Flows and Temperatures for Endangered Fishes in the Green River Downstream from Flaming Gorge Dam as Identified in the 2000 Flow and Temperature Recommendations

Table 2-1.—Recommended Magnitudes and Duration of Maximum Spring Peak and Summer-to-Winter Base Flows and Temperatures for Endangered Fishes in the Green River Downstream From Flaming Gorge Dam as Identified in the 2000 Flow and Temperature Recommendations

Location	Flow and Temperature Characteristics	Hydrologic Conditions and 2000 Flow and Temperature Recommendations[1]				
		Wet[2] (0–10% Exceedance)	Moderately Wet[3] (10–30% Exceedance)	Average[4] (30–70% Exceedance)	Moderately Dry[5] (70–90% Exceedance)	Dry[6] (90–100% Exceedance)
Reach 1 Flaming Gorge Dam to Yampa River	Maximum Spring Peak Flow	• 8,600 cfs (244 cubic meters per second [m^3/s])	• 4,600 cfs (130 m^3/s)	• 4,600 cfs (130 m^3/s)	• 4,600 cfs (130 m^3/s)	• 4,600 cfs (130 m^3/s)
	Peak flow duration is dependent upon the amount of unregulated inflows into the Green River and the flows needed to achieve the recommended flows in Reaches 2 and 3.					
	Summer-to-Winter Base Flow	1,800–2,700 cfs (50–60 m^3/s)	1,500–2,600 cfs (42–72 m^3/s)	800–2,200 cfs (23–62 m^3/s)	800–1,300 cfs (23–37 m^3/s)	800–1,000 cfs (23–28 m^3/s)
Above Yampa River Confluence	Water Temperature Target	• 64 degrees Fahrenheit (°F) (18 degrees Celsius [°C]) for 3-5 weeks from mid-August to March1	• 64 °F (18 °C) for 3-5 weeks from mid-August to March 1	• 64 °F (18 °C) for 3-5 weeks from mid-July to March 1	• 64 °F (18 °C) for 3-5 weeks from June to March 1	• 64 °F (18 °C) for 3-5 weeks from mid-June to March 1
Reach 2 Yampa River to White River	Maximum Spring Peak Flow	• 26,400 cfs (748 m^3/s)	• 20,300 cfs (575 m^3/s)	• 18,600 cfs[7] (527 m^3/s) • 8,300 cfs[8] (235 m^3/s)	• 8,300 cfs (235 m^3/s)	• 8,300 cfs (235 m^3/s)
	Peak Flow Duration	Flows greater than 22,700 cfs (643 m^3/s) should be maintained for 2 weeks or more, and flows 18,600 cfs (527 m^3/s) for 4 weeks or more.	Flows greater than 18,600 cfs (527 m^3/s) should be maintained for 2 weeks or more.	Flows greater than 18,600 cfs (527 m^3/s) should be maintained for 2 weeks in at least 1 of 4 average years.	Flows greater than 8,300 cfs (235 m^3/s) should be maintained for at least 1 week.	Flows greater than 8,300 cfs (235 m^3/s) should be maintained for 2 days or more except in extremely dry years (98% exceedance)
	Summer-to-Winter Base Flow	2,800–3,000 cfs (79–85 m^3/s)	2,400–2,800 cfs (69–79 m^3/s)	1,500–2,400 cfs (43–67 m^3/s)	1,100–1,500 cfs (31–43 m^3/s)	900–1,100 cfs (26–31 m^3/s)
Below Yampa River Confluence	Water Temperature Target	Green River should be no more than 9 °F (5 °C) colder than Yampa River during summer base flow period.	Green River should be no more than 9 °F (5 °C) colder than Yampa River during summer base flow period.	Green River should be no more than 9 °F (5 °C) colder than Yampa River during summer base flow period.	Green River should be no more than 9 °F (5 °C) colder than Yampa River during summer base flow period.	Green River should be no more than 9 °F (5 °C) colder than Yampa River during summer base flow period.
Reach 3 White River to Colorado River	Maximum Spring Peak Flow	• 39,000 cfs (1,104 m^3/s)	• 24,000 cfs (680 m^3/s)	• 22,000 cfs[9] (623 m^3/s)	• 8,300 cfs (235 m^3/s)	• 8,300 cfs (235 m^3/s)
	Peak Flow Duration	Flows greater than 24,000 cfs (680 m^3/s) should be maintained for 2 weeks or more, and flows 22,000 cfs (623 m^3/s) for 4 weeks or more.	Flows greater than 22,000 cfs (623 m^3/s) should be maintained for 2 weeks or more.	Flows greater than 22,000 cfs (623 m^3/s) should be maintained for 2 weeks in at least 1 of 4 average years.	Flows greater than 8,300 cfs (235 m^3/s) should be maintained for at least 1 week.	Flows greater than 8,300 cfs (235 m^3/s) should be maintained for 2 days or more except in extremely dry years (98% exceedance)
	Summer-to-Winter Base Flow	3,200–4,700 cfs (92–133 m^3/s)	2,700–4,700 cfs (76–133 m^3/s)	1,800–4,200 cfs (52–119 m^3/s)	1,500–3,400 cfs (42–95 m^3/s)	1,300-2,600 cfs (32–72 m^3/s)

Appendix C

April 22, 2016 Memorandum from the Recovery Program Director containing the Research Request for 2016 Green River Spring Flows

Upper Colorado River Endangered Fish Recovery Program

Noreen Walsh, Chairperson
Implementation Committee

Thomas E. Chart
Program Director

U.S. Fish and Wildlife Service - P.O. Box 25486 - Denver Federal Center - Denver, CO 80225 - (303) 236-9895 Fax (303) 236-8739

IN REPLY REFER TO:
FWS/CRRP/K3a1/65115

APR 22 2016

Memorandum

To: Mr. Brent Rhees, Regional Director, Upper Colorado Region, Bureau of Reclamation
Ms. Heather Patno, Chair, Flaming Gorge Technical Working Group, Bureau of Reclamation

From: Thomas Chart, Director, Upper Colorado River Endangered Fish Recovery Program

Subject: Recovery Program's Research Request for 2016 Green River Flows

The Upper Colorado River Endangered Fish Recovery Program (Recovery Program) supports the Bureau of Reclamation's (Reclamation) operations at Flaming Gorge Dam in 2016 consistent with the 2005 Biological Opinion (U.S. Fish and Wildlife Service (USFWS) 2005) and 2006 Record of Decision (ROD; U.S. Department of Interior 2006). As in the past five years, an objective of our request this year is to continue to build on past research (Bestgen et al. 2011) and recent success to benefit the razorback sucker (*Xyrauchen texanus*) population throughout the Green River by timing the river-floodplain connection with the presence of wild-produced razorback sucker larvae. This year the Recovery Program expands our request to explore two additional experimental flow scenarios based on recent research: a) elevated summer base flows in most average and drier year hydrologic conditions to improve survival of Age-0 Colorado pikeminnow (*Ptychocheilus lucius*) (Bestgen and Hill 2015a); and b) future considerations for an experimental spike flow in the early summer (post peak) to negatively affect early life stages of nonnative smallmouth bass (*Micropterus dolomieu*) (Bestgen and Hill 2015b). From comments received (dated February 26, 2016) and in discussion with the Recovery Program's Management Committee on March 7, 2016, we understand that Reclamation has concerns that current NEPA coverage may not be sufficient to fully address some of the potential impacts of this year's new flow requests, concerns about public relations, and water availability to meet the requests. The Recovery Program appreciates Reclamation's willingness to work with the Flaming Gorge Technical Work Group (FGTWG) to address base flows within existing authority under the 2006 ROD.

The Recovery Program is currently evaluating the Green River Flow and Temperature recommendations (Muth et al. 2000). A Green River Evaluation and Assessment Team (GREAT)

was convened in 2015 to initiate this evaluation, which is scheduled for completion in January 2017. The GREAT consists of representatives from Argonne National Laboratory (ANL – co-lead of this evaluation), Colorado State University (co-lead of this evaluation), Reclamation, Western Area Power Administration, National Park Service, USFWS (Program Director's Office and the Utah Ecological Services Field Office), and the State of Utah. The GREAT is reviewing past performance under the ROD and considering all available information to determine if Muth et al. 2000 should be revised. At this point in that evaluation, we can report that the GREAT is strongly considering revisions to formally recognize the importance of: a) larval triggered spring operations (including ramping rates), b) elevated base flows and the onset of the base flow period, and c) summer spike flows to disrupt nonnative smallmouth bass spawning success. Such revisions would be coupled with implementation plans. If / when the Recovery Program approves revisions of Muth et al. 2000, we then expect Reclamation will determine if additional NEPA analysis is necessary. The Recovery Program will commit to work with Reclamation (through the GREAT evaluation and Recovery Program committee review of revisions to Muth et al. 2000) to provide the information needed to assist Reclamation with that NEPA determination.

Request 1 – River / Floodplain Connection - The Recovery Program's 2016 spring flow request is based on objectives outlined in our *Study Plan to Examine the Effects of Using Larval Sucker Occurrence in the Green River as a Trigger for Flaming Gorge Dam* (LTSP; Larval Trigger Study Plan Ad Hoc Committee 2012). In the LTSP we describe a desired range of experimental floodplain connection scenarios (post larval detection) and studies we would implement to evaluate those scenarios. Minimally, to complete the experiment, the Recovery Program requests three years with flows < 18,600 cfs and three years with flows ≥ 18,600 cfs and with connecting flows in each of these years of at least seven days duration. However, spring peak flow magnitude requests will be driven by hydrologic conditions in the upper Green River Basin and to some extent the Yampa River basin; therefore, it may not be possible to complete the experiment in six consecutive years. The LTSP experiment began officially in 2012; however, the Recovery Program was able to gather some pre-LTSP related information during 2011. Reclamation's spring operations in 2011 were dictated by flood control concerns, but resulted in significant floodplain connection in Reach 2 after larval razorback sucker were detected in the river. Beginning in 2012, Reclamation's high spring releases (Figure 1) have been timed specifically to achieve LTSP objectives in Reach 2 (Figure 2). The resulting Reach 2 flows and preliminary results of biological monitoring in Reach 2 floodplain habitats are summarized in Table 1 and discussed in greater detail in the attached Appendix. In 2012, Reclamation and the Recovery Program connected floodplain habitats (e.g. Stewart Lake and Old Charley Wash) after larvae were detected in the river and documented larval entrainment into those floodplains. In 2013, dam operations in accordance with the LTSP experiment again connected floodplains and entrained larval fish, but also progressed by supporting over-summer survival and rapid growth of entrained larvae. Further, the eventual release of these fish back to the Green River represented a major milestone in LTSP implementation and represents a positive step forward in the recovery of razorback sucker. In 2014, larval entrainment was documented at 5 of 6 sampled floodplains (Stirrup, Escalante, Stewart Lk, Above Brennan, and Leota 7 (confirmed via capture of Age-0 in the fall)) (Webber et al. 2014; Schelly et al. 2014). The Bonanza Bridge floodplain was not sampled for larvae in the spring; only nonnative species were collected when UDWR sampled the site in the fall (Schelly et al. 2014). Age-0 razorback sucker were again found in Stewart Lake and were released to the Green River in September 2014; those razorback suckers were more numerous and larger in size than those in 2013 (Schelly et al. 2014). Even more importantly, later in September 2014, researchers collected wild produced Age-0 razorback sucker in Green River Reach 2 main channel backwater habitats for the first time since 2000 (Breen et al. 2014). In 2015, larval razorback sucker were detected on 7 May, and 8 days earlier than ever previously documented (since 1992) (Bestgen and Jones 2015). Larvae were entrained into Stewart Lake and Johnson Bottom, but were not detected at Escalante Ranch, the only other wetland

sampled during the spring (Jones et al. 2015; Schelly and Breen 2015). Juvenile razorback sucker were collected during the summer in Johnson Bottom, but apparently did not survive to autumn when this newly renovated habitat was drained. Stewart Lake was drained in September 2015 and once again wild juvenile razorback sucker were released to the river. Although survival of young razorback sucker to the fall was not as high in 2015 as it was in 2013 and 2014, these experimental LTSP releases continue to provide the Recovery Program valuable information related to recovery of this endangered species.

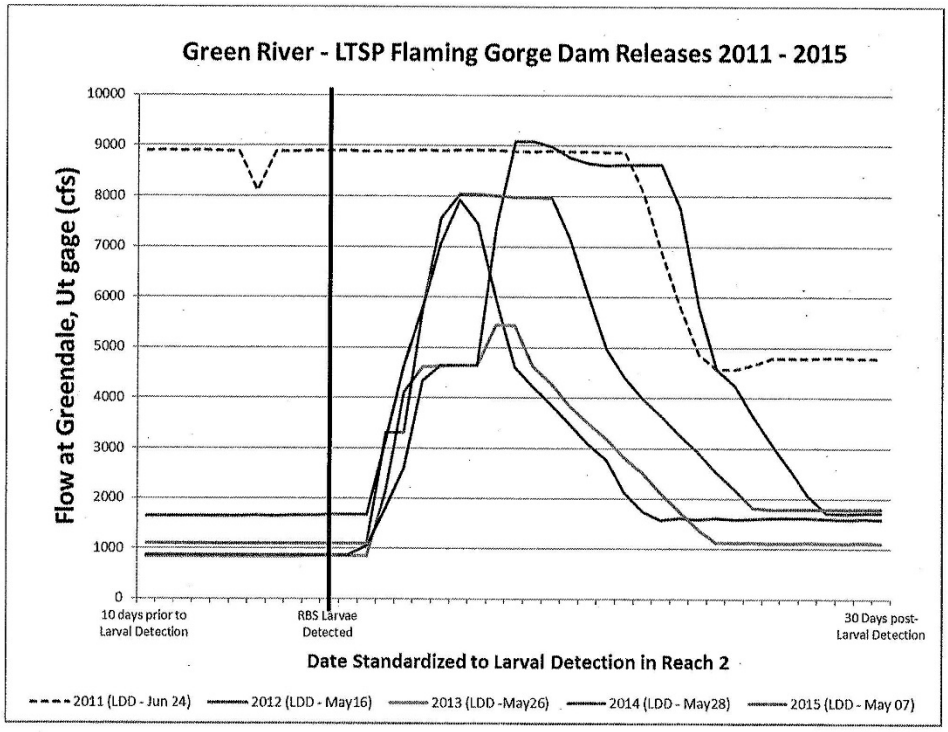


Figure 1. Reclamation's spring, LTSP releases from Flaming Gorge Dam 2012 – 2014. Spring 2011 releases (dashed line) were largely driven by flood control concerns, but are included here because significant floodplain connection occurred in Reach 2 after larvae were detected. Chronology of annual hydrographs has been standardized to 1st larval detection date (LDD). Actual annual LDD's are identified in the legend.

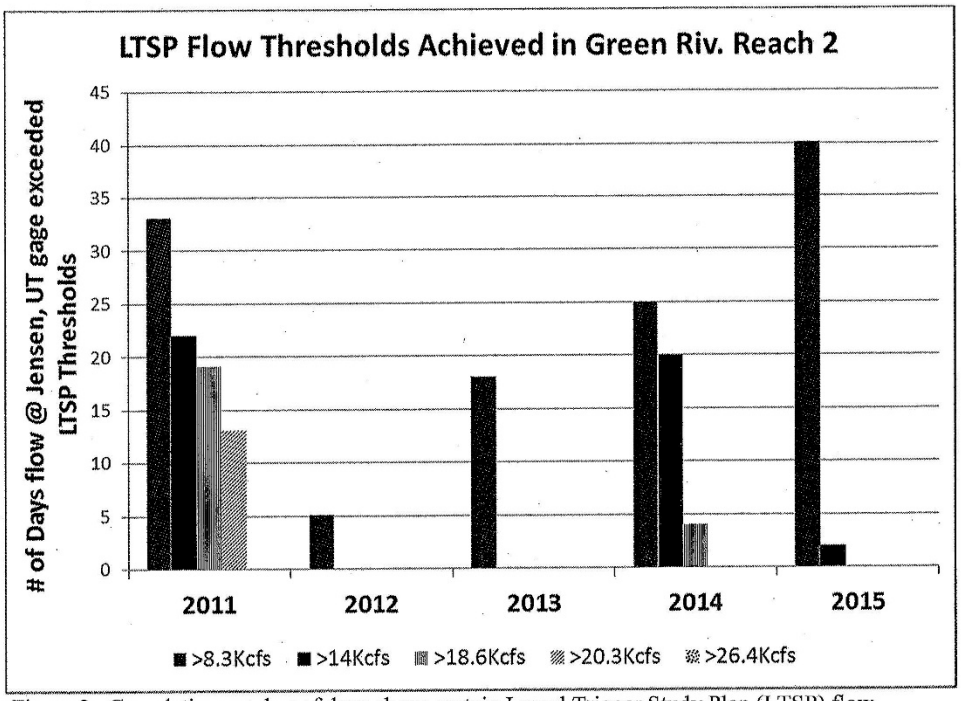


Figure 2. Cumulative number of days above certain Larval Trigger Study Plan (LTSP) flow thresholds in the Green River Reach 2 (as measured @ Jensen, UT gage); 2012 – 2015 (note: 2011 was pre-LTSP) when razorback sucker larvae were present.

Appendix C-5

Table 1. A summary of biological findings associated with Larval Trigger Study Plan operations and Recovery Program studies. Not all potential study floodplains are listed.

Year / date of 1st RBS larval capture	Hydrologic Class. - Green / Yampa River	Floodplains[1] – RBS Larvae Detected[2]					Floodplains – RBS Juveniles Detected[3]				
		ER	SL	Le	JB	AB	ER	SL	Le	JB	AB
2011 / Jun24	Mod Wet/ Wet	Prior to start of LTSP study – larvae presumably entrained in all wetlands.					Juvenile RBS detected in Wyasket Lk. and Leota				
2012 / May16	Dry / Dry	NA	Y	NA	NA	NA	NA	NA	NA	NA	NA
2013 / May26	Mod Dry / Mod Dry	NA	Y	NA	NA	NA	NA	Y	NA	NA	NA
2014 / May28	Avg (Above Med) / Mod Wet	Y	Y	N	N	Y	N	Y	Y	N	N
2015 / May07	Mod Dry / Mod Dry	N	Y	NA	Y	NA	N	Y	NA	Y	N

1 ER = Escalante Ranch; SL = Stewart Lk; Le = Leota Bottoms; JB = Johnson Bottom; AB = Above Brennan

2 NA = habitat did not connect - not available for sampling, i.e. particular floodplain did not connect; **Y**, N = yes or no - larvae or juvenile detected in floodplain

Request 2 – Elevated Summer Base Flows – Since the ROD was signed, the Recovery Program has made only one specific summer base flow request, in 2008. The objectives of that request were: a) to create more nursery habitat for Age-0 Colorado pikeminnow in Reach 2; b) to provide a Reach 2 base flow which was scaled more closely to the observed 2008 spring peak flow; and c) disadvantage nonnative smallmouth bass in Reaches 1 and 2. Beginning in 2009, the USFWS – Utah Field Office has submitted similar base flow requests directly to Reclamation. All the base flow requests submitted to date exercised seasonal flow variability identified in Muth et al. 2000 and relied on preliminary summaries of the long term (1979 – present) Age -0 Colorado pikeminnow fall monitoring program that indicated survival of that life stage was higher when base flows in most average and drier hydrology years were higher.

