

RECLAMATION

Managing Water in the West

Annual Report of Operations For Flaming Gorge Dam Water Year 2009



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Annual Report of Operations for Flaming Gorge Dam

Water Year 2009

Introduction

This report details the operations of Flaming Gorge Dam during water year 2009, and is produced pursuant to the February 2006 Record of Decision for the Operation of Flaming Gorge Dam (ROD)¹, the Operation of Flaming Gorge Dam Final Environmental Impact Statement (FEIS)², and 2005 Final Biological Opinion on the Operation of Flaming Gorge Dam (2005 BO)³. This is the fourth year of operations of Flaming Gorge Dam under the ROD and this report is the fourth 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 (Western). 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 outlined in the FEIS. The ROD implements the proposed action by

¹ [Record of Decision Operation of Flaming Gorge Dam Final Environmental Impact Statement \(February 2006\)](#)

² [Operation of Flaming Gorge Dam FINAL Environmental Impact Statement \(September 2005\)](#)

³ [2005 Final Biological Opinion on the Operation of Flaming Gorge Dam](#)

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).

Operational Decision Process for Water Year 2009

The Flaming Gorge Technical Working Group (FGTWG) was established pursuant to the FEIS as recommended in the Flow Recommendations. Members of the FGTWG include biologists and hydrologists from Reclamation, the U.S. Fish and Wildlife Service (Service), and Western. 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. This process concurrently serves the informal consultation and coordination requirements of the ESA for the action agencies as committed to in the ROD.

The Flaming Gorge Working Group (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 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 2009, 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 and a timeline of how this process was implemented in 2009 can be found in Appendix B. The implementation of the four steps of the process in 2009 is described below:

Step 1: Request for Research Flows

The FGTWG received a memorandum dated February 26, 2009, (Appendix C), from the Director of the Recovery Program providing the Recovery Program's research request for 2009 Green River spring flows. The flow request from the Recovery Program was for 15,000 cubic feet per second (cfs), or greater, for a minimum of 5 consecutive days in Reach 2 of the Green River. The FGTWG also received base flow requests from the Recovery Program (Appendix D) and the Service on April 1, 2009 (Appendix E). Western submitted a base flow request to Reclamation on April 2, 2009, (Appendix F).

The Recovery Program request indicated that they would be assessing the emigration rates of previously stocked razorback sucker from the Stirrup floodplain to the main stem of the Green River. Previous studies indicated a 30 centimeter (cm) water depth in passages between floodplains and the main river channel (e.g., levee breaches and outlet structures) is required for juvenile and adult Colorado pikeminnow and razorback sucker fish passage. The Recovery Program therefore requested a flow of 15,000 cfs to maintain a minimum

depth of 30 cm at the connection channel of Stirrup Floodplain and the Green River for a minimum of 5 days. The Recovery Program estimated 15,000 cfs to be sufficient based on observations made in 2007. The request also indicated that the Recovery Program was still analyzing early findings on the 2008 flows effects on smallmouth bass reproduction and would recommend more specific base flow targets once the category for 2009 had been established and spring flows had subsided.

Step 2: Development of Spring Proposal

The FGTWG met on March 17, 2009, to begin the development of a flow proposal for the spring of 2009. 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 2009 described three possible flow regimes that were consistent with the ROD and FEIS (see Appendix G for details). Depending upon the outcome of hydrologic conditions during spring runoff, the intent was to achieve one of these proposed flow regimes.

Step 3: Solicitation of Comments

In its April 1, 2009, memorandum, the Service requested the maximum release of 40 percent higher flows than the average daily base flow in Reaches 1 and 2 of the Green River during the summer period through September 30. The intent of the request was to negatively impact nonnative fish species (particularly smallmouth bass) and provide benefits to endangered fish.

In order to maximize hydropower production during periods of increased electrical demand, Western submitted a written request to Reclamation on April 2, 2009, for the minimum 40 percent lower flows than the average daily base flow through September 30, 2009, with a redistribution of water from the summer into the winter period (November through February). Western further requested that the winter period hourly release follow a daily double peak pattern, releasing greater amounts of water during the morning and afternoon electrical peak demand and conserving water during the evening and afternoon hours when demand decreases.

On April 15, 2009, Reclamation presented the 2009 FGWTG flow proposal to the Working Group. The main purpose of this Working Group meeting was to clearly describe the FGTWG proposed flow regime for the Green River, the intended operation of Flaming Gorge Dam for the spring and summer of 2009, and to receive comments from stakeholders and the public regarding the impacts this operation might have on stakeholder resources associated with the operation of Flaming Gorge Dam. Meeting minutes were recorded and written comments were solicited by Ed Vidmar, Chairperson of the Working Group.⁴ Reclamation received comments from the public during the 2009 decision-making process. These comments are available to review in Appendix H.

⁴ Working Group Meeting notes are available at http://www.usbr.gov/uc/water/crsp/wg/fg/fg_20090415.html and http://www.usbr.gov/uc/water/crsp/wg/fg/fg_20090826.html.

Step 4: Final Decision

In response to the base flow requests of Western and the Service, the FGTWG reconvened on May 26, 2009, to develop a flow proposal for the Green River during the base flow period (August through February of the following year). The FGTWG recommendation to Reclamation was to implement the Service's request to disadvantage smallmouth bass in Reach 1 and improve conditions for endangered fish in Reach 2 using the maximum base release of 40 percent higher flows than the average daily base flow through September 30, 2009.

After reviewing the FGTWG proposal and all public input received at the Working Group, Reclamation determined the Recovery Program spring flow request could be achieved within normal operating parameters. Reclamation made the decision to operate during the spring of 2009 to achieve a flow regime in Reach 2 of at least 15,000 cfs for a minimum duration of 5 days measured at the stream gage located at Green River near Jensen, Utah stream gage, (USGS 09261000) (Jensen). Releases were also managed in an attempt to achieve an instantaneous peak of 18,600 cfs in Reach 2.

Reclamation determined the Service's base flow request could also be achieved within normal operating parameters and made a decision to utilize the base flow flexibility and maintain high base flow releases through September 30. Reclamation also determined that releases during the winter period would follow a double-peak pattern request submitted by Western pursuant to ROD constraints, existing hydrologic conditions, and electrical demand.

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 2008 through April 2009). The Upper Green River Basin snowpack condition was below average on January 1, 2009, at 78 percent of average.⁵ On April 1, 2009, the snowpack condition in the Upper Green River Basin had increased to 88 percent of average. The Yampa River Basin snowpack condition was below average on January 1, 2009, at 96 percent of average. On April 1, 2009, the snowpack condition in the Yampa River Basin had increased to 108 percent of average.

The Colorado Basin River Forecast Center (CBRFC), beginning in January every year and continuing through June, issues a monthly projection 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 and the Yampa River forecasts over the 2009 water supply season is shown in Table 1.

⁵ Percent of average is based on the 1971-2000 period of record.

Table 1 – Progression of CBRFC Unregulated Inflow⁶ Volume Forecasts for the April through July Water Supply Period

Forecast Issuance Month	Flaming Gorge Reservoir		Yampa River near Maybell, CO		Little Snake River near Lily, CO	
	(kaf)	(% of Average)	(kaf)	(% of Average)	(kaf)	(% of Average)
January	910	76	910	92	350	97
February	910	76	1,070	108	400	109
March	845	71	1,070	108	430	117
April	810	68	1,070	108	430	117
May	890	75	1,040	105	490	133
June	850	71	965	97	445	121
July	1,170	98	---	---	---	---
Actual	1,197	101	1,138	114	522	142

Summary of Flaming Gorge Operations

Flaming Gorge Dam releases under the Flow Recommendations are increased coinciding with the immediate peak and 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 higher elevation snowmelt.

Yampa River flows measured at the U.S. Geological Survey (USGS) Yampa River at Deerlodge Park, Colorado, stream gage, (USGS 09260050) (Yampa River), increased above 11,000 cfs in late April and again the second week of May. Based on having had two peaks above 11,000 cfs with a third forecasted to occur the third week of May, Flaming Gorge releases were increased to power plant capacity (4,360 cfs) for 10 days on May 12, 2009. Unfortunately, an unexpected cold front moved into the system and Yampa River flows decreased for a period of time. The Yampa River peak occurred on May 27, 2009, when flows on the Yampa River reached 16,475 cfs, resulting in an instantaneous peak measured at Jensen of 19,400 cfs. The daily average peak at Jensen reached 18,500 cfs on May 22, 2009.

Flows at Jensen remained above 15,000 cfs for 16 days from May 14 to May 28, 2009, with two days containing instantaneous flows greater than 18,600 cfs. Flaming Gorge Dam releases were decreased from power plant capacity at a rate of 500 cfs per day beginning May 21, 2009, to a daily average release rate of 1,650 cfs on May 27, 2009. Releases resumed within-day fluctuations for power generation with a single daily peak beginning May 22, 2009, and continuing through September 30, 2009. Flaming Gorge Dam releases (blue line), and flows for the Yampa River (brown line) and Green River at Jensen (green line) are illustrated in Figure 1.

⁶ Unregulated inflow is defined as the actual inflow to the reservoir corrected for change and 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.

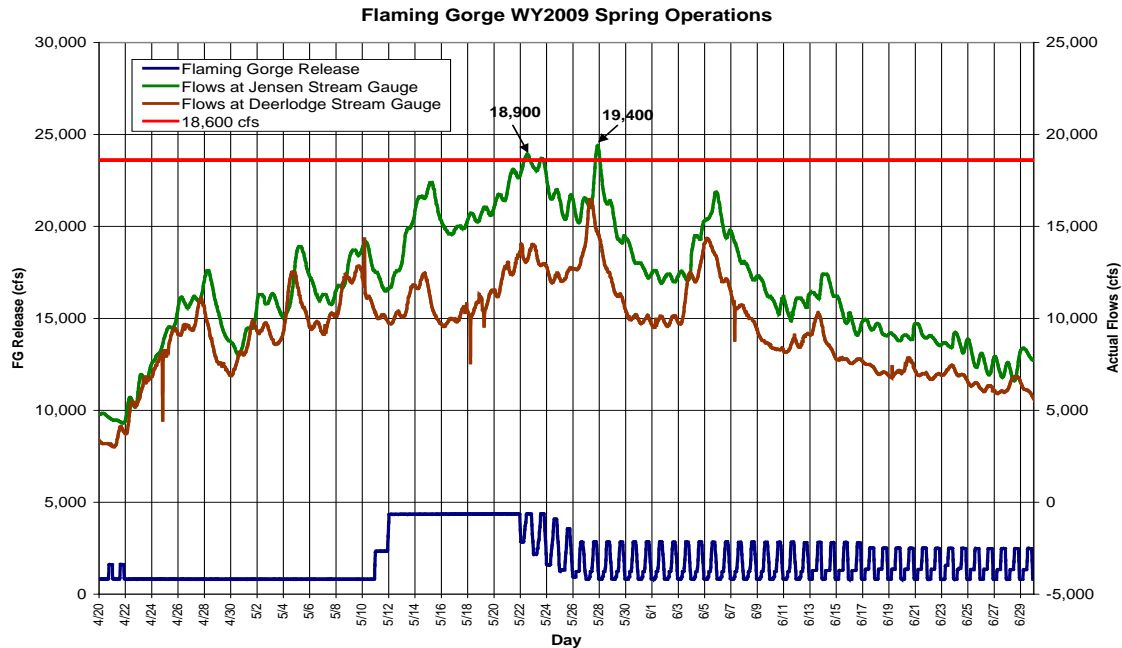


Figure 1 – 2009 Flaming Gorge Spring Releases and Flows Measured at Yampa River at Deerlodge and Green River at Jensen.