In February 2016, the Recovery Program technical committees (Biology and Water Acquisition) approved a report (Bestgen and Hill 2015a), which provided a formal analysis of the Age-0 monitoring data and coupled that with Colorado pikeminnow larval monitoring (1992 – 2012; one year missing). Bestgen and Hill concluded (1 of 19 conclusions in the report):

> *Age-0 Colorado pikeminnow abundance was highest in the middle Green River in moderate flow years (1700-3000 ft3/sec), lower in some low flow years because larvae were fewer (< 1700 ft3/sec), and low in most high flow years (>3000 ft3/sec) because backwater habitat was reduced. Patterns were similar in the lower Green River except higher abundances of age-0 pikeminnow were in slightly higher flows.*

In Table 10 of their report (reproduced below), Bestgen and Hill compare their proposed base flow recommendations for Reaches 2 and 3 with the original Muth et al. 2000 recommendations. Although the new base flows (all hydrologic conditions) fall entirely within the overall Muth et al. (2000) base flow range in both reaches, they represent a substantial increase during the dry and moderately dry years. Considering the status of Colorado pikeminnow in the Green River as discussed in Bestgen and Hill (2015a), the Recovery Program requests that Reclamation strive to meet these proposed base flows on an experimental basis through September 30 of each year. We understand that Reclamation may need to revert to the Muth et al. (2000) base flow ranges after September 30 to manage the reservoir; those changes would be discussed with the FGTWG.

Reclamation's operations during the summer of 2015 resulted in Reach 2 flows that were consistent with this new information. Flows at Jensen, Utah averaged 2,118 cfs through the months of August and September. The Utah Division of Wildlife Resources (UDWR) (Breen et al. 2015) captured 202 Age-0 Colorado pikeminnow in their middle Green River fall 2015 monitoring, which was their 3rd highest catch in the past 20 years. Summer base flows in Reach 3 (measured at Green River, UT) averaged 2,328 cfs for the same months and were higher than upstream due to tributary inputs. The UDWR captured 461 Age-0 Colorado pikeminnow in their lower Green River monitoring, which also represented their 3rd highest catch from that reach in the past 20 years.

Bestgen and Hill (2015a) also recognized the importance of achieving the proposed base flows in Reach 2 as soon as possible after Colorado pikeminnow larvae were detected in the annual drift monitoring conducted at Echo Park, CO. This incorporates a new 'larval triggered' element for this species, similar to that for razorback sucker in the middle Green River, and for base flow management not specifically discussed in Muth et al. (2000). In some cases, this may require reducing Flaming Gorge releases to as low as 800 cfs then increasing flows in response to declining Yampa flows. The Recovery Program recognizes the utility of providing optimal nursery habitat conditions in Reach 2 as the drifting larvae arrive and then continuing those flows through the summer growth and recruitment period. The Recovery Program will coordinate with Reclamation in documenting real-time presence

of larval Colorado pikeminnow captured in Project 22f drift samples that are collected in the lower Yampa River. More detail on monitoring effects of experimentally elevated summer base flows on young Colorado pikeminnow abundance and survival are described below. The Recovery Program (via the GREAT) will likely revise Muth et al 2000 to recognize the science that supports elevated base flows. Such a revision would include an elevated base flow implementation plan. We expect that implementation plan will define criteria for success, identify a finite time frame and address uncertainties.

Table 10. Comparison of base flow levels in Muth et al. (2000) and those proposed in this report for the middle and lower Green River, Utah. The higher upper ends of flow ranges in Muth et al. (2000) for the lower Green River reflect uncertainty about tributary inputs, while proposed targets represent preferred ranges.

	Reach 2, Middle Green River flows		Reach 3, Lower Green River flows	
Hydrologic classification	2000 (Muth et al.)	Proposed	2000 (Muth et al.)	Proposed
Dry (10% of years, 0 to 10% exceedance)	26-31 m^3/s (900-1,100 ft^3/s)	48-51 m^3/s (1,700-1,800 ft^3/s)	37-74 m^3/s (1,300-2,600 ft^3/s)	48-57 m^3/s (1,700-2,000 ft^3/s)
Moderately dry (20% of years)	31-43 m^3/s (1,100-1,500 ft^3/s)	51-57 m^3/s (1,800-2,000 ft^3/s)	42-96 m^3/s (1,500-3,400 ft^3/s)	57-65 m^3/s (2,000-2,300 ft^3/s)
Average (40% of years)	43-68 m^3/s (1,500-2,400 ft^3/s)	57-74 m^3/s (2,000-2,600 ft^3/s)	51-119 m^3/s (1,800-4,200 ft^3/s)	65-79 m^3/s (2,300-2,800 ft^3/s)
Moderately wet (20% of years)	68-79 m^3/s (2,400-2,800 ft^3/s)	62-79 m^3/s (2,200-2,800 ft^3/s)	77-133 m^3/s (2,700-4,700 ft^3/s)	74-91 m^3/s (2,600-3,200 ft^3/s)
Wet (10% of years, 90 to 100% exceedance)	79-85 m^3/s (2,800-3,000 ft^3/s)	68-85 m^3/s (2,400-3,000 ft^3/s)	91-133 m^3/s (3,200-4,700 ft^3/s)	79-108 m^3/s (2,800-3,800 ft^3/s)

Excerpted from Bestgen and Hill 2015a

Request 3 (future) – Smallmouth Bass Spike Flow – The Recovery Program now considers persistent competition and predation from nonnative predators (smallmouth bass, northern pike (*esox lucius*), and walleye (*sander vitreus*) on the native and endangered fish community our greatest remaining threat to recovery. Our nonnative predator control strategy to date consists of: 1) mechanical (primarily boat based electrofishing) removal of these predators from 600+ miles of the Green and Colorado rivers and their tributaries, 2) controlling escapement from reservoir sources (e.g. chemical renovation, screening outlets, incentivized harvests), and 3) changes in sport fish management to utilize species that are considered more compatible with endangered fish recovery. Of these three nonnative predators, smallmouth bass are the most widespread and spawn in main channel habitats. Spawning populations are found in the Yampa River, Green River (Reaches 1, 2, and 3), White River, and in the Colorado River. Adult male smallmouth bass guard shallow shoreline nests where the female deposits eggs and where recently hatched young remain to develop. Fish biologists from other parts of the country have long reported that sudden increases in flow (spikes) and/or increased turbidity can displace the recently hatched young from those protected nests into less favorable habitat, which results in high mortality of the Age-0 cohort (see Bestgen and Hill 2015b for a summary of those studies). Such environmental changes may also cause adult male bass to abandon nests, which also increases mortality of young bass. For years, the Recovery Program's Biology Committee (BC) has recognized that induced spike flows could be an important complement to the nonnative fish removal strategy mentioned above because it could influence smallmouth bass spawning success on a reach-wide scale. The BC also recognized that considerable information needed to be gathered on smallmouth bass spawning ecology in our rivers to characterize a meaningful flow manipulation in terms of timing, magnitude, duration, techniques for evaluation. Since 2003, Bestgen and Hill have analyzed otolith microstructure to estimate hatching dates and growth rates of early life stages of smallmouth bass collected in regulated or partially regulated reaches of the Green River, and the free-flowing Yampa River, Colorado and Utah. Bestgen and Hill (2015b) summarize that information and provide the Recovery Program with the basis for a spike flow experiment.

NOTE: ***The Recovery Program is not requesting a spike flow in 2016.*** *The Recovery Program (via the GREAT) is in the process of evaluating and potentially revising Muth et al. 2000. Revisions will consider the new science on the importance (and potential implementation) of spike flows.*

As with elevated base flows, the Recovery Program (via the GREAT) is considering a revision to Muth et al. 2000 to incorporate periodic summer spike flows to disrupt smallmouth bass spawning. Such a revision would include an implementation plan that would be based on Reach 1 and 2 hydrology and thermal regimes as well as real-time observations of smallmouth bass spawning behavior. More specifically, Bestgen and Hill (2015b) provide the following general considerations for implementation of a spike flow:

- Smallmouth bass reproduction is most successful during years of drier hydrology (e.g. Average (below median) to Dry) because spawning occurs early and Age-0 growth is adequate for fish to survive their first winter. Therefore spike flows would have the greatest effect in these below median hydrologic year types.
- Smallmouth bass spawning can occur over a multiple (typically four to five) week period. For the reasons mentioned above, a spike flow that targets the early to middle portion of that spawning activity would have the greatest effect. Also targeting the early smallmouth bass spawn reduces possible collateral effects on Colorado pikeminnow reproduction, which occurs later.
- The magnitude of a spike flow is of critical importance. Smallmouth bass have been observed

to select spawning sites at the lower end of cutoff side channels. A cursory review of flow / stage relationships indicate that rapidly increasing flows from a low level (e.g. <1500cfs) in Reach 1 up to power plant capacity (~4500cfs) would create flow-through conditions in many side channels habitats both in Lodore Canyon (Reach 1) and in the upper portions of Reach 2 thereby disrupting established spawning sites.

- Timing of the spike flow will be equally important. Timing of releases for disruption of reproduction should be predicted with Bestgen and Hill (2015b) smallmouth bass hatching date distribution, but verified with observations. Although there is a flow magnitude component to the onset of reproduction, Bestgen and Hill (2015b) report that time of smallmouth bass spawn is closely correlated with the onset of a main channel temperature of 16°C. Ideally, flows in the Yampa River will have dropped to moderate to low levels to maximize the disturbance in downstream Island and Rainbow Parks in the upper portion of Reach 2.
- Duration of the Spike Flow – Flows would have to be sustained for a long-enough period, perhaps 2-3 days in the reaches to be affected, to have the desired impact, and to allow investigators to measure effects.
- Evaluation - Understanding effects of flow disturbances would likely require an assessment of physical effects of increased flows, in addition to a biological assessment. Physical habitat changes during flow increases should focus on those characteristics that may disrupt nesting success (increased velocity over the nests, reconnection of a side channel). A physical effects analysis may involve finding and marking active nests, taking measurements of velocity and depth characteristics around the nest area before and during the flow disruption, and describing macro-habitat features of the site, including whether the nest was located in the downstream end of a secondary channel.

THE RECOVERY PROGRAM'S 2016 GREEN RIVER FLOW REQUEST:

The Recovery Program's 2016 Green River Flow Request comprises two components: an LTSP spring peak and new Reach 2 base flow target ranges that should be achieved coincident with the presence of drifting Colorado pikeminnow larvae and maintained through September 30. The Recovery Program believes all aspects of this request are supported by sound science and we understand that achieving both components may not be possible based on water availability. To assist Reclamation and the FGTWG, should such deliberations be necessary, the Recovery Program prioritizes these flow experiments as follows:

Priority 1 – LTSP spring peaks
Priority 2 – New, proposed Reach 2 base flow ranges as per Bestgen and Hill (2015a)

1. Implement the LTSP. The Recovery Program requests that the Flaming Gorge Technical Work Group match Recovery Program research needs identified in the LTSP with the best available spring flow forecast information to develop a specific middle Green River floodplain connection scenario. Our LTSP study design matrix (Table 2) details the range of experimental conditions we would like to assess with recognition that more than one cell of that matrix could be accomplished in a single year. The Recovery Program Director's office will distribute the pertinent FGTWG recommendation to the Biology and Management committees and Principal Investigators as quickly as possible.

The Recovery Program will provide a real-time assessment of razorback sucker larval presence (i.e., the 'larval trigger') through ongoing monitoring under Recovery Program Project No. 22f. Based on information provided in Bestgen et al. (2011), waiting for this larval trigger will likely cause Reclamation to make spring releases from Flaming Gorge Dam after the Yampa River has peaked, which may necessitate releases in excess of power plant capacity to meet the flow magnitude thresholds needed for river-floodplain connections. As addressed in the LTSP, the Recovery Program is prepared to direct sampling efforts each year to the appropriate floodplain habitats based on hydrologic forecasting and the FGTWG request. The Recovery Program is poised and properly funded to follow through on specific LTSP field investigations again in 2016 (e.g., Project Nos. 22F, 164 and 165[3]). The Recovery Program hopes that Stewart Lake water levels can be maintained in 2016 for a duration that is similar to that realized in 2014, because prolonged favorable conditions for razorback sucker growth into late summer results in larger fish with a higher probability of surviving their first winter.

[4]These (3) project scopes of work are available at: http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/project-scopes-of-work.html

Table 2. The Larval Trigger Study Plan design matrix

Peak Flow (x) as Measured at Jensen, Utah	Proposed Study Wetlands[a, b]	Number of Days (x) Flow to Be Exceeded and Corresponding Hydrologic Conditions [c]		
		1 ≤ x < 7	7 ≤ x < 14	x ≥14
8,300 ≤ x < 14,000 cfs	Stewart Lake (f), Above Brennan (f), Old Charley Wash (s)[d]	Dry	Moderately dry	Moderately dry and average (below median)
14,000 ≤ x < 18,600 cfs	Same as previous plus Escalante Ranch (f), Bonanza Bridge (f), Johnson Bottom[e] (s), Stirrup (s), Leota 7 (s)	Average (below median)	Average (below median)	Average (below median)
18,600 ≤ x < 20,300 cfs	Same as previous	Average (above median)	Average (above median)	Average (above median)
20,300 ≤ 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 ≥ 26,400 cfs	Same as previous	Wet	Wet	Wet

(a) f = flow-through wetland, s = single-breach wetland

(b) Up to eight wetlands would be sampled in a given year with the three in the lowest flow category being sampled in all years.

(c) Exceedance percentages and peak flow recommendations for each hydrologic condition as described in Muth et al. 2000. 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.

(d) Access to the Old Charley Wash floodplain has been denied since 2012.

(e) In 2015, Johnson Bottom was re-contoured and canals were cleaned; this wetland can now entrain larvae when flows are <14,000cfs.

The Recovery Program assumes that our 2016 LTSP spring flow request will be refined in concert with the FGTWG using the best available flow forecast information.

2. Elevated Base Flows. We request that Reclamation operate dam releases to achieve (*see text box*) the proposed experimental base flow ranges as presented in Bestgen and Hill (2015a) in Reach 2 through September 30. We request that Reclamation experiment with alternative down-ramping rates to achieve the summer base flow target as soon as possible after Colorado pikeminnow larvae are detected in the drift. The Program Director's office will coordinate with Colorado State University, Reclamation, and the FGTWG with predictions of larval presence and communicate real time larval collection information as soon as it is available.

The Recovery Program appreciates Reclamation's willingness to work within the Flaming Gorge Technical Work Group (FGTWG) in 2016 in an attempt to increase base flows within existing authority under the 2006 ROD.

The Recovery Program has two monitoring projects (Project 22f – Larval Monitoring and Project 138 Age-0 Colorado pikeminnow fall monitoring) in place and funded to assist in the implementation and evaluation of this new experimental base flow operation. These same projects and resulting data are what we rely on each year to assess flow and temperature effects on Colorado pikeminnow

reproduction, growth, and survival, and provide the basis for flow recommendations previously described and as outlined in Bestgen and Hill (2015a). Annual drift net sampling begins in late spring each year in the lower Yampa River prior to Colorado pikeminnow reproduction. That daily sampling allows us to determine the onset of reproduction by Colorado pikeminnow, and eventual presence of drifting larvae that disperse from the lower Yampa River spawning areas. Larvae subsequently drift downstream to the low gradient and sand-bedded middle Green River where backwater nursery habitat is abundant. When pikeminnow larvae are first detected in field samples (samples are sorted daily, preliminary identifications will be made in the field, and quickly followed by verification in the laboratory), the FGTWG would be consulted to initiate the onset of the base flow period. This could result in flow release changes from Flaming Gorge Dam, if changes are needed, for the summer base flow period that extends through 30 September.

This larvae-presence driven approach is similar to the one used in the LTSP to document first presence of razorback sucker larvae in light trap samples in the middle Green River. Drift net sampling will continue throughout the reproductive season for pikeminnow, and typically ends in early to mid-August when no larvae are captured for several consecutive days. Consultation with the FGTWG through the summer growth and survival period is planned so that Flaming Gorge Dam flow releases may be altered to provide recommended flow levels in the middle Green River reaches. Alterations may be needed because Yampa River flows decline through summer such that Flaming Gorge Dam flow rates may occasionally need to be increased.

Annual backwater sampling in the middle and lower Green River reaches would then take place in autumn, following the summer Colorado pikeminnow reproduction and survival period. This long-term and spatially extensive sampling consists of seine hauls made in about 30-40 backwaters throughout each nursery habitat reach and documents density and size of pikeminnow that resulted from summer reproduction. Understanding reproductive effort at spawning sites, resulting recruitment of young-of-year Colorado pikeminnow in autumn, and documenting flow and habitat conditions in nursery habitat reaches, allows us to understand if and why managed flow conditions were successful to produce year-classes of young pikeminnow abundant enough to contribute substantially to adult life stages in several years.

We may also consider additional summer (early August) seine sampling in nursery reach backwaters to obtain an additional measure of pikeminnow survival and growth. This may be useful to provide an early indication of success of flow management and serves as a backup measure of recruitment success should autumn sampling be compromised by unforeseen flow events. There was such an occurrence in 2014, when late summer storms mobilized fine sediment and filled backwaters with deep mud, which compromised sampling efficiency throughout nursery habitat reaches in autumn.

We may also consider an otolith-aging investigation to understand if base flow onset timed with presence of larvae was successful to enhance survival of early hatching fish. This would be accomplished by understanding if early hatching cohorts of larvae survived to autumn, based on comparing hatching dates of fish captured in autumn to presence of larvae in summer (sensu Bestgen et al. 2006). Past analyses have shown that early hatching cohorts are underrepresented in autumn, sometimes by a substantial amount, and apparently survived at lower rates than later hatching cohorts (Bestgen et al. 1997; 2006). Presence and abundance patterns of early hatching cohorts in autumn relative to abundance of larvae in summer, would allow us to understand the importance of using the pikeminnow larvae presence to trigger onset of the base flow period.

In the longer term, the Recovery Program (via the GREAT) is considering a revision to Muth et al. 2000 that would formally recognize the science that supports elevated base flows. Such a revision would include an implementation plan.

In closing, the Recovery Program appreciates Reclamation's efforts in the past to achieve the flow and temperature recommendations and assist in recovery of the endangered fishes. We recognize that greater reliance on the LTSP biological trigger (presence of larval razorback sucker) may require greater volumes of water during the spring in some years, but we believe this experiment is consistent with the biological intent of Muth et al. (2000) and this research is essential to the recovery of the endangered fish. The Recovery Program's sampling results from the past three years, and particularly the large number of juvenile razorback suckers collected at Stewart Lake in 2013 and 2014, clearly demonstrate the effectiveness of the LTSP operations. Similarly, our request for experimentation with elevated base flows within Reclamation's authority under the 2006 ROD would require greater volumes of water released during the summer months, but we feel this request is also justified by the available science and worth pursuing to reach our common goal of endangered fish recovery.

To summarize, the Recovery Program (via the GREAT) is considering revising Muth et al. 2000 to formally incorporate new information related to: a) larval triggered spring operations (including ramping rates), b) elevated base flows (including a biologically triggered onset of the base flow period), and c) summer spike flows to disrupt nonnative smallmouth bass spawning. Such revisions would include implementation plans intended to assist Reclamation with your determination of the need for additional NEPA analysis.

Thank you for considering these Recovery Program 2016 flow requests.

Literature Cited (including Appendix citations)

Bestgen, K. R., D. W. Beyers, G. B. Haines, and J. A. Rice. 1997. Recruitment models for Colorado squawfish: Tools for evaluating the relative importance of natural and managed processes. Final report to the National Biological Survey and National Park Service, Fort Collins, Colorado. 55 pp.

Bestgen, K. R., D. W. Beyers, G. B. Haines, and J. A. Rice. 2006. Factors affecting recruitment of young Colorado pikeminnow: synthesis of predation experiments, field studies, and individual-based modeling. Transactions of the American Fisheries Society 135:1722-1742.

Bestgen, K.R., G.B. Haines, and A.A. Hill. 2011. Synthesis of floodplain wetland information: timing of razorback sucker reproduction in the Green River, Utah, related to streamflow, water temperature, and floodplain wetland availability. Final Report to the Upper Colorado River Endangered Fish Recovery Program. U. S. Fish and Wildlife Service, Denver, CO. Larval Fish Laboratory Contribution 163. Final Report available at: http://www.coloradoriverrecovery.org/documents-publications/technical-reports/hab/Bestgenetal.2011FloodPlainSynthesisFinalReport.pdf

Bestgen, K. R., K. A. Zelasko, and G. C. White. 2012. Monitoring reproduction, recruitment, and population status of razorback suckers in the Upper Colorado River Basin. Final Report to the Upper Colorado River Endangered Fish Recovery Program, U. S. Fish and Wildlife Service, Denver. Larval Fish Laboratory Contribution 170. Available at: http://www.coloradoriverrecovery.org/documents-publications/technical-reports/rsch/BestgenetalProject159RZBMonitoringOctober2012Final.pdf

Bestgen, K.R., A. Webber, and T. Jones. 2013. Project 22f - Interagency standardized monitoring program (ISMP) assessment of endangered fish reproduction in relation to Flaming Gorge operations in the middle Green and lower Yampa rivers-Yampa and middle Green River assessment of Colorado pikeminnow and razorback sucker larvae. FY2013 Annual Report available at: http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2012/rsch/22f.pdf

Bestgen, K.R. and A.A. Hill. 2015a [*in review*]. Reproduction, abundance, and recruitment dynamics of young Colorado pikeminnow in the Green and Yampa rivers, Utah and Colorado , 1979 - 2012.

Bestgen, K.R. and A.A. Hill. 2015b [*in review*]. River regulation affects reproduction, early growth, and suppression strategies for invasive smallmouth bass in the Upper Colorado River basin.

Bestgen, K.R. and T. Jones. 2015. Project 22f - Interagency standardized monitoring program (ISMP) assessment of endangered fish reproduction in relation to Flaming Gorge operations in the middle Green and lower Yampa rivers-Yampa and middle Green River assessment of Colorado pikeminnow and razorback sucker larvae. FY2015 Annual Report.

Bestgen, K.R. and T. Jones. 2014. Project 22f - Interagency standardized monitoring program (ISMP) assessment of endangered fish reproduction in relation to Flaming Gorge operations in the middle Green and lower Yampa rivers-Yampa and middle Green River assessment of Colorado pikeminnow and razorback sucker larvae. FY2014 Annual Report. Available at: http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2014/rsch/22f%20ISMP-2014.pdf

Breen. M.J. 2011. Project C6 RZ-RECR- Razorback emigration from the Stirrup floodplain (RM 275.7). FY2011 Annual Report available at: http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2011/hab/C6RZRECRrev.pdf

Breen, M.J. and J. Skorupski. 2012. Project 165 - Use of the Stewart Lake floodplain by larval and adult endangered fishes. FY2012 Annual Report available at: http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2012/hab/FR165.pdf

Breen, M.J., J.T. Herdmann, and C.M. Michaud. 2014. Project 138 - Annual fall monitoring of young of year Colorado pikeminnow and small bodied native fishes. FY 2014 Annual Report available at: http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/project-annual-reports.html#V.

Breen, M.J., R.C. Schelly, and C.M. Michaud. 2015. Project 138 - Annual fall monitoring of young of year Colorado pikeminnow and small bodied native fishes. FY 2015 Annual Report.

Grippo, M., K.E. LaGory, J.W. Hayse, L. J. Walston, C. C. Weber, and D. Waterman. 2015. Relationships between flow and the physical characteristics of Colorado pikeminnow backwater nursery habitats in the Middle Green River, Utah. *in Draft.*

Jones, T., C. Smith, and D. Beers. 2015. Project 164 - Middle Green River floodplain sampling. FY2015 Annual Report available at: http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2015/hab/FR164.pdf

Larval Trigger Study Plan Ad Hoc Committee. 2012. Study Plan to Examine the Effects of Using Larval Sucker Occurrence in the Green River as a Trigger for Flaming Gorge Dam. Available at: http://www.coloradoriverrecovery.org/documents-publications/technical-reports/isf/larvaltriggerstudyplan.pdf

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 FG-53 to the Upper Colorado River Endangered Fish Recovery Program. U. S. Fish and Wildlife Service, Denver, CO.

Skorupski, J.A, I. Harding, and M.J. Breen. 2013. Project 165 - Use of the Stewart Lake floodplain by larval and adult endangered fishes. FY2013 Annual Report available at: http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2013/hab/FR165.pdf

Schelly, R. C., J.T. Herdmann, and M.J. Breen. 2014. Project 165 - Use of the Stewart Lake floodplain by larval and adult endangered fishes. FY2014 Annual Report available at: http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2013/hab/FR165.pdf

Schelly, R. C. and M.J. Breen. 2015. Project 165 - Use of the Stewart Lake floodplain by larval and adult endangered fishes. FY2015 Annual Report available at: http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2015/hab/FR165.pdf

U.S. Bureau of Reclamation. 2013a. Annual Report of Operations For Flaming Gorge Dam Water Year 2011 – Final Report. 21pp + 10 appendices.

U.S. Bureau of Reclamation. 2013b. Annual Report of Operations For Flaming Gorge Dam Water Year 2012 – Final Report. 22pp + 12 appendices.

U.S. Bureau of Reclamation. 2014. Annual Report of Operations For Flaming Gorge Dam Water Year 2013 – Draft Report.

U.S. Department of the Interior. 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.

U.S. Fish and Wildlife Service. 2005. Final Biological Opinion on the operation of Flaming Gorge Dam. U.S. Fish and Wildlife Service, Denver, Colorado.

Webber, A., and T. Jones. 2011. Project C6- Baeser - Rearing razorback sucker in Baeser Bend, wetland of the Green River. FY2011 Annual Report available at: http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2011/prop/C-6Baeser.pdf

Webber, A., and T. Jones. 2012. Project 164 - Middle Green River floodplain sampling. FY2012 Annual Report available at: http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2012/hab/FR164.pdf

Webber, A., and T. Jones. 2013. Project 164 - Middle Green River floodplain sampling. FY2013 Annual Report available at: http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2013/hab/FR164.pdf

Webber, A., C. Smith, and T. Jones. 2014. Project 164 - Middle Green River floodplain sampling. FY2014 Annual Report available at: http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2013/hab/FR164.pdf

cc: Malcolm Wilson, Chief, Water Resources Group, USBR, 125 So. State, Salt Lake City, Utah
Katrina Grantz, Chief Adaptive Management Group, USBR, 125 So. State, Salt Lake City, Utah
Henry Maddux, Chairman, UCREFRP - Management Committee, Utah Department of Natural Resources, 1594 W. North Temple Salt Lake City, UT 84114-5610
Pete Cavalli, Chairman, Recovery Program Biology Committee, WY Game and Fish Dept., P.O. Box 850, Pinedale, WY 82941
Larry Crist, Field Supervisor, Ecological Service, USFWS, Utah Field Office, 2369 West Orton Circle, Suite 50, West Valley City, Utah 84119-7603
Lynn Jeka, Manager, Western Area Power Administration, 12155 West Alameda Parkway, Lakewood, CO 80228
Shane Capron, Environmental Group Team Lead, Western Area Power Administration, CRSP Management Center, 12155 W Alameda Pkwy, Lakewood, CO 80228

Appendix: A Discussion of LTSP Related Operations, Physical Conditions in Reach 2 of the Green River and Preliminary Biological Findings

LTSP-Related Operations and Findings: 2011

In 2011, the Recovery Program identified two spring flow objectives: a) to provide floodplain connection after larval razorback sucker were detected in the Green River; and, secondarily b) to connect the Stirrup floodplain as outlined in Recovery Program Project No. C6 RZ-RECR. Therefore, the Recovery Program requested: a) that Reclamation's spring 2011 operations be timed to coincide with the presence of larval razorback sucker in Reach 2 habitats; and b) that if the hydrology remains wet-average, moderately wet, or wet that Reclamation release flows that maintained 18,600 cfs or greater for two weeks or more in Reach 2 (post-larval detection). The Recovery Program's request also considered scenarios in the event that the hydrology trended drier; it did not.

The May final forecast of April-July unregulated inflow volume to Flaming Gorge Reservoir was classified moderately wet. The Yampa River forecast was wet. All of the wet hydrologic classification peak flow targets for Reach 2 under the ROD were met in 2011 (Reclamation 2013a). Razorback sucker larvae were detected on June 24, 2011. The following spring flows conditions were recorded post-larval detection: ten days $\geq$ 22,700 cfs; 19 days $\geq$ 18,600 cfs; and 21 days $\geq$ 15,000 cfs.

USFWS field crews sampled 14 wetland habitats during September, October, and November 2011. Juvenile razorback sucker were collected in Wyasket Lake (n=15; size range 106-161 mm total length) and in Leota Unit 4 (n=3; size range 85-110 mm total length). This was the first evidence of over-summer survival of wild produced razorback sucker larvae since 1996 (Webber and Jones 2011). Breen (2011) reported 1,216 unique endangered fish detections at stationary PIT tag antennas set in the Stirrup floodplain levee breach during the extended period of riverine connection.

LTSP Operations and Findings: 2012

In 2012, hydrologic classifications for the Yampa River and Upper Green River basins were categorized as 'dry'. The Recovery Program and the Flaming Gorge Technical Work Group (FGTWG) ultimately agreed to focus the 2012 spring flow request on the driest category of experimental conditions outlined in the LTSP, i.e. a peak flow between 8,300 and 14,000 cfs for 1 to 7 days. The Recovery Program detected wild produced razorback sucker larvae on May 16, 2012 (Bestgen et al. 2012). Reclamation ramped up Flaming Gorge releases to a peak of 7,420 cfs, which resulted in a peak flow at Jensen, Utah of 10,200 cfs on May 24, 2012 (Reclamation 2013b). Flows at Jensen, Utah were sustained above 8,300 cfs for 5 days after larvae were detected. Floodplain connection occurred at Stewart Lake and Old Charley Wash. Utah Division of Wildlife Resources (UDWR) crews documented larval entrainment into Stewart Lake and described physical conditions at that floodplain site (Breen and Skorupski 2012). Similarly, USFWS field crews documented larval entrainment into the Old Charley site. Unfortunately, all fish entrained at both locations likely perished, because water quality deteriorated quickly after flows declined. During the spring and summer months of 2012, USFWS crews (Webber and Jones 2012) sampled fish and monitored water quality at a variety of other floodplains that still held water from the extensive period of connection in 2011, but did not connect in 2012.

Personnel from Western Area Power Administration (Western), Argonne National Laboratory (funded by Western), and the Recovery Program surveyed Reach 2 levee breach elevations in Autumn 2012 to better assess connection flows for future LTSP experiments. Those data, in preliminary form, were available for FGTWG discussions in Spring 2013.

LTSP Operations and Findings: 2013

In 2013, the spring hydrologic classification started off 'dry' but turned 'moderately dry'. Reclamation reviewed the FGTWG recommendation and decided to implement the LTSP recommendations for moderately dry hydrologic conditions and to increase releases when larvae were detected (Reclamation 2014; Draft Report). The Recovery Program and the Flaming Gorge Technical Work Group (FGTWG) ultimately agreed to focus the 2013 spring flow request on the moderately dry category of experimental conditions outlined in the LTSP, i.e. a peak flow between 8,300 and 14,000 cfs for 7 to 14 days. The Recovery Program detected wild produced razorback sucker larvae on May 26, 2013 (Bestgen et al. 2013). Flaming Gorge Dam releases were increased to full power plant capacity (~4,500 cfs) on May 29, 2013. Yampa River flows dropped below 4,000 cfs and Flaming Gorge Dam releases were increased 1,000 cfs on June 4th above power plant capacity for a total release of ~5,500 cfs to maintain flows in Reach 2 above 8,300 cfs. Releases returned to power plant capacity on June 5, 2013. The Green River measured at Jensen, Utah reached its peak of 10,700 cfs on June 6, 2013. Flows at Jensen, Utah were above 8,300 cfs for 25 days total and above 8,300 cfs during larval presence for 18 consecutive days. Prior to, during, and after floodplain connection, Stewart Lake proper and the Stewart Lake drain were sampled using an assortment of techniques to monitor the fish community. UDWR biologists documented that razorback sucker larvae were entrained into Stewart Lake and grew quickly (~1mm/day) during the ~2 month inundation period. On July 31, 2013, UDWR began draining Stewart Lake because of declining water quality. A total of 613 Age-0 razorback sucker were collected, of which 592 were released alive to the Green River (Skorupski et al. 2013). This was the largest number of juvenile razorback suckers ever documented in the Colorado River Basin, demonstrating the importance of appropriately timed connections between the river and floodplain wetlands. Razorback sucker larvae were not detected in the Escalante Ranch wetland; the only other wetland identified in the LTSP that connected to the Green River in 2013 (Webber and Jones 2013).

LTSP Operations and Findings: 2014

In 2014, Flaming Gorge Reservoir was expected to receive 135 % of average inflow. Observed volume was 118% by September 2, 2014. Reclamation targeted LTSP 'Average' hydrologic conditions (Reclamation 2014; Draft Report). The Recovery Program detected wild produced razorback sucker larvae on May 28, 2014 (Bestgen and Jones 2014). Reclamation began their ramp up to bypass flows on May 30, 2014; ramp down to base flows was initiated 15 days later when Yampa River flows no longer supported meaningful floodplain connection in Reach 2 (see Figure 1 and Table 1).

UDWR and USFWS biologists documented that razorback sucker larvae were entrained into Stewart Lake, Escalante Ranch, the Stirrup, and Above Brennan in 2014 (Schelly et al. 2014; Webber et al. 2014). Larval entrainment at Leota7 was confirmed in the fall via capture of Age-0 razorback sucker. UDWR biologists used floodgate structures to control flows and picket weirs to exclude large-bodied nonnative fishes at Stewart Lake. Stewart Lake filled to capacity

in 2014 during the larval drift period. Stewart Lake was drained in September, beginning 92 days post-initial connection. A total of 749 razorback suckers were sampled returning to the Green River during drawdown of the wetland. Furthermore, the fish released back to the Green River had a mean length of 97 mm TL, with one fish reaching a length of 168 mm, indicating substantial growth while in Stewart Lake and improving these individuals' chances of overwinter survival when released back to the river. Later in September 2014, researchers collected wild produced Age-0 razorback sucker in Green River Reach 2 main channel backwater habitats for the first time since 2000 (Breen et al. 2014). For the second consecutive year, Stewart Lake has demonstrated the enormous potential of managed wetlands for razorback sucker recovery under the Larval Trigger Study Plan.

Escalante Ranch The USFWS set larval light traps in late May through mid-June; wild larval razorback sucker were collected. They also sampled with 18 fyke nets from 24 -28 March to determine overwinter (2013-2014) survival of 989 bonytail (*Gila elegans*) stocked by the Ouray National Fish Hatchery on 19 September 2013. Five individuals (TL=255, 295, 254, 275, 300mm) were captured. The low number of fish caught suggests high winter mortality, which is possibly a result of the low dissolved oxygen levels in this wetland from October until ice-off as revealed by data recorded by a mini-DOT logger. Fall sampling in the Escalante Ranch wetland occurred from 20–22 October and 10 fyke nets were set to determine the relative abundance and recruitment of razorback sucker. Despite collections of larval razorbacks in this wetland in June 2014 only one adult (TL = 503mm) was collected in the fall.

Above Brennan The USFWS set larval light traps in early to mid-June; wild larval razorback sucker were collected. This wetland reset (dried) in 2012. USFWS sampled the wetland in late August for larger sized fish. They caught one razorback sucker (TL=418mm) (in a fyke net) and many nonnatives. These included, in order of abundance, common carp (*Cyprinus carpio*), fathead minnow (*Pimephales promelas*), black bullhead (*Ameirus melas*), young-of-year black crappie (*Pomoxis nigromaculatus*), red shiner (*Cyprinella lutrenis*), adult white sucker (*Catostomus commersoni*), and one young-of-year smallmouth bass. The razorback sucker was translocated into the Green River adjacent to the floodplain.