In June 2009, the Green River above Flaming Gorge Dam received 275 percent of average precipitation. Flaming Gorge Reservoir elevation increased a total of 13.24 feet (ft) from the annual minimum elevation of 6020.05 ft above sea level on May 24, 2009, to a peak elevation of 6033.74 ft on July 18, 2009.

Releases from Flaming Gorge averaged 1,650 cfs from May 27 through July 1, 2009, when releases were increased to 1,800 cfs because of increased forecasted inflows and observed increases in reservoir storage resulting from above-average precipitation above Flaming Gorge Dam. Releases were increased to an average of 2,025 cfs beginning on July 15, 2009, in response to continued high inflows and remained at that release rate through September 30, 2009. Releases were decreased to an average of 1,700 cfs beginning in October and continuing through the end of January when releases were again decreased to 1,550 cfs. Releases followed an hourly single-peak fluctuation pattern from August through October and an hourly double-peak fluctuation pattern from November through February.

The end of water year 2009 elevation for Flaming Gorge Reservoir was 6,031.12 ft, which was 9.87 ft above the previous end of water year elevation.

Spillway Inspection

In the 2005 BO the Service determined that one of the mechanisms by which populations of nonnative fish may be increased as a result of implementing the ROD was entrainment of fish to the Green River below Flaming Gorge by water released through the spillway in high water years. To address this concern, the 2005 BO directs Reclamation to provide the results of its annual spillway inspections. The 2009 spillway inspection concluded that water

released during the inspection did not result in the entrainment of nonnative fish in the Green River below Flaming Gorge Dam.⁷

Flow Objectives Achieved in Water Year 2009

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. 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 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).

After the spring flow objectives in Reach 1 and Reach 2 have been achieved, flows should be gradually reduced to achieve base flow levels by no later than the date specified in the Flow Recommendation. Base flows in Reaches 1 and 2 should be managed to fall within the prescribed base flow ranges described in the Flow Recommendations based on the observed April through July unregulated inflow into Flaming Gorge Reservoir.

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. During the December through February base-flow period, the daily flows should be within ± 25 percent of the mean base flow.

Additionally, 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, (Muth et al 2000).

⁷ Email communication with Plant Supervisor at Flaming Gorge Dam.

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

Year	May 1st A-J Unreg Inflow Forecast (kaf)	Spring Hydrologic Classification	Observed A-J Unreg Inflow (kaf)	Base Flow Hydrologic Classification
2006	1,100	Average (Abv Median)	724	Moderately Dry
2007	500	Dry	370	Dry
2008	820	Average (Blw Median)	728	Moderately Dry
2009	890	Average (Blw Median)	1,197	Average (Abv 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 2009 was 890 thousand acre-feet (kaf) and resulting spring hydrologic classification was average (below median).⁸ The peak-flow magnitude for Reaches 1, 2, and 3 are 4,360 cfs, 18,500 cfs, and 21,500 cfs, respectively.

⁸ 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.

The Reaches 1, 2 and 3, Flow Recommendation spring objectives and the desired frequency of achievement are described in Tables 2, 3 and 4. Water year 2009 is the fourth year of operations under the ROD and thus is the fourth year for establishing the long-term frequencies of these spring flow objectives.

Table 3 – Reach 1 ROD Flow Objectives Achieved in 2009

Spring Peak Flow Objective	Desired Frequency of Achievement %	Achieved in 2009	Achievement Rate to Date (Cumulative Frequency %)*
Peak \geq 8,600 cfs for at least 1 day	10 %	No	0 %
Peak \geq power plant capacity for at least 1 day	100 %	Yes	100 %

*Based on four years of operation under the ROD (2006-2009)

Table 4 – Reach 2 ROD Flow Objectives Achieved in 2009

Spring Peak Flow Objective	Desired Frequency Percent of Achievement	Achieved in 2009	Achievement Rate to Date (Cumulative Frequency %)*
Peak \geq 26,400 cfs for at least 1 day	10 %	No	0 %
Peak \geq 22,700 cfs for at least 2 weeks	10 %	No	0 %
Peak \geq 18,600 cfs for at least 4 weeks	10 %	No	0 %
Peak \geq 20,300 cfs for at least 1 day	30 %	No	25 %
Peak \geq 18,600 cfs for at least 2 weeks	40 %	No	25 %
Peak \geq 18,600 cfs for at least 1 day	50 %	Yes	75 %
Peak \geq 8,300 cfs for at least 1 day	100 %	Yes	100 %
Peak \geq 8,300 cfs for at least 1 week	90 %	Yes	100 %
Peak \geq 8,300 cfs for at least 2 days except in extreme dry years	98 %	Yes	100 %

*Based on four years of operation under the ROD (2006-2009)

Table 5 – Reach 3 ROD Flow Objectives Achieved in 2009

Spring Peak Flow Objective	Desired Frequency Percent of Achievement	Achieved in 2009	Achievement Rate to Date (Cumulative Frequency %)*
Peak >= 39,000 cfs for at least 1 day	10 %	No	0 %
Peak >= 24,000 cfs for at least 2 weeks	10 %	No	0 %
Peak >= 22,000 cfs for at least 4 weeks	10 %	No	0 %
Peak >= 24,000 cfs for at least 1 day	20 %	No	25 %
Peak >= 22,000 cfs for at least 2 weeks	40 %	No	25 %
Peak >= 22,000 cfs for at least 1 day	50 %	No	25 %
Peak >= 8,300 cfs for at least 1 day	100 %	Yes	100 %
Peak >= 8,300 cfs for at least 1 week	90 %	Yes	100 %
Peak >= 8,300 cfs for at least 2 days except in extreme dry years	98 %	Yes	100 %

Base Flow Objectives

Base flows are classified from 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 1,197 kaf and resulting base flow hydrologic classification was average (above median). Reach 1 flows were reduced to base flows by May 27, 2009. The observed April-July unregulated inflow volume into Flaming Gorge Reservoir, August final forecast and average daily releases needed to achieve the May 1, 2010 elevation target of 6027 feet were used to calculate the Reach 2 daily average base flow of 2,260 cfs.

Observed August through November base flows in Reach 2 were within 40 percent of the established base flow (i.e. between 1356 cfs to 3,160 cfs). Observed December through February base flows in Reach 2 were within 25 percent of the established base flow (i.e. between 1,695 cfs to 2,825 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.

Observed August through November base flows in Reach 3 as measured at the USGS Green River at Green River, Utah stream gage were maintained above the average classification minimum flows of 1,800 cfs and below the average classification maximum flow of 4,200 cfs.

Temperature Objectives Achieved in Water Year 2009

The Operational Plan for the Flaming Gorge Selective Withdrawal Structure (SWS) was completed by a subset of the FGTWG in June 2007. The SWS is a series of three gated intake structures that allow water to be drawn from different elevations in the reservoir. During summer months, water temperatures within the reservoir vary according to the reservoir elevation level and the adjustment of the SWS maintains some control over the water temperatures released into the Green River below Flaming Gorge Dam.

The Flow Recommendations indicate that warmer water would provide cues for adults migrating to spawning areas, aid reproductive success of fish in adulthood, enhance the likelihood of reproduction of certain fish in Lodore Canyon (Reach 1), and enhance growth of early life stages of fishes in nursery habitat including those in Echo, Island, and Rainbow Parks (all in Reach 2). Improving conditions in Lodore Canyon also could result in expansion of endangered fish populations into lower Reach 1 and upper Reach 2. The timing of warm water releases is an important component of matching native fish life cycle reproduction and growth.

The operational plan provides guidelines in an attempt to meet the water temperature objectives below Flaming Gorge Dam that are contained within the 2006 ROD and described further in Table 4, below. Operational guidelines direct operators to achieve maximum gate elevation (40 ft below reservoir surface) by June 15 of each year in order to deliver outflow temperatures of 15-16 degrees Celsius (C) (as measured at the Greendale Gage, USGS 09234500) during the summer months.

In Wyoming of 2009, the gate elevation target was achieved as scheduled but required several readjustments during the latter half of June to adjust for rapidly rising lake levels during that time period. Attempts to maintain gate elevations at exactly 40 ft below the surface on July 28, 2009, triggered generating unit bearing temperature alarms to sound, however, and the gates were returned to their an elevation of approximately 43 ft below the surface.

During the week of August 31, outflow temperatures of 16-17 degrees C had apparently triggered intermittent bearing temperature alarms to sound. In the process of remedying the situation, dam personnel discovered a substantial amount of woody debris entrained in the cooling water straining devices. Additionally, dam personnel observed swirling on the water surface near the dam face and a considerable amount of woody debris floating in the area as well. They interpreted this as the early stages of vortex formation, and the dam manager ordered that the SWS gates be lowered 5 ft in elevation from 42 ft to 47 ft below the surface. This action did not affect outflow temperatures significantly.

Average daily temperatures at Gates of Lodore (USGS 404417108524900) in 2009 equaled or exceeded Reach 1 objectives (18 degrees C; Figure 2) for 47 days (6 weeks, 5 days) beginning on June 28, and continuing through September. Reach 2 objectives (difference between Yampa and Green rivers does not exceed 5 degrees C; Figure 3) were achieved during June through September 2009. Maximum difference between the Yampa and Green rivers was 4.8 degrees C on July 18 and exceeded 4 degrees C for a total of 8 days between July 3 and July 28.