The USFWS returned to Above Brennan in the fall from 27-29 October, their native fish catch consisted of one adult razorback sucker (TL=470mm), which was translocated into the Green River.

Leota The USFWS sampled with larval light traps in late June – native flannelmouth sucker (*Catostomus latipinnis*) were collected, but razorback sucker were not (entrainment confirmed later in the year). Leota 7 reset in 2012 thru 2013 and connected directly to the Green River during 2014 peak flows. USFWS sampled with 10 fyke nets between 14-17 October; five young-of-year individuals (TL 101-152mm) were captured and released to a backwater near the Leota canal outlet at RMI 256. Nonnative fishes caught included common carp, fathead minnow, black bullhead, and green sunfish (*Lepomis cyanellus*), of which almost all were young-of-year. The fact that few adult nonnative fish were observed suggests that razorback larvae can survive and recruit in the presence of similarly sized competitors or predators. The presence of these larger predator species in the other wetlands is likely responsible for the lack of razorback recruitment in those sites. The Leota complex was also very large, with the different sub-units connected through water control structures and canals. It is possible that juvenile razorback sucker were present throughout the complex.

MiniDOT loggers were set in Above Brennan wetland and Leota 7 to monitor water conditions throughout the winter of 2014-2015.

Bonanza Bridge and Stirrup The UDWR conducted fall sampling of naturally functioning wetlands subject to inundation in 2014 to assess Age-0 razorback sucker survival elsewhere in the reach (Schelly et. al. 2014). Nonnative species comprised the entire fall catch at Bonanza Bridge and most of the catch at the Stirrup; 21 bonytail were also collected. Comparison of these results with the success at Stewart Lake suggests that modification of additional wetland breaches through installation of floodgates to control filling and improve water retention—in combination with blocking weirs to exclude adult nonnative fishes—would improve razorback sucker recruitment in these nursery habitats.

LTSP Operations and Findings: 2015

Hydrologic conditions during the Spring 2015 were extremely varied. In early May, both the Yampa and Flaming Gorge Inflow forecasts were classified as 'moderately dry', but then the weather turned cold and wet, which resulted in a wetter April – July runoff. The Recovery Program detected razorback sucker larvae on May 7, 2015; eight days earlier than ever detected before (period of sampling started in 1992). Reclamation and the FGTWG agreed to target LTSP 'moderately dry' conditions, i.e., achieve Reach 2 flows between 8,300 – 14,000cfs for as many days as the Yampa River would support meaningful floodplain connection. Reclamation began their ramp up from 1,100cfs on May 10, 2015 to a peak release of 8,030cfs 5 days later. Ramp down operation commenced on May 21 and was down to base flow on May 31, 2015 (see Figure 1 above). In Reach 2, flows were above 8,300cfs for 40 consecutive days and above 14,000cfs for 2 days post larval detection (see Figure 2 above). The Reach 2 peak of 14,900cfs occurred on May 21, 2015.

Three study floodplains connected in 2015: Stewart Lake, Escalante Ranch, and Johnson Bottom. Larvae were detected in Stewart Lake and Johnson Bottom. Above Brennan connected at the peak with a sheet flow through one of the upstream breeches; not deemed biologically significant (Jones et al. 2015; Schelly and Breen 2015).

Stewart Lake Outlet gates were opened on May 9, 2015 and were closed for the final time on May 28, 2015 with Stewart Lake within 10cm of full pool. Through the summer, continuous loggers revealed dissolved oxygen levels consistently in the range of 6-9 mg/L in open water near the surface and in the middle of the water column, with low dissolved oxygen zones (below 1 mg/L) near the benthos or in dense vegetation. Temperatures ranged from 14-22 °C, and were typically on the upper end of this range in the upper portion of the water column during the latter period of inundation. Stewart Lake outlet gate was opened for draining on 1 September 2015. Draining was completed on 13 September 2015. Whereas in 2014, fish sampling alternated with periods of un-sampled free releases (Schelly et al. 2014), this year sampling continued without interruption even in the absence of 24/7 staffing.

With uninterrupted sampling in 2015, the total estimated number of fishes trapped during 13 days of draining was 371,990 (comprising 371,866 nonnatives and 124 natives). Notably, the relative species composition of the nonnative component shifted dramatically compared to 2014. This was mainly a result of an explosion of green sunfish in 2015, constituting 33% of the total fishes processed at draining (n = 121,501). In striking contrast, green sunfish were a negligible component of the 2014 Stewart Lake sample (n = 329; Schelly et al. 2014).

Curiously, fewer (n = 87) Age-0 razorback suckers were sampled during the draining of Stewart Lake in 2015 than in previous years (n = 729 in 2014, n = 579 in 2013). Despite the smaller sample size, the mean total length of the 2015 Stewart Lake razorback sucker class at draining was 107 mm, 10 mm longer than the mean total length in 2014. Some possible explanations include reduced densities of drifting larvae related to the record breaking early date of larval first appearance, or increased predation on larval razorback suckers early in the inundation phase by the extremely high numbers of green sunfish documented in the system this year.

Escalante Ranch Larval light traps were deployed at this floodplain, but razorback sucker larvae were not detected. The existing burden of nonnative fishes in the floodplain likely explained the lack of collections.

Johnson Bottom NOTE: *The Cooperative Recovery Initiative renovation of Johnson Bottom was completed in time for spring flows in 2015. This renovation consisted of re-contouring portions of the wetland to facilitate draining, clearing canals, refurbishing the breech, and retrofitting the water control gate with a large bodied fish exclusion device.* The water control gate at Johnson Bottom was opened on May 11, in anticipation of the Flaming Gorge releases. Flows at the Ouray gage (13 miles downstream) at that time were approximately 10,000 cfs. Razorback sucker larvae were collected in the Johnson Bottom canal when the gate was opened and were collected in the wetland beginning May 19. On May 16, the uncontrolled breach began flooding at ~13,000 cfs at the Ouray gage. CRFP crews installed a net across the breach on May 13, in an attempt to reduce nonnative fish movement into the wetland. The net failed for a variety of reasons periodically, but was repaired daily. Adult carp entered the wetland through the breach. The gate was closed on May 22 because the floodplain pool had equilibrated with river stage - river flows were still over 14,000 cfs but declined soon thereafter. A mid-July sampling rotation yielded 115 age-0 razorback sucker, one age-1 Colorado pikeminnow, and four adult bonytail. Around mid-August, dissolved oxygen levels did approach zero for a few hours each night until photosynthesis increased during the day. There was no evidence of a fish kill during this time, and sampling at the end of summer (see below) yielded many fish of different species and sizes. Wetland water level / quality was freshened with an 8" river pump for 10 days between August 27 and September 11, which increased the wetland depth by six inches.

The wetland was drained starting on October 19. Slotted screens were installed in the drain gate, and the water was run through a fish kettle (easily sampled) before it entered the canal back to the river. During draining, crews captured 38 white sucker, two adult bonytail, one age-0 bluehead sucker (*Catostomus discobolus*), and one age-0 flannelmouth sucker. No razorback sucker or Colorado pikeminnow were captured, only one of the bonytail captured in July was collected during draining. The nonnative fish community was sub-sampled: 71% fathead minnow, 23% red shiner, 5% green sunfish, and small numbers (<1%) of white sucker, brook stickleback (*Culaea inconstans*), black bullhead and carp.

Water levels in the wetland dropped as low as 0.77 meter before pumping commenced. However, the collection of nonnative suckers (in a range of sizes) and other species when the wetland was drained suggests that summertime water quality issues may not have been the primary reason for poor razorback sucker survival. Pelicans and other piscivorous birds were observed at the wetland, sometimes in large numbers, throughout the summer.

Appendix D

February 26, 2016 Memorandum from Reclamation to the Recovery Program in Response to the draft Green River research flow request letter dated 2/17/16

United States Department of the Interior
BUREAU OF RECLAMATION
Upper Colorado Regional Office
125 South State Street, Room 8100
Salt Lake City, Utah 84138-1102

IN REPLY REFER TO:

MEMORANDUM

To: Tom Chart, Program Director, Upper Colorado River Endangered Fish Recovery Program.

From: Dave Speas (preparer), Biology Committee Representative, USBR

Re: Response to the draft Green River research flow request letter dated 2/17/16

2/26/16

Thank you for your timeliness in sharing the subject draft flow request letter with us and for the opportunity to comment on it in advance of its formal submission to Reclamation. I submit the following comments in my capacity as Reclamation's Biology Committee representative, but they also represent input from conversations and written comments from my colleagues in USBR's Upper Colorado Region, to whom I owe my thanks. Some of comments dealing with non-biological matters herein may be supplemented later through input from Reclamation's representative on the Management Committee and/or discussions through the Flaming Gorge Technical Work Group (FGTWG).

Reclamation is very concerned about its ability to meet the subject flow requests in 2016 for reasons we address in detail below. These reasons largely stem from concerns that our current NEPA coverage may not be sufficient to address some of the potential impacts of the flow requests, concerns about public relations, and water availability to meet the requests. In addition to flow request 3 (spike flows to disadvantage bass, deferred to 2017), *we suggest that formal implementation of flow request 2 (elevated base flows) be deferred until at least 2017 so that we can begin identifying impacts of the proposed flows from the NEPA perspective, seek NEPA compliance where necessary, conduct more public outreach on the new flow requests, and participate in development of a base flow study plan.* We would be pleased, however, to work within the FGTWG in 2016 in an attempt to increase base flows within our existing authority under the 2006 Record of Decision (ROD; Reclamation 2006).

Since there is more than one flow request being made this year (and likely more than one in coming years), Reclamation believes the FGTWG should be prepared to carefully prioritize the flow requests in relation to hydrology as well as status of the endangered fish as evidenced by the current state of the science. They should probably also be prepared to pursue a decision making process in the event that water availability limits implementation to one or two proposals (as opposed to all three in one year) while meeting other established flow objectives in the 2006

ROD. Such trade-offs may become frequent with multiple flow requests in the future, also, so the Recovery Program would be best served to develop a flow- and fish status-based prioritization strategy to share with the FGTWG on an annual basis.

We offer the following comments on the three individual flow requests, two of which are considered "new" for 2016 as the letter describes.

1) **Larval Trigger Study Plan (LTSP) flows**. Spring peak flows triggered by appearance of Razorback Sucker larvae has proven to be a highly effective way of transporting these fish to favorable floodplain habitat nursery areas. Reclamation applauds the Program and its lead scientific entity, the Larval Fish Laboratory (LFL) at Colorado State University, for developing the "larval trigger" flow proposal and believes that it has to potential to become a powerful management tool in the recovery of Razorback Sucker. Reclamation supports implementation of LTSP in 2016 provided that we can obtain the appropriate documentation from the U.S. Fish and Wildlife Service (USFWS) acknowledging such action gives Reclamation the same "credit" on a biological basis as meeting the appropriate spring release objectives under the 2006 ROD, and recognizing also that flow objectives in the latter may not be attainable during years when LTSP is in effect.

   While successful rearing of age-0 fish from Stewart Lake proves a significant indicator of LTSP's potential to support recovery, we feel that floodplain management (as an aspect of habitat restoration in the Recovery Program's action plan) requires additional emphasis and resources to provide for fish production at levels sufficient to support recovery in the Green River sub-basin. In the Green River Floodplain Management Plan, Valdez and Nelson (2004) estimated that about 2,032 acres of floodplain wetland habitat need to function to produce a recruitment rate of about 1,740 adult fish per year to reach recovery targets. The implication of that study is that not only Stewart Lake, but Escalante, the Leota ponds, Johnson Bottom and five other wetlands (including Old Charlie) are necessary to provide this level of recruitment. Since the inception of LTSP (Table 1 in the request letter), successful production of age-0 Razorback Sucker has occurred at primarily at Stewart Lake, which yielded as many as 766 wild-produced fish in 2014. The significance of this cannot be overstated from a biological standpoint, yet it is evident from objectives set forth in Valdez and Nelson (2004) that the Stewart Lake example—and the associated requirements for relatively intensive water level management, non-native fish screening, monitoring and draining to facilitate escapement—needs to be replicated to consistently boost the overall level of annual recruitment. Reclamation encourages the Recovery Program to intensify its efforts to identify, secure, restore (if necessary), manage and/or operate other promising habitats (such as the Leota ponds and Johnson Bottom) to increase levels of recruitment beyond those observed mainly from Stewart Lake. As a component of these management actions, also, the Recovery Program should consider revising and updating the LTSP

study plan to account for any changes in levee breach elevation since that document, which could potentially influence spring flow elevations in the future. Finally, more focus on annual operations, monitoring and management of floodplain wetlands would also have the added benefit of resolving uncertainties identified in Valdez and Nelson (2004) and the Green River Study Plan (2007) and refining expectations of floodplain wetland production potential.

2) **Elevated summer base flows to enhance Colorado Pikemimuow rearing habitat**. I have provided comments to the authors of the report which led to this proposal (Bestgen and Hill, 2015a; in review), which were generally accepted and/or addressed by the authors. I consider the report to be scientifically sound and gave it my approval as a Biology Committee member (although the report will not receive approval from the Management Committee until later this spring). While the data set was large (22 years) and systematically collected, it was characterized by high levels of variability which required a great deal of interpretation by the authors to translate into support for the conclusions and recommendations. I view this report to be one of the more challenging works produced through the Recovery Program (for reasons I outline below), as will be implementation of its recommendations.

   The proposed base flows represent a significant departure from those currently covered in the 2006 ROD and described in Muth et al. (2000), which envisioned releases from the dam that equated as much as possible to pre-dam hydrology in the Green River. According to Bestgen and Hill (2015a), fall abundance of Colorado pikeminnow was above average in 10 of 16 (63%) years in Reach 2 (as defined in Muth et al. 2000) when base flows were between 1,700 and 3,000 cfs (Figure 18 in Bestgen and Hill 2015a). In contrast, only 17% of years when base flows were less than 1,700 cfs produced above average abundance, and abundance of pikeminnow above 3,000 cfs was always below average. Based on this, the authors recommended 1,700 – 1,800 cfs in Reach 2 during dry years (90-100% exceedance), 1,800 – 2000 cfs in moderately dry years (70-90% exceedance), and 2,000-2,600 during average years (30-70% exceedance). These new targets are about 75%, 46% and 18% above their counterparts in Muth et al. (2000), respectively, and may represent a significant deviation from the "hydrologically driven" assumptions underlying the current flow recommendations. For example, if implemented, the proposed flows for dry years would actually fall within the "average" base flows in Muth et al. (2000; 1,500 – 2,400 cfs), or two hydrologic classifications wetter than the current dry designation. Whereas Reclamation is allowed under the ROD to provide flows in excess of 40% in excess of recommended base flow objectives, this flexibility would not be sufficient to meet the new proposals for dry year objectives and would fall short slightly during moderately dry years, also. Another significant departure from the existing ROD is specification of flow objectives for Reach 3 (see author

comments regarding importance of Reach 3, also). Currently Reclamation's obligation under the 2006 ROD is to achieve flow recommendations for Reaches 1 and 2, with the assumption that such actions should achieve objectives for Reach 3 most of the time. While the Reach 3 objectives are usually met, they are not set forth as obligations under the 2006 ROD.

Over the years, Reclamation has learned from public feedback that there is controversy associated with releases from the dam that are not hydrologically or operationally driven. Although this could be assumed to be less problematic during the base flow period, it poses a precedent that is contrary to agreements and understandings during preparation of the Final Environmental Impact Statement (FEIS; Reclamation 2005) and Endangered Species Act consultation. In particular, Reclamation was informally assured by the USFWS Utah Field Office that we would not be asked to deviate from the hydrologic classifications in any given year, since the targets were based on historic hydrology that included the full range of drought years to wet years.

There are also lingering questions about how effective elevated base flows will be at supporting higher levels of Colorado Pikeminnow production and whether proposed monitoring efforts can detect such effects. Data in support of the elevated base flows were highly variable, as stated above, and it appears that the best case scenario for increased pikeminnow production would be about 63% and 40% of the time in reaches 2 and 3, respectively. In my comments to the authors, I asked whether it was "worth it" to release more water (including releases out of reservoir storage) in dry years to maintain high base flows even if there are no or few larvae in the river, which is often the case in such years. Their response was that while production of larvae is indeed low in the Yampa River during low water years, higher base flows in dry years was largely to improve habitat conditions in the Lower Green River (Reach 3 in Muth et al. 2000). While Reach 3 typically supports higher larval abundance than the Reach 2, percentage of years where fall pikeminnow abundance in Reach 3 was higher than average was only 40%, compared with 63% in Reach 2. (As stated above, also, focusing emphasis away from Reach 2 and placing it more on Reach 3 contrasts significantly with current assumptions underlying the 2006 ROD.)

It is apparent from Bestgen and Hill (2015a), also, that the exact role(s) of base flows in conveying benefits to Colorado Pikeminnow are somewhat obscure. To this end, they remarked (in written response to comments provided on earlier drafts) that, "At this point…it seems prudent to give the fish what has worked in the past, regardless of the mechanisms involved." Although uncertainties about the causative mechanisms of a management action are not at all uncommon in fisheries management, such uncertainties about elevated base flows in dry years are a little unsettling to water managers given the

inherent scarcity of water in the Green River sub-basin compounded by drought, climate change, and competing water demands. For example, benefits accrued to Colorado Pikeminnow through base flows may be offset by predation by and competition with non-native fish (widely recognized as a primary obstacle to recovery), including recent invaders like Walleye in addition to established Smallmouth Bass and Northern Pike populations. While Reclamation appreciates the effort that the Recovery Program puts forth annually to control non-native fish, the dynamic nature of the Green River fish community makes it difficult to predict (and document) how effects of flows will translate into benefits for endangered fish.

The Recovery Program identifies two ongoing projects in their request letter that are expected to document response of Colorado Pikeminnow to elevated base flows. These two projects (larval drift and fall abundance of Colorado Pikeminnow fry/fingerlings) are the same that provided data that formed the basis of the Betgen and Hill report, so it is plausible that they would be able to document a response (either positive or negative). However, unlike LTSP which has a peer-reviewed, stand-alone study plan with relatively discrete criteria for success and completion, effects of base flows on Colorado Pikeminnow will likely become evident after a considerable period of time (i.e., it took 22+ years to document patterns in the report) and could be difficult to quantify. The Recovery Program "may also consider" additional studies to supplement ongoing projects, however scopes of work for these projects have not been developed to date, and uncertainties about underlying mechanisms of higher base flows (see Bestgen comment, above) may make it difficult to document a response or lead to additional monitoring needs. As identified in Bestgen and Hill (2015a), also, a study plan should be developed which defines criteria for success, identifies a finite time frame and identifies uncertainties should be developed prior to formal implementation of elevated base flows as described in the 2016 flow request letter. Such a plan could also function as a proposed action for NEPA analysis.

The sum of the preceding points is causing Reclamation managers to wonder 1) whether water to accomplish these objectives is or will be available and 2) whether additional NEPA may become necessary to implement these base flows, especially together with LTSP and flow request 3 (smallmouth bass spike flows). Regarding the first point, no official assessment of impacts due to elevated base flows is available at this time, but preliminary modelling suggests that severe drawdown of Flaming Gorge Reservoir due to elevated base flows is possible under certain conditions. Such drawdown elevations may fall outside levels analyzed in the 2005 FEIS and could significantly compromise authorized purposes of the dam and the ability to comply with endangered fish flow recommendations. While such a drawdown event is thought to occur somewhat

infrequently, impacts associated with water delivery and implementation of flow recommendations during drawdown and recovery could be significant.

Reclamation is pleased to work with the Recovery Program and its partners to provide flows to aid in endangered fish recovery, and has welcomed the opportunity to implement LTSP largely due to its negligible impacts to water availability/delivery, its consistency with the ROD (including its hydrologic classifications as well as real-time hydrology), its high probability of success, presence of a study plan with a completion time frame, and its experimental nature. Superficially, elevated base flows (individually or together with smallmouth bass spike flows) don't resemble LTSP on the first two counts in that they could impact water supplies and/or delivery and they represent a significant departure from the existing flow recommendations covered under the 2006 ROD due to their reconfiguration of base flow objectives and assumptions as described above. Probability of success under elevated base flows is considerable (roughly 40-60%, depending on geographic locality) but uncertainties persist, as outlined above.

While the request letter characterizes elevated base flows as an experiment which is an element of adaptive management and thus a means of implementation under the 2006 ROD, the lack of a stand-alone study plan for base flows and the open-ended nature of the action is a source of concern for Reclamation as well. Also, the 2016 request letter reads, "Considering the status of Colorado Pikeminnow in the Green River as discussed in Bestgen and Hill…the Recovery Program requests that Reclamation strive to meet these proposed base flows on an experimental basis through September 30 of each year". While subtle, this statement and many of the response comments provided by Bestgen and Hill suggest that the proposal to increase base flows is driven at least as much by management needs for Colorado Pikeminnow as it is by research needs. I support the authors' contention that Colorado Pikeminnow require great strides toward enhanced management action (non-native fish removal, flows). It is apparent that experiments as described in the 2016 request letter will likely become more and more routine at Flaming Gorge, and Reclamation managers suspect that additional regulatory compliance for cumulative impacts of multiple experiments may be necessary.

As a final note on the elevated base flow request, Reclamation seeks clarification as to whether it should "strive to meet the proposed base flows" (2016 flow request, page 6, middle) or whether there are higher expectations to comply with the request. In the past few years, Reclamation has responded to requests from the U.S. Fish and Wildlife Service to exercise its flexibility under the 2006 ROD to increase base flows by 40% beyond objectives. As the requests letter also points out, this approach met the new base flow targets in 2015 and is certainly consistent with the request. We suggest that this provision of the 2006 ROD may be an appropriate means to pursue higher base flows in

2016 while Reclamation continues to evaluate feasibility of the formal elevated base flow proposal.

3) **Spike flows to disadvantage smallmouth bass.** As with the base flow proposal, I reviewed and commented on the report (Bestgen and Hill 2015b; under review) which led to this proposal to begin planning in 2016 for for a 2-3 day spike flow (powerplant release) in 2017 to disrupt Smallmouth Bass spawning or hatching in the Green River. I have always been an emphatic supporter of this type of experiment and am very pleased to see that it is at a point to begin implementation. The latter should begin with planning and public outreach, as the flow request letter appropriately alludes to. Another benefit to deferring this experiment to 2017 includes development of a more solidified study plan, which is not in place at this time. Like the proposed elevated base flows, a study plan would function to define expectations, experimental time frames, and uncertainties and could function as the basis for a proposed action in NEPA documents.

   I have no comments on the justification for this experiment, as the scientific literature is fairly unanimous in its documentation of negative impacts from sudden and dramatic changes in flows and/or temperature during the Smallmouth Bass spawning chronology. Otolith work conducted through the LFL indicates that these fish are relatively predictable spawners in the Green River ecosystem in relation to flows and temperatures, so some advance public notification of the timing of such spike flows should be possible (but uncertain in terms of public acceptance, perhaps; see below). In general, though, the best science seems to suggest that careful timing of a disturbance from Flaming Gorge Dam should exact the desired response.

   Reclamation managers share a number of concerns that must be addressed during the coming year in advance of any experimentation in 2017. Chief among these is public outreach and evaluation of the potential for additional NEPA compliance. In terms of public outreach, Reclamation encourages Recovery Program representatives to become actively engaged in making the prospects for a spike flow known to the general public through the Flaming Gorge Working Group process in 2016 and early 2017 as well as other channels that may be appropriate public relations venues. We believe that one of the most vocal and actively engaged groups in the Flaming Gorge Work Group would be anglers, who are often collectively represented by the Green River Outdoor Guide Association (GROGA). The GROGA and its constituency will probably voice concerns over timing, predictability and advance notice of a smallmouth bass spike flow, as they have done the same in relation to main spring peak flows for LTSP. The main reason for this would be impacts to the quality of the fishing for their clients, or equally likely is the possibility of client cancellations of trips planned outside advance notice of smallmouth spike flows. Both of these factors could impose a financial burden on these businesses.

There could also be concerns about any sharp changes in temperature associated with alterations to operation of the selective withdrawal structure; they routinely monitor river parameters and usually make inquiries if something appears out of the ordinary with regards to temperature, which, like flows, can affect angling and client satisfaction. Perhaps enlisting the assistance of the Utah Division of Wildlife Resources would be helpful in reaching out to these groups.

Other groups which will likely have concerns about spike flows are agricultural operators and other residents of the Green River floodplain in Reach 1, Reach 2, and perhaps Green River, Utah in Reach 3. Reclamation is concerned that effects of post-peak flooding were never analyzed in the 2005 Environmental Impact Statement because such actions were not an element of the preferred alternative. Despite the experimental nature of Smallmouth Bass peak flows and the high likelihood of success, impacts due to flooding in the post peak period could be diverse and unquantified. As is the case with the elevated base flow proposal (request 2), also, bass spike flows may also be a significant departure from the "hydrologically driven" assumptions underlying the 2006 ROD, particularly in dry years. Reclamation will continue to determine if supplemental NEPA compliance is necessary to implement smallmouth bass spike flows.

In closing, Reclamation greatly appreciates the high-quality scientific research being conducted by the Recovery Program and its use in adaptive management for recovery purposes. Please contact us if you require additional clarification of our comments. We look forward to working with the Recovery Program in the future to resolve the concerns outlined above, and to continue to assist in the recovery of endangered fish of the Upper Colorado River.

References:

Bestgen, K.R. and A.A. Hill. 2015a [in review]. Reproduction, abundance, and recruitment dynamics of young Colorado pikeminnow in the Green and Yampa rivers, Utah and Colorado , 1979 - 2012.

Bestgen, K.R. and A.A. Hill. 2015b [in review]. River regulation affects reproduction, early growth, and suppression strategies for invasive smallmouth bass in the Upper Colorado River basin.

Muth, R.T., L.W. Crist, K.E. LaGory, J.W. Hayse, K.R. Bestgen, J.K. Lyons, T.P. Ryan, and R.A. Valdez. 2000. Flow Recommendations for Endangered Fishes in the Green River Downstream of Flaming Gorge Dam, Final Report, Upper Colorado River Endangered Fish Recovery Program Project FG-53, Denver, Colo.

Green River Study Plan ad hoc Committee. 2007. Study Plan for the Implementation and Evaluation of Flow and Temperature Recommendations for Endangered Fishes in the Green River Downstream of Flaming Gorge Dam. Final Report.

Reclamation. 2005. Operation of Flaming Gorge Dam Final Environmental Impact Statement. Bureau of Reclamation Upper Colorado Regional Office, Salt Lake City.

Reclamation. 2006. Record of Decision, Operation of Flaming Gorge Dam Final Environmental Impact Statement. Bureau of Reclamation Upper Colorado Regional Office, Salt Lake City.

Valdez, R.A. and P. Nelson. 2004. *Green River Subbasin Floodplain Management Plan*. Upper Colorado River Endangered Fish Recovery Program, Project Number C-6, Denver, Colo.

AppendixE

May 27, 2016 Memorandum from the U.S. Fish and Wildlife Service for the 2016 Green River Spring and Base Flows to Assist in Recovery of the Endangered Species

United States Department of the Interior
FISH AND WILDLIFE SERVICE
UTAH FIELD OFFICE
2369 WEST ORTON CIRCLE, SUITE 50
WEST VALLEY CITY, UTAH 84119

May 27, 2016

In Reply Refer To
FWS/R6
ES/UT
06E23000-2008-FA-0180

Memorandum

To: Mr. Brent Rhees, Director, Upper Colorado Region, U. S. Bureau of Reclamation
Ms. Heather Patno, Chair, Flaming Gorge Technical Working Group, Bureau of Reclamation

From: Field Supervisor, Utah Field Office, U.S. Fish and Wildlife Service

Subject: 2016 Green River Spring and Base Flows to Assist in Recovery of the Endangered Fishes

This letter describes our recommendations for 2016 spring and base flows in Reach 2 (with consideration of effects in Reach 3) of the Green River for discussion by the Flaming Gorge Technical Working Group (FGTWG) in development of recommendations for Flaming Gorge Dam operations. Our intent is to work with other FGTWG members to ensure consistency with the 2005 biological opinion (BO; U.S. Fish and Wildlife Service 2005) and 2006 record of decision (ROD; U.S. Department of Interior 2006), which call for flows and water temperatures to protect and assist in recovery of endangered fishes (Muth et al. 2000).

The following recommendations are subject to forecasted and real-time May – July hydrologic conditions in the upper Green River drainage, with recognition that trade-offs of spring and base flows should be considered and used to adjust operations as deemed appropriate.

Spring Research Flows

We support the Upper Colorado River Endangered Fish Recovery Program's (Recovery Program) 2016 Spring Flow Request, as explained in their April 22, 2016 letter. We believe the primary objective, to time Flaming Gorge releases and resultant floodplain connection with the Green River during presence of razorback sucker larvae, is consistent

with the intent of the Flow and Temperature Recommendations for Endangered Fishes in the Green River Downstream of Flaming Gorge Dam (Flow Recommendations; Muth et al. 2000), the 2005 BO, and the 2006 ROD. Specifically, the objectives and criteria presented in their letter are consistent with the common goals of the Flow Recommendations, BO and ROD: to use the best available science to guide Flaming Gorge operations and recovery actions in an adaptive management framework. Timing Flaming Gorge releases concurrently with larvae presence is proving to be a major step forward in re-establishing a stable population of razorback sucker in the Green River basin.

The *Study Plan to Examine the Effects of Using Larval Sucker Occurrence in the Green River as a Trigger for Flaming Gorge Dam* (LTSP) details the range of experimental conditions the Recovery Program recommends assessing, with recognition that more than one set of flow conditions identified in their LTSP study matrix could be accomplished in a single year. Because the LTSP describes a systematic analysis for evaluating the success of operating Flaming Gorge concurrently with razorback sucker recovery, we feel it is very important to follow their flow recommendations whenever possible.

Based on recent information provided by Reclamation to the FGTWG by conference call, we understand that inflow into Flaming Gorge is in the average below median hydrologic category and the Yampa River drainage is categorized as average above median. We understand that Bureau of Reclamation (Reclamation) intends to increase releases up to bypass levels (up to a total dam release of 8,600 cfs) between seven to ten days, which is subject to modification due to actual hydrology. Based on that information, it appears that 'average below median' LTSP study objectives will be achieved in 2016. We applaud the coordination between Reclamation and the Recovery Program for what appears to be another successful year of spring studies.

Justification for the LTSP under the Flaming Gorge BO and ROD

The LTSP is an important document that will assist in consistent evaluation of the benefits of Flaming Gorge operations to razorback sucker. The LTSP and updated flow release is supported by the most recent scientific research into endangered fish ecology and floodplain management (Bestgen et al. 2011). As the Recovery Program described in the LTSP, the Bestgen et al. (2011) report synthesized long term data, evaluated the ability to operate Flaming Gorge Dam for the purpose of entraining wild razorback larvae into floodplain habitats, and created a set of conclusions and recommendations to guide future management. The Flow Recommendations support utilizing up-to-date research and monitoring, such as the Bestgen et al. (2011) report:

> "the collection of additional data on endangered fishes and their habitats should focus on the evaluation and possible modification of our recommendations by following an adaptive-management process" (Muth et al. 2000, p. 5-39);

as well as biological information to guide the onset of spring peak flow:

> "Examples of real-time and other year-specific information to be considered in determining annual patterns of releases . . .
>
> - Initial appearance of larval suckers in established reference sites in Reach 2 (e.g., Cliff Creek)" (Muth et al. 2000, p. 5-9, Table 5.3).

Similarly, the 2005 BO recommends adaptive management in implementing the proposed action (operations of Flaming Gorge Dam) (U.S. Fish and Wildlife Service 2005, p. 16) and set forth this process as a conservation measure:

> "The adaptive management process will rely on the Recovery Program for monitoring and research studies to test the outcomes of implementing the proposed action and proposing refinements to dam operations" (U.S. Fish and Wildlife Service 2005, p. 17);

and

> "[Bureau of] Reclamation, Western [Area Power Administration], and the [U.S. Fish and Wildlife] Service will use any new information collected in these studies to determine the need for management actions or modification of operations as determined appropriate" (U.S. Fish and Wildlife Service 2005, p. 17).

Therefore, we believe that the 2005 BO supports the Recovery Program's 2016 Spring Flow Request and implementation of the LTSP and we support the Bureau of Reclamation's (Reclamation) implementation of this request. The Recovery Program determined they need a minimum of six study years to meet the objectives of the LTSP. Unless otherwise specifically stipulated, this letter conveys the Service's interpretation of ESA compliance under the 2005 BO as it relates to Reclamation's future LTSP-related spring operations. We recognize that Reclamation's targeting of a biological trigger (presence of larval razorback sucker) rather than a hydrological one (Yampa River flows) deviates from past operations and may require greater volumes of water in some years. However, we conclude that this experiment is consistent with the intent of the Flow Recommendations and will assist in the recovery of the endangered fish.

We further recognize that timing releases from Flaming Gorge Dam consistent with the Recovery Program's 2016 Spring Flow Request and the LTSP may require the hydrologic tradeoff of not meeting the 2000 Flow and Temperature Recommendations for Reach 2. Nevertheless, we support Reclamation following the Recovery Program's 2016 Spring Flow Request and LTSP, and consider that doing so will meet Reclamation's responsibility to the ROD objectives in 2016.

Base flow operations

Because of projected average year conditions, we believe that Green River base flow augmentation is a very important consideration for 2016. We propose the following approach to base flow operations in 2016, which is heavily influenced by a recent report presented to the Recovery Program that summarizes 33 years of Age-0 Colorado pikeminnow collection information in Green River Reaches 2 and 3 (Bestgen and Hill

2015a; *in review*). Here we excerpt from the author's conclusions and recommendations, which will serve as the primary basis for our 2016 baseflow request:

- *Conclusion - Age-0 Colorado pikeminnow abundance declined in both the middle and lower Green River reaches over time, especially since about 1994.*
- *Conclusion - Middle Green River base flows in the range of 51-85 m^3/sec (1,800-3,000 ft^3/sec) were consistent with higher densities of age-0 Colorado pikeminnow in autumn and with more backwater habitat.*
- *Conclusion - Lower Green River base flows in the range of 62-108 m^3/sec (2,200-3,800 ft^3/sec) were consistent with higher densities of age-0 Colorado pikeminnow in autumn and with higher backwater habitat availability; the existing upper end of flow ranges in wetter classifications may need to be reduced. Flow recommendations for the lower Green River naturally follow from flows in the upstream middle Green River.*
- *Conclusion - Timing of the onset of base flow conditions should be linked with first presence of Colorado pikeminnow larval drift in the lower Yampa River to ensure adequate backwater conditions throughout the reproductive period and longer growing seasons for age-0 Colorado pikeminnow.*
- *Recommendation - Initiate immediately, an experimental program of base flows in the middle and lower Green River that are higher than presently recommended for average and drier hydrologic conditions and begin those flows earlier in summer, with a goal to bolster populations of age-0, juvenile, and eventually adult, Colorado pikeminnow abundance in the Green River.*

Base Flow Request:

As per Reclamation's *Proposed Flow and Temperature Objectives for 2016* document, Reaches 1 and 2 should have base flow ranges as described in the Flow Recommendations and based on the observed April through July unregulated inflow into Flaming Gorge Reservoir. April through July unregulated inflow into Flaming Gorge Reservoir was categorized as 'average below median' in 2016. Pursuant to the Flow Recommendations, during the August through November base-flow period, the daily flows should be within ± 40 percent of mean base flow. The recommended 'average' Reach 2 baseflow range from the Flow Recommendations is 1,500 – 2,400 cfs. When we apply the summer seasonal variability of + 40 percent, the 'average' category shifts to 2,100 – 3,360 cfs. Consistent with the information presented in Bestgen and Hill (2015a), we request that Reclamation maintain a baseflow of ≥ 2,100 cfs in Reach 2 through at least September 30, 2016. The 30 September end date is consistent with the duration of time needed to maintain conditions for improved growth and survival of age-0 Colorado pikeminnow. We understand that Reclamation may not be able to maintain that target base flow in Reach 2 beyond September 30, 2016 and still balance annual operations.

We interpret the Flow Recommendations as recommending Reclamation incorporate seasonal variability into dam operations to assist in the recovery of endangered fishes and accommodate natural variability, but not allow for manipulation that targets a specific

operational pattern. Our 2016 base flow request, which complies with the ROD and the BO, is consistent with the intent of the flow recommendations, is based on information gathered by the Recovery Program, and responds to current biological conditions in the Green River system including reduced survival of age-0 Colorado pikeminnow.