Table 6. Temperature Objectives for the Green River below Flaming Gorge Dam

Temperature Objectives	Reach*	Desired Frequency %	Achieved in 2009
Temperatures $\geq 64^\circ\text{ F}$ (18° C) for 3-5 weeks from June (average-dry years) or August (moderately wet-wet years) to March 1	1	100%	100%
Green River should be no more than 9° F (5° C) colder than the Yampa River during the base flow period	2	100%	100%

*Reach 1 is from the dam to the Yampa River confluence; Reach 2 is from the Yampa River to Sand Wash, UT.

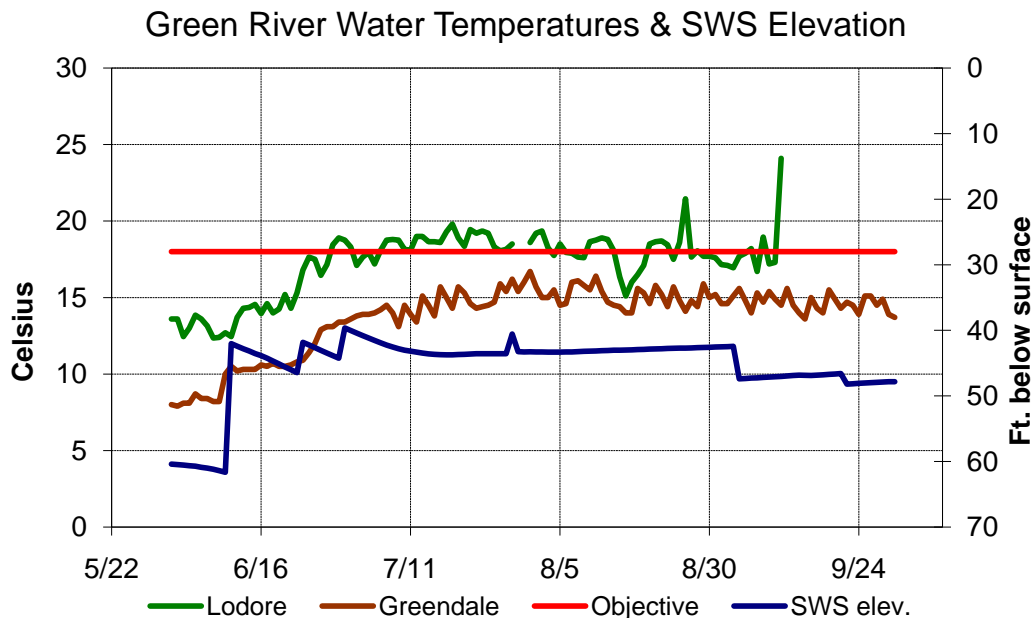


Figure 2. Reach 1 Green River Average Daily Temperatures & SWS Elevation

Temperatures are recorded at the Gates of Lodore gage (USGS 404417108524900) (green series), Greendale gage (USGS 09234500) (brown series), Reach 1 objective (red line), and SWS gate depth below reservoir surface (blue series, second axis), June-Sept 2009. SWS gate depths are the average of 3 units.

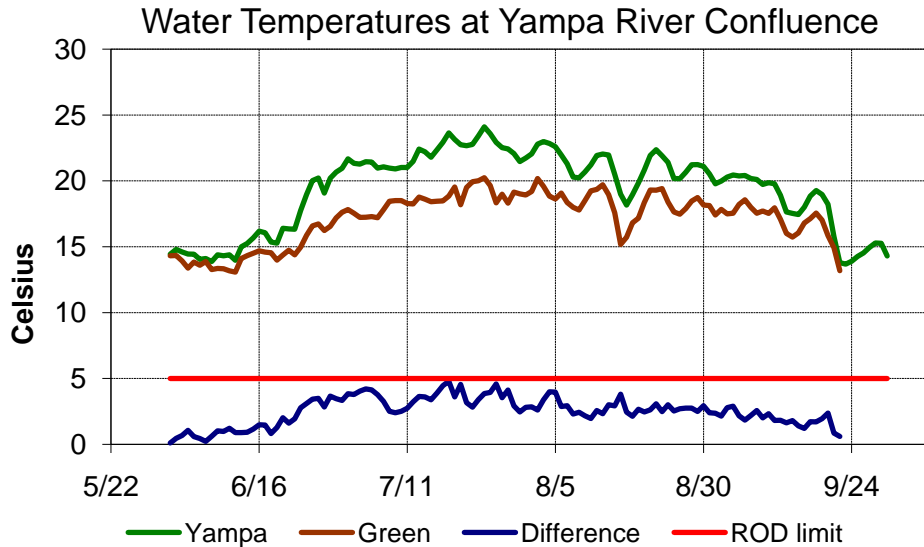


Figure 3. Green River Temperatures at the Yampa River Confluence

Temperatures are recorded at the Green River (USGS 404417108524900) (brown series) and the Yampa River (USGS 09260050) (green series), the difference between the two rivers (red line), and the maximum temperature difference specified in the 2006 ROD (blue series line), June-Sept 2000.

Recommendations

Reclamation operated Flaming Gorge Dam and Reservoir to comply with the commitments in the ROD and, to the extent possible, meet the goals and objectives of the Flow Recommendations. Reclamation increases Flaming Gorge Dam releases in the spring to match the immediate peak and post-peak of the Yampa River. Reclamation works closely with the CBRFC in determining the timing of the Yampa River spring peak. This coordination should continue in the future to assist Reclamation in determining the probability of the magnitude and timing of the Yampa River peak. It is also recommended that Reclamation increase coordination with the Recovery Program researchers on the Green and Yampa Rivers during the spring peak event.

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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.⁹

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

⁹ 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 (Western).

2. Flaming Gorge Technical Working Group (FGTWG) - 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 Western, as well as other qualified individuals who choose to participate on a voluntary basis. 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).

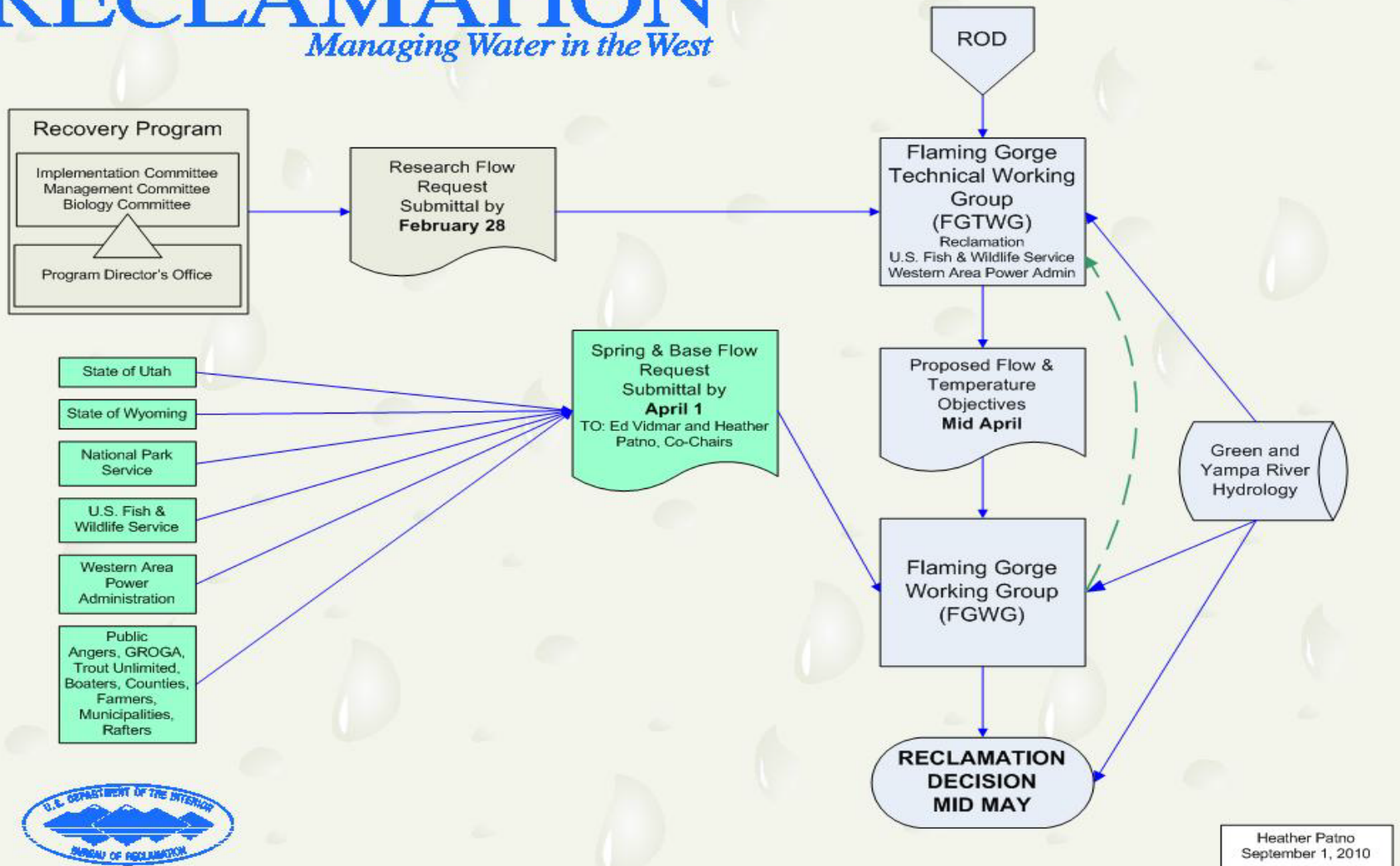
The FGTWG proposal should be finalized by early April in time to present to the Working Group.

3. Flaming Gorge Working Group – 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. Operational Plan - 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.

RECLAMATION

Managing Water in the West



Appendix B

Flaming Gorge Decision Process for 2009 Chronology of Events

Week of February 23rd

A letter was received by Reclamation from the Upper Colorado River Endangered Fish Recovery Program (Recovery Program) requesting spring flow releases of 15,000 cfs for five consecutive days for research and requesting further discussion on base flows. (See Appendix C).

Week of March 2nd

The March final forecast for Flaming Gorge Reservoir and the Yampa River near Deerlodge, Colorado, was issued. Forecasts statistically put the Green River Basin into the average hydrologic classification and the Yampa River in the moderately wet classification.

Week of March 16th

The Flaming Gorge Technical Working Group met to begin development of a flow proposal for the spring of 2007.

The March mid-month forecast issued by the River Forecast Center for Flaming Gorge Reservoir April-July unregulated inflow volume indicated hydrology was in the moderately dry hydrologic classification and the Yampa River was in the average classification.

Week of March 30th

Reclamation received an email from the Recovery Program indicating that no base flow research request was being submitted for the 2009 base flow period.

Reclamation received a base flow request from the U.S. Fish & Wildlife Service (Service) for higher base flows during the summer period from the end of the spring high flow release through September 30, 2009.

Reclamation received a base flow request from Western Area Power Administration (Western) for minimum flow releases during the summer and increased releases during the winter to benefit hydropower and allow double peak flow regimes.

Week of April 6th

The Flaming Gorge Technical Working Group held a conference call to discuss the working draft of the flow proposal.

The flow proposal was completed by the Flaming Gorge Technical Working Group. The flow proposal was provided to Reclamation for consideration.

Week of April 13th

A Flaming Gorge Working Group meeting was held in Vernal, Utah.

Week of April 20th

Comments from the Flaming Gorge Working Group accepted until April 29, 2009.

The Yampa River shows signs of early peak exceeding 10,000 cfs on April 27 and 28, 2009. No actions were taken at Flaming Gorge Dam.

Week of May 4th

Reclamation made the decision to operate during the spring of 2009 to achieve a flow regime in Reach 2 of at least 15,000 cfs for a minimum duration of five days measured at the stream gage located at Green River near Jensen, Utah stream gage (USGS 09261000) (Jensen). Releases would also be managed in an attempt to achieve an instantaneous peak of 18,600 cfs in Reach 2.

Warm temperatures in the region increase flows in the Yampa River above 12,000 cfs on May 4 and flows remain above 10,000 cfs on May 4 and 5, 2010. Flows exceed 12,000 cfs again on May 9, 2010.

Week of May 11th

Flaming Gorge Dam directed to increase releases beginning on May 8th to achieve power plant capacity on May 11th.

Week of May 18th

Flaming Gorge achieves approximately 4,350 cfs on May 15th. The Yampa River peaks on May 22, 2009, at 14,000 cfs. Flaming Gorge Dam directed to begin ramp down on May 21st. Ramp down rate is set to 500 cfsd from power plant capacity of 4,300 cfs, with fluctuations for power generation beginning on May 22nd.

Week of May 25st

The Flaming Gorge Technical Working Group held a conference call to discuss base flow flexibility and tradeoff of maintaining high summer flows at the cost of winter hydropower double peak flows.

Reclamation determined the Service's base flow request could be achieved within normal operating parameters and made a decision to utilize the base flow flexibility and maintain

high base flow releases through September 30. Releases during the winter period would follow a double-peak pattern request submitted by Western pursuant to ROD constraints, existing hydrologic conditions and electrical demand.

Reach 2 flows achieve 18,500 cfs on May 22nd and 18,300 cfs on May 23rd. Reach 2 flows achieve 15 days above 15,000 cfs. Ramp down to a summer base flow release of 1,650 cfsd was completed on May 27th.

Week of June 15th

Flaming Gorge hourly releases are adjusted in order to comply with the 0.1 meter stage change restriction at Jensen, Utah as the Yampa River declined to approximately 2,000 cfs. Average daily releases are maintained at 1,650 cfsd.

Week of June 22th

Flaming Gorge releases are temporarily adjusted at the request of the Forest Service in order to remove a boat lodged downstream.

Week of June 29th

Flaming Gorge Working Group meeting held in Dutch John, Utah to discuss Flaming Gorge process, Record of Decision base flow fluctuation requirements and the Yampa River flow components.

Flaming Gorge Reservoir elevations increased 10 feet from June 1st to June 30th with forecasted inflows also increasing. Releases are increased from 1,650 cfsd to 1,800 cfsd in order to meet the targeted May 1st elevation. The 1,800 cfsd is achieved on July 4, 2009.

Week of July 6th

Flaming Gorge hourly releases are adjusted in order to comply with the 0.1 meter stage change restriction at Jensen, Utah as the Yampa River declined to approximately 2,000 cfs. Average daily releases are maintained at 1,800 cfsd.

Week of July 13th

Flaming Gorge Reservoir elevations continue to increase and the average daily release is increased from 1,800 cfsd to 2,025 cfsd. The 2,025 cfsd is achieved on July 19, 2009.

Week of July 27th

Flaming Gorge hourly releases are modified in order to comply with the 0.1 meter stage change restriction at Jensen, Utah as the Yampa River declined to approximately 500 cfs. Average daily releases are maintained at 2,025 cfsd.

Week of August 24th

Flaming Gorge Working Group meeting held in Vernal, Utah to discuss past spring releases, current hydrology and upcoming winter base flows.

Week of September 21st

Flaming Gorge hourly releases are decreased to winter base releases of 1,750 cfsd beginning October 1st of the next water year.

Appendix C

February 26, 2009 Memorandum from the Recovery Program Director for Spring Flows 2009 and

Memorandum

February 26, 2009

To: Larry Walkoviak, Director, Upper Colorado Region, Bureau of Reclamation
Heather Patno, Chair, Flaming Gorge Technical Working Group, Bureau of Reclamation

From: Robert Muth, Director, Upper Colorado River Endangered Fish Recovery Program

Subject: Recovery Program's Research Request for 2009 Green River Spring Flows

The Upper Colorado River Endangered Fish Recovery Program (Recovery Program) supports the Bureau of Reclamation's (Reclamation) operations at Flaming Gorge Dam in 2009 consistent with the 2005 biological opinion (U.S. Fish and Wildlife Service 2005) and 2006 record of decision (ROD; U.S. Department of Interior 2006). Within that range of operations, the Recovery Program requests the following spring-runoff research flows. In addition, we are providing some preliminary information to the Flaming Gorge Technical Working Group (FGTWG) for their initial discussions of 2009 base-flow operations. As in past years, the Recovery Program will maintain close communications with Reclamation and the FGTWG in the coming months.

Spring-Runoff Flows

If current hydrology forecasts persist (i.e., average to moderately wet in the Yampa River drainage and average in the upper Green River drainage), the Recovery Program requests a spring-runoff flow of at least 15,000 cubic feet per second (cfs) for a minimum of 5 consecutive days in Reach 2 of the Green River. If hydrologic conditions in the Yampa River and/or upper Green River drainages become drier, the Recovery Program reserves the opportunity to revisit this request through the FGTWG.

The purpose of this research flow is to achieve the objectives of Recovery Program Study No. RZ-RECR: *Razorback emigration from the Stirrup floodplain*. This study is designed to assess emigration rates to the river of razorback suckers stocked into the Stirrup floodplain wetland located in Reach 2 at River Mile 276.

During spring runoff 2009, the Utah Division of Wildlife Resources will assess emigration rates of the stocked razorback suckers from the Stirrup floodplain wetland to the Green River. Previous investigations into fish passage requirements for juvenile and adult Colorado pikeminnow and razorback sucker identified a minimum depth of 30 cm (Burdick 1997). In 1997, the Recovery Program breached the levee that surrounds the Stirrup so it would connect at approximately 13,000 cfs (Valdez and Nelson 2004). However, based on subsequent field observations, we estimate that at least 15,000 cfs is necessary to achieve the desired depth of 30 cm in the Stirrup connection channel.

Summer Base Flows

The Recovery Program is currently evaluating a request for base flows in 2009 that may be similar to our 2008 recommendation (Muth 2008). Once the hydrologic category for 2009 is established and spring-runoff flows begin to subside, the Recovery Program will recommend more specific base-flow targets and provide a scientific basis for that recommendation.

Data are still being analyzed, but early findings suggest that base flows recommended by the Recovery Program in 2008 (i.e., maintain average daily releases at Flaming Gorge Dam within a range of 1,500 to 1,700 cfs through at least September 30) may have had the desired effects on smallmouth bass reproduction in Reach 1 and upper Reach 2 and on Colorado pikeminnow backwater nursery habitats in Reach 2 (see *rationale* in Muth 2008). Also, for the most part, the ROD temperature objectives were met in Reaches 1 and 2 during summer 2008 (Dave Speas, Reclamation, personal communication).

In closing, the Recovery Program appreciates the efforts of Reclamation, Western Area Power Administration, and the FGTTWG to achieve the flow and temperature recommendations and assist in recovery of the endangered fishes. Thank you for considering this Recovery Program request for research flows.

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- Burdick, B.D. 1997. Minimum flow recommendation for passage of Colorado squawfish and razorback sucker in the 2.3-mile reach of the lower Gunnison River: Redlands Diversion Dam to the Colorado River confluence. Final Report to the Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.
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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.

Valdez, R.A., and P. Nelson. 2004. Green River Subbasin floodplain management plan. Upper Colorado River Endangered Fish Recovery Program, Denver, Colorado.

Appendix D

April 1, 2009 Memorandum from the Recovery Program Director for Base Flows 2009

Memorandum

April 1, 2009

To: Larry Walkoviak, Director, Upper Colorado Region, Bureau of Reclamation (Reclamation)
Heather Patno, Chair, Flaming Gorge Technical Working Group, Reclamation

From: Robert Muth, Director, Upper Colorado River Endangered Fish Recovery Program (Recovery Program)

Subject: 2009 Green River Base Flows

On February 26, 2009, the Recovery Program submitted its request for spring-runoff research flows and indicated that it was still considering a base-flow request. This is to notify Reclamation and the Flaming Gorge Technical Working Group (FGTWG) that the Recovery Program Director's Office is not requesting specific research base flows for the Green River in 2009.

The Recovery Program supports Reclamation's operations at Flaming Gorge Dam consistent with the 2005 biological opinion and 2006 record of decision to help meet the flow and temperature recommendations (Muth et al. 2000) and assist in recovery of the endangered fishes. The Recovery Program Director's Office is willing to serve as an information source to the FGTWG as they develop their recommendations for 2009 operations.

Please contact me if you have any questions.