Our rationale for requesting elevated base flows through September 30 is consistent with our requests in 2008 – 2013 and again in 2015, and is bolstered by the information presented in Bestgen and Hill (2015a).

A secondary benefit of elevating the base flow target in Reach 2 and the associated increased releases from Flaming Gorge Dam (at least through September 30, 2016) is the deleterious effect higher flows have on spawning time and growth of nonnative and predaceous smallmouth bass in Reach 1 and to a lesser extent in the upper portions of Reach 2. To illustrate this point, we provide a graphical comparison of two Reach 1 base flow hydrologies and thermal regimes (years 2005 and 2007) and the resultant effect on smallmouth bass spawning chronology (Figure 1). During a relatively wet and cool year (2005), smallmouth bass spawning occurred nearly 3 weeks later than during a drier, warmer year (2007). The same relationship was observed in related investigations on the Yampa River.

Also, preliminary information from population dynamics modeling of smallmouth bass in the upper Colorado River basin indicates that any disruption of early season spawning nests results in the largest reductions to future sub-adult and adult density (Bestgen and Hill 2015a; *in review*). Furthermore, Bestgen and Hill recommend undertaking any means of early season nest disturbance, including flow releases, to reduce abundance of invasive smallmouth bass. Elevated releases from Flaming Gorge to primarily benefit Colorado pikeminnow will therefore also delay spawning and reduce growth of smallmouth bass.

The Flow Recommendations call for a base flow range of 1,800 – 4,200 cfs in Reach 3 during 'average' hydrologic years. Bestgen and Hill (2015a) recommend a preferred base flow range of 2,200 – 3,800 cfs for this lower Green River reach in all years. In drier than average years, the Green River between the Jensen, Utah and Green River, Utah gauges can become a 'losing' reach, where substantial volumes of flow are subsumed into the alluvium and are unavailable as surface water. Our Reach 2 base flow request of $\geq$ 2,100 cfs may support the lower end of the Flow Recommendation base flow range in Reach 3. It is important to provide preferred flows in this important reach of the Green River, because in recent years, we have learned the critical role lower Green River nursery habitats play in Colorado pikeminnow population viability (Bestgen et al. 2010).

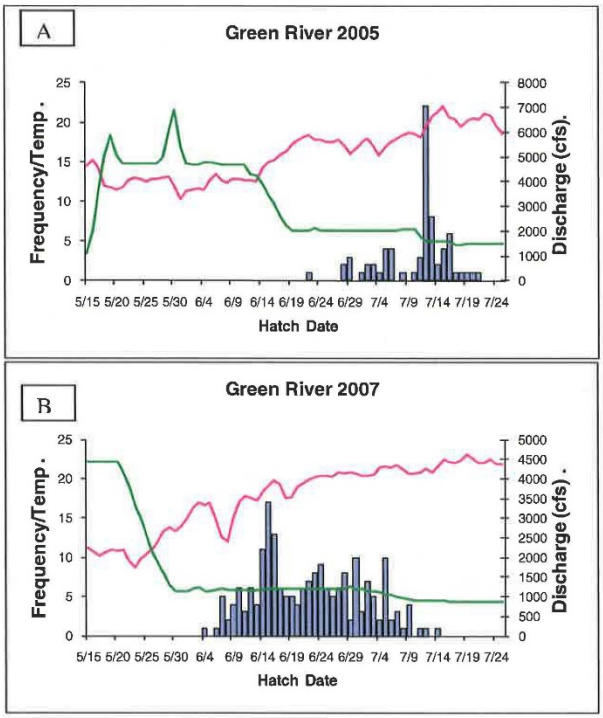


Figure 1. A comparison of flow (green), temperature (purple), and smallmouth bass hatching dates (bars) in Lodore and Whirlpool canyons (Green River - Reach 1 and upper Reach 2). A) 2005 conditions included higher base flows and cooler temps; B) 2007 conditions included lower base flows and warmer temps. Figures excerpted from Recovery Program Project #115 2009 Annual Report (preliminary information)[1]

Conclusions

In summary, we request that Reclamation:

- Time spring bypass flow releases (up to 8,600 cfs) for up to ten days (subject to modification based on actual hydrology) from Flaming Gorge to correspond with the presence of wild produced razorback sucker larvae according to the LTSP in order to improve entrainment success; and

[1] Available online at: http://coloradoriverrecovery.org/documents-publications/work-plan-documents/arpts/2009/nna/115.pdf

- Enhance summer base flows in Reach 2 of the Green River by maintaining ≥2,100 cfs through September 30, 2016.

We believe that data gathered by the Recovery Program make a strong case for these proposed operations in 2016 and should benefit young life stages of endangered fish. We hope that hydrology conditions in the Upper Green and Yampa River drainages will supply sufficient water to meet these needs. Furthermore, we believe that these operations are consistent with the existing BOs for Flaming Gorge and the Flaming Gorge ROD.

We thank Reclamation for the opportunity to provide this input and look forward to participating in the FGTWG process. If you have any questions or concerns, please contact George Weekley at 801-975-3330 x137.

Literature Cited

Bestgen, K.R., G.B. Haines, and A.A. Hill. 2011. Synthesis of floodplain wetland information: timing of razorback sucker reproduction in the Green River, Utah, related to streamflow, water temperature, and floodplain wetland availability. Final Report to the Upper Colorado River Endangered Fish Recovery Program. Larval Fish Laboratory Contribution 163.

Bestgen, K.R., J. A. Hawkins, G. C. White, C. D. Walford, P. Badame, and L. Monroe. 2010. Population Status of Colorado Pikeminnow in the Green River Basin, Utah and Colorado 2006-2008. Final Report. Colorado River Recovery Implementation Program Project Number 128 Larval Fish Laboratory Contribution 161.

Bestgen, K.R. and A. Hill. 2015a [*in review*]. Reproduction, abundance, and recruitment dynamics of young Colorado pikeminnow in the Green River Basin, 1979-2012. Larval Fish Laboratory Contribution 183.

Bestgen, K.R. and A. Hill. 2015b [*in review*]. River regulation affects reproduction, early growth, and suppression strategies for invasive smallmouth bass in the upper Colorado River basin.

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

Shuter, B.J., J.A. MacLean, F.E.J. Fry, and H.A. Regier. 1980. Stochastic simulation of temperature effects of first-year survival of smallmouth bass. Transactions of the American Fisheries Society 109:1-34.

U.S. Department of the Interior. 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.

U.S. Fish and Wildlife Service. 2005. Final Biological Opinion on the operation of Flaming Gorge Dam. U.S. Fish and Wildlife Service, Denver, Colorado.

Appendix F

Comment Letters Received through the Flaming Gorge Working Group Process

GARY R. HERBERT
Governor
GREGORY S. BELL
Lieutenant Governor

State of Utah
DEPARTMENT OF NATURAL RESOURCES
MICHAEL R. STYLER
Executive Director
Division of Wildlife Resources
GREGORY SHEEHAN
Division Director

March 16, 2016

Heather Patno
Bureau of Reclamation
Hydraulic Engineer
125 South State Street
Salt Lake City, UT 84138-1102

Dear Heather:

We have tentatively scheduled our spring 2016 tailwater fishery assessment (electrofishing), contingent on flows being approved for the operation. Our following flow request is similar to previous years:

DATE	FLOW (cfs)	TIME (MDST)	OBJECTIVE
April 18-19	1600	1900-0200	Electrofishing
April 19	1600	1600-2300	Electrofishing

All times are in Mountain Daylight Savings Time and not hour-ending. We may need to schedule a make-up electrofishing flow in the event that we are unable to complete the sampling during the scheduled two nights.

Please consider this request in light of all other constraints and respond at your earliest convenience. Contact me if you have any questions and once again we appreciate your continued support with our fishery monitoring efforts.

Sincerely,

Ryan Mosley
Flaming Gorge Project Leader
PO Box 145
Dutch John, UT 84023
Cell (435)621-2546
Office (435)885-3164

1594 West North Temple, Suite 2110, PO Box 146301, Salt Lake City, UT 84114-6301
telephone (801) 538-4700 • facsimile (801) 538-4709 • TTY (801) 538-7458 • *www.wildlife.utah.gov*

UTAH DNR WILDLIFE RESOURCES

GARY R. HERBERT
Governor
GREGORY S. BELL
Lieutenant Governor

State of Utah
DEPARTMENT OF NATURAL RESOURCES
MICHAEL R. STYLER
Executive Director
Division of Wildlife Resources
GREGORY SHEEHAN
Division Director

August 9, 2016

Heather Patno
Bureau of Reclamation
Hydraulic Engineer
125 South State Street, room 8100
Salt Lake City, UT 84138-1102

Dear Heather:

We have tentatively scheduled our fall 2016 tailwater fishery assessment (electrofishing), contingent on flows approved for the operation. Our following flow request is similar to previous years:

DATE	FLOW (cfs)	TIME (MDST)	OBJECTIVE
Sept 6-7	1600	1900-0200	Electrofishing
Sept 7	1600	1600-2300	Electrofishing

All times are in Mountain Daylight Savings Time and not hour-ending. We may need to schedule a make-up electrofishing flow in the event that we are unable to complete the sampling during the scheduled two nights.

Please consider this request in light of all other constraints and respond at your earliest convenience. Contact me if you have any questions and once again we appreciate your continued support with our fishery monitoring efforts.

Sincerely,

Ryan Mosley
Flaming Gorge Project Leader
PO Box 145
Dutch John, UT 84023
Office (435)885-3164
Cell (435)621-2546

1594 West North Temple, Suite 2110, PO Box 146301, Salt Lake City, UT 84114-6301
telephone (801) 538-4700 • facsimile (801) 538-4709 • TTY (801) 538-7458 • *www.wildlife.utah.gov*

Patno, Heather <hpatno@usbr.gov>

Flow Proposals

5 messages

Doug Burton <dougburton@ymail.com> Tue, Mar 1, 2016 at 8:34 AM
To: "Patno, Heather" <hpatno@usbr.gov>

Heather... attached is the GROGA flow request for spring 2016. Please consider this at your FGTWG and FGWG meetings. If you have any questions or need clarification please contact me via email or phone (307-371-4178). Thank you

Doug Burton

flows pdf.pdf
22K

Patno, Heather <hpatno@usbr.gov> Tue, Mar 1, 2016 at 8:51 AM
To: Doug Burton <dougburton@ymail.com>

Doug,

Thank you for your proposal and the request for releases. There are new research flows that will be proposed at the FGWG this year that you may find interesting based on your request. Please do come and listen to the proposed research flows.

We look forward to seeing you there.

Best,
Heather

On Tue, Mar 1, 2016 at 8:34 AM, Doug Burton <dougburton@ymail.com> wrote:

> Heather... attached is the GROGA flow request for spring 2016. Please consider this at your FGTWG and FGWG meetings. If you have any questions or need clarification please contact me via email or phone (307-371-4178). Thank you
>
> Doug Burton

--
Heather E. Patno
Hydraulic Engineer

Upper Colorado Region
Bureau of Reclamation
Telephone: (801) 524-3883

Doug Burton <dougburton@ymail.com> Tue, Mar 1, 2016 at 8:59 AM
To: "Patno, Heather" <hpatno@usbr.gov>

Thanks Heather.... I plan to attend. With the changes in the Green River UT dates, let me confirm that the Vernal meeting is still 4/19 (Tuesday) at 11:00 at the DWR building... Thanks!

When you are torn between 2 choices, always pick the one that will make the best story.....
[Quoted text hidden]

Tue, Mar 1, 2016 at 1:08 PM

SPRING 2016 FLOW SHAPING PROPOSALS

As the water year shapes up, GROGA and the angling community would like to request a change in the way bypass flows are down-ramped, in case we get enough runoff to have bypass flows this year.

The current program of dropping the flows 1000 cfs. per day above maximum power plant generation drives the fish from typical lies. This condition lasts well beyond the actual down-ramp, often for months. Some discussion of this has occurred at previous FGWG meetings.

Prior to the adopting of the 400 cfs/day down-ramp after maximum power plant generation is reached, we have observed the same behavior when the flows were rapidly dropped from 4600. With the 400 cfs/day strategy that has not re-occurred.

The angling community would like to see the 400 cfs/day strategy applied from the beginning of the down-ramp of bypass flows as well. This change would not necessarily impact the amount of water bypassed if the extra ramp-down time was planned.

GROGA would also request that the flow changes in both the up-ramping and down-ramping of the spring T&E releases occur at the end of the day, rather than the start. By making the changes in the evening, any turbidity or increase in flotsam would have several hours to clear before the fishing day. The fish would also have those hours to adjust to that days flows.

Patno, Heather <hpatno@usbr.gov>

Flaming Gorge Dam Release schedule

3 messages

The Owen Family <owenfamily4@msn.com> Tue, Mar 29, 2016 at 7:36 AM
To: "ResourceMgr@usbr.gov" <resourcemgr@usbr.gov>

Hello,
In the past I have been able to find the anticipated release CFS from Flaming Gorge Dam on your website.
But I am not able to find it this year.
All I found was a Jan 14, 2016 Current Status statement:
"It is anticipated that releases will remain at 800 cfs until the beginning of spring runoff sometime in May or June."
We have a fishing trip planned for mid April and that information is very useful for us.

Is that statement about anticipated releases still true?

Thanks for you help on this,
Mike Owen
303-594-4641

Heather Patno <hpatno@usbr.gov> Tue, Mar 29, 2016 at 11:26 AM
To: The Owen Family <owenfamily4@msn.com>
Cc: "ResourceMgr@usbr.gov" <resourcemgr@usbr.gov>

Hello Mike,

We are in the process of updating our website, so thank you for your email because it alerts us to issues. The website is accurate and releases will likely be 800 cfs through April into early May.

Heather

Sent from my iPhone. Please excuse any terseness or typos.
[Quoted text hidden]

Owen Family <owenfamily4@msn.com> Tue, Mar 29, 2016 at 11:32 AM
To: Heather Patno <hpatno@usbr.gov>

Thank you

Sent from my Phone
[Quoted text hidden]

Patno, Heather <hpatno@usbr.gov>

Projected Water Levels for 2016 on Green River for Uintah County (Ouray)

1 message

'Andrew Wallace' via BOR UCR DL IBR4UCRDRESMGR <resourcemgr@usbr.gov> Tue, May 3, 2016 at 6:34 PM
Reply-To: Andrew Wallace <andrewally@yahoo.com>
To: "resourcemgr@usbr.gov" <resourcemgr@usbr.gov>

I am wondering where I can find out, or who can tell me the Green River and Flaming Gorge estimated flow/release schedules for this upcoming early summer. I am helping on a farm that is affected by high water and we don't want to plant a high input crop if the River is going to be at high flows. The farm is located East of Pelican Lake in Uintah County, Utah. We desperately need to find this information to help protect our investments in inputs along with equipment.

You may contract me via email or call me on my cell at: (435) 760-4665, The farmer and land is owned by Josh Horrocks and there are over 90 acres that are flooded during high flow years which is 1/2 of the farmable land on this property. You may also contact the landowner, Josh Horrocks at: 435-7601682 or at Horrocksjosh@yahoo.com

Please let us know asap where we can find this information, or who can assist us!

Thanks,

Andrew Wallace
2122 S. Vernal Ave.
Vernal, UT 84078
(435) 760-4665

Patno, Heather <hpatno@usbr.gov>

flaming gorge

2 messages

Jinni and Dave Thomas <jinnithomas@comcast.net> Fri, May 6, 2016 at 1:11 PM
To: resourcemgr@usbr.gov

flow rate est. for june 20 to june 27 thanks?

Patno, Heather <hpatno@usbr.gov> Mon, May 9, 2016 at 9:02 AM
To: Jinni and Dave Thomas <jinnithomas@comcast.net>
Cc: "ResourceMgr@usbr.gov" <resourcemgr@usbr.gov>

Hello,

Thank you for your email. Flaming Gorge is operating under the Larval Trigger Study Plan again this year where the "trigger" for spring peak releases from Flaming Gorge Dam are determined by the appearance of larval razorback sucker in the Green River. Biologists began sampling the river today and information regarding the release will be disseminated once Reclamation has received confirmation of larvae in the river. Please check back on our website, which will be updated regularly with information. http://www.usbr.gov/uc/water/crsp/cs/fgd.html

Unfortunately, the system is hydrologically driven and we have very little information regarding actual conditions that far in the future. Current estimates are anywhere between 1,000 cfs and 1,600 cfs.

Regards,
Heather

> On Fri, May 6, 2016 at 1:11 PM, Jinni and Dave Thomas <jinnithomas@comcast.net> wrote:
> | flow rate est. for june 20 to june 27 thanks?

--
Heather E. Patno
Hydraulic Engineer
Upper Colorado Region
Bureau of Reclamation
Telephone: (801) 524-3883

Patno, Heather <hpatno@usbr.gov>

flows for May

2 messages

Gary & Barb Lane <riverrats04@gmail.com> Sat, May 7, 2016 at 6:55 AM
To: ResourceMgr@usbr.gov

Hi folks,

I have a permit to run Lodore Canyon May 21-24 and am trying to decide if I there will be enough water that I can bring my dory boat or better off using a raft. Do you know by now what kind of releases you will be having during that time frame?