Appendix E

Memorandum from the U.S. Fish & Wildlife Service for Spring and Base Flows 2009



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

April 1, 2009

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

Memorandum

To: Larry Walkoviak, Director, Upper Colorado Region, Bureau of Reclamation (Reclamation)

Heather Patno, Chair, Flaming Gorge Technical Working Group, Bureau of Reclamation

From: Larry Crist, Field Supervisor, Utah Field Office, U.S. Fish and Wildlife Service (Service)

Subject: 2009 Green River Spring and Base Flows to Assist in Recovery of the Endangered Fishes

This provides the Service's current assertions regarding 2009 spring and base flows in Reach 2 of the Green River for discussion by the Flaming Gorge Technical Working Group (FGTWG) on April 7 in development of recommendations for Flaming Gorge Dam operations. The Service's intent is to work with other FGTWG members in recommending flows that assist in recovery of the endangered fishes while consistent with the 2005 biological opinion (BO) and 2006 record of decision (ROD). The following is subject to forecasted and/or real-time April-July hydrologic conditions in the upper Green River drainage, with recognition that trade-offs between and within spring and base flows should be considered and used to adjust operations as deemed appropriate.

First, the Service supports the Upper Colorado River Endangered Fish Recovery Program's (Recovery Program) February 26, 2009, request for a spring-runoff research flow. Providing a flow regime that adequately connects the Stirrup floodplain wetland with the Green River is crucial to the assessment of emigration rates of stocked razorback suckers. Knowledge gained from that assessment will further the understanding of the function of such floodplain wetlands in establishing self-sustaining razorback sucker populations.

Second, the Service proposes the following average base-flow magnitudes per hydrologic category, with reference to recommendations of Muth et al. (2002).

April–July Forecast: Flaming Gorge Inflow/ Hydrologic Category	Muth et al. (2000) Average Base-Flow Magnitudes (cfs), Reach 2	Service’s Proposed Average Base-Flow Magnitudes (cfs), Reach 2
Dry	900–1,100	1,060–1,100
Moderately Dry	1,100–1,500	1,420 to \geq 1,500
Average	1,500–2,400	2,220 to \geq 2,400
Moderately Wet	2,400–2,800	2,720 to \geq 2,800

This base-flow proposal is based on the Service’s basic understanding of preliminary results from 2008 Recovery Program studies, which suggest that the higher flows (spring and base) in Reaches 1 and 2 of the Green River negatively affected nonnative fish species (particularly smallmouth bass) and provided benefits to the endangered fishes. The proposed base flows would facilitate the conduct of similar Recovery Program studies in 2009. The Service requests that representatives of the Recovery Program Director’s Office participate in the April 7 FGTWG discussions as an information source.

In addition and in accordance with the BO and ROD, the Service supports Reclamation’s release of water of an appropriate temperature to meet thermal targets in both upper Lodore Canyon and in Echo Park. Experience gained in 2008 and previous years indicates that the base flows proposed above will not likely compromise Reclamation’s ability to meet these temperature targets to an appreciable extent.

We recognize and appreciate Reclamation’s ongoing efforts to recover the endangered fishes of the Colorado River system, if you have any questions or concerns please contact Paul Abate or Larry Crist at 801-975-3330.



Appendix F

Email from Western Area Power Administration for Base Flows 2009

From: "Clayton Palmer" <cspalmer@wapa.gov>
To: <HPATNO@uc.usbr.gov>
Date: 4/2/2009 5:06:44 PM
Subject: Western's proposed 2009 Green River Base Flows

Hello:

Since the hydrological condition for WY 2009 have not been determined and Reclamation and FG TWG do not yet know what hydrological category WY 2009 will be for the purposes of complying with the FG ROD, Western's proposed base flow is dependent on hydrological conditions.

Western proposes the following:

- * that the Flaming Gorge be brought to maximum power plant for the length of time specified in the FG ROD as per the appropriate hydrological condition.
- * that the Spring Peak release from Flaming Gorge assist in providing water for the UC RIP research request as described in its letter to Reclamation.
- * that once the Spring Peak release has been completed (as described above) that Reclamation reduce releases at Flaming Gorge Dam to base flows, lowering the daily average release in conformance with the FG ROD.
- * that the Summer season (July - Sept) base flows be lowered to the lowest release allowed in Reach 1 (accounting for the 25% discretionary allowance and accounting for the meeting Reach 2 base flow minimums).
- * that the Summer daily pattern - to the extent there is water to "shape" - be patterned to follow electrical demand from SLCA/IP customers (a single peak pattern).
- * that available water out of the Summer Season base flows be move to the Winter Season months of November - February.
- * that the Winter Season daily pattern follow the electrical demands from the SLCA/IP customers (a double peak pattern).

The daily patterns for the Summer Season and for the Winter Season will be those used by Western in the Summer Season of 2008 and the Winter Season of 2008 - 09, but would be adjusted to meet target daily volumes as prescribed by the hydrological condition and the distribution of the base flow water by month.

Western will prepare specific daily patterns at the appropriate time and would be happy to prepare "sample" patterns for Reclamation or for presentation at the Flaming Gorge Operations Working Group.

Thank you for considering Western's request. I would be happy to answer questions or to further clarify our request.

Clayton Palmer
cspalmer@wapa.gov
(801) 524-3522

CC: "Jeff Ackerman" <Ackerman@wapa.gov>, "Burt Hawkes" <HAWKES@wapa.gov>, "Sam Loftin" <LOFTIN@wapa.gov>, "Jennifer Turnbull" <Turnbull@wapa.gov>

Appendix G

Flaming Gorge Technical Working Group – Proposed Flow and Temperature Objectives for 2009

Flaming Gorge Technical Working Group Proposed Flow and Temperature Objectives for 2009

Current Hydrologic Classification

For the purposes of implementing the 2006 Flaming Gorge Record of Decision (ROD) in 2009, an evaluation has been made of the current hydrologic conditions in the Upper Green River (*i.e.* above Flaming Gorge Dam). The evaluation centered on the historical unregulated inflow statistics for Flaming Gorge Dam during the period from 1963 through 2008. Based on these statistics and the April 1, 2009, forecast of 810,000 acre-feet for Flaming Gorge, the most likely hydrologic classification will be average (30% to 70% exceedance) for spring 2009. Appendix A illustrates the April 1, 2009, final forecast for Flaming Gorge Reservoir in relation to the hydrologic categories described in the Flow and Temperature Recommendations for Endangered Fishes in the Green River Downstream of Flaming Gorge Dam (Muth, et al, 2000) (Flow Recommendations).

Green River Basin Hydrology

The April 1, 2009, forecast of April through July unregulated inflow (current forecast) for Flaming Gorge Reservoir is 810 thousand acre-feet (KAF) (68% of 30-year average). This forecast falls at approximately 68% exceedance based on the historic unregulated inflow record (1963-2008). Figure 1 shows the current forecast in relation to the historic unregulated inflow volumes.

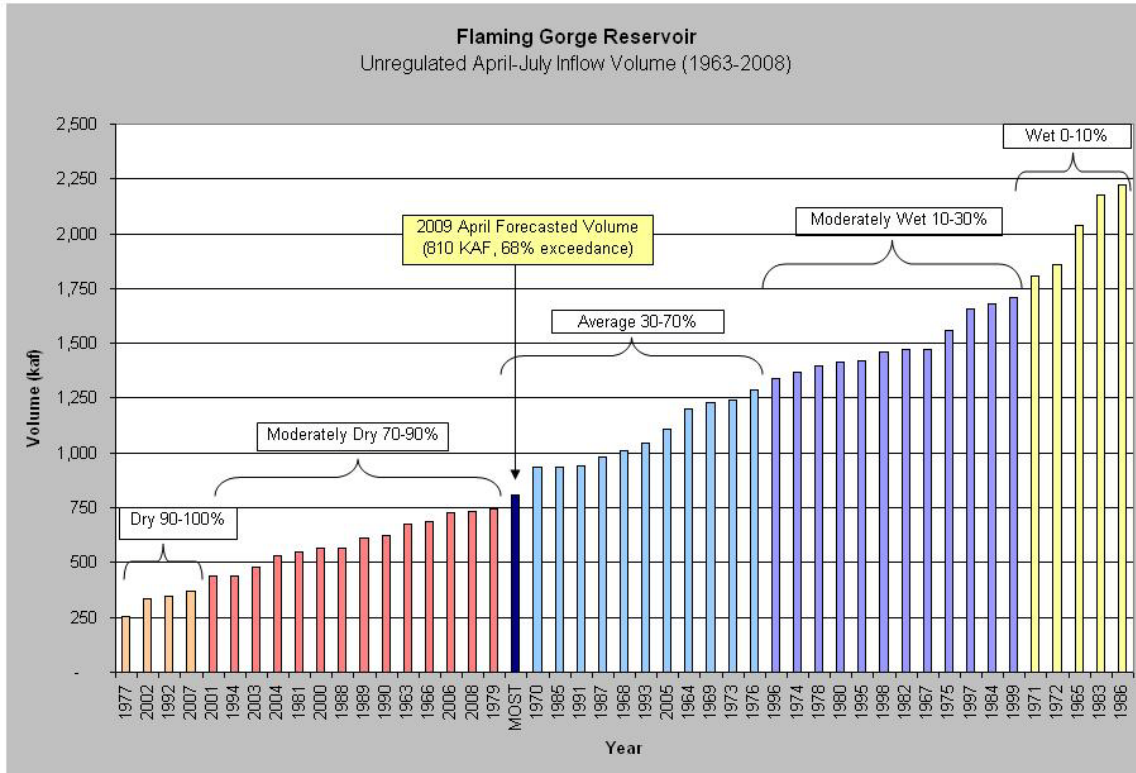


FIGURE 1—Flaming Gorge Reservoir April final forecast and ranked historic unregulated April through July inflow volume for years 1963-2008.

Flaming Gorge Reservoir currently has a water surface elevation of approximately 6020.23 feet above sea level. There is approximately 2.988 million acre-feet of live storage (79% storage capacity) in Flaming Gorge and approximately 0.764 million acre-feet of space.

Yampa River Basin Hydrology

The current forecast for the Little Snake River and Yampa River combined (Little Snake at Lily plus Yampa at Maybell) is 1,500 KAF (110% of 30-year average). This forecast falls at approximately 30% exceedance based on a ranking of the historic record (1922-2008).

Figure 2 below shows the current forecast in relation to historic flow volumes.

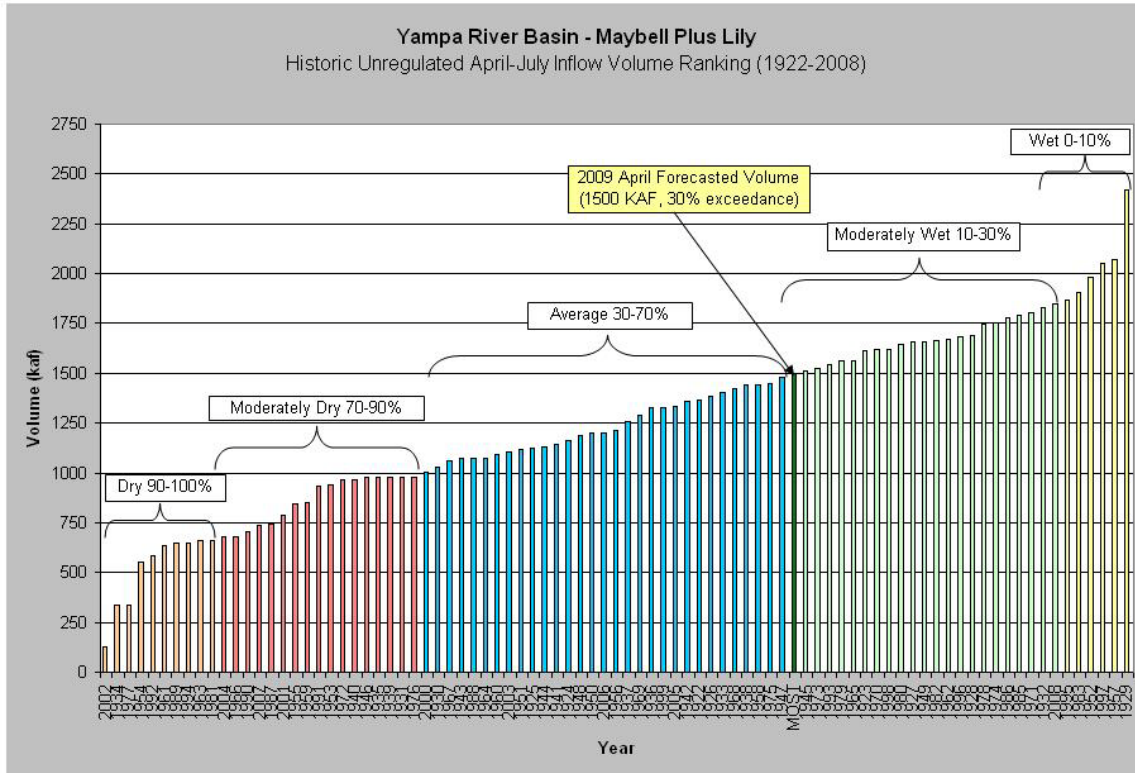


FIGURE 2—Yampa River Basin (Maybell plus Lily) current forecast and ranked historic unregulated April through July inflow volume for years 1922-2008.

Hydrologic conditions in the Yampa River basin look promising for high flows this year based on the current forecast.

Green and Yampa River Basin Hydrology (combined)

The current forecast for the combined Green River above Flaming Gorge Reservoir, Little Snake River near Lily, Colorado and the Yampa River near Maybell, Colorado (combined forecasts equal the Jensen, Utah unregulated flow) is 2,310 KAF. The combined April through July forecast for these points is the best indicator of the unregulated flow volume most likely to occur on the Green River at Jensen, Utah during 2009. This volume falls at 61% exceedance when compared to the historic record (1947-2008).

Figure 3 below indicates the current April through July forecast falls where within the wet to dry continuum of the historic record.

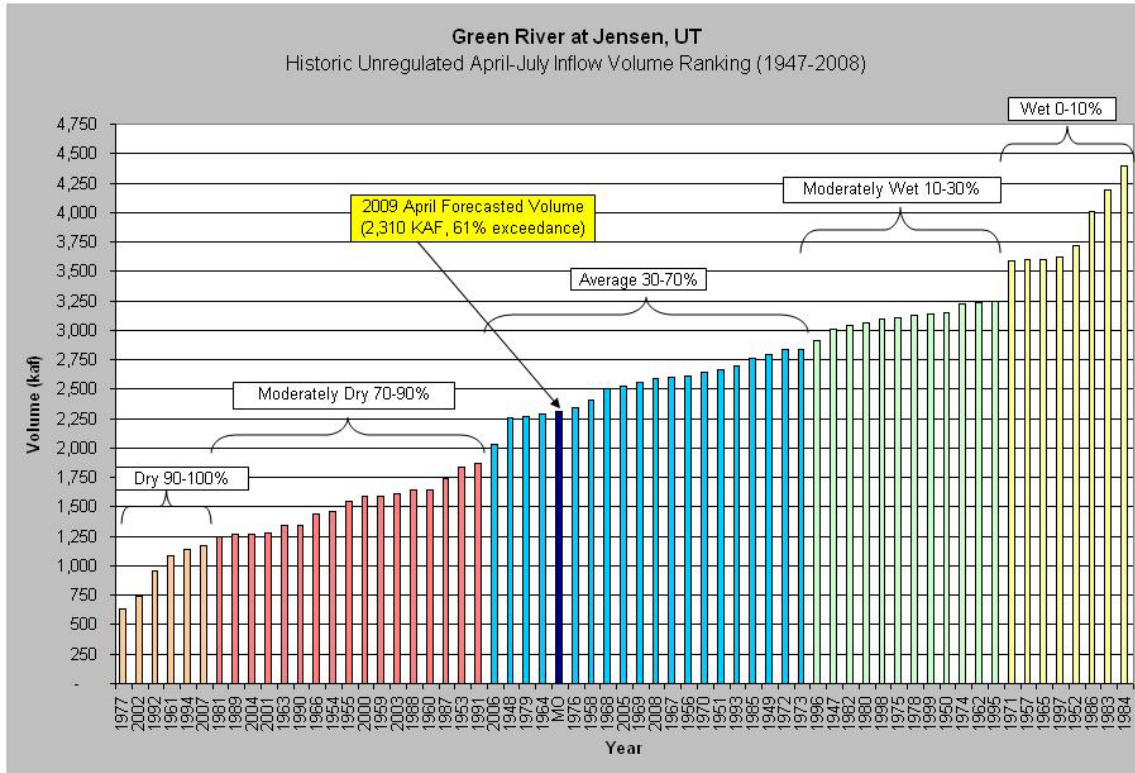


FIGURE 3—Green River at Jensen, Utah current forecast and ranked historic unregulated April through July inflow volume for years 1947-2008.

Probabilities of Flow Events for Spring 2009

Similar to 2008 hydrology, the 2009 Flaming Gorge Reservoir forecast is significantly different from the 2009 forecast for the Yampa River Basin. However, the Yampa River Basin forecast is lower this year than last. An analysis was completed to assist in the determination of appropriate flow objectives for spring and summer 2009. The ten most similar historic years for the Yampa River Basin (Maybell plus Lily) compared to the current forecast (Table 1) were analyzed assuming a normal distribution. Table 2 presents the percent exceedance of cumulative days greater than or equal to various flow levels at Yampa River (Maybell plus Lily).

Table 1
Yampa River (Maybell plus Lily) – April through July Unregulated Volume
Ten Similar Years to the April 1, 2009 Final Forecast
Thousand Acre-Feet (KAF)

Year	April-July Unreg Inflow Volume (KAF)
MIN	1,045
1968	1,420

1938	1,439
1958	1,443
1975	1,450
1947	1,479
MOST	1,500
1945	1,514
1973	1,527
1993	1,543
1979	1,562
1965	1,564
MAX	2,040

Table 2
Spring 2009 – Days above Specific Flow Thresholds in the Yampa River (Maybell plus Lily)
Based on the April 1, 2009, Final Forecast
Percent Exceedance (%)

% Exceed	Days above 10,000 cfs	Days above 11,000 cfs	Days above 12,000 cfs	Days above 13,000 cfs	Days above 14,000 cfs	Days above 15,000 cfs	Days above 16,000 cfs
25%	27	24	19	13	10	9	6
50%	26	19	14	10	8	5	3
75%	22	16	13	9	7	4	1
90%	21	15	11	9	6	3	0

Record of Decision Spring Flow Objectives

If the April through July unregulated inflow into Flaming Gorge Reservoir remains in the range from 783 KAF to 1,337 KAF the hydrological classification would be average. The ROD spring flow objectives for average years are:

Average Spring Flow Objectives

Reach	Spring Peak Magnitude (cfs)	Spring Peak Duration
Reach 1	≥ 4,300 cfs	That necessary to achieve duration target in Reach 2
Reach 2	≥ 18,600 cfs in 50% of average years	Two weeks (i.e. 14 days) in 25% of all average years
	≥ 8,300 cfs in 50% of average years	One week (i.e. 7 days) in 50% of average years

Flow Recommendations and FEIS

It is likely that hydrologic conditions into Flaming Gorge Reservoir will change before implementation of the proposed 2009 flow objectives. In the event conditions become drier

and the Flaming Gorge Reservoir unregulated inflow forecast for April through July falls below 783 KAF, the hydrological classification would be moderately dry. ROD spring flow objectives for moderately dry years are:

Moderately Dry Spring Flow Objectives

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

Flow Recommendations and FEIS

In the event conditions become even drier and the Flaming Gorge Reservoir unregulated inflow forecast for April through July falls below 418 KAF, the hydrological classification would be dry. ROD spring flow objectives for dry years are:

Dry Spring Flow Objectives

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

Flow Recommendations and FEIS

If conditions become wetter than the current forecast at Flaming Gorge Reservoir and the April through July forecast increases above 1,337 KAF, the hydrological classification would be moderately wet. ROD spring flow objectives for moderately wet years are:

Moderately Wet Spring Flow Objectives

Reach	Spring Peak Magnitude (cfs)	Spring Peak Duration
Reach 1	≥ 4,300 cfs	that necessary to achieve duration target in Reach 2
Reach 2	≥ 20,300 cfs	1 day in moderately wet years
	≥ 18,600 cfs	2 weeks (i.e. 14 days) in moderately wet years

Flow Recommendations and FEIS

If conditions become even wetter and the Flaming Gorge Reservoir unregulated inflow forecast for April through July increases above 1,774 KAF, the hydrological classification would be wet. ROD spring flow objectives for wet years are:

Wet Spring Flow Objectives

Reach	Spring Peak Magnitude (cfs)	Spring Peak Duration
Reach 1	≥ 8,300 cfs	That necessary to achieve duration target in Reach 2
	≥ 26,400 cfs	One day in wet years
Reach 2	≥ 22,700 cfs	Two weeks (i.e., 14 days) in wet years
	≥ 18,600 cfs	Four weeks (i.e., 28 days) in wet years

Flow Recommendations and FEIS

Recovery Program Research Request

Reclamation and the FGTWG received a memorandum dated February 26, 2009, from Robert Muth, Director of the Upper Colorado River Endangered Fish Recovery Program (Recovery Program). The Recovery Program will be assessing the emigration rates of previously stocked razorback sucker from the Stirrup floodplain to the main stem of the Green River. Studies have identified a 30 cm water depth in passages between floodplains and the main river channel (e.g., levee breaches and outlet structures) is required for juvenile and adult Colorado pikeminnow and razorback sucker fish passage. The Recovery Program estimates, based on field observations, that at least 15,000 cfs is necessary to achieve the desired depth of 30 cm in the Stirrup connection channel. The Recovery Program requested a spring peak research flow of 15,000 cfs, or greater, for a minimum of five consecutive days in Reach 2 of the Green River under current hydrologic conditions.