Thank you.
Gary

Patno, Heather <hpatno@usbr.gov> Mon, May 9, 2016 at 8:59 AM
To: Gary & Barb Lane <riverrats04@gmail.com>

Hello,

Flaming Gorge is operating under the Larval Trigger Study Plan again this year where the "trigger" for spring peak releases from Flaming Gorge Dam are determined by the appearance of larval razorback sucker in the Green River. Biologists began sampling the river today and information regarding the release will be disseminated once Reclamation has received confirmation of larvae in the river. Please check back on our website, which will be updated regularly with information.
http://www.usbr.gov/uc/water/crsp/cs/fgd.html

Regards,
Heather
[Quoted text hidden]
--
Heather E. Patno
Hydraulic Engineer
Upper Colorado Region
Bureau of Reclamation
Telephone: (801) 524-3883

Patno, Heather <hpatno@usbr.gov>

Flaming Gorge

4 messages

Carlene Carson <carlenecarson@gmail.com> Sun, May 8, 2016 at 6:11 AM
To: resourcemgr@usbr.gov

What is the date of the opening of the Flaming Gorge Dam gates for the spring release of 2016?
Thanks Vern

Patno, Heather <hpatno@usbr.gov> Mon, May 9, 2016 at 8:55 AM
To: Carlene Carson <carlenecarson@gmail.com>
Cc: "ResourceMgr@usbr.gov" <resourcemgr@usbr.gov>

Hello Vern,

Flaming Gorge is operating under the Larval Trigger Study Plan again this year where the "trigger" for spring peak releases from Flaming Gorge Dam are determined by the appearance of larval razorback sucker in the Green River. Biologists began sampling the river today and information regarding the release will be disseminated once Reclamation has received confirmation of larvae in the river. Please check back on our website, which will be updated regularly with information. http://www.usbr.gov/uc/water/crsp/cs/fgd.html

Regards,
Heather

On Sun, May 8, 2016 at 6:11 AM, Carlene Carson <carlenecarson@gmail.com> wrote:
> What is the date of the opening of the Flaming Gorge Dam gates for the spring release of 2016?
> Thanks Vern

--
Heather E. Patno
Hydraulic Engineer
Upper Colorado Region
Bureau of Reclamation
Telephone: (801) 524-3883

carlenecarson@gmail.com <carlenecarson@gmail.com> Mon, May 9, 2016 at 10:56 AM
To: "Patno, Heather" <hpatno@usbr.gov>

Thanks Heather, However from the web site I cannot seem to find a date, I will keep looking. Thanks again Vern

Sent from my iPad
[Quoted text hidden]

Heather Patno <hpatno@usbr.gov> Mon, May 9, 2016 at 11:20 AM
To: "carlenecarson@gmail.com" <carlenecarson@gmail.com>

Hi Vern,

We don't have a date. The date is determined with a biological trigger. Current estimates are for the last week in May, but uncertainty is high.

Regards,

Patno, Heather <hpatno@usbr.gov>

Green River spring flush

2 messages

Kirk Skabo <kdskabo@centurylink.net> Tue, May 10, 2016 at 12:26 PM
To: "resourcemgr@usbr.gov" <resourcemgr@usbr.gov>

Hi,

I'm hoping you may be close to knowing the timing of the flushing flow/releases. Couple friends and I are hoping (dreaming?) to sneak in a float fishing weekend Sat-Mon if this release holds off a week yet. Any info you might be able to share? Sure would be hugely appreciated, either way!

Thank you!!

Kirk Skabo
719-482-6637
kdskabo@centurylink.net
Sent from my iPhone

Patno, Heather <hpatno@usbr.gov> Tue, May 10, 2016 at 12:59 PM
To: Kirk Skabo <kdskabo@centurylink.net>
Cc: "resourcemgr@usbr.gov" <resourcemgr@usbr.gov>

Hello,

The trigger for spring releases is based on observed larval razorback sucker in the Green River. Current estimates are for that to occur the last week in May, although uncertainty exists surrounding that estimate. It is likely releases will remain the same this weekend. Please check the website for updated information on spring releases prior to going as Reclamation will update the website.

Regards,
Heather
[Quoted text hidden]
--
Heather E. Patno
Hydraulic Engineer
Upper Colorado Region
Bureau of Reclamation
Telephone: (801) 524-3883

Patno, Heather <hpatno@usbr.gov>

Flaming Gorge Dam Flow Projections?

2 messages

william sidenfaden <wrsides1@gmail.com> Sat, May 14, 2016 at 10:18 AM
To: ResourceMgr@usbr.gov

Dear Sirs,

Flaming Gorge RECLAMATION PROJECT and my Fisherman Request:

I have perused your UC home site, Flaming Gorge, Dated May 12th, 2016 regarding the RECLAMATION Project (razorback sucker);
and would appreciate your "insight" regarding the FLOWS projection during the Memorial Day Week (may 31 thru June 4th).

My family and I have been planning a Float & Fish vacation on the Upper (Section A) Green River that week. Your informational
posting, dated May 12th regarding the variable flows releases (contingent on the "little sucker larvae") is very disturbing.
1. The sudden bump in flows sounds ominous to boating safety.
2. The viable Flows (up & down) seemingly will disrupt my fishing success
3. Other variables to consider..please advise

I welcome your thoughts, insight and advise,

Bill Sidenfaden

Patno, Heather <hpatno@usbr.gov> Sun, May 15, 2016 at 5:27 PM
To: william sidenfaden <wrsides1@gmail.com>
Cc: "ResourceMgr@usbr.gov" <ResourceMgr@usbr.gov>

Dear Mr. Sidenfaden,

Thank you for your email and questions. Reclamation attempts to provide information to the public in a timely manner in order to address the very questions you have raised. We appreciate your concern regarding boater safety and attempt to prepare for your trip. Current estimates regarding the spring peak release from Flaming Gorge Dam will increase from approximately 800 cubic feet per second (cfs) to 8,600 cfs over the course of a few days during the time period you are referencing, although timing of the actual releases will be based on observed larvae in the river. The river continues to be safe at all levels given the appropriate preparation and awareness of conditions. Releases at 8,600 cfs will be swift and the current powerful with trips down the Green River taking hours rather than the whole day.

Fishing communities are concerned with fishability during the spring peak release. Fishermen have communicated that the spring peak greatly assists ecological conditions and fishability during the post-peak period, although fishability during the peak decreases.

Please continue checking the website as we will update with information as it is received. Enjoy your trip.

Regards,

Heather Patno

[Quoted text hidden]
--
Heather E. Patno
Hydraulic Engineer
Upper Colorado Region
Bureau of Reclamation
Telephone: (801) 524-3883

Patno, Heather <hpatno@usbr.gov>

(no subject)

2 messages

Gary & Barb <wapitirg49@spro.net> Mon, Jun 6, 2016 at 10:14 AM
To: resourcemgr@usbr.gov

Hi,

I am floating the Green River through Gates of Lodore Canyon and am having trouble trying to deciper flow information to help get a general idea as to what the flows might be May 21 (our launch day) of 2016. Is there a link to flaming gorge dam release in cfs on a daily basis? How far in advance can flows being released from the dam be counted on? I'm trying do decide on bringing a dory or not. Thank you. Gary. Live in Idaho, never been on the Green before.

Patno, Heather <hpatno@usbr.gov> Mon, Jun 6, 2016 at 10:24 AM
To: Gary & Barb <wapitirg49@spro.net>
Cc: "ResourceMgr@usbr.gov" <resourcemgr@usbr.gov>

Hello:

Thank you for your email. Unfortunately, Flaming Gorge is being actively managed for increasing inflow and dam safety, alleviating flooding downstream and attempting to benefit the endangered razorback sucker. During spring runoff, this equates to real time operations as flows on the Yampa River are unregulated and snowmelt drives the river. The website will be updated as soon as information is known, which is generally two to three days in advance. Flaming Gorge releases may have more certainty closer to June 21, but that is uncertain also.

Regards,
Heather
[Quoted text hidden]
--
Heather E. Patno
Hydraulic Engineer
Upper Colorado Region
Bureau of Reclamation
Telephone: (801) 524-3883

Patno, Heather <hpatno@usbr.gov>

Flaming Gorge release question

3 messages

Nance, Lauren C <Lauren.Nance@xcelenergy.com> Wed, Jun 8, 2016 at 9:44 AM
To: "resourcemgr@usbr.gov" <resourcemgr@usbr.gov>

Dear USBR Operations,

I just read your last update from 6/6/2016 on releases, and you mentioned that releases may increase this Saturday 6/11. I was wondering what the max release rate is for the reservoir? I saw a 8600cfs number mentioned related to the larval program.

Do you expect the reservoir to spill?

I am about to raft down the Gates of Lador section of river launching 6/10 and am just concerned for our group's safety with the large flows.

Thank you,

Lauren

http://www.usbr.gov/uc/water/crsp/cs/fgd.html

Patno, Heather <hpatno@usbr.gov> Wed, Jun 8, 2016 at 1:18 PM
To: "Nance, Lauren C" <Lauren.Nance@xcelenergy.com>
Cc: "resourcemgr@usbr.gov" <resourcemgr@usbr.gov>

Hello:

Thank you for your email. We appreciate your concern for safety and planning your trip in advance. Reclamation will be increasing its releases to 8,600 cfs tomorrow and anticipates that releases will remain at that level for the next 5-7 days. This will be the maximum release from Flaming Gorge Dam this year as it is not expected to spill.

Kind regards,
Heather
[Quoted text hidden]
--
Heather E. Patno
Hydraulic Engineer
Upper Colorado Region
Bureau of Reclamation
Telephone: (801) 524-3883

Nance, Lauren C <Lauren.Nance@xcelenergy.com> Wed, Jun 8, 2016 at 3:03 PM
To: "Patno, Heather" <hpatno@usbr.gov>

Heather, Thank you so much for the updated information. Wow high flows! I will share this with our group.

Lauren Nance, P.E.
Xcel Energy | Responsible By Nature
Water Resources Analyst
1800 Larimer Street, Suite 1300, Denver, Colorado 80202
P: 303.294.2032 **F:** 303.294.2328
E: lauren.nance@xcelenergy.com

From: Patno, Heather [mailto:hpatno@usbr.gov]
Sent: Wednesday, June 08, 2016 1:19 PM
To: Nance, Lauren C
Cc: resourcemgr@usbr.gov
Subject: Re: Flaming Gorge release question

[Quoted text hidden]

Patno, Heather <hpatno@usbr.gov>

Flow Rate

2 messages

Nathan Thesing <thesinn@gmail.com> Wed, Jun 8, 2016 at 12:24 PM
To: resourcemgr@usbr.gov

Hello,

I was out on your website today and noticed that the plan to increase the flow rate to ~8,600 cfs is scheduled for tomorrow?

Why is a Thursday selected? There are many local fly fishing outfits who are dependent on weekend work and this increase rate may have will be affect on their business this weekend? Why aren't these releases done early week to protect the local businesses and people who use these waters on the weekends. There is less activity early week so it would seem to make more sense?

Can you please elaborate so I understand?

Thanks

Nate

Patno, Heather <hpatno@usbr.gov> Wed, Jun 8, 2016 at 1:08 PM
To: Nathan Thesing <thesinn@gmail.com>
Cc: "ResourceMgr@usbr.gov" <resourcemgr@usbr.gov>

Hello:

Thank you for your email. Flaming Gorge is adaptively managed for multiple purposes including evacuating storage for dam safety, alleviating flooding downstream and providing flows to assist in recovery of endangered species in the Green River. Timing of spring releases is currently addressing all these needs. We invite to you attend our Flaming Gorge Working Group meetings held in April and August to better understand the real time operations of Flaming Gorge under the 2006 Record of Decision and allow Reclamation to more fully answer your questions. You can read the Record of Decision here: http://www.usbr.gov/uc/envdocs/rod/16Feb2006_OperationFGD_ROD.pdf

Kind regards,
Heather Patno
[Quoted text hidden]
--
Heather E. Patno
Hydraulic Engineer
Upper Colorado Region
Bureau of Reclamation
Telephone: (801) 524-3883

Patno, Heather <hpatno@usbr.gov>

Planned Flaming Gorge Releases July 2016

2 messages

Birgit Buss <bussbirgit1@gmail.com> Sat, Jun 11, 2016 at 1:42 PM
To: resourcemgr@usbr.gov

Hello,

Can you give me an estimate of planned releases (CFS) for the middle of July?

Thanks so much,
-- Birgit

Patno, Heather <hpatno@usbr.gov> Mon, Jun 13, 2016 at 9:17 AM
To: Birgit Buss <bussbirgit1@gmail.com>
Cc: "ResourceMgr@usbr.gov" <resourcemgr@usbr.gov>

Hello:

Thank you for your email. Current estimates for July releases are difficult because Flaming Gorge will be operated to achieve between 2,000 cfs and 2,200 cfs measured on the USGS streamgage on the Green River at Jensen, Utah. Releases will decrease to 800 cfs by the end of June and may begin increasing at a rate of 50 cfs/day in mid-July to reach an estimated summer release of 1,850 cfs. The Yampa River will be the indicator of Flaming Gorge release schedule for the summer.

Please let me know if you have any questions or comments.

Kind regards,
Heather
[Quoted text hidden]
--
Heather E. Patno
Hydraulic Engineer
Upper Colorado Region
Bureau of Reclamation
Telephone: (801) 524-3883

Patno, Heather <hpatno@usbr.gov>

Water flow question

7 messages

Joseph Armstrong <jaf9678@gmail.com> Mon, Jun 13, 2016 at 6:42 AM
To: ResourceMgr@usbr.gov
Cc: "ARMSTRONG, JOSEPH C GS-11 USAF ACC 366 CES/CENP" <joseph.armstrong@us.af.mil>

Dear Resource Manager:
I was just wondering if you think the flow rates will be lower by June 24th.
We have a crew of 18 floating the Green River and just want to keep track.

Thank you

Joseph Armstrong

Patno, Heather <hpatno@usbr.gov> Mon, Jun 13, 2016 at 9:15 AM
To: Joseph Armstrong <jaf9678@gmail.com>
Cc: "ResourceMgr@usbr.gov" <ResourceMgr@usbr.gov>, "ARMSTRONG, JOSEPH C GS-11 USAF ACC 366 CES/CENP" <joseph.armstrong@us.af.mil>

Hello:

Thank you for your email. It is expected that releases will begin decreasing by June 19, 2016, and will approximately 3,100 cfs by June 24, 2016, with decreases of 500 cfs/day until Flaming Gorge reaches 800 cfs on June 29, 2016. The website should be updated with this information within the next few days.

Please let me know if there are any additional questions or comments.

Regards,
Heather
[Quoted text hidden]
--
Heather E. Patno
Hydraulic Engineer
Upper Colorado Region
Bureau of Reclamation
Telephone: (801) 524-3883

ARMSTRONG, JOSEPH C GS-11 USAF ACC 366 CES/CENP Mon, Jun 13, 2016 at 10:26 AM
<joseph.armstrong@us.af.mil>
To: "Patno, Heather" <hpatno@usbr.gov>, Joseph Armstrong <jaf9678@gmail.com>
Cc: "ResourceMgr@usbr.gov" <ResourceMgr@usbr.gov>

Heather:
Thanks very much - that's fantastic - sounds like perfect flow rates. Appreciate the information.

V/r

Joseph Armstrong

Base Energy Manager
366 CES/CENP
Mountain Home AFB
(208) 828-3914
[Quoted text hidden]

Patno, Heather <hpatno@usbr.gov> Tue, Jun 14, 2016 at 3:00 PM
To: Joseph Armstrong <jaf9678@gmail.com>
Cc: "ResourceMgr@usbr.gov" <ResourceMgr@usbr.gov>

Hello:

Updated information is available. Flaming Gorge Dam is currently releasing 8,600 cfs and the reservoir is at elevation 6,031.83 ft. Inflows into the reservoir have been higher than anticipated and reservoir storage has been increasing.

Initial projections for decreasing release volumes indicated that the reservoir would be at or around elevation 6,029 ft by June 20, 2016. Reclamation will continue releasing 8,600 cfs and evacuating storage until the elevation is approximately 6,029 ft. Flaming Gorge Reservoir is now projected to reach 6,029 ft around June 29, an additional 10 days from previous projections. Releases may begin decreasing prior to this time if targeted storage levels are achieved.

All predictions are based on current available data, uncertainty exists and releases may change. Official notification of release schedules will be communicated as hydrology develops.

Kind regards,
Heather

On Mon, Jun 13, 2016 at 6:42 AM, Joseph Armstrong <jaf9678@gmail.com> wrote:
[Quoted text hidden]

--
Heather E. Patno
Hydraulic Engineer
Upper Colorado Region
Bureau of Reclamation
Telephone: (801) 524-3883

Joseph Armstrong <jaf9678@gmail.com> Fri, Jun 17, 2016 at 1:09 PM
To: "Patno, Heather" <hpatno@usbr.gov>

Heather:
Just checking on the predicted flow rate for June 26th and / or possible planned release cfs.
Same question - just a different day.

Thank you
Joseph Armstrong
[Quoted text hidden]

Patno, Heather <hpatno@usbr.gov> Fri, Jun 17, 2016 at 1:17 PM
To: Joseph Armstrong <jaf9678@gmail.com>

Hi, Flaming Gorge Reservoir continues to increase with spring runoff and releases are likely to remain at 8,600 cfs through the end of June.

[Quoted text hidden]

Joseph Armstrong <jaf9678@gmail.com> Fri, Jun 17, 2016 at 4:40 PM
To: "Patno, Heather" <hpatno@usbr.gov>

Heather:
Thank you!

Joseph

[Quoted text hidden]

Patno, Heather <hpatno@usbr.gov>

Flaming Gorge storage and Green River releases

18 messages

Cross, Jared N (N-PRODUCTIVE) <Jared.N.Cross@ulalaunch.com> Tue, Jun 14, 2016 at 7:01 PM
To: "hpatno@usbr.gov" <hpatno@usbr.gov>
Cc: "planejac@comcast.net" <planejac@comcast.net>, J Cross <jared.n.cross@hotmail.com>, "dklein@usbr.gov" <dklein@usbr.gov>, "evidmar@usbr.gov" <evidmar@usbr.gov>, "TroutCreekFliesUT@aol.com" <TroutCreekFliesUT@aol.com>, "info@flaminggorgeresort.com" <info@flaminggorgeresort.com>

Heather,

I have to say, I am extremely upset at the news posted today, 6/14, about the status of Flaming Gorge releases here: http://www.usbr.gov/uc/water/crsp/cs/fgd.html

> "Flaming Gorge Reservoir is at elevation 6,031.83 ft. Inflows into the reservoir have been higher than anticipated and reservoir storage has been increasing. Initial projections for decreasing release volumes indicated that the reservoir would be at or around elevation 6,029 ft by June 20, 2016. Reclamation will continue releasing 8,600 cfs and evacuating storage until the elevation is approximately 6,029 ft. Flaming Gorge Reservoir is now projected to reach 6,029 ft around June 29, an additional 10 days from previous projections. Releases may begin decreasing prior to this time if targeted storage levels are achieved."

This is now the 3rd year in a row that poor management of the 8,600cfs Spring releases from the dam (and the reservoir storage for the releases) have ruined my planned week-long fishing trip to the Green River. I keep trying to miss these massive, unfishable releases, yet every year you guys don't manage to get it right. I thought for sure that by planning a trip up there at the end of June this year instead of the beginning of the month, I would be OK to miss these flows. I understand that there are a lot of considerations, including the weather, but from where I sit (on the outside looking in), this is the third time I've been left scratching my head and thinking, "Why did they do it like that?"