Reclamation and the FGTWG received a memorandum dated April 1, 2009, from the Recovery Program indicating that there is no specific base flow research request for the 2009 base flow period.

Proposed Flow Objectives for Spring 2009

The 2005 Operations of Flaming Gorge Dam Final Environmental Impact Statement (FEIS) specifically addresses the content of this operating plan in Section 2.5.3.1. The operating plan is to describe the current hydrologic classification of the Green River and Yampa River Basins, including the most probable runoff patterns for the two basins. This information has been provided above. The operating plan is also to identify the most likely Reach 2 flow magnitudes and durations that are to be targeted for the upcoming spring release. It further specifies that “[b]ecause hydrologic conditions often change during the April through July runoff period, the operations plan would contain a range of operating strategies that could be implemented under varying hydrologic conditions. Flow and duration targets for these

alternate operating strategies would be limited to those described for one classification lower or two classifications higher than the classification for the current year.”

The potential classifications for 2009 are as follows:

Average Classification

The current forecast of 810 KAF into Flaming Gorge reservoir is on the dry side of average and the 1,500 KAF for the Yampa River Basin would fall into the moderately wet category of the Flow Recommendations. The following proposed flow objectives apply to an average hydrologic classification as determined by the May 1, 2009 final forecasted unregulated inflows for the April through July period into Flaming Gorge Reservoir. Proposed Reach 1 flows should be managed to achieve a peak of 4,300 cfs or greater in order to accommodate the Recovery Program spring peak research request, timed coincident with the spring peak flows of the Yampa River. To accommodate the Recovery Program spring peak research request, the flows in Reach 1 should be managed to achieve at least 15,000 cfs in Reach 2 for a minimum duration of five days. Flows in Reach 1 should also be managed to achieve an instantaneous peak of 18,600 cfs in Reach 2. Once the spring peak research flows and instantaneous peak objectives have been achieved in Reach 2, Reach 1 flows should be gradually reduced at a rate of 500 cfsd to base flow levels.

Moderately Dry Classification

If the Flaming Gorge Reservoir forecast falls below 783 KAF the spring flow proposal would fall into the moderately dry classification.

If the Yampa River Basin forecast remains above 1,248 KAF and Reach 2 flows exceed 14,000 cfs, it is proposed that Reach 1 flows should be managed to achieve a peak of 4,300 cfs or greater in order to accommodate the Recovery Program spring peak research request, timed coincident with the spring peak flows of the Yampa River. Flows in Reach 1 should also be managed to achieve an instantaneous peak of 18,600 cfs in Reach 2. Once the spring peak research request and instantaneous peak objectives have been achieved in Reach 2, Reach 1 flows should be gradually reduced at a rate of 350 cfsd to base flow levels.

If the Yampa River Basin forecast falls below 1,248 KAF, it is proposed that flows in Reach 1 would be managed up to 4,300 cfs to achieve 8,300 cfs in Reach 2 for at least one week. In the event this occurs, it is unlikely that the Recovery Program research flow request could be accommodated.

Moderately Wet Classification

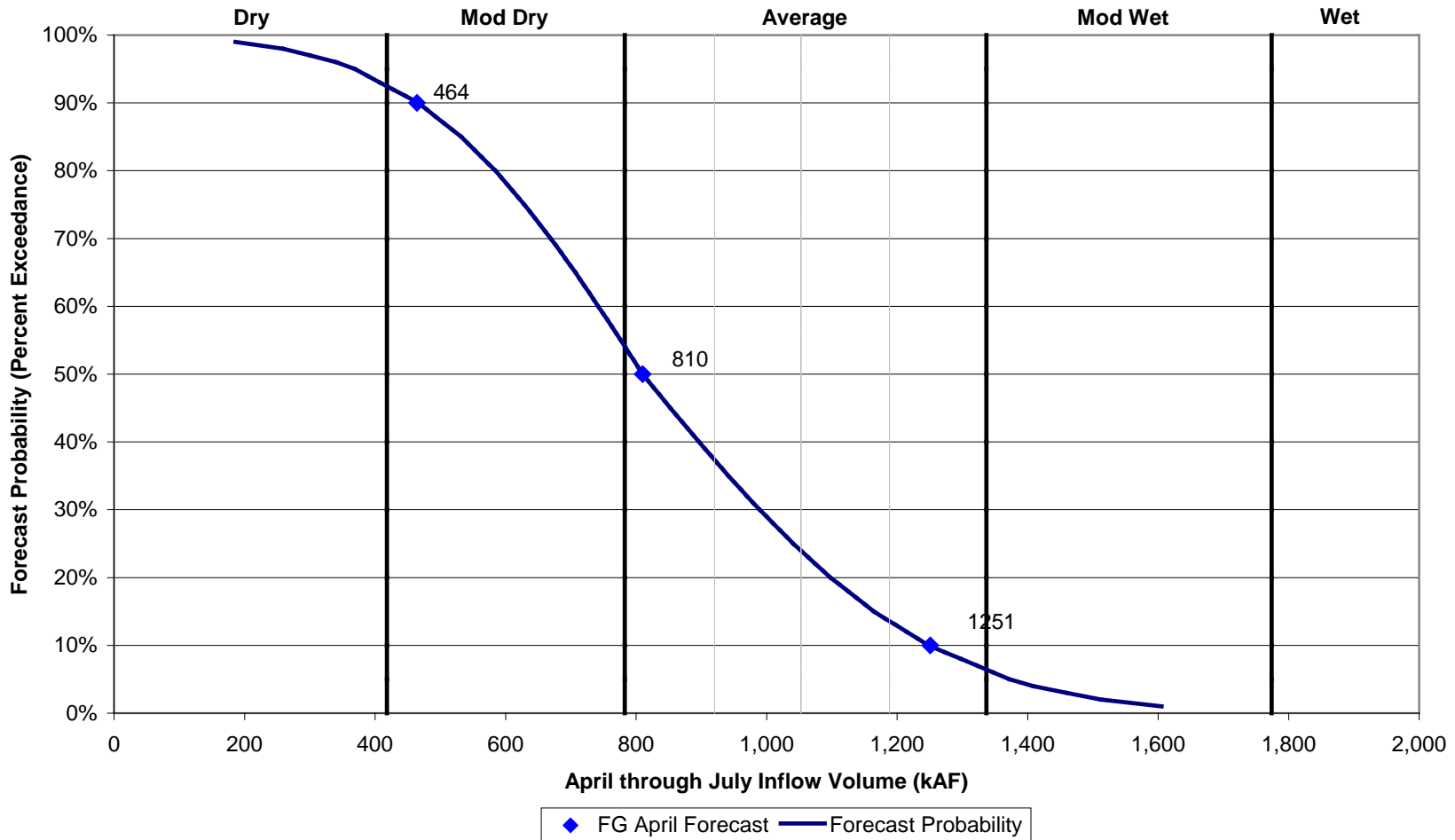
If Flaming Gorge Reservoir forecast increases above 1,346 KAF, it is proposed that Reach 1 flows be managed to achieve the objectives outlined in the average hydrologic classification. In addition, flows in Reach 1 would be managed in order to achieve a one-day peak flow of 20,300 cfs in Reach 2 and 18,600 cfs in Reach 2 for at least two weeks. Reach 1 flows should be gradually reduced at a rate of 1000 cfsd to base flow levels.

Proposed Base Flow and Temperature Objectives for Summer 2009

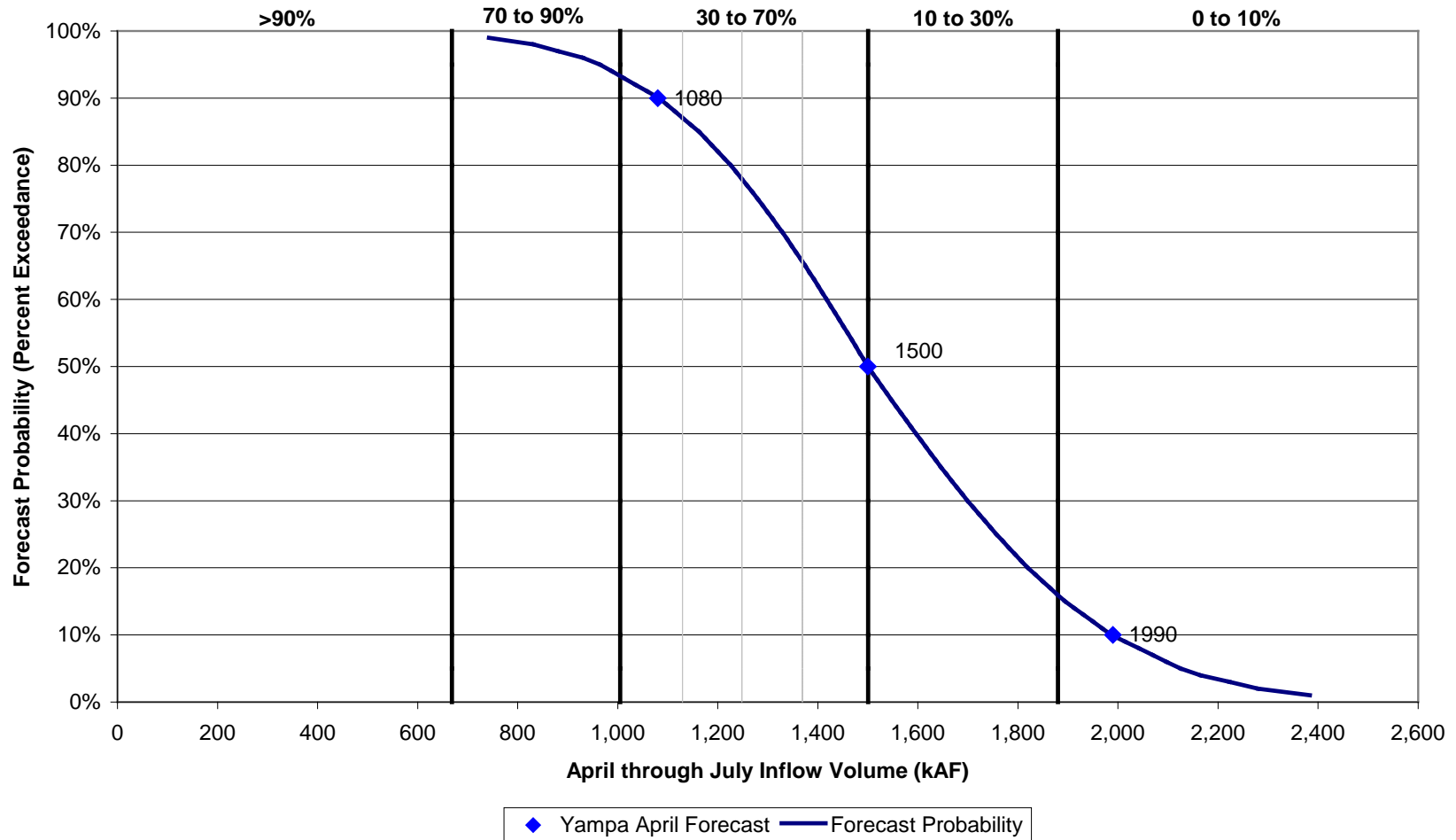
After the spring flow objectives in Reach 1 and Reach 2 have been achieved, flows should be gradually reduced to achieve base flow levels by no later than July 15, 2009. Base flows in Reaches 1 and 2 should be managed to fall within the prescribed base flow ranges described in the Flow Recommendations based on the observed April through July unregulated inflow into Flaming Gorge Reservoir. Pursuant to the Flow Recommendations, during the August through November base-flow period, the daily flows should be within $\pm 40\%$ of mean base flow. During the December through February base-flow period, the daily flows should be within $\pm 25\%$ of the mean base flow. Additionally, the mean daily flows should not exceed 3% variation between consecutive days and daily fluctuations at Flaming Gorge Dam should produce no more than a 0.1 meter daily stage change at Jensen, Utah.

Additionally, the temperature of flows should be managed to be at least 18° C for 2 to 5 weeks in Upper Lodore Canyon during the beginning of the base flow period. Water temperatures in the Green River should also be managed to be no more than 5° C colder than those of the Yampa River at the confluence of the Green and Yampa Rivers for the summer period of 2009 (June through August).

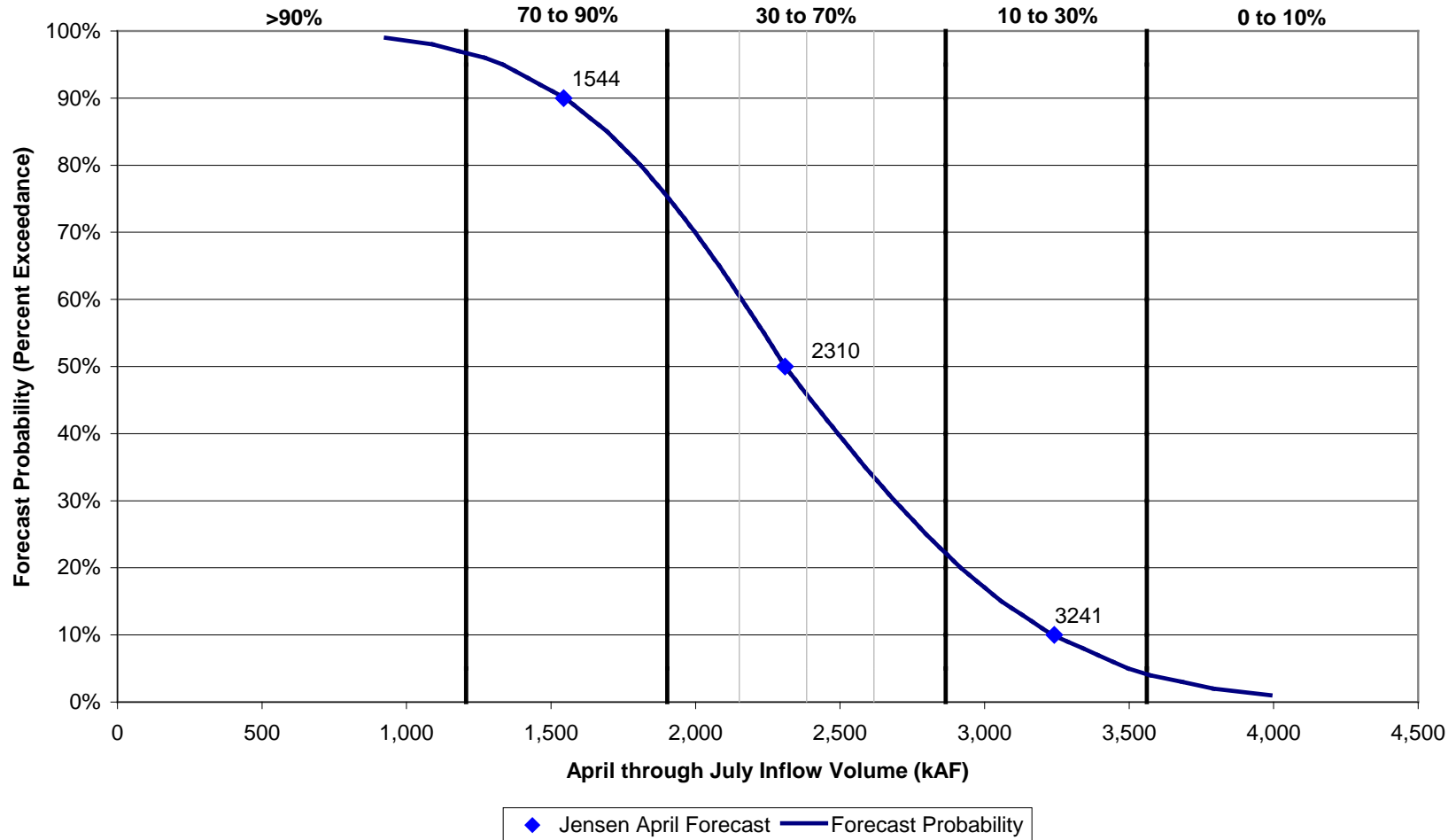
Flaming Gorge Reservoir
April through July Historic Inflow (1963-2008)
 Related to Flow Recommendation Percent Exceedances



Yampa River - Maybell Plus Lily
April through July Historic Inflow (1922-2008)
 Related to Flow Recommendation Percent Exceedances



Green River at Jensen, Utah
April through July Historic Inflow (1947-2008)
 Related to Flow Recommendation Percent Exceedances



Appendix H

Comment Letters Received from the Public during the 2009 Decision-Making Process

April 10, 2009

Heather,

We at Eagle Outdoor Sports, Inc. fully support the agencies opinion for base flows after the peak flow not the Western (Electrical) position.

It seems that power generation historically wins out over what is best for the endangered fish as well as the recreation use of the rivers. We need the higher base flows to support the recreation use to its full potential.

Although Western may represent income to the government, so does multiple use and recreation use represent income to the government.

We hope our voice is also heard in your meetings and for this decision.

Sincerely,
Rex Mumford

President - Eagle Outdoor Sports, Inc.

April 23, 09

Ed,

I just wanted to follow up with official comments about the two proposals (USFWS & WAPA) for use of the "extra" water this season. As President of Green River Outfitter & Guides Association (GROGA) we would more favor USFWS proposal for higher base flows for the summer and a low base flow through the winter months. We feel that there is not enough data yet to say that the double peak has no effect on the fishery. I know that Utah State Univ. just completed their bug study and the Utah DWR just completed their fish study and I hope decisions are not made until they have a report of their findings. Their report should be a resource for the decision made.

Our first choice would be higher base flows with no fluctuation during the summer and low base flows during the winter with no double or single peak. Our second choice would be a single peak during the summer and low base flow in winter. We still feel that a "big flush" is needed in the river to break up the silt deposits left over from the effects of the Mustang Fire. This sediment is hardening on the river bed and consuming critical habitat for the trout and invertebrates in the system. When all the cracks and holes are filled with concrete is like managing a deer herd on barren ridge tops with no valleys to feed in. We understand that this takes water to do but the longer we wait, the more water it will take and more damage downstream in Jensen. I think it would need to be done when the Yampa is at low flows. The duration would be short to pick up the trash and move it 20 miles and then be back in business.

Kevin Clegg

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Division of
Wildlife Resources

JAMES F. KARPOWITZ
Division Director

JON M. HUNTSMAN, JR.
Governor

GARY R. HERBERT
Lieutenant Governor

April 23, 2009

Mr. Ed Vidmar
BOR Provo Area Office
302 East 1860 South
Provo, UT 84606-7317

Subject: Comments to Proposals at FWG Meeting

After hearing the two proposals from WAPA and the USFWS at the April 15th Flow Group meeting, Utah Wildlife Resources would like to make the following comments. If water is available to "shape" during only one season (i.e. winter vs. summer), DWR prefers that flows from Flaming Gorge Dam be fluctuated during the summers months. Trout in the tailwater fishery are better able to contend with fluctuating flows during the summer months, especially where load following is conducted in a daily single peak. Warmer water temperatures and invertebrate food availability also assist trout in dealing with the energetic demands of flow fluctuations.

DWR remains opposed to double peak load following flow regimes during the winter months and feels that the energetic demands placed on the trout fishery during this period could potentially have a negative impact on this irreplaceable resource.

Additionally, DWR would like to thank Dave Speas and Steve Hulet of the BOR for adjusting the future fall operations of Flaming Gorge Dam to allow for warmer water to be released later into the season. The operational change should allow for a longer production season for the trout fishery and hopefully allow fish to over winter in better condition.

Thank you for the opportunity to comment.

Lowell Marthe
UDWR Flaming Gorge Project Leader