To clarify my point, this is how I see things this year, as they currently stand:

How do you expect to reach the target level of 6,029' by June 29 with current inflows averaging 10,000cfs??? If my calculations are correct (pretty sure they are), in order to evacuate ~109,000 Acre-feet of water to get to 6,029', you would need to maintain 4,000cfs outflow above inflows for very close to 14 days in order to achieve that goal. I don't suppose you are planning to open the spillway, right? I'm looking at the hydrology data, and in my opinion, the writing is on the wall; you won't likely be able to get there from here, especially with the weather forecast for the next week. If that is the case, why don't you guys just come out and say it? Releases will need to maintained at 8,600cfs until at least two weeks reservoir inflows AFTER inflows drop below ~4,600cfs.

I am really trying to keep this civil here, as we've exchanged e-mails in the past and you've given me good information back then to help me plan my trips based on the old ~5,000 cfs Spring releases. However, I am extremely upset that I may be canceling yet another trip this year for the same reasons as the last 2 years, and I'm trying to rationalize it in my head. I realize that you will likely take this e-mail as me basically saying that you don't know how to do your job, but am I just completely missing something here? As I do not expect a reply to this e-mail, please just let this be some food for thought from a member of the public who uses the recreational services below Flaming Gorge and in the Dutch John, UT area, and has been doing so for more than 25 years. Between myself and my extended family who also join me there, we take close to $10,000 that we would be spending in the area and go elsewhere with our money when this happens. These kinds of high releases, especially when they're longer than 5-7 days, severely impact the surrounding community who rely on the recreational opportunities that the river provides to make a living. I can guarantee you that my family and I are not the only people who refuse to spend that kind of money and time to travel there when the river flows are this high, as it not only ruins our fishing trip, but is unsafe for my young children. So much for safely fishing the 17-year Cicada hatch...

Thanks for your time.

Jared N. Cross | *Aerophysics* United Launch Alliance

7958 S. Chester Street

Centennial, CO 80112

Mail Stop A4000

Telephone: (303)705-2790 office

(303)269-6754 fax (unattended)

(817)793-1337 cell

E-mail: jared.n.cross@ulalaunch.com

Patno, Heather <hpatno@usbr.gov>

FW: Flaming Gorge Working Group - June 23, 2016

1 message

Cross, Jared N (N-PRODUCTIVE) <Jared.N.Cross@ulalaunch.com> Wed, Jun 15, 2016 at 6:42 PM
To: "hpatno@usbr.gov" <hpatno@usbr.gov>

Heather,

First, apologies for my tone in my e-mail yesterday evening. I was/am really upset that we will not be making our annual trip to the Green again this year, as the whole family was REALLY looking forward to it after not having gone for 3 years now, and I was venting to a certain degree. We've made trips every year since at least 1990, so we really miss it! Unfortunately, my work travel schedule makes it extremely difficult to work out a long trip, so we have to plan well in advance. We figured late June would be a safe bet this year, but alas, it apparently will not be.

I received a forwarded copy of your message below. While I would really love to be at this meeting, that's right when we were planning to come up to the Green. With the high flows predicted (and almost 100% certain), we just canceled our trip today and will be going somewhere else instead. I just hope that minutes and any presentations from this meeting will be posted on the website so that I may review them at a later time. For what it is worth, over the years I have read ALL the working group minutes and viewed ALL presentations posted relating to the Flaming Gorge/Green River management, which is initially how I found your contact info years ago.

My one question for you is this: why keep flows at 8,600 for so long right now, versus using the same volume of water to raise the summer/fall base flows to a more reasonable and steady level, which would also avoiding the power-peaking releases that have become common? That seems like a win/win to me. My assumption is that you would say it has to do with dam safety and the water elevation in the reservoir, but if you were to begin to see a steady decrease in inflow (yesterday was already lower than the two prior days, and the snowpack estimate says there's not much of anything left), wouldn't it be safe to begin lowering the outflow so long as the reservoir elevation continues to drop?

Hoping to see a response, but I understand if I burned that bridge and you ignore me. Thanks, -Jared Cross.

---------- Forwarded message ----------
From: **Patno, Heather** <hpatno@usbr.gov>
Date: Wed, Jun 15, 2016 at 11:43 AM
Subject: Flaming Gorge Working Group - June 23, 2016
To: Heather E Patno <HPatno@usbr.gov>

Hello:

Reclamation has received many calls and emails this year from individuals trying to understand Flaming Gorge operations. We would like to provide an opportunity to see the progression of forecasts and related operations this year.

Reclamation will be holding an ***ad hoc*** Working Group meeting next Thursday, June 23, 2016, at 7:00 p.m. located at the Uintah Conference Center, 313 East 200 South, Vernal, Utah, 84078.

The Flaming Gorge Working Group is an open public forum for information exchange between Reclamation and the stakeholders of Flaming Gorge Dam. The public is encouraged to attend and comment on the operations and plans presented by Reclamation at these meetings. For more information on this group and these meetings please contact Dale Hamilton at 801-379-1186 or Heather Patno at 801-524-3883.

Kind regards,
Heather

Heather E. Patno

Hydraulic Engineer

Upper Colorado Region

Bureau of Reclamation

Telephone: (801) 524-3883

Patno, Heather <hpatno@usbr.gov>

Water Release

3 messages

Nathan Leishman <nleishman@campbellsci.com> Thu, Jun 16, 2016 at 5:23 PM
To: "resourcemgr@usbr.gov" <resourcemgr@usbr.gov>

I was planning on visiting the green river below the dam to float from the dam to little hole next week but by looking at the flowrate right now, it looks a bit too fast. Do you have an idea or prediction of what the plan for the flowrate will be next week from Wednesday to Saturday? Hopefully I can get an idea so I know whether to postpone trip or not.

Thanks

Nate

Patno, Heather <hpatno@usbr.gov> Fri, Jun 17, 2016 at 9:03 AM
To: Nathan Leishman <nleishman@campbellsci.com>
Cc: "resourcemgr@usbr.gov" <resourcemgr@usbr.gov>

Hello:

Thank you for your email and concern with safety on the river. Flaming Gorge is expected to release 8,600 cfs through June 29, 2016. Please let me know if you have any further questions.

Kind regards,
Heather
[Quoted text hidden]
--
Heather E. Patno
Hydraulic Engineer
Upper Colorado Region
Bureau of Reclamation
Telephone: (801) 524-3883

Nathan Leishman <nleishman@campbellsci.com> Fri, Jun 17, 2016 at 9:14 AM
To: "hpatno@usbr.gov" <hpatno@usbr.gov>

Thanks for the info. Postponement it will be,

Sent from my Verizon 4G LTE Smartphone
[Quoted text hidden]

Patno, Heather <hpatno@usbr.gov>

Fwd: Comment for Reclamation

2 messages

Duke, Marlon <mduke@usbr.gov> Fri, Jun 17, 2016 at 4:12 PM
To: Christopher Watt <cwatt@usbr.gov>, Malcolm Wilson <mmwilson@usbr.gov>, Brent Rhees <brhees@usbr.gov>, Christopher Cutler <ccutler@usbr.gov>, Heather Patno <hpatno@usbr.gov>, Kathleen Callister <kcallister@usbr.gov>, Amee Andreason <aandreason@usbr.gov>

Thanks everybody for the help drafting a response to Mr. Powell in Jensen, Utah. Below, FYI, is what I just emailed to him.

Marlon

---------- Forwarded message ----------
From: **Duke, Marlon** <mduke@usbr.gov>
Date: Fri, Jun 17, 2016 at 4:10 PM
Subject: Re: Comment for Reclamation
To: Duanep@ubtanet.com

Mr. Powell,

Thank you for your message on June 11 regarding Green River flows. We appreciate your concerns and are doing our best to manage releases amid the high runoff conditions we are facing upstream from Flaming Gorge reservoir. In addition to high runoff rates on the Green River, the Yampa River is experiencing particularly high runoff. This is contributing to the flows you are experiencing at Jensen.

At this point in the season, the rate of release from Flaming Gorge Dam is about safely managing the amount of snowmelt we are receiving and not in response to endangered fish requirements. As of today, average daily inflow into Flaming Gorge is 9,974 cubic feet per second (cfs) and the reservoir is filling rapidly. For this reason, we must continue the current release rate until the reservoir reaches an elevation of 6,029 feet, which we anticipate should occur on or around June 29. When the reservoir reaches elevation 6,029 feet, we will begin reducing the rate of release from the dam.

The Colorado Basin River Forecast Center forecasts that Yampa River flows will go down over the next several days. That decline should result in a drop of the Green River at Jensen.

One of the inputs into our Flaming Gorge Dam operational decisions is flood level descriptions from the National Weather Service (NWS). NWS defines bankfull as the established gauge height at a specific location above which the river will overflow the lowest natural stream bank. It further defines flood levels as minor, moderate and major. Minor flood level at Jensen is defined as 24,000 cfs. Moderate flood level is defined as 28,400 cfs and major flood level occurs at 36,000 cfs. By continuously managing releases, Reclamation officials at Flaming Gorge Dam have been able to keep the flow rate downriver from the confluence of the Green and Yampa Rivers at or below 20,500 cfs while maintaining safe water levels at the reservoir this spring.

We will hold a public meeting of the Flaming Gorge Working Group next Thursday, June 23 at 7:00 PM to discuss Flaming Gorge operations. I invite you to attend and participate there for more detailed information about this year's hydrology and planned operations at the dam. The meeting will be held at the Uintah Conference Center, 313 East 200 South, Vernal, Utah.

Thank you again for your message; I hope this information is helpful. We will continue to monitor inflows to Flaming Gorge, Yampa and Green Rivers and adjust releases as spring flows subside and become more manageable.

Marlon

--
Marlon B. Duke
Public Affairs Officer, Upper Colorado Region
U.S. Bureau of Reclamation
(o) 801-524-3774
(c) 385-228-4845

---------- Forwarded message ----------
From: <Duanep@ubtanet.com>
Date: Sat, Jun 11, 2016 at 9:19 AM
Subject: Comment for Reclamation

From Duane Powell (Duanep@ubtanet.com) on 06/11/2016 at 08:06:51MSGBODY:
My name is Duane Powell. I own a ranch in Jensen Utah and I have a complaint. The Green River is overflowing it's bank and is causing damage to my crops. I check the website that tells me what the level and cubic feet of the river is doing. If you qould drop the out take of the river on the dam 1 foot we people along the river would not get flooded out and the fish would still be saved. Please do this for us.
Thank you
Duane Powell

Previous Page: http://www.usbr.gov/main/comments.cfm

--
Marlon B. Duke
Public Affairs Officer, Upper Colorado Region
U.S. Bureau of Reclamation
(o) 801-524-3774
(c) 385-228-4845

Patno, Heather <hpatno@usbr.gov>

Flaming Gorge Dam flows

16 messages

Andrew Sexton <k_syrah@hotmail.com> Tue, Jun 21, 2016 at 10:03 AM
To: "resourcemgr@usbr.gov" <resourcemgr@usbr.gov>

To Whomever is in charge:

You have done a poor job of managing the outflows this year. In the 17 consecutive years I have gone in June, there has never been a remote chance of having the river be like it is now. In case you need to be reminded, June is the absolute peak season for recreation on the Green. By not allowing for greater outflows earlier, you have effectively ruined the prime dates for all of the guide services and various businesses who rely upon the Green for their livelihood. You could've started increased flows much earlier than you did--the month of May comes to mind(like it has every year prior). What you have done is akin to the candy suppliers withholding products to retail outlets until the day after Halloween.

If I were a guide or a different fishing/Green-based business, I would see about getting reparations from you to make up for lost income.

As for me, I have looked forward to my annual trip all year, and when you announced the flows to drop two weeks ago, I was relieved. Fast forward to your announcement last week, and I am horrified. Obviously, one can't control the weather, but you collectively control the environment of one of the greatest places on Earth. I suggest you consider the consequences of your delinquency to act this year, and find suitable replacements for the future.

Duke, Marlon <mduke@usbr.gov> Tue, Jun 21, 2016 at 4:06 PM
To: k_syrah@hotmail.com
Bcc: hpatno@usbr.gov

Mr. Sexton,

Thank you for contacting us. We appreciate your concern and are doing our best to manage releases amid the high runoff we are facing upstream from Flaming Gorge Reservoir. As you mentioned, this year's high flows are occurring a little later than the averages we've seen during the past 16 years of drought. The difference this year is significant accumulations of snow and rain very late in the season which did not appear on even the best forecasts.

We work hard to balance operational decisions across an array of mandatory factors. Variability is inherent in many of those factors—including seasonal hydrology. We rely on forecasts from the Colorado Basin River Forecast Center. Of course, real precipitation and runoff amounts don't always precisely match those forecasts. This year we saw a number of late-season storms and snow accumulation across the basin; all the way through late May. The variability of that precipitation led to increased runoff and high late-season inflows into the reservoir. Because that precipitation wasn't included in earlier forecasts, we've had to adjust release amounts and timelines to manage reservoir levels.

Current average inflow into Flaming Gorge is 9,974 cubic feet per second (cfs) and the reservoir is still rising. For this reason, we must continue the current release rate of approximately 8,600 cfs. Forecasts indicate upstream inflows will begin to level and decline over the next several days. We will begin reducing the rate of release once the reservoir reaches an elevation of 6,029 feet, which we expect will occur on or around June 29.

Thank you again for your message. I hope this information is helpful. We will continue to monitor inflows and adjust releases as those flows subside and become more manageable.

Best,

Marlon

--

Marlon B. Duke
Upper Colorado Region
U.S. Bureau of Reclamation
(o) 801-524-3774
(c) 385-228-4845

> On Tue, Jun 21, 2016 at 10:03 AM, Andrew Sexton <k_syrah@hotmail.com> wrote:
>
> > To Whomever is in charge:
> >
> > You have done a poor job of managing the outflows this year. In the 17 consecutive years I have gone in June, there has never been a remote chance of having the river be like it is now. In case you need to be reminded, June is the absolute peak season for recreation on the Green. By not allowing for greater outflows earlier, you have effectively ruined the prime dates for all of the guide services and various businesses who rely upon the Green for their livelihood. You could've started increased flows much earlier than you did--the month of May comes to mind(like it has every year prior). What you have done is akin to the candy suppliers withholding products to retail outlets until the day after Halloween.
> >
> > If I were a guide or a different fishing/Green-based business, I would see about getting reparations from you to make up for lost income.

Patno, Heather <hpatno@usbr.gov>

Fwd: Comment for Reclamation

2 messages

Duke, Marlon <mduke@usbr.gov> Fri, Jun 17, 2016 at 4:12 PM
To: Christopher Watt <cwatt@usbr.gov>, Malcolm Wilson <mmwilson@usbr.gov>, Brent Rhees <brhees@usbr.gov>, Christopher Cutler <ccutler@usbr.gov>, Heather Patno <hpatno@usbr.gov>, Kathleen Callister <kcallister@usbr.gov>, Amee Andreason <aandreason@usbr.gov>

Thanks everybody for the help drafting a response to Mr. Powell in Jensen, Utah. Below, FYI, is what I just emailed to him.

Marlon

---------- Forwarded message ----------
From: **Duke, Marlon** <mduke@usbr.gov>
Date: Fri, Jun 17, 2016 at 4:10 PM
Subject: Re: Comment for Reclamation
To: Duanep@ubtanet.com

Mr. Powell,

Thank you for your message on June 11 regarding Green River flows. We appreciate your concerns and are doing our best to manage releases amid the high runoff conditions we are facing upstream from Flaming Gorge reservoir. In addition to high runoff rates on the Green River, the Yampa River is experiencing particularly high runoff. This is contributing to the flows you are experiencing at Jensen.

At this point in the season, the rate of release from Flaming Gorge Dam is about safely managing the amount of snowmelt we are receiving and not in response to endangered fish requirements. As of today, average daily inflow into Flaming Gorge is 9,974 cubic feet per second (cfs) and the reservoir is filling rapidly. For this reason, we must continue the current release rate until the reservoir reaches an elevation of 6,029 feet, which we anticipate should occur on or around June 29. When the reservoir reaches elevation 6,029 feet, we will begin reducing the rate of release from the dam.

The Colorado Basin River Forecast Center forecasts that Yampa River flows will go down over the next several days. That decline should result in a drop of the Green River at Jensen.

One of the inputs into our Flaming Gorge Dam operational decisions is flood level descriptions from the National Weather Service (NWS). NWS defines bankfull as the established gauge height at a specific location above which the river will overflow the lowest natural stream bank. It further defines flood levels as minor, moderate and major. Minor flood level at Jensen is defined as 24,000 cfs. Moderate flood level is defined as 28,400 cfs and major flood level occurs at 36,000 cfs. By continuously managing releases, Reclamation officials at Flaming Gorge Dam have been able to keep the flow rate downriver from the confluence of the Green and Yampa Rivers at or below 20,500 cfs while maintaining safe water levels at the reservoir this spring.

We will hold a public meeting of the Flaming Gorge Working Group next Thursday, June 23 at 7:00 PM to discuss Flaming Gorge operations. I invite you to attend and participate there for more detailed information about this year's hydrology and planned operations at the dam. The meeting will be held at the Uintah Conference Center, 313 East 200 South, Vernal, Utah.

Thank you again for your message; I hope this information is helpful. We will continue to monitor inflows to Flaming Gorge, Yampa and Green Rivers and adjust releases as spring flows subside and become more manageable.

Marlon

--
Marlon B. Duke
Public Affairs Officer, Upper Colorado Region
U.S. Bureau of Reclamation
(o) 801-524-3774
(c) 385-228-4845

---------- Forwarded message ----------
From: <Duanep@ubtanet.com>
Date: Sat, Jun 11, 2016 at 9:19 AM
Subject: Comment for Reclamation

From Duane Powell (Duanep@ubtanet.com) on 06/11/2016 at 08:06:51MSGBODY:
My name is Duane Powell. I own a ranch in Jensen Utah and I have a complaint. The Green River is overflowing it's bank and is causing damage to my crops. I check the website that tells me what the level and cubic feet of the river is doing. If you qould drop the out take of the river on the dam 1 foot we people along the river would not get flooded out and the fish would still be saved. Please do this for us.
Thank you
Duane Powell

Previous Page: http://www.usbr.gov/main/comments.cfm

--
Marlon B. Duke
Public Affairs Officer, Upper Colorado Region
U.S. Bureau of Reclamation
(o) 801-524-3774
(c) 385-228-4